HANDHELD MULTI-FUNCTIONAL OSCILLOSCOPE

ADS-4072, ADS-4112, ADS-4122, ADS-4132, ADS-4132D, ADS-4152, ADS-4202, ADS-4222, ADS-4232, ADS-4232D

User's Manual

www.tmatlantic.com

CONTENT

To customer,

Handled multi-functional oscilloscope includes oscilloscope, multimeter and recorder functions having the following features:

- Complete electrical isolation between channels, with function of floating measurement
- up to 190 k wfms/s waveform refresh rate
- 5.7 inch TFT LCD screen, 640 * 480 resolution, 16 bit color depth
- 9 bit AD sample, display higher precise measurement
- Touch+Button+Wheel, convenient control performance
- Quick drag and zoom on touch screen
- Serial bus decode（optional Software，which can make UART（RS232/RS422/RS485）/SPI/I2C/CAN/LIN bus trigger and decode
- Record the waveform trend plot
- Support HD video trigger
- 31 kind of automatic measurements
- Unexpected operating response speed
- Support USB Master/Slave interface, which can plug U device or connect to the PC
- Replaceable Li battery

Chapter One Safety Information

Read First

1.1 Safety information

To avoid personal injury and prevent damage of products or other related devices, customer should read safety information and use this product in accordance with the relevant provisions.

- Only trained personnel can operate maintenance procedure
- Avoid fire and personal injury
- Properly connect instrument probes
- View all terminal ratings. In order to avoid fire and excessive current impact, please refer all the ratings and marks of the product specifications
- Do not operate the instrument with the cover removed or the case opened, hazardous voltage exposure is possible
- Replace the battery in the specified method, choose the specified power adapter, and recommended battery for charging. Firstly, you should insert the power adapter into AC power jack, and then connect it to the instrument.
- Avoid body contact with the exposed circuit directly
- Store under the floating air
- Do not use in damp or wet environment
- Do not use in flammable and explosive environment
- keep the instrument's surface dry and clean

1.2 Safety notes and symbols

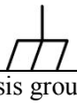
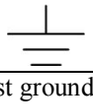
Safety notes in this manual. The following safety notes and symbols are used throughout this manual. Familiarize yourself with each of the notes and its meaning before operating this instrument

⚠ **Warning** *denotes a hazard. It calls attention to a procedure, which, if not correctly performed or adhere to, could result in injury or loss of life. User should not proceed beyond warning notes until the indicated conditions are fully understood and met.*

⚠ **Caution** *denotes a hazard. It calls attention to a procedure, which, if not correctly performed or adhered to, might result in damage or destruction of the instrument. User should not proceed beyond a caution notice, until the indicated conditions are fully understood and met.*

Danger *means while you are in violation of the provisions of this tag may immediately cause damage to you*

Symbols on products

				
Hazardous voltage	Refer to the manual	Protective earth terminal	Chassis ground	Test ground

Please read the following safety information to avoid personal injury and prevent products or damage related products. In order to avoid the possibility of danger so this product can only be used in the specified manner.

⚠ **Warning**

To avoid electrical shock or fire if a product input is connected to more than 42Vpp (30 Vrms) or 60Vdc:

- *Please use the pens and voltage probes provided by the instrument, or use the standard products in the* accessory description
- *Before using, inspect voltage probes , test pens and accessories from mechanical damage and replace them when damaged*
- *Remove all probes, test leads and accessories that are not in use*

Chapter Two Oscilloscope Quick Start Guide

Through reading this chapter, you will have a preliminary understanding for handled multifunctional oscilloscope and do basic operation and measurement.

This chapter mainly introduce the following contents：

- General inspect
- Introduce the names of the instrument's parts
- Use bracket
- Install& replace battery
- Introduce buttons and their functions
- Turn on /off
- Turn on oscilloscope
- Basic knowledge of oscilloscope user interface
- understand touch screen
- Function test
- Probe compensation

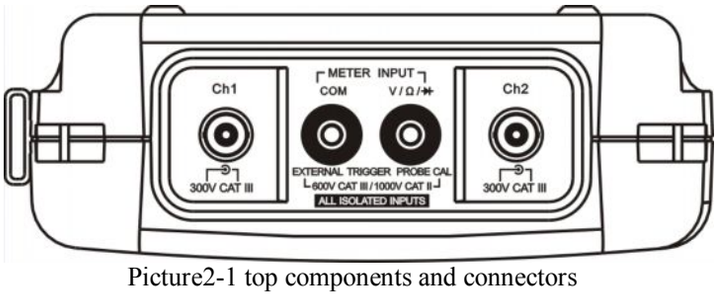
2.1 General check

When you receive your product container, check the instrument according to the following procedure.

1) **Check if there exists damage caused by transport.**
   a. If the container appears damage, please keep it, until the whole instrument and accessories pass through electronic performance and mechanical test.
2) **check the accessories**
   a. Each oscilloscope container has a shipping list. You can refer it to check if the attachment is complete. If the attachment is missing or damaged, please contact our agent or local office
3) **Entire instrument check**
   a. If situation happens like, broken of appearance of the oscilloscope, or failure to pass the performance taste, please contact our agent or local office which responsible for this business. If the instrument damaged by transport, please refer to the packing case and contact with Transportation Company and our Agent, we will arrange repair or replacement.

2.2 Introduce the names of instrument's parts

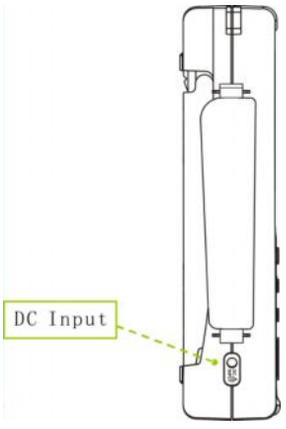
Top components and connectors： Look at the top of the instrument, the instrument has four safety BNC jack signal inputs, and two safety banana jack inputs. Isolated input architecture allows independent floating measurements with each input.

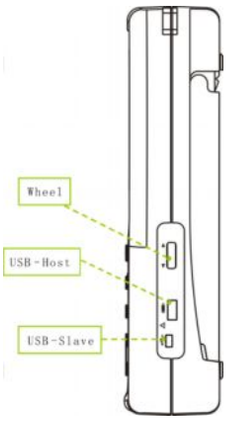


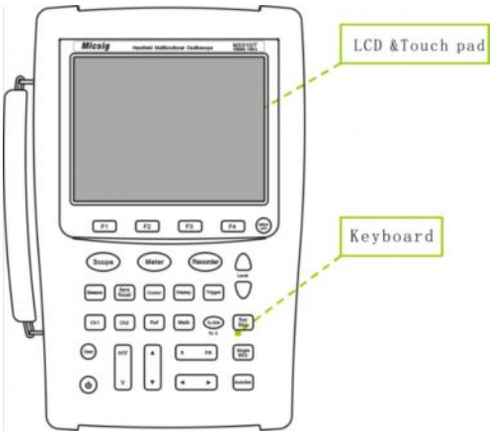
Picture2-1 top components and connectors

Left components and connectors： The handle and power jack. Refer to picture2-2.

External power jack: by special adapter to convert the alternating current (AC) to direct current (DC), then supply power for oscilloscope.







Picture 2-2 left components Picture2-3 right components Picture 2-4 front panel

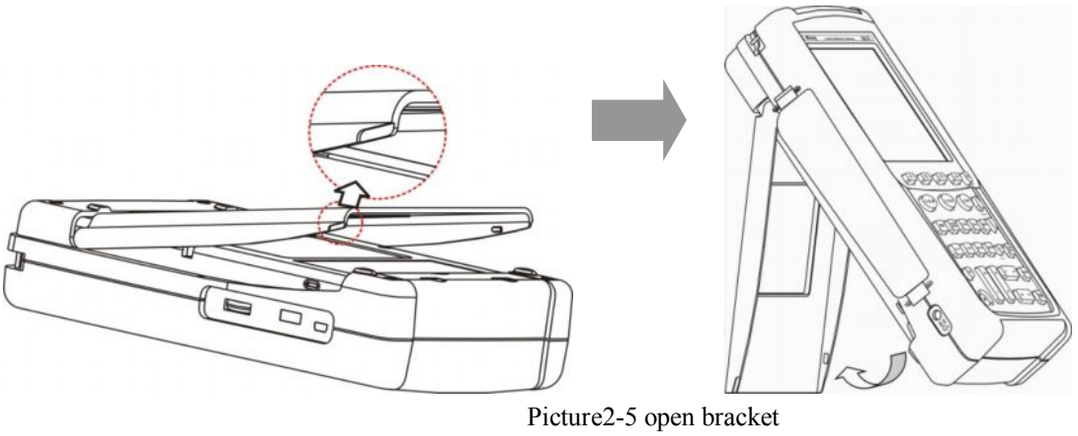
Right components: This includes a wheel and a USB port. Refer to picture 2-3.

Wheel: fast move oscilloscope trigger level, the horizontal position, vertical position, the cursor and to quick adjust the brightness of oscilloscope waveform, the intensity of (graticule, afterglow) and the trigger hold-off time. The usage of the wheel is shown in the following chapters.

Front panel includes the keyboard, LCD and touch panel. Refer to picture 2-4

2.3 Use bracket

First flat front panel on the desktop and then use your both index fingers to dig it out from stern notch on either side of the bracket with little upward force. Shown as picture2-5, (circle zone indicts bracket stern north)



Picture2-5 open bracket

2.4 Install and replace battery

When using the battery, the upper right corner of the screen displays the battery icon ()，which indicates the remaining battery power. When battery is in under -voltage threshold or battery icon flashes which means it should be replaced, if continue use will result oscilloscope automatic power off. At this moment user should use an external power adapter. In case battery is not full, please plug in power adapter, so the battery in charging status, the upper right corner of screen shows power in-charging icon (). Turn off channels that are not in use, week the screen background brightness and reduce the memory depth or refresh rate to lower power consumption.

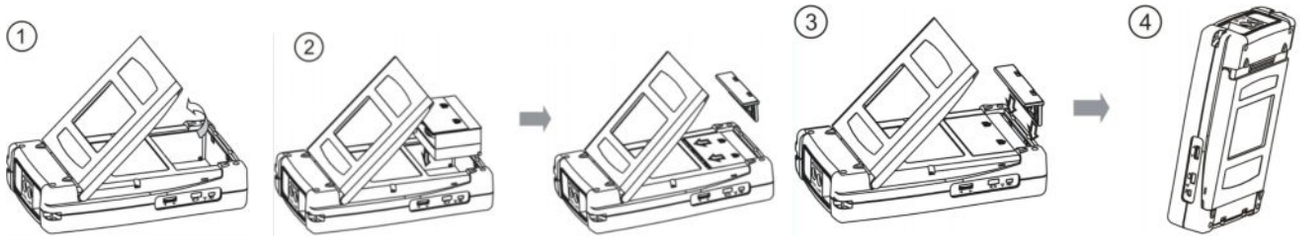
Steps for install battery

1)open the bracket，refer to picture 2-6 ○, 1

2)put the battery into the compartment and push the battery from bottom up until the battery completely push to the top housing，refer to picture 2-6 ○, 2

3)insert the battery baffle，refer to pitcture2-6 ○, 3

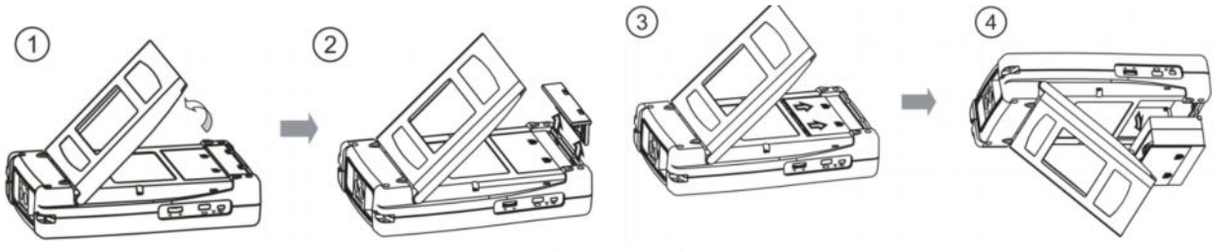
4)shut the bracket，refer to picture 2-6 ○, 4



Picture2-6 steps for install battery

Steps for remove battery

1) Open bracket, refer to picture 2-7 ○, 1
2) Use fingers to dig up the lock chip from each side with some strength to pull up the battery baffle, refer to picture2-7 ○, 2;
3) Press the battery fingerprint parts down and pull the battery to the bottom of the battery compartment, refer to picture 2-7 ○, 3;
4) Level up the rear panel and the battery automatically slides out under the gravity, refer to picture2-7 ○, 4.



Picture 2-7 remove battery

Notes: For the first use or long time no use, users should charge the battery before using it.

2.5 Know the buttons and their functions

Scope ____Turn on oscilloscope and mode switch to open the menu

Meter ____Turn on multimeter

Recorder ____Turn on recorder

F1 _____ function button menu，corresponding to the function shown in the bottom screen

F2 _____function button menu，corresponding to the function shown in the bottom screen

F3 _____functional button menu，corresponding to the function shown in the bottom screen

F4 _____functional button menu，corresponding to the function shown in the bottom screen

MENU OFF ____Menu off or return on the menu

_____Adjust trigger level forward, adjust the parameters in the current menu item or move the cursor etc.

_____Adjust trigger level backward, adjust the parameters of the menu options and move the cursor etc.

User _____System function button，for system configuration and etc.

⏻ _____Power button, turn on/off oscilloscope

Measure ____Function button, open the auto-measurement menu

Save Recall ____Function button can turn on store& recall menu

Cursor _____Turn on cursor menu

Display _____Function button can open display menu

Trigger _____Function button can turn on trigger menu

Run Stop _____Stop or restart the waveform capture, or lock screen in multimeter mode

Single SEQ ____Function button trigger and capture one single waveform then sop, press Run Stop button to escape this mode

AutoSet _____Function button, which can automatically adjust the vertical scale, vertical position and horizontal time base, making the waveform display as the best effect.

To 50% ____Function button，50% shortcut button which can move the waveform to the center of the screen, or make the trigger voltage to the center of the waveform amplitude

Ch1 _____Open / close the Ch1 or set Ch1 as current channel

Ch2 _____Open / close the Ch2 or set Ch2 as current channel

Ref _____Function button, open the reference menu and select the reference waveform (user can choose four reference waveforms which displayed on the screen at a time)

Math _____Function button, open or close the math channel, and set math channel as current channel.

_____Function button; adjust the vertical scale of the selected channel

____Function button, vertical position adjustment button, move the vertical position of the selected waveform

___Function button, adjust the horizontal scale (horizontal time base)

___Function button, horizontal position adjustment, waveform horizontal movement


_____Wheel, quick adjust the trigger level, the cursor, or move waveform, or used in parameter setting

2.6 Turn on & turn off

Press power button ⏻ to turn on instrument，repress this button to turn off，long press this button for 3 seconds can forcedly shut off the instrument.

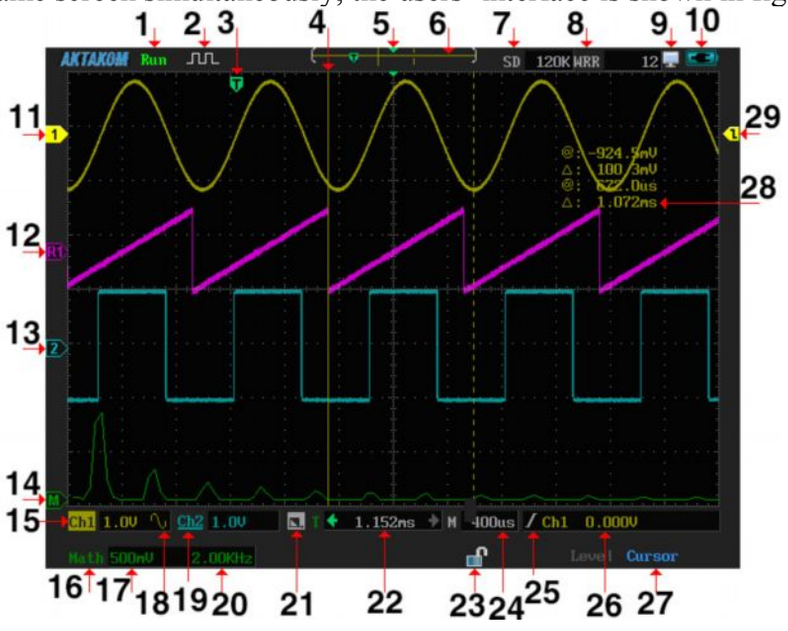
⚠ **warning：** Shut off this instrument may cause data loss.

2.7 Turn on oscilloscope

Turn on the instrument then enter the oscilloscope mode (as the default mode). If the instrument is in multimeter or recorder mode, press Scope key to scope mode. When the instrument in scope work mode, the keyboards are all available and press these buttons, you can open a menu or switch some sort of functions directly. For example, in oscilloscope mode, press Scope to main menu.

2.8 General knowledge of users' interface

This section does a simple introduction and description to oscilloscope users' interface. After reading this section, you can familiar with the oscilloscope display interface in a short time. For the specific settings and adjustments, users can refer Chapter Three. The screen items shown in the following picture may not appear on the same screen simultaneously, the users' interface is shown in figure 2-8.



Picture 2-8 users' interface

Users' interface:

1. There are five kinds of wave capturing mode indicator

Auto: in auto mode, according the input signal to automatically adjust the vertical scale, the horizontal time scale, and the trigger mode to make the waveform displays as the best.

Run: sampling waveform data

Stop: stop sampling waveform data

Waiting trigger: a transient state just before trigger event occur

Rolling: sampling waveform data when scroll the touch screen

2. The probe calibration related square wave output indicator

3. The trigger position icon indicates the waveform trigger position

4. The cursor can be divided into vertical cursor and horizontal cursor, used for measuring cursor

5. The extension position icon, the center point of the time base zooming out

6. Waveform position indicator, indicate the position of waveform on current screen between the total sampling data.

7. Memory Depth, the display value 120K at the right side, which means the current channel memory depth.

8. Refresh rate, actual wfrms/s at the left side

9. USB connection icon, which means connect it to PC.

10. User can view the battery charge status in the following ways

Connect to external power, power capacity remaining battery full, battery under-voltage

11. Display Ch1 zero position, the point is solid, which indicates Ch1 as current channel, and the pointer color is the same as the waveform color.

12. Trigger level position, when logic trigger happen there are two pointers, the yellow one is Ch1 trigger level, and blue one is Ch2 trigger level.

13. Reference waveform icon: When the pointer is solid, indicating the reference waveform is current waveform.

14. Ch2 zero position, when the pointer is hollow indicating Ch2 is not the current channel.

15. Math channel icon, when the pointer is solid indicating the math channel is the current channel.

16. Ch1, reverse color of Ch1 means Ch1as the current channel and the right reading 1.00 V means vertical scale of Ch1

17. Math channel, reverse color of math channel means math channel as current channel

18. Math channel, the reading 500 mv means vertical scale of math channel
19. Coupling mode information， here indicates the Ch1 as AC coupling sample. Coupling examples

Ac coupling sample ground

If there is no icon displayed in arrow 18, which means this is a DC coupling sample.

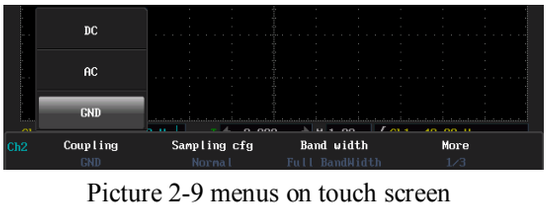
20. Ch2, here the underline means this channel inverted open, the reading 1.00 V is vertical scale of Ch2.
21. Current in FFT mode, frequency span per grid is 2.5 KHz.
22. Memory depth, the current channel memory depth is 120 k
23. The bandwidth limit icon that means Bandwidth is limited to 20MHz (3db), full bandwidth displays no icon
24. The value indicates the relative trigger position of current channel, the green arrow next to the readout means the trigger position deviating from the center to the left or right
25. Horizontal scale (horizontal time base)
26. Trigger condition icons， rise trigger， fall trigger， dual edge trigger
27. Set trigger level value, on the left side of the Ch1 is current trigger source
28. Trigger level, cursor switch indicator
29. Value of cursor measurement

2.9 Understand touch screen

2.9.1. The touch screen function menu

When the function menu opens, you can directly press the touch screen to select menu.
Set the "coupling" as GND, please follow these steps,

1) Press Scope to open the main menu
2) Press “coupling”
3) Press touch screen to select coupling as GND； As shown in picture2-9
4) Press MENU OFF to close function menu then the set is finished.



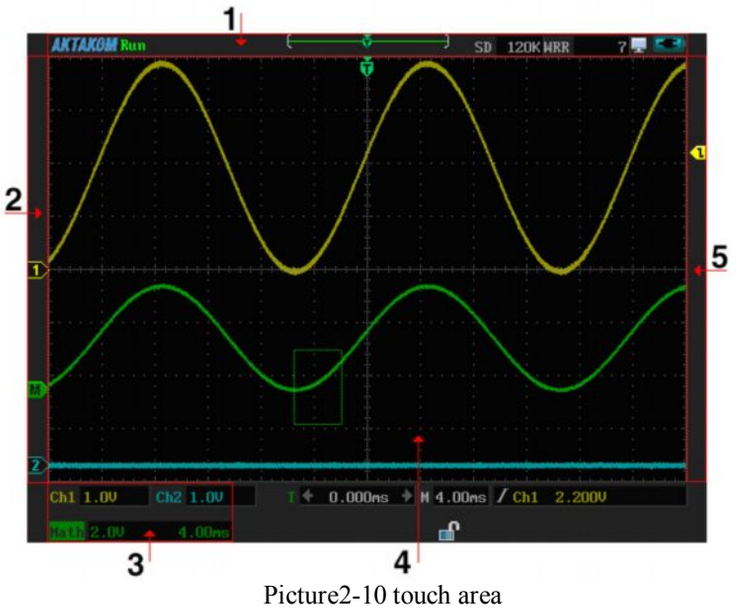
Picture 2-9 menus on touch screen

2.9.2. Five operating areas on the touch screen

Frames of the waveform display divide the touch screen into five areas, only the function menu turned off, can operate these areas. See figure 2-10.

Touchable area description:

1. Horizontal drag area: From the upper waveform window to screen, top. You can move waveform horizontally in this area.
2. Vertical drag and the current channel selection area: where the waveform displays from the left frame to the right frame. Press the channel icon switch to the current channel, vertical drag only applies to the current channel.
3. Current channel switch area: press the frame corner at Ch1, Ch2, Math, or Ref and users can switch one of them to the current channel.
4. Waveform zoom area: the whole waveform display area can be used as waveform zoom in/out area.
5. Trigger level and drag the cursor area: the area between waveform window's right edge and screen’s right edge where users can move the trigger level or drag the cursor.



Picture2-10 touch area

2.10 Function test

Testing the instrument to make sure whether it is working normally. Please follow these steps for simple function test

1) Connect the instrument to external power jack，press ⏻ to turn on，to see whether the top right corner of screen has a charging icon.

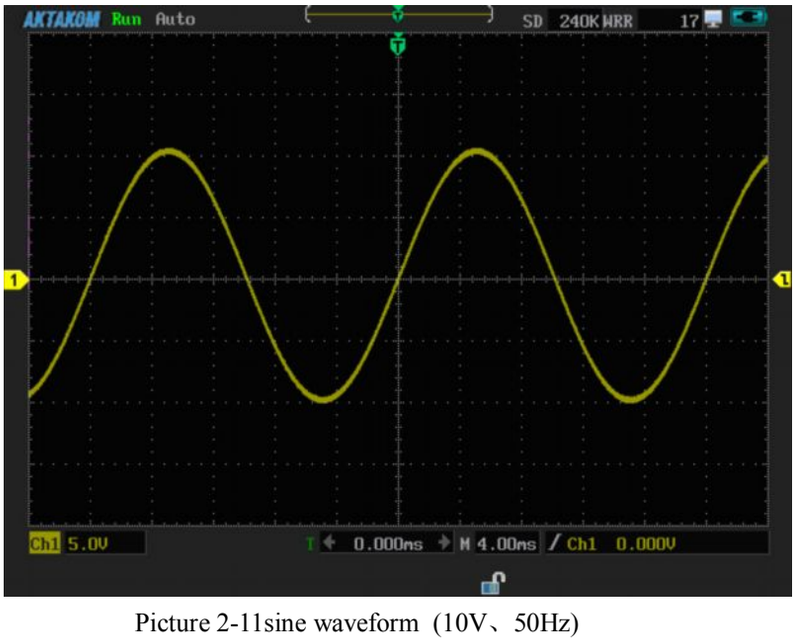
2) Put the probe slot to the Ch1 BNC jack, slightly insert and rotate the slots tighten clockwise direction.

3) Connecting the (10x) probe to the sine wave signal source（10v, 50Hz）

4) Press AutoSet to display signal waveform. View picture 2-11.

5) Switch to the Ch2，and connect the probe to the Ch2, and repeat the step3 and 4.

If find the waveform display abnormal, during the function test, please refer to the fault-handling Chapter or contact with our after-sales service center.



Picture 2-11sine waveform（10V、50Hz)

2.11 Probe compensation

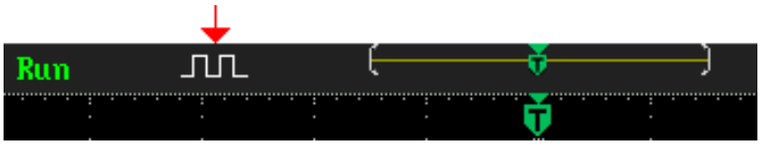
Before connecting to any channels, users should make a probe compensation to insure the probe match to the input channel. The probe without compensation will lead to larger errors or mistakes, and probe compensation optimizes the signal path and makes the measurement more precise. If the temperature is 10 degree or above, this progress must be done to insure the accuracy of the measurement. See picture2-

Picture 2-12 probe compensation menu

Procedures of probe compensation as follow

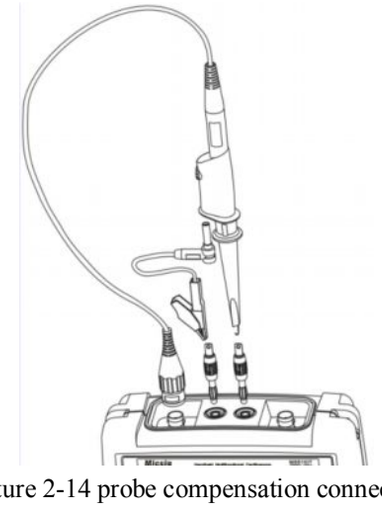
1) Connect the oscilloscope probe to Ch1. If you are using a hook head, users should ensure the good connection with the probe.

2) Press Scope then F4 then F4 and F2, set the probe calibration signal output as start , then at the top left corner the square wave screen icon is flashing, indicate square wave signal is output, see figure 2-13;

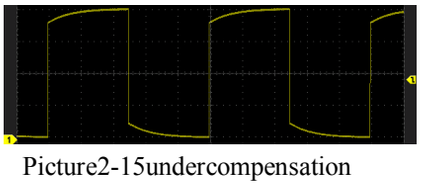


Picture 2-13 signal output of probe compensation

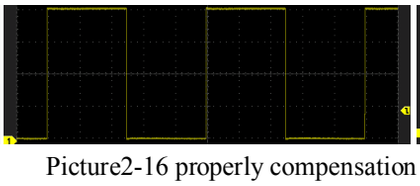
3) Put the banana plug into multimeter jack, and put the probe, which needs calibration to the banana head. See picture2-14，press AutoSet to adjust the waveform display or manual adjustment，if necessary，users can repeat the above steps and observe the waveform，shown as picture 2-15, 2-16, 2-17.



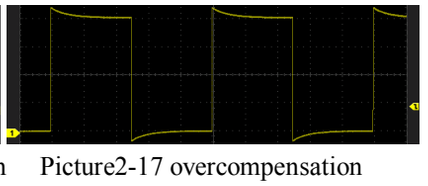
Picture 2-14 probe compensation connection



Picture2-15undercompensation

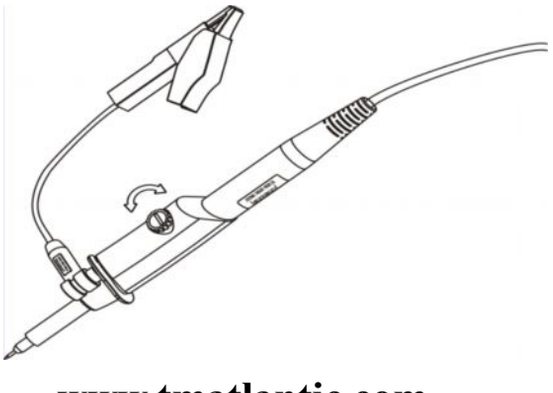


Picture2-16 properly compensation



Picture2-17 overcompensation

If the waveform on the screen is shown as under -compensation or over-compensation, please adjust the probe, until the waveform shown as correct-compensation.



Picture 2-18 probe adjustment

⚠ **Warning** in any case using the probe should follow these steps

- *Ensure the wire insulation is good to avoid probe electric shock while measuring high voltage;*
- *Keep your fingers behind the probe security circle to prevent electric shock;*
- *Do not touch metal parts of the probe-head to prevent electric shock;*
- *Before the measurement, please correctly connect the probe ground end.*

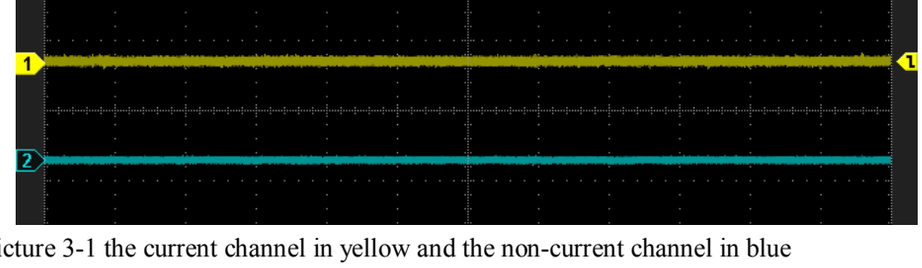
Chapter Three Use Oscilloscope

This chapter mainly includes the following contents

- Channel selection
- Set the channel coupling mode
- Set the channel sampling mode
- Bandwidth selection
- Use delay
- Set channel polarity
- Set probe ratio
- Auto- calibration
- Set auto-measurement type
- Set the save/restore menu
- The cursor measurement
- Set display menu
- Set trigger menu
- Use vertical and horizontal button
- Use auto-set
- Use math menu
- Run/stop button and single sequence
- Reference channel
- Use 50% shortcut button
- Using touch screen zoom waveform

3.1 Channel selection

Current channel: oscilloscope can display multiple waveforms simultaneously, but there is only one waveform can display on the top, which is called the current channel. The current channel arrow is solid, otherwise the arrow is hollow, and the differences are shown in figure 3-1.



Picture 3-1 the current channel in yellow and the non-current channel in blue

Use buttons: the two buttons Ch1 and Ch2, corresponding to Ch1 and Ch2 at the front panel

Press on these two buttons can achieve the following three functions, respectively

(a) open channel (b) close channel (c) Set the channel as current channel

Taking Ch2 for example

If Ch2 is in open state, but not the current channel, press Ch2 to set Ch2 as current channel.

If Ch2 is in current channel state, press Ch2 to close Ch2.

If Ch2 is in off state, press Ch2 to start Ch2, then the Ch2 is set as the current channel.

Use the touch screen: the left side of the screen is vertical drag and current channel selection area. Press

the arrow-pointing channel or press the channel icon under the current channel selection area can set the non-current channel to current channel. But user can't close the channel here.

3.2 Set channel coupling mode

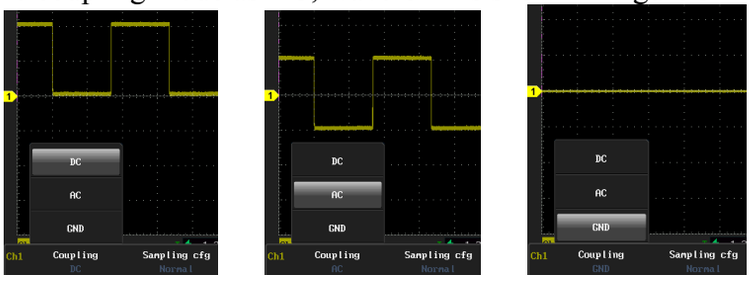
Press Scope to enter main menu, press F1 to choose coupling mode as DC,AC or GND， user can operate the steps on touch screen directly.

Tips： This setting applies only for the current channel, if need setting other channels， user should switch to the current channel first, then press Ch1 or Ch2 to switch directly, no need to exit the main menu

1)Ch1 connects to the DC bias of square wave signal; please follow these steps to set the DC coupling sample

2) Press Scope to enter main menu set

3) Press F1 to set the coupling mode as DC, waveform is shown in figure 3 -2 DC.



DC AC GND

Picture3-2 coupling

DC: DC coupling, the measured signal contains the DC and AC components both can get through, as shown in figure 3-2 DC;

AC:AC coupling， the measured signal of DC signals are blocked, only allowing the AC component get through, as shown in figure 3-2 AC;

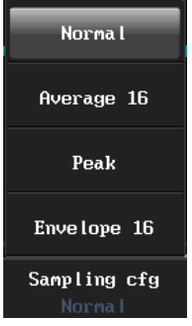
GND: the measured signal is blocked, as shown in figure 3-2 GND.

Sample coupling mode in the left corner of screen, as shown in picture 3-3, coupling GND is Ch1, coupling AC is Ch2, and if there is no arrow point means the channel is DC coupling.

Picture3-3 coupling icon

3.3 Set channel sampling mode

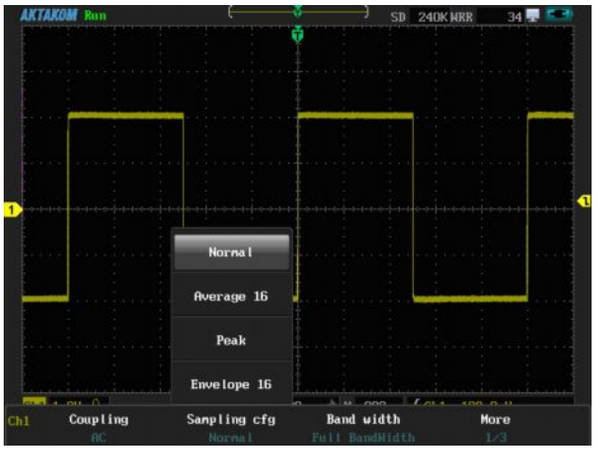
Press Scope and F2 to export sampling cfg menu, then press F2 and you can choose the sampling config (user can operate the steps on touch screen).The sampling config menu is shown in picture 3-4.



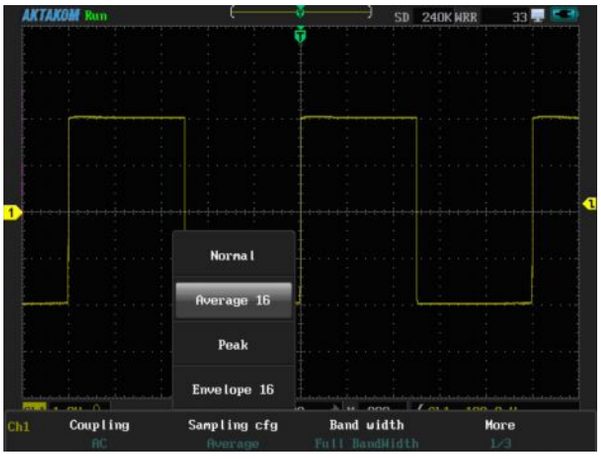
Picture3-4 sampling config menu

Systems can support four kind of sampling configs

1. **Normal** scope samples signal through equivalent time intervals to build waveform, The default setting is normal. Waveform is shown in picture3-5.



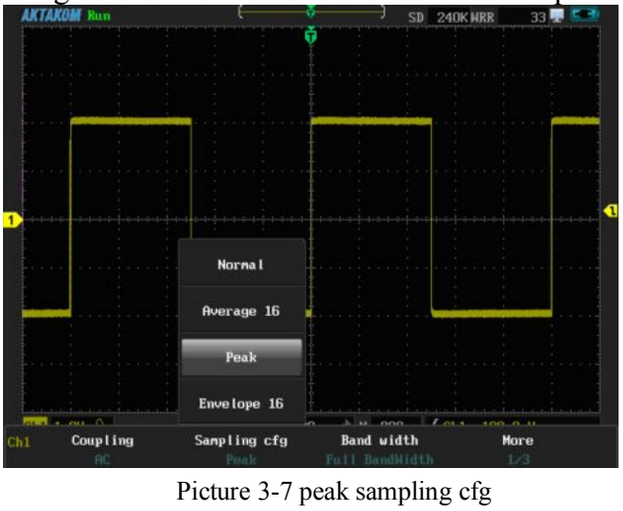
Picture 3-5 normal sampling config



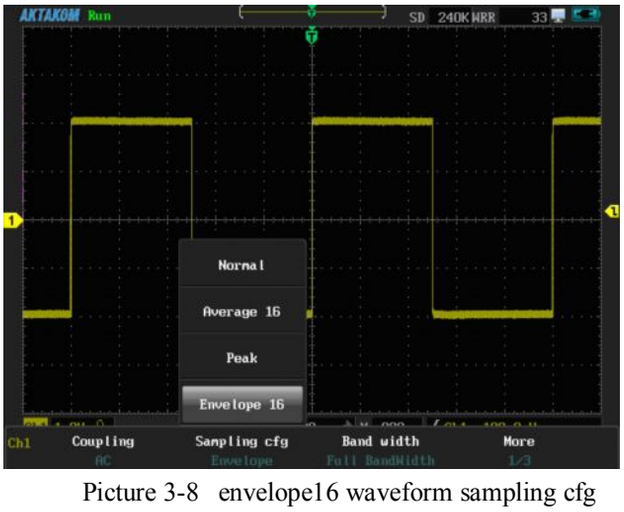
Picture3-6 average 16 sampling config

2. Average: waveform does average processing from multiple sampling. You can use the average functions to reject random or uncorrelated noise in the waveform without loss of bandwidth. Press or roll the wheel to set the waveform average number, selectable average number is 2, 4, 8, 16, 32, 64, 128, 256, and the waveform is shown in figure 3-6.

3. Peak in this mode, using two continuous capture intervals (include the highest point and the lowest point) can get the possible missing narrow pulses and can be used for burr detection, however, the noise is much higher than normal. See the waveform in picture3-7.



Picture 3-7 peak sampling cfg

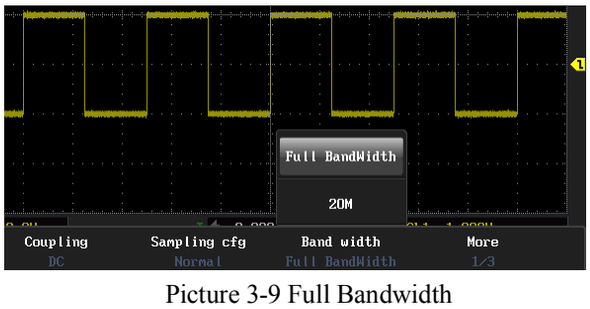


Picture 3-8 envelope16 waveform sampling cfg

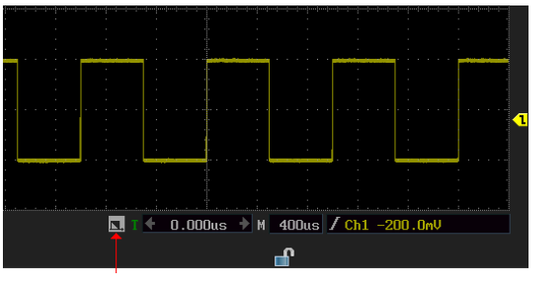
4.Envelope: Here you can see the waveform rejection after several samplings. In the specified N sampling, always display the Mini-Max values at the same acquisition positions. Press or roll the wheel to set the number of waveform rejection, which can be set to 2, 4, 8, 16, 32, 64, 128, 256, or infinite, waveform is shown in figure 3-8.

3.4 Bandwidth selection

Press Scope and F3 to set the required bandwidth limit , the 20MHz bandwidth can only keep low frequency component under 20MHz, and high frequency component above 20MHz can attenuation effectively. The difference between full bandwidth and 20MHz can be expressed by waveform. Full bandwidth is shown in picture 3-9; 20MHz bandwidth is shown in picture 3-10.



Picture 3-9 Full Bandwidth



Picture 3-10 20 MHz Bandwidth

In picture 3-10, the arrow point indicates bandwidth(20MHz).

3.5 Use delay

You can begin to capture the waveform for some time after the trigger point has been detected. When delay is **on**, the trigger can be removed from the screen, and the horizontal extension point locates in the middle of the screen, and adjusts the horizontal time scale can observe more details of the waveform.

Sometimes the measured value is not stable while measuring pulse width. This is called pulse width jitter. In this case, turn on delay function and extend the time base; and delay sampling after rising trigger to observe the falling waveform jitter. For example,

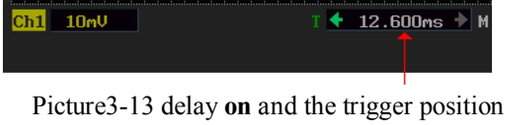
1) Press Scope then F4 then F1 to choose delay **on**
2) Move the waveform to the left, making the falling edge of waveform in the middle of the screen, as shown in figure 3-11,

Picture 3-11 **on** delay menu

Picture 3-12 delay state

3) Press s ns to enlarge waveform until it jitters significantly, observe the jitter effect shown as 3-12

Turn on the delay, the trigger readout under the bottom of the screen is time value; when delay is off**,** the trigger readout is a percentage, the most left side screen is 0%, the most right side is 100%; two kind of displays as shown in figure 3-13, 3-14.



Picture3-13 delay **on** and the trigger position

Picture3-14 delay **off** and trigger position

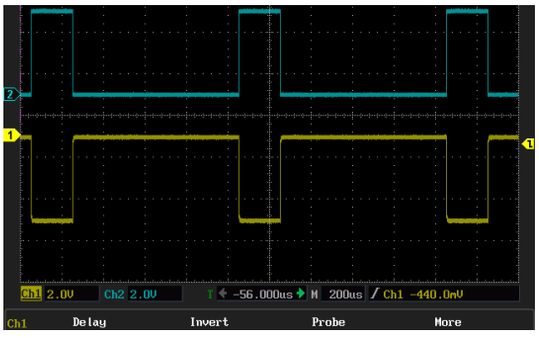
Note: when the delay **on**, adjust the time scale, and zoom the waveform on the center point of the screen. When Delay **off**, adjust the time scale, and zoom the waveform on the trigger position

3.6 Set channel polarity

The waveform polarity is relative to the zero level (ground), if the actual signal is positive however in the instrument is negative, which called negative polarity or phase invert. By setting the Ch1 and Ch2 channel's polarity users can make the two channels work respectively in a phase invert or normal state. Follow the examples to set channel polarity.

Ch1 and Ch2 connect to the same rectangular pulse signal simultaneously and make the Ch1 and Ch2 both **on**

1) press Scope then F4 and F2 ,
2) Set Ch1 as current channel, press F2 to select invert **on**
3) Set Ch2 as current channel，press F2 to select invert **off**，waveform is shown in picture 3-15.



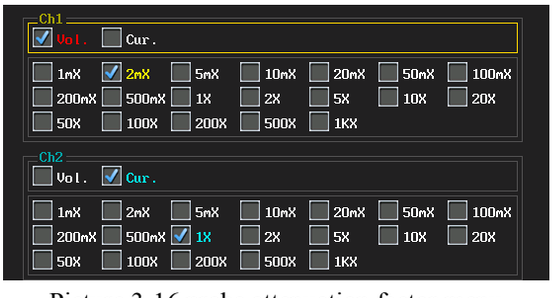
Picture 3-15 invert polarity of the two waveforms

3.7 Set channel attenuation ratio

To coincide with actual use probe attenuation radio, it is necessary to adjust channel attenuation factor under the channel menu. Such as probe attenuation radio of 1:1, corresponding to the input channel attenuation factor set as 1 x. When probe attenuation factor is changed, users need to enter this menu to set the corresponding attenuation factor, only the set matches, can display waveform's amplitude rightly. Probe attenuation radios and attenuation factors are shown in the table below,

Probe attenuation radio	Attenuation radio menu
1:1	1X
10:1	10X
100:1	100X

Press Scope then F4 then F3 and F2 to open channel attenuation factor menu, and set the current channel factor, if need to set another channel, no need to exit, users can switch the current channel to do so, as shown in picture3-16.



Picture 3-16 probe attenuation factor menu

3.8 Auto-calibration

According to the current environment, auto-calibrate each channel scale's zero position and parameter. In oscilloscope mode, press Scope then F4 then F4 and F1 into auto-calibration mode. When auto-calibration function is active, the upper left corner of the screen displays calibrating in red, after calibrating finished, the red calibrating disappear. When the temperature changes largely, auto-calibration can make the instrument maintain high accuracy of measurement

- Auto-calibration should be down without probe
- auto-calibration process takes about two minutes
- if the temperature changes above 10 □, we recommended users perform the auto-calibration

3.9 Set auto measurement type

Press Measure can open auto-measurement menu and there are 31 kinds of auto-measurement types to Ch1, Ch2 math and reference channel. Before choosing the measurement type, must set the measured channel as current channel. The instrument can display four measurements simultaneously. Types and specifications are shown in the table

Serial	Type	Instructions

1	Period	The time required to complete the first cycle in a waveform or gated region; period is the reciprocal of frequency and is measured in seconds.
2	Rate	Reciprocal period time
3	Rise time	the time required for the leading edge of the first pulse in the waveform or gated region to rise from the low reference value(default=10%)to the high reference value(default=90%)of the final value
4	Fall time	the time required for the falling edge of the first pulse in the waveform or gated region to rise from the low reference value(default=90%)to the high reference value(default=10%)of the final value
5	P duty cycle	the ratio of the positive pulse width to the signal period expressed as a percentage. the duty cycle is measured on the first cycle in the waveform or gated region
6	N duty cycle	the ratio of the negative pulse width to the signal period expressed as a percentage. the duty cycle is measured on the first cycle in the waveform or gated region
7	Delay	the time between the mid reference(default 50%) amplitude point of two different waveforms
8	P pulse width	the distance between the mid reference(default 50%)amplitude points of a positive pulse. the measurement is made on the first pulse in the waveform or gated region
9	N pulse width	the distance between the mid reference(default 50%)amplitude points of a negative pulse. the measurement is made on the first pulse in the waveform or gated region
10	Burst width	the duration of a burst(a series of transient events) and is measured over the entire waveform or gated region
11	P overshoot	this is measured over the entire waveform or gated region and is expressed as P overshoot = [(max– high)/amplitude] x 100%
12	N overshoot	this is measured over the entire waveform or gated region and is expressed as N overshoot = [(low- mini)/amplitude] x 100%
13	phase	The amount of time that one waveform leads or lags another waveform, expressed in degrees where 360° comprises one waveform cycle.
14	peak-peak	The absolute difference between the max. and min. amplitude in the entire waveform or gated region
15	amplitude	the high value less the low value measured over the entire waveform or gated region
16	high	The value is used as 100% whenever high reference, mid reference, or low reference values are needed, such as in fall time or rise time measurements. it can be calculated using either the min/max or histogram method. the min/max method used the maximum value found. the histogram method used the most common value found above the midpoint. this value is measured over the entire waveform or gated region
17	low	The value is used as 0% whenever high reference, mid reference, or low reference values are needed, such as in fall time or rise time measurements. it can be calculated using either the min/max or histogram method. the min/max method used the maximum value found. the histogram method used the most common value found above the midpoint. this value is measured over the entire waveform or gated region
18	max	Typically the most positive peak voltage. max is measured over the entire waveform or gated region
19	mini	Typically the most negative peak voltage. min is measured over the entire waveform or gated region
20	Mean	the arithmetic mean over the entire waveform or gated region
21	Cycle mean	the arithmetic mean over the first cycle in the waveform or the first cycle in the gated region
22	RMS	the true Root Mean Square voltage over the entire waveform or gated region
23	Cycle RMS	the arithmetic mean over the first cycle in the waveform or the first cycle in the gated region

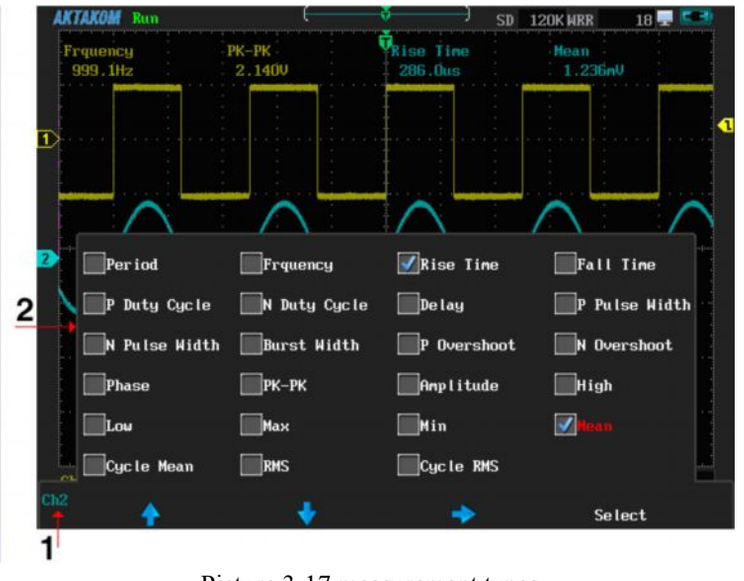
Use button: Use the wheel or touch screen to select measurement types and related settings.

press F1 to upward cycle，press F2 to downward cycle，press F3 to right cycle，press  or roll the wheel to left/ right, from top to bottom cycle，press F4 to confirm or cancel options.

Press the touch screen to choose item or cancel this measurement type directly.

Measure Ch1 frequency and Vpp，measure Ch2 rise time, Vmean, please follow these steps.

1) Plug probes to Ch1 and Ch2 respectively, and connect them to signal source；
2) Set Ch1 as current channel，press Measure then the screen popup measurement types，press on the touch screen，select Ch1 measurement type as the “Frequency” and peak-peak；press Ch2 to choose Ch2 as current channel, and set Ch2 measurement types as rise time and mean
3) Adjust the vertical scale and horizontal scale; make the waveform display At least one entire cycle. Picture 3-17



Picture 3-17 measurement types

Introductions of measurement types on the screen: 1 current channel 2 measurement types menu

3.10 Store/ restore menu

On this menu, users can do operations like, save/recall waveform, and adjust the memory depth, dynamic waveform record/playback, save/recall settings, and screen snapshot

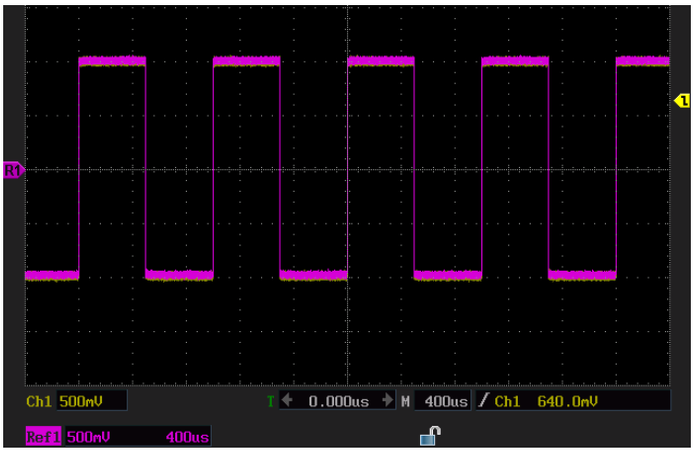
3.10.1 Save

Press Save Recall and F1 to enter the save waveform menu, to save Ch1/Ch2/math waveform as reference waveform, marked in color purple. Date and time under the To Ref R*means this memory has already saved waveforms, blank means no waveform saved. Picture3-18

Picture 3-18 the reference waveform

Please follow these steps to save Ch1 waveform to R1,

1) Connect probe to Ch1 and connect it to the signal source.
2) Press Save Recall and F1 to enter the save waveform menu.
3) Press F1 to store waveform to R1, shown in picture 3-19，yellow waveform is Ch1 waveform，after the waveform being saved displays as purple waveform. The two waveforms overlap with each other.



Picture 3-19 stored waveform to R1

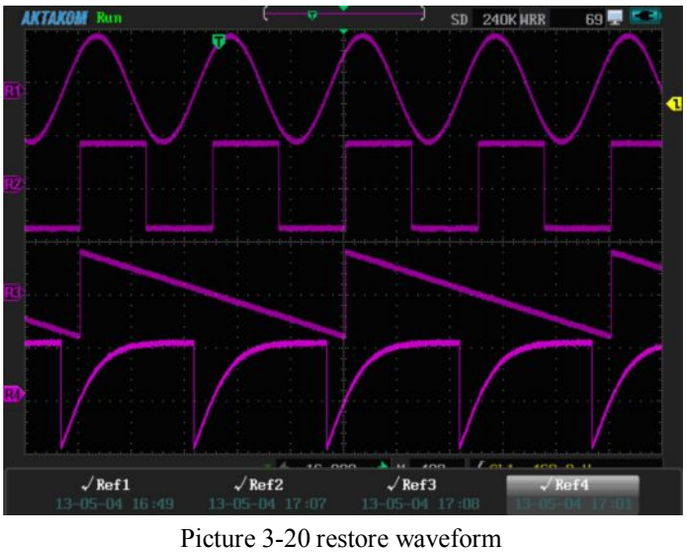
It can save four reference waveforms (R1/R2/ R3/ R4) at most. If continue save into the same position, the original waveform will be covered.

3.10.2 Restore

Press Save Recall and F2 to enter the waveform recall menu，the recalled waveform is in purple and the instrument can display four recalled waveforms simultaneously if waveform recall menu displays in gray which means no waveform data. If marked “Refer R” illustrates the waveform is selected.

Please follow the steps to recall waveform

1) Press Save Recall and F2 to enter the waveform recall menu；
2) Press F1 to recall waveform Ref1 and then the Ref1 is the current waveform
3) Press F2 then F3 and F4 to restore waveforms （R2/R3/ R4）.



Picture 3-20 restore waveform

3.10.3 Memory depth

Memory depth means the oscilloscope’s capacity of storing sample points. For example, the store depth is 120K, and it says it can store 120k sample points.

Press Save Recall and F3 to enter the adjustment menu of store depth, if it is a single channel, it can be set to2.4K,24k,240k,and a dual channel can be set to1.2k,12K，120k,and press to adjust the value of store depth.

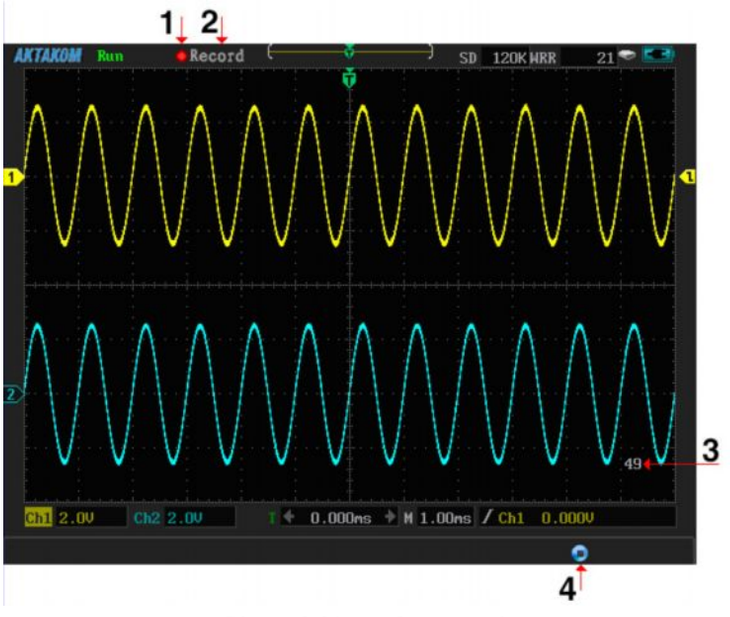
3.10.4 Dynamic record

Dynamic record can easily record the waveform and memory operation steps. Only after identifying the USB device can start dynamic record, then the upper corner of the screen show U device icon and the dynamic record（Note: system divides U device into four store area

automatically, based on the need to store the four different information into separate areas. If the record area has stored waveform, the record will overlap the last record）

- **Waveform record**

Press Save Recall then F4 then F1 and F1 to enter the waveform record menu，then press F1 then F2 then F3 or F4 to select the corresponding store area and start waveform record, as shown in picture3-21.



Picture 3-21waveform record

Interface descriptions of waveform record

1：recording icon，the icon flashes while recording

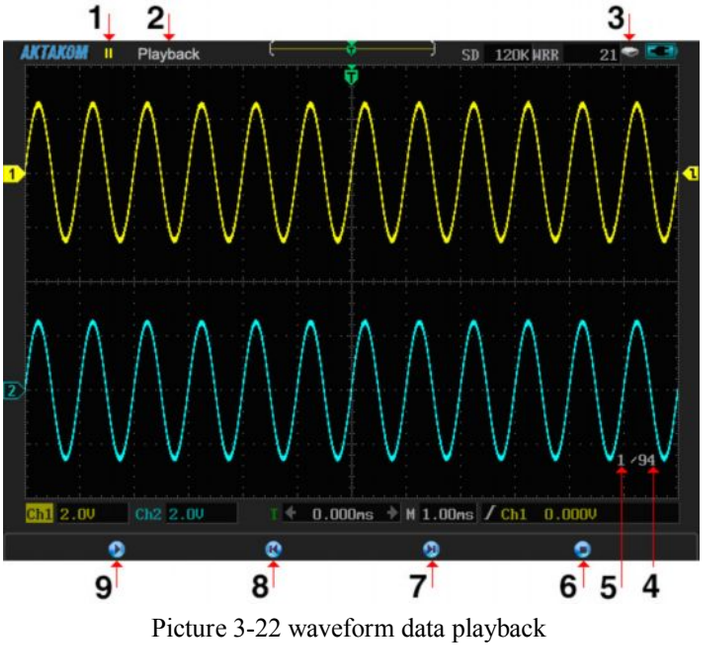
2：Dynamic record mode, display the current work mode is waveform record

3： Frame number for the current record

4：stop，press F4 to record waveform and return to the previous menu

- playback waveform data

Press Save Recall then F4 then F1 and F2 to enter the waveform playback menu；Then press F1 then F2 then F3 or F4 to select corresponding store area and press F1 to start the waveform playback. See picture 3-22.



Picture 3-22 waveform data playback

Interface descriptions of waveform playback

1：run,timeout,stop， the current state is running.

2：dynamic record mode，the current state is waveform playback mode

3：External USB device icon

4：Total frames

5：Playback current frame number

6：stop， press F4 to stop waveform playback and return to the previous menu

7：Forward

8：Back

9：play stop， press F1 to operation

tips：Press ◄ ► can quick forward or backward, each press can forward/back10 frames, and long pressing this button means quick forward/backward

3.10.5 Store settings

To store current setting, press Save Recall then F4 and F2 to enter store settings menu, press the function menu to select one store slot（Up to 9 storage slots is available）.

3.10.6 Restore settings

Restoring a setting from this instrument, users should press Save Recall then F4 and F3 to restore settings menu, press F1 to restore the default setting. Details of restore settings are shown as appendix C. choose other menu item can restore corresponding saved setting.

3.10.7 Screen snapshot

After identifying the U device, the menu color of the screen shot changes from white to grey, then the screen shot function can use. Screen shot will format the current screen to BMP image and save it to U device. Press Save Recall then F4 and F1 to complete screen shot

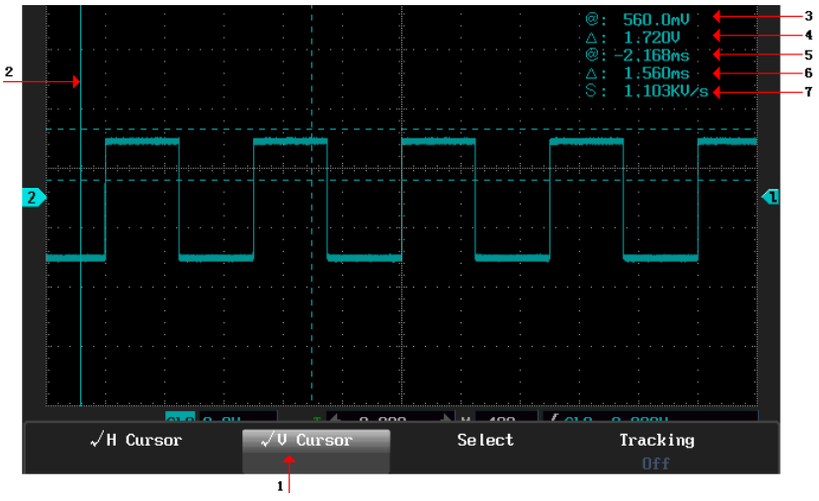
3.11 Cursor measurement

Press Cursor to enter cursor menu. There are vertical and horizontal cursors，horizontal cursor measures vertical direction value, and vertical cursor can measure both horizontal and vertical direction values. Using the cursor under the cursor menu to choose vertical cursor to open cursor or close the cursor and switch the horizontal or vertical cursor.

Take the vertical cursor for example

- When the vertical cursor is closed，press “vertical cursor”，correspondingly press F2 to open vertical cursor. Then vertical cursor is current cursor. Which is marked in .
- When the vertical cursor is open, but not the current cursor, then press F2 to set the vertical cursor as the current cursor.
- If vertical cursor is the current cursor, then press F2 to shut down vertical cursor.

Instructions about activate/move the cursor： press Cursor to open the cursor menu and select the current cursor，then press F3 to activate the cursor（activated cursor is in solid line and others as hidden line），press or roll the wheel to move the active cursor；press F4 to open the tracking mode and activate the two cursor simultaneously，then press or roll the wheel to move the two cursors simultaneously. The results are shown in the upper-right of the screen. See picture3-23.



Picture 3-23 H Cursor and V Cursor

Interface descriptions of horizontal and vertical cursor

1：Current cursor

2: Activated cursor

3 @：（1）when only horizontal cursor opened, indicating the activated horizontal cursor is relative to the voltage difference value which is at the zero level .

(2) When only open vertical cursor, indicating the activated vertical cursor and the waveform intersection point are relative to the zero level of voltage difference value.

（3）when horizontal and vertical cursor opened simultaneously, indicating the last activated horizontal cursor is relative to the zero level of voltage difference value.

4 △:（1）when horizontal cursor opened, indicating voltage difference value between two horizontal cursors

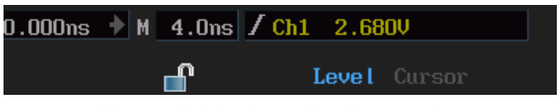
（2）when vertical cursor opened alone, indicating the voltage difference value between two vertical cursors and waveform intersection point.

5 @: The last activated vertical cursor is relative to the time difference value of the trigger point

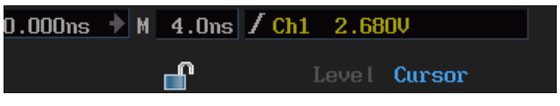
6 △: Time different value between two vertical cursors

7 S:equal to horizontal cursor△（voltage difference）/the vertical cursor（time difference），that is the slope of the four cursors intersection

Instructions of the cursor or trigger level switch operation： after opening the cursor menu，press MENU OFF to close the menu，the bottom right corner of the screen displays Level and Cursor, then press F4 or press the touch screen to switch. When the Level is active，press or roll the wheel can adjust trigger level，see picture3-24，while the Cursor is light on，the operator is the cursor，see picture3-25.



Picture 3-24 trigger level operation



Picture 3-25 operate the cursor

3.12 Set display menu

In this menu, you can set waveform as **Draw Type**, **Brightness**, **Graticule**, and **Graticule Intensity**, **Persist** , **Time base** and **Refresh Rate**

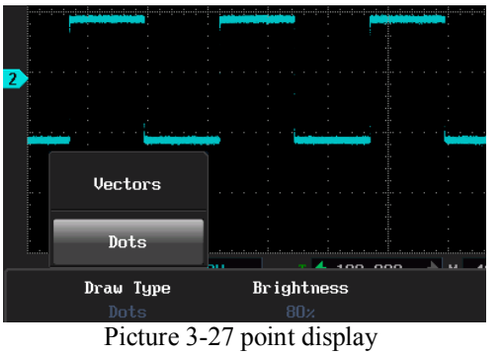
3.12.1 Waveform settings

Set waveform draw type mode and waveform brightness. Waveform display mode shows as sampling dots and vectors, the waveform brightness displays in percentage. See picture3-26

Picture 3-26 waveform set menu

a) Following the below steps to set waveform as sampling dots.

1) Press Display to enter the display menu;
2) Press F1 to enter waveform setting;
3) Press F1 to enter draw type set;
4) Press F1 to choose skeleton pattern as Dots. See picture 3-27.



Picture 3-27 point display

b) Following the below steps to set waveform brightness

1) Press Display F1 F2 to choose brightness set
2) Press ∩ ∪ or roll the wheel to adjust the waveform brightness.

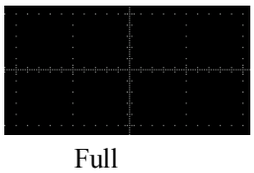
3.12.2 Graticule set

To set the graticule type and intensity, the type includes full, grid, cross hair and frame. Graticule set menu as shown in picture 3-28

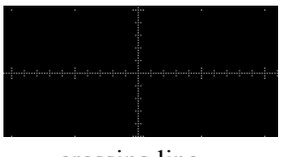
Picture 3-28 graticule set menu

Following the below steps to set graticule

1) press Display and F2 to enter "graticule" setting
2) press F1 to set graticule type, view picture3-29 and the frame type shows the border
3) Press F2 and select the graticule intensity and then press ∩ ∪ or roll the wheel to adjust graticule intensity.



Full



crossing line

grid

Picture 3-29 Graticule type

3.12.3 Persist adjustment

Active persist to delay waveform illumination's attenuation, the Time can be set as 100ms~10s,∞, or auto. Keep all the waveform illumination spots, until toggle the control setting to remove persist display.

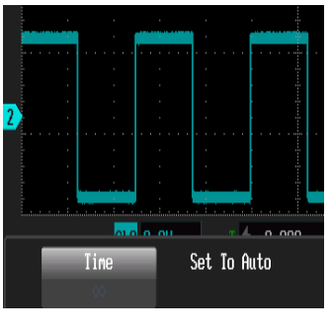
Tips for adjusting afterglow time: Singly press ∩ or ∪ for precise adjustment and long press ∩ or ∪ for rough adjustment

Following these steps for persistence settings

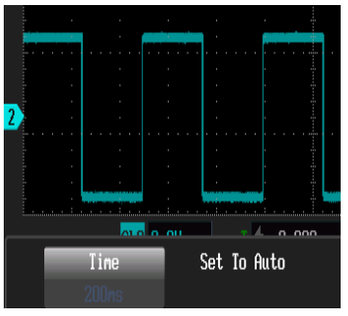
1) press Display F3 to enter persist set;

2) press F1 to persistence set and press or roll track-wheel to adjust the persistence time; press F2 to auto persist; Press F3 to erase persist.

persist time is ∞ shown in picture 3-30, persist time is 200ms shown in picture 3-31.



Picture 3-30 persist time ∞



Picture 3-31 persist time 200ms

3.12.4 Time base

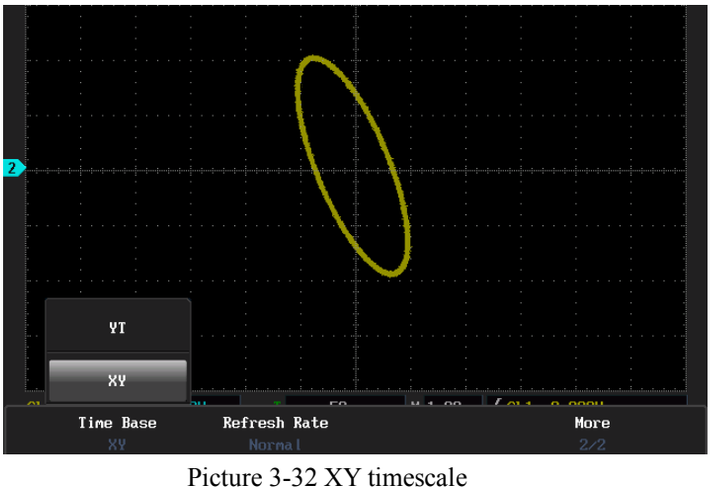
In the Time base menu, you can set the waveform display as YT or XY- mode. YT model shows the relative relationships between vertical voltage and horizontal time; in horizontal axis, XY mode shows as Ch1, and in vertical axis shows as Ch2.

The following functions are invalid in XY display:

- Reference& math waveform
- cursor
- Trigger control
- Auto

1) Following the steps to choose time base:

- press Display to enter display menu;
- Press F4 and F1 to select time base as XY, waveform is shown in picture 3-32.



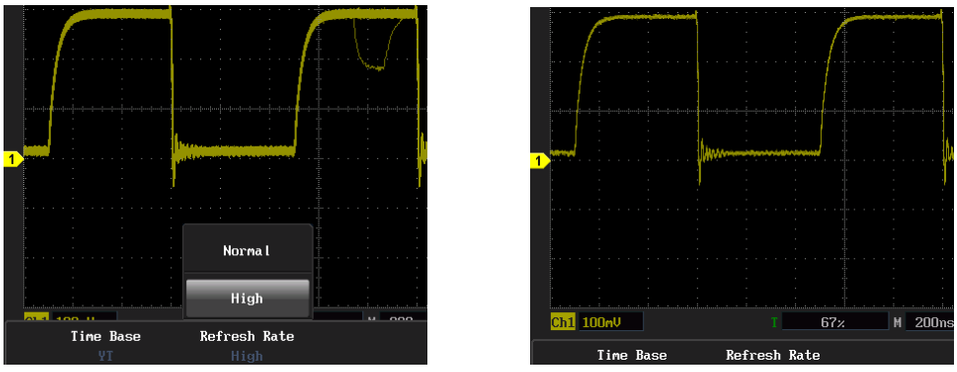
Picture 3-32 XY timescale

3.12.5 Adjusting refresh rate

High refresh rate of the oscilloscope will provide more signal character, and can greatly increase the probability of the oscilloscope to capture instantaneous abnormality, such as jitter, stunt pulse, low frequency disturbance and instantaneous error.

Please follow the steps for setting refresh rate

Press Display then F4 and F2 to adjust the refresh rate, high refresh, and normal refresh which are shown in picture3-33.



High refresh rate　　Normal refresh rate

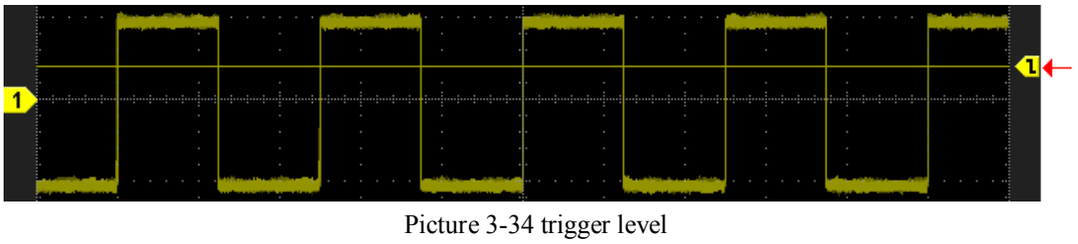
Picture 3-33 refresh rate

3.13 Set trigger menu

Press Trigger and F1 to enter the trigger type choice menu，there are five kind of trigger types available

1. Edge trigger：When the edge trigger signal reaches a certain given trigger level, then trigger happens.
2. Pulse width trigger：When signal of the pulse width reaches a certain given trigger condition and the signal voltage reaches the given trigger level, then trigger happens.
3. Logic trigger：When two channel levels satisfy a certain logic operation result, then trigger happens.
4. Serial bus trigger: serial decode and trigger for UART（RS232/RS422/RS485）/SPI/I2C/CAN/LIN.

Trigger level： Trigger level is the signal's voltage value which trigger event occurs, shown as . Press or roll the wheel to adjust trigger level，the screen will temporarily display a horizontal line to show the level position. See the trigger level at picture3-34（arrow shows the trigger level is horizontal line）.



Picture 3-34 trigger level

Trigger coupling mode：

DC	Let signal pass through AC and DC component
AC	Filter DC component from trigger signal
HF rejection	Reject the trigger signal which is higher than 35Khz
LF rejection	Reject trigger signal which is below 90KHz
Noise rejection	Reject high-frequency noise from trigger signal

Trigger mode：

Auto	No matter whether meet the trigger condition waveform displays. In a period if the instrument cannot reach the trigger condition, it can trigger automatically.
Normal	Only display When effective trigger event happens.
Single sequence	Trigger only signal times.

Trigger hold-off time：Rejection time refers to the hold time of oscilloscope retrigger. Before the end of the rejection, the oscilloscope won't trigger. Correctly set hold time can make complex

waveform trigger stable (e.g., pulse series). The trigger hold time can be set to 200 ns ~ 10 s.

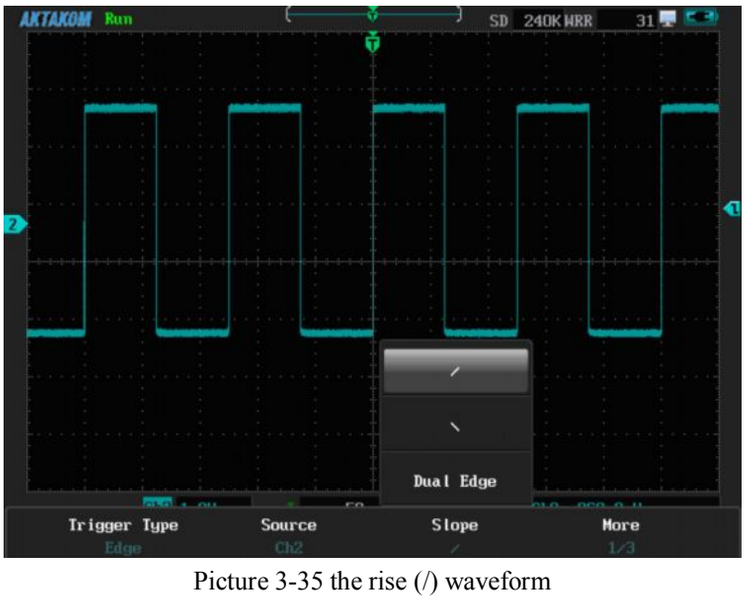
3.13.1 Edge trigger

When the signal meet the given edge trigger condition, and signal voltage reaches the given trigger level, then trigger happens. Edge trigger menu descriptions are shown as below table.

Trigger	Set	Descriptions
Trigger Source	Ch1	Set Ch1 as source trigger
	Ch2	set Ch2 as source trigger
	EXT	Set external signal as trigger signal source
slope	/	Set trigger on rising edge "/"
	\	Set the signal trigger \
	Dual edge	Set the signal in the rising and falling edge trigger

Set trigger on Ch2's rising edge, trigger mode as auto and trigger coupling as DC, refer to the following steps:

1) press Trigger and F1 to select the trigger type as edge
2) press F2 to select source signal as Ch 2
3) press F3 to set slope is "/"(rising edge)，press ∩ ∪ or roll the wheel to adjust the trigger level.
4) press F4 F2 to select coupling mode as DC；
5) Press F3 to select trigger mode as normal；
6) Press F4 and F2 to set the hold-off time and press ∩ ∪ or roll the wheel to adjust time，rise trigger(/) waveform is shown in picture 3-35.



Picture 3-35 the rise (/) waveform

Tips for adjusting rejection time： Singly press ∩ or ∪ for precise adjustment；Longing press ∩ or ∪ to rough adjustment.

EXT trigger refers to the external source as a trigger source; the external signal source can be square waveform, sine waveform, etc. Using external trigger, users should fisrtly connect the multimeter jack to signal source, then set trigger condition and trigger level according to the proper value of the signal source

Connect Ch1 to sine waveform, select external trigger, connect the signal source to square waveform (2.0V), select trigger condition as rising edge (/) and trigger level as 1.78V. Please follow these steps

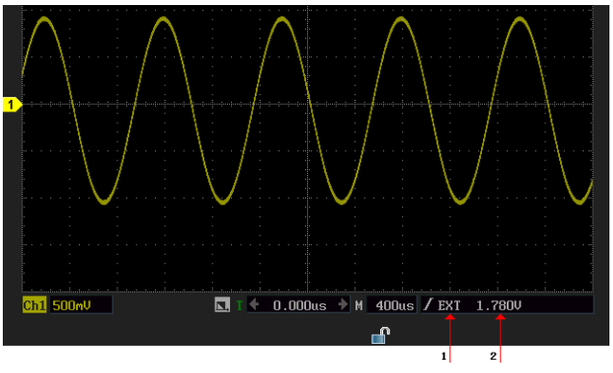
1) press Trigger and F1 to select trigger mode as edge trigger；
2) press F2 to select source as EXT；

3) press F3 to select slope as rise edge (/) and press or roll the wheel to adjust trigger level to 1.78V;

4) press F4 and F2 to select coupling mode as DC;

5) press F3 to select the trigger mode as normal;

6) press F4 and F2 to select "rejection time "and press or roll the wheel to adjust rejection time. The waveform is shown as picture3-36.



Picture 3-36 （EXT）trigger waveform

3.13.2 Pulse width trigger

When the trigger signal pulse width is 40 ns - 10 (s) and reaches the given condition and if the signal voltage reaches the trigger level, then trigger happens. Pulse width menu is shown in the table below:

Trigger configure item	options	Descriptions
Trigger source	Ch1	Set the Ch1 as trigger signal source
	Ch2	Set the Ch2 as trigger signal source
	EXT	Set external signal as trigger signal source
Polarity	positive	Set signal as positive polarity pulse width trigger
	negative	Set signal as negative polarity pulse width trigger
Conditions	< T	Trigger if the pulse width is less than T
	> T	Trigger if the pulse width is more than T
	= T	Trigger if the pulse width equals to T
	≠T	Trigger if the pulse width not equals to T

Notes: conditions of equals or not equals, indicating that the floating range is 5%

connect Ch2 to square waveform（amplitude=2.0V，frequency=2KHz），trigger type as the pulse width，conditions as≠1.0ms，trigger level as 0V，follow the steps as below：

1） press Trigger and F1 to select the trigger type as pulse width

2） press F2 to select trigger source as Ch2;

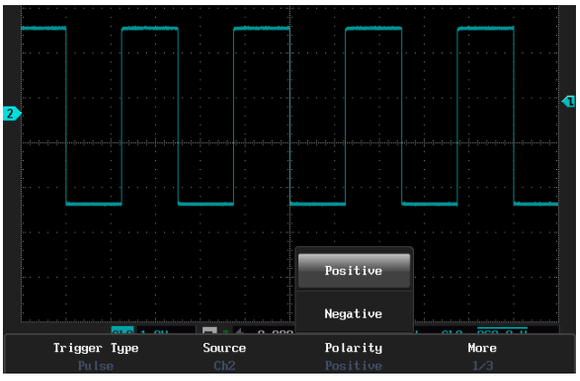
3） press F3 to select the polarity as positive;

4） Press to roll the wheel as the trigger level to 0V.

5） press F4 and F2 to select trigger condition as"≠" and press or roll wheel to adjust time as 1.0ms;

6） Press F3 to select trigger mode as normal;

7) press F4 and F2 to select rejection time and press or roll the wheel to adjust rejection time，positive polarity pulse width trigger waveform is shown in picture3-37.



Picture 3-37 positive polarity pulse width trigger

3.13.3 Logic trigger

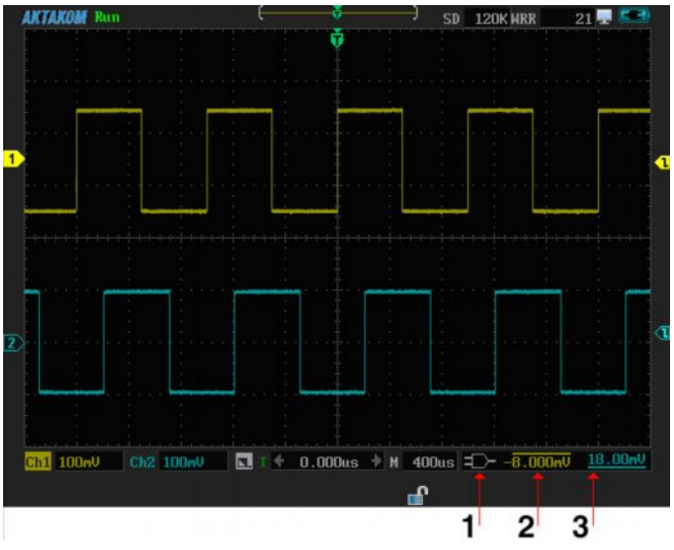
According to the given trigger level, firstly convert the two channels' sample values into logic value. If reaching the trigger condition, then trigger happens. Logic trigger menu's descriptions are shown in the table.

Trigger config items	options		Descriptions
Trigger source	**Ch1 logic**	low	If Ch1 lower than trigger level, set Ch1 as 1
		high	If Ch1 higher than trigger level, set Ch1 as1
	Ch2 logic	low	If Ch2 lower than trigger level, set Ch2 as 1
		high	If Ch2 higher than trigger level, set Ch2 as1
Logic operator	AND		The logic of two trigger sources as AND
	OR		The logic of two trigger sources as OR
	NAND		The logic of two trigger sources as "NAND"
	NOR		The logic of two trigger sources as "NOR"
Conditions	Change to true value		Trigger if the logic changes to true value
	Change to false value		Trigger if the logic changes to false value
	>、<、=、≠T		If logic status for hold time as>、<、=、≠, then trigger

If Ch1 logic as "high", Ch2 logic as "low", AND then trigger, follow the steps as below,

1) press Trigger F1 to select logic trigger
2) Press F2 to set Ch1as logic high
3) press F3 to enter Ch1logic level setting mode，then press ∩ ∪ or roll the wheel to adjust
4) press F4 and F2 to set Ch2 logic low
5) press F3 to set Ch2 logic level，press ∩ ∪ or roll the wheel for adjustment
6) press F4 and F2 to set logic operator as AND
7) press F3 to set trigger condition as true-value
8) press F4 and F2 to select trigger mode as normal
9) press F3 to select rejection time，then press ∩ ∪ or roll the wheel to adjust rejection time. Trigger logic waveform is shown in picture 3-38.

1. Logic trigger operation mode
2. Ch1 logic trigger level, the readout under the upper line means CH1logic as high.
3. Ch2 logic trigger level, the readout above the underline means CH2 logic as low.



Picture 3-38 logic trigger

3.13.4 Video trigger

Triggering on video signal field or line supports PAL, SECAM, NTSC, 720P, or1080P standard. It can trigger on different voltage scale, and users can adjust voltage gear to view waveform.

Video trigger menu descriptions are shown in the table below：

Trigger selections	Setting	Descriptions
Trigger source	Ch1	Set Ch1 as trigger signal source
	Ch2	Set Ch2 as trigger signal source
Polarity	positive	Set signal positive polarity trigger
	negative	Set signal negative polarity trigger
Standard	625/PAL	Base on PAL standard
	SECAM	Base on SECAM signal trigger
	525/NTSC	Base on NTSC signal trigger
	720P（50Hz，60Hz）	Base on 720P（50Hz，60Hz）signal trigger
	1080I（50Hz，60Hz）	Base on 1080I（50Hz，60Hz）signal trigger
	1080P（24Hz，25Hz，30Hz，50Hz，60Hz）	Base on 1080P（24Hz，25Hz，30Hz，50Hz，60Hz）signal trigger
Trigger on	Odd fields	Interlaced scanning signal trigger in odd fields
	Even fields	Interlaced scanning signal triggered in even fields
	All fields	Interlaced or non-interlaced scanning signal trigger in any fields
	All lines	trigger on line of signal.
	line	Signal trigger in a specified line

Ch2，positive polarity，video standard PAL，odd trigger，follow steps as below：

1) press Trigger and F1 to select trigger type as video trigger；
2) press F2 to select signal source as Ch2；
3) press F3 to select polarity as positive；
4) press F4 and F2 to select video standard as 625/PAL；
5) press F3 to select trigger **on** as odd fields；
6) press F4 and F2 to select trigger mode as “ abnormal”
7) press F3 to select rejection time，press or roll the wheel to adjust rejection time；Video standard PAL odd fields trigger is shown in 3-39.

Picture 3-39 arrow descriptions：

1 - video standard，upper-line means positive trigger，and under-line means negative trigger.

2 - indicating trigger condition mode

Picture 3-39 standard PAL odd fields trigger

3.13.5 Serial bus trigger（optional）

Refer to **Chapter Four Serial Bus Trigger and Decode.**

3.14 Using the vertical and horizontal button

1. Vertical button

Vertical scale adjustment 

: it can adjust vertical scale factor for all channels' waveform. press 

to adjust the vertical scale factor of the current channel，display the waveform on the screen properly. The range of 1:1 probe vertical scale factor is 5 mv/div ~ 50 v/div and the range of 1:10 probe vertical scale factor is 50 mv/div ~ 500 v/div, step by step of the way 1-2-5.

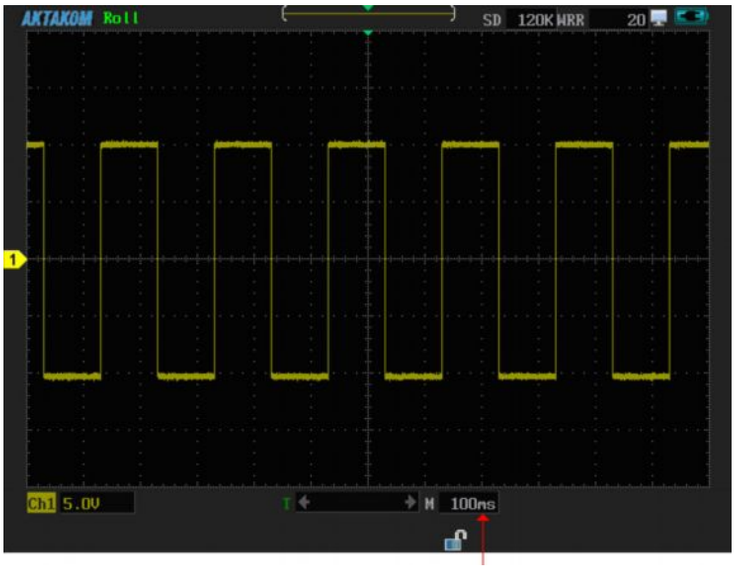
Vertical button 
: Adjust all vertical channel waveforms. Each pressing, the waveform of current channel will move one pixel; long press can make waveform position quick move. Before using the wheel to move waveform，users need to press the vertical  button，and then roll the wheel to up and down waveform.

2. Horizontal button

Horizontal button 

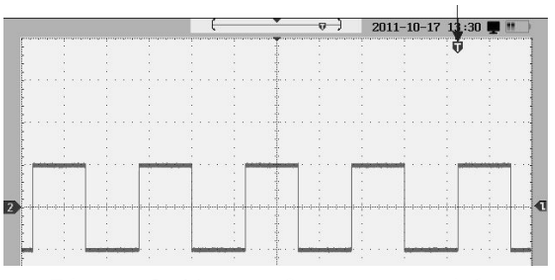
: simultaneously adjust the horizontal scale of all channels（horizontal time scale）. Horizontal time scale is 4ns/div～10s/div，step by step of the way 1-2-4.

When horizontal time scale is greater than or equals to100 ms, enter the roll mode, which is commonly used to observe waveform less than 2 Hz the roll mode is shown in picture3-40. (The left upper corner of the screen shows the rolling screen; arrow points the time scale is 100 ms).



Picture 3-40 roll mode

Horizontal button ◄ ►：Adjust all channels' horizontal positions, with each pressing, the waveform move one pixel and long pressing can make the waveform quick move. T on the screen is trigger position，if left/right move the waveform，the T position move left/right for user's needs. The waveform moves to right is shown in picture 3-41（arrow points trigger position).



Picture 3-41 waveform moves rightward

3.15 Use auto set

Pressing AutoSet and the instrument can automatically adjust the settings of vertical, horizontal scale and trigger to make waveform display properly. And it suits for single channel and multiple channels as well. Pressing AutoSet，at the upper left corner of the screen appears auto icon, indicates the instrument is in auto mode，re-pressing AutoSet to leave auto mode.

In auto mode：

- According to signal amplitude , the instrument can adjust the vertical scale automatically
- According to signal frequency, adjust horizontal time scale automatically
- According to signal amplitude, adjust trigger level automatically
- Manually adjust vertical scale factor, time base and the trigger level. Next change auto mode to manual mode.

Auto set function changes the instrument by the following ways：

- Sampling mode as normal
- The bandwidth limit sets to full bandwidth
- Invert **off**
- Delay **on**
- Trigger type as edge trigger
- Slope as rise (/)

- Trigger as DC coupling mode
- Trigger mode as auto
- Hold-off time as 200ns

3.16 Use math menu

1. Function of Math dual waveform calculation

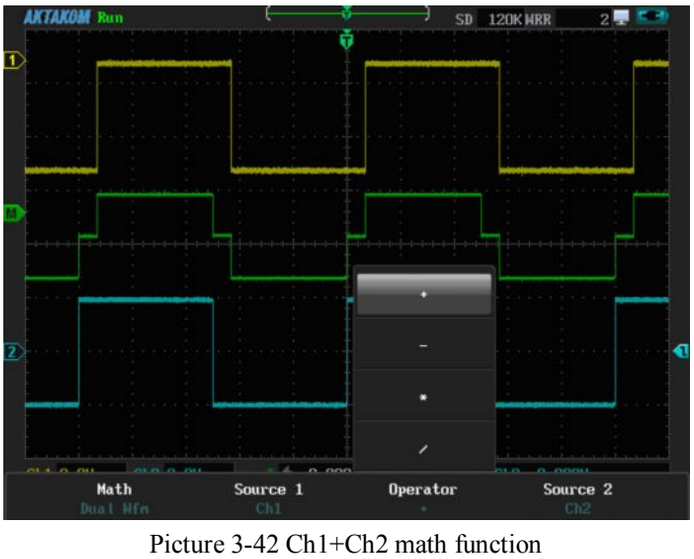
Press Math to open or close math waveform and set math waveform as current waveform. Press Math and F1 to set the channel as dual waveform calculation, signal source can be Ch1 or Ch2, math operation is shown in the following two waveforms.

operator	operation mode
+	source1 + source2
_	source1 - source2
*	source1 * source2
/	source1 / source2

NOTES： While math waveform displaying on the screen, make sure the waveform will not extend out of the top or bottom waveform window, if some waveforms are out of screen, the math waveform operation results may not correct.

Math waveform Ch1 + Ch2， follow the steps as,

1) press Math to enter math menu；
2) press F2 to select signal source as“Ch1”；
3) press F3 to select function as“+”；
4) press F4 to select signal source as“Ch2”； Then view the math waveform operation is shown in picture3-42.



Picture 3-42 Ch1+Ch2 math function

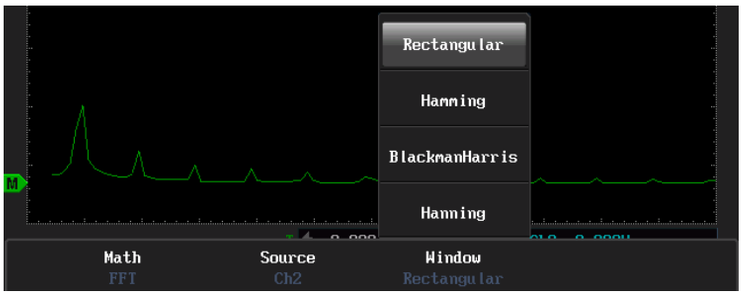
2. Use math function of FFT

Successively press Math and F1 to set math as FFT operation. Set Ch1 and Ch2 as signal source, by using the FFT operation; transform the waveform from time- domain to frequency-domain for waveform spectrum analysis. To reduce the effect of side-lobes (leakage), it is recommended to use auto-window; this will automatically adapt the waveform part that is analyzed to a complete number of cycles.

Select rectangular, hanning, hamming or blackmanharris window and ensure the entire waveform amplitude remains on the screen.

Rectangular window：

Trait: best analysis for frequency resolution, but not for amplitude resolution. It is recommended to measure transient or narrow pulse, composite sine waves which amplitude are almost equal and their frequency are very close，or relatively slow changed bandwidth random noise spectrum. As shown in picture 3-34.



Picture 3-43 FFT windowing

Hanning、hamming windows：

Better analysis for frequency rate, not for amplitude rate. hamming window frequency rate is better than hanning window. It is recommended to measure sine, cycle and narrow band random noise.

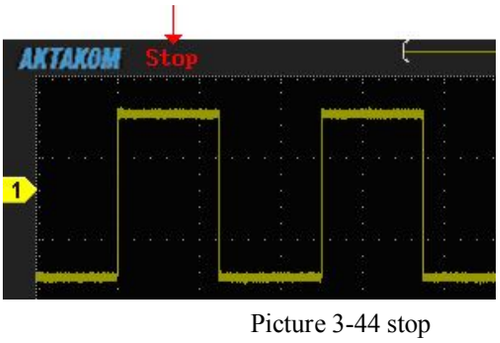
BlackmanHarris window：

Best analysis for amplitude rate, but not for frequency rate. It is recommended to measure single frequency signal, look for higher harmonics.

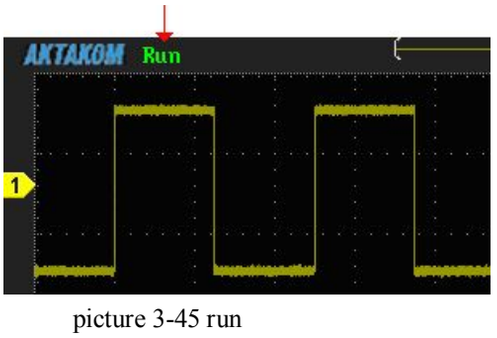
3.17 Run/stop button and single sequence

1. Run/stop button

Press Run Stop and switch oscilloscope's working state between stop and run. In stop state, the last waveform still displays on the screen. Stop state is shown in picture3-44（the top left corner shows a stop sign)，run state is shown in picture3-45（the top left corner shows run）.



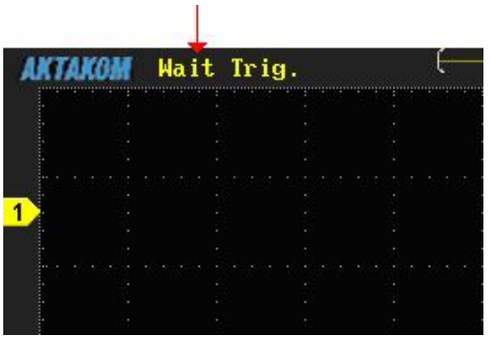
Picture 3-44 stop

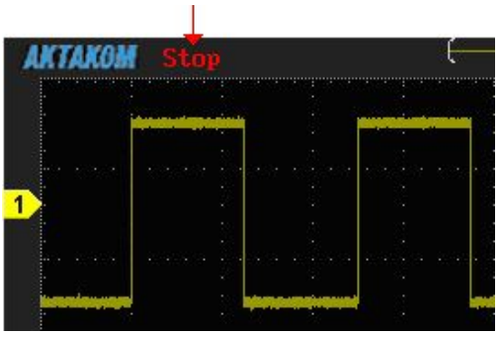


picture 3-45 run

2. Use single sequence to observe waveform

Press Single SEQ, and the signal is triggered after reaching the trigger condition; capture the waveform on the screen. Before triggering, the left upper corner of the screen display as wait trigger，shown as picture 3-46；after triggering，display stop，shown as 3-47. Repress Single SEQ to enter a state of continuous sampling.





Picture 3-46 wait trigger picture 3-47after trigger

3.18 Reference channel

Press Ref to open and close reference waveform, and set the reference waveform as the current waveform. After restoring the reference waveform can zoom, move or measure etc.

3.19 Use 50% shortcut

Use To 50% to quick adjust the trigger level, vertical position, trigger position, vertical cursor, horizontal cursor.

1.Quick adjust the trigger level to the center of the trigger source of waveform amplitude: press or , then press To 50%, The trigger level will automatically set in the center of the waveform

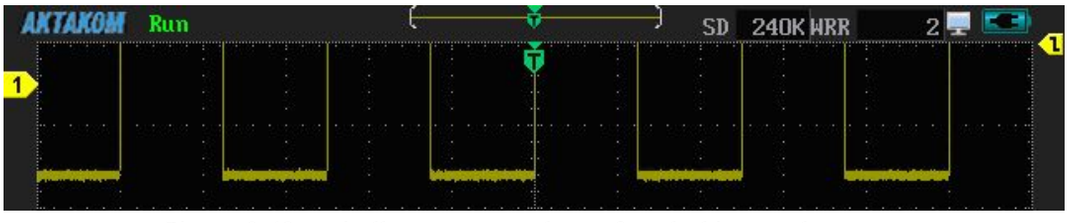
2.Quickly adjust the vertical position to the middle of the screen：Press then press To 50% to adjust zero level position of the current channel to the screen center.

3. Quickly adjust the trigger position to the middle of the screen：Press then To 50% to adjust the current channel's trigger position to the center of the screen.

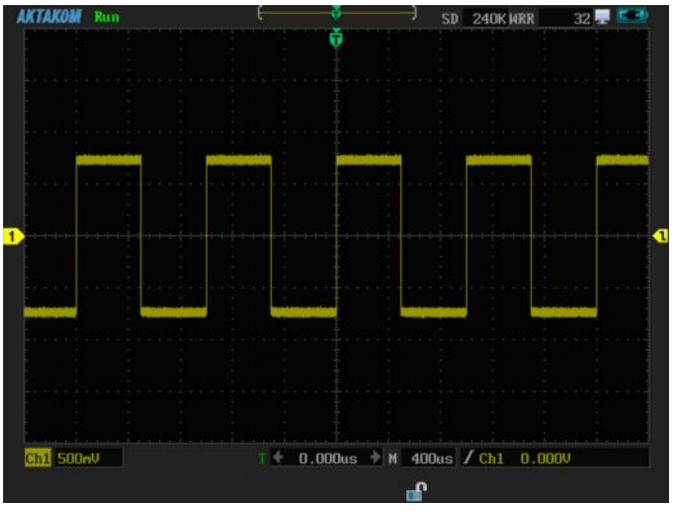
4.in Y-axis, quickly adjust the vertical cursors at left/right half screen to the middle: press Cursor to choose vertical cursor，then press To 50% to adjust the vertical cursor at left/right half screen to the middle.

5.in X-axis, quickly adjust the horizontal cursor at top/bottom half screen to the middle: press Cursor to choose horizontal cursor，then press To 50% to adjust the horizontal cursor at left/right half screen to the middle.

move the waveform out of range the screen shown in picture3-48, "TO after 50%"is shown in picture3-49.



Picture 3-48 vertically move upward waveform leaking out the screen



Picture 3-49 after using 50% shortcut

3.20 Use touch screen zoom waveform

Using the touch screen can easily zoom waveform to view waveform details, save operation time. Zooming operation only can be performed in the waveform zooming area.

Please follow these steps to use touch screen enlarge waveform,:

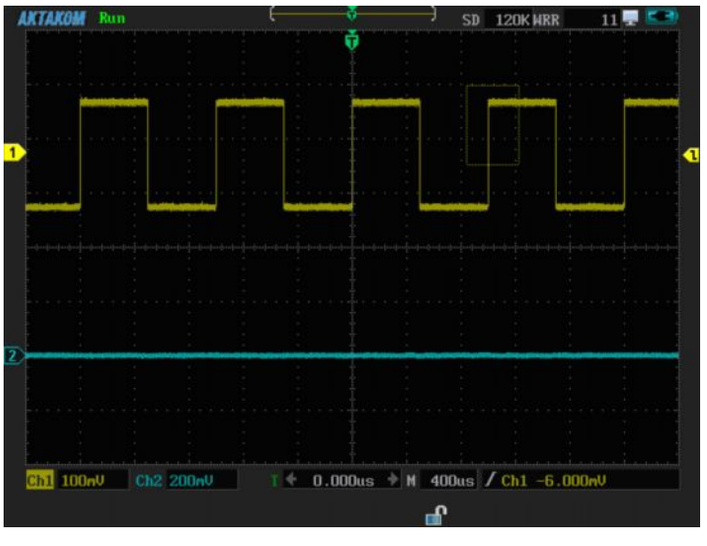
1.Press touch screen, select enlarge area in the upper left corner, and then drag the magnified area at the bottom right corner, rectangular frame appears in picture3-50

Note：Drag the touch screen from left to right to amplify waveform, and drag from right to left to shrink waveform.

2. Release the touch screen, waveform amplifies automatically. See picture 3-51

Rectangular frame selection：

Zoom ratio is associated with the size of the magnified area. The smaller of the size, the bigger of the ratio and vice versa. The center position of waveform in magnified zone that will be moved to the center of screen, vertical position remains the same. Make sure the position not move while zoom out



Picture3 -50 magnify selection area

Picture 3-51 magnified waveform

Chapter Four Serial Bus Trigger& Decode

This chapter contains the detailed information of serial bus decoding. Recommend you read this chapter carefully to understand the setting and operation of a handled multi-function oscilloscope bus trigger and decode.

This chapter mainly include the below contents:

- UART（RS232/RS422/RS485）bus trigger and decode
- LIN bus trigger and decode
- CAN bus trigger and decode
- SPI bus trigger and decode
- I2C bus trigger and decode

Press Scope then Trigger and F1 to select serial bus, enter serial bus decode mode, press F2 to select one kind of bus type，there are UART（RS232/RS422/RS485）/LIN/CAN/SPI/I2C five kind of types. Each one has two kind of display mode: graphic and raw text modes press Display to switch.

In serial bus decode mode:

- When the auto-set，measure, cursor, and reference math functions are out of use, the signal inversion function is also forbidden.
- Press the save/recall button can take snapshot of the screen
- When dual channels open, waveform drawing mode is “line”, the bandwidth as full bandwidth, the sampling mode as normal, the time base is YT-mode, refresh rate as high refresh rate, memory depth is 120 k
- If system in rolling in other modes switch to the serial decode, the time base automatically adjust to 40 ms(the maximum time base in the serial bus decode mode)

The bus type selection dialog is shown in picture4-1

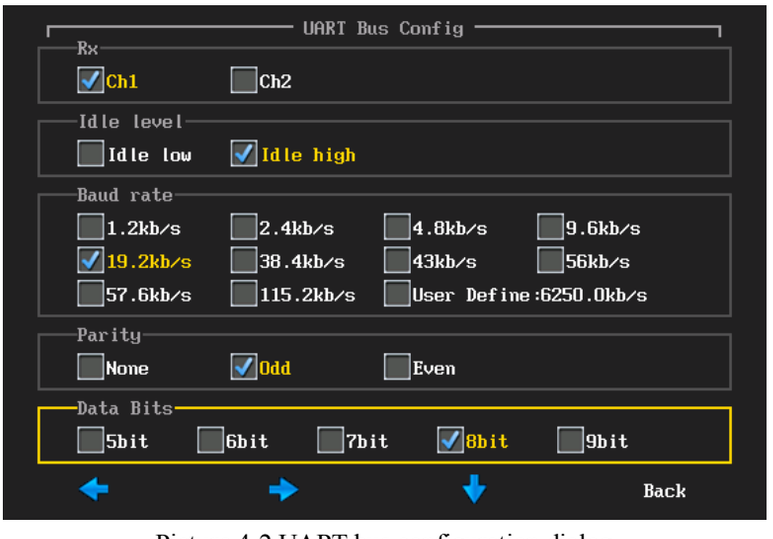
Picture 4-1 the bus type selection dialog

4.1 UART（RS232/RS422/RS485）bus trigger and decode

For correctly decoding UART（RS232/RS422/RS485）bus data and making trigger stable, users should adjust the bus configuration, trigger mode set and trigger level.

- **Bus configuration**

（1） Press F3 and then popup bus configuration dialog，set Rx channel，idle level，baud rate，parity，data bits, see picture4-2；



Picture 4-2 UART bus configuration dialog

Note： the yellow rectangle box means the selection is in set (√)means selected, in the above picture it is setting data bits，the selected Ch1,idle high ,19.2kb/s, odd and 8bit.

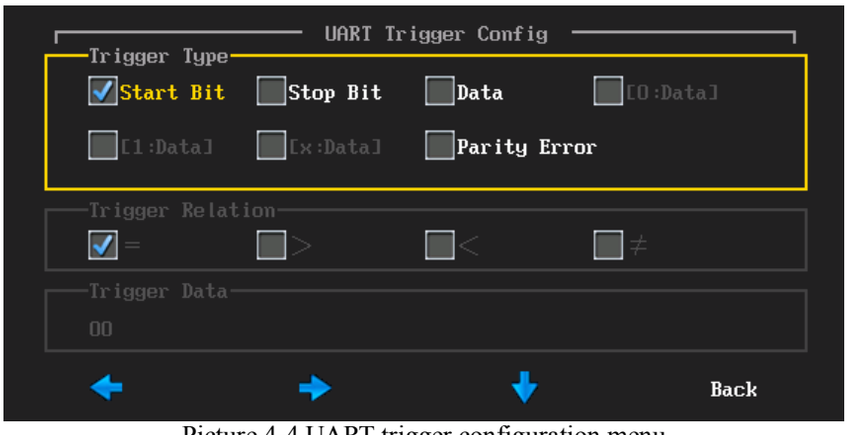
（2） Press F1 F2 to choose left/right keys respectively. Press F3 to move downward cycle，press F4 to return. Set baud rate, using the buttons for user define. Press or roll the wheel to adjusted value，if need user define, the touch screen pop up the virtual keyboard, at the user define area, input values, press **Enter** on the virtual keyboard. The virtual keyboard is shown in picture4-3.

Picture 4-3 virtual keyboard

Trigger mode

（1） press F4 to open the trigger configuration menu, set the trigger type, trigger relation

and trigger data，see picture4-4.



Picture 4-4 UART trigger configuration menu

（2） Press F1 F2 to select left/right respectively，press F3 to move downward cycle, press F4 to back；after selecting the trigger data，press or roll the wheel to adjust, or press the data on the touch screen, or use the virtual keyboard to modify；

UART trigger configuration menu descriptions:

a) Start bit — trigger at the start bit of the measured signal

b) Stop bit —trigger at the stop bit of the measured signal, no matter the measured signal uses 1, 1.5, or 2 stop bits not, the trigger will occur at the first stop bit.

c)【data】— Trigger at the specified data bit, when measured signal data bits are effective as five to eight bits, select the data, and select the trigger relationship as =, >, <, ≠, then select the trigger data, press or roll the wheel to adjust，or press the data on the touch screen, using the virtual keyboard to modify.

d)【0: data】—the measured signal data bits is nine . Only when the ninth bit is zero, then trigger. The trigger relation, trigger data configuration and data, trigger simultaneously.

e) 【1: data】—the measured signal data bits is nine . Only when the ninth bit is one, then trigger. The trigger relation, trigger data configuration and data, trigger simultaneously.

f)【x: data】—the measured signal data bits is nine . Only when the ninth bits is X, then trigger. The trigger relation, trigger data configuration and data, trigger simultaneously;

g) Parity error — parity bit is valid at parity error，trigger while parity error.

The measured signal data bits is 8bit, parity bit, odd,baud rate,19.2kb/s,trigger mode as start bit，follow the steps as below：

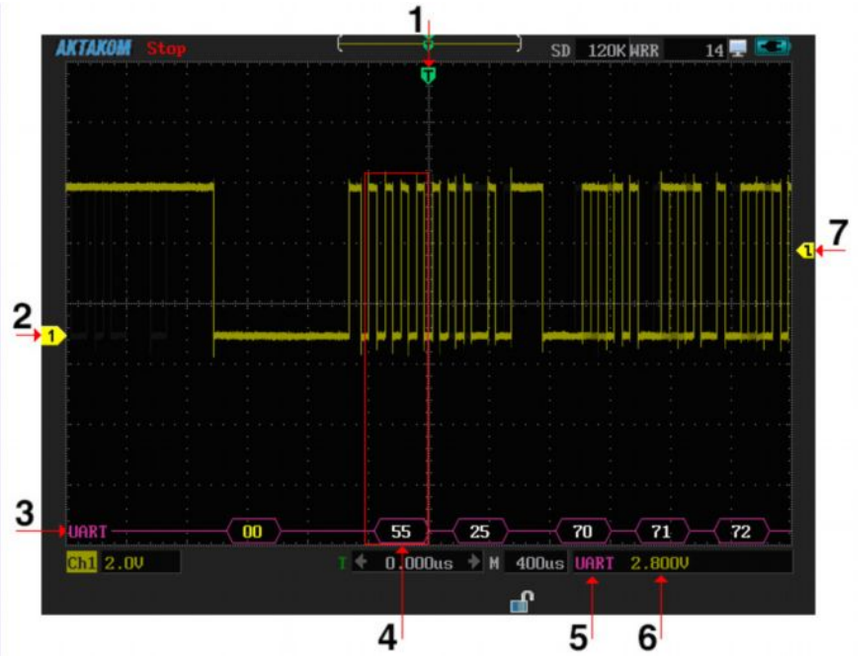
（1） in working mode，press Trigger，then press F1 to select the trigger type as serial bus.

（2） press F2 to select bus type as UART.

（3） press F3 to popup bus configuration menu, select Ch1,idle high, 19.2kb/s, odd, 9bit，then press F4 to back；

（4） press F4 to pop-up trigger mode Setting menu, press the start, then press F4 to back.

（5） according the signal amplitude to adjust trigger level,UART trigger graphical interface is shown in figure 4-5, text interface shown in figure 4-6.



Picture4-5 UART graphic interface

UART interface 1. Trigger position

2. Signal source Ch1

3. Decode packets

4. Decode the data and the corresponding waveform

5. Bus type

6.Trigger level value

7. Trigger level

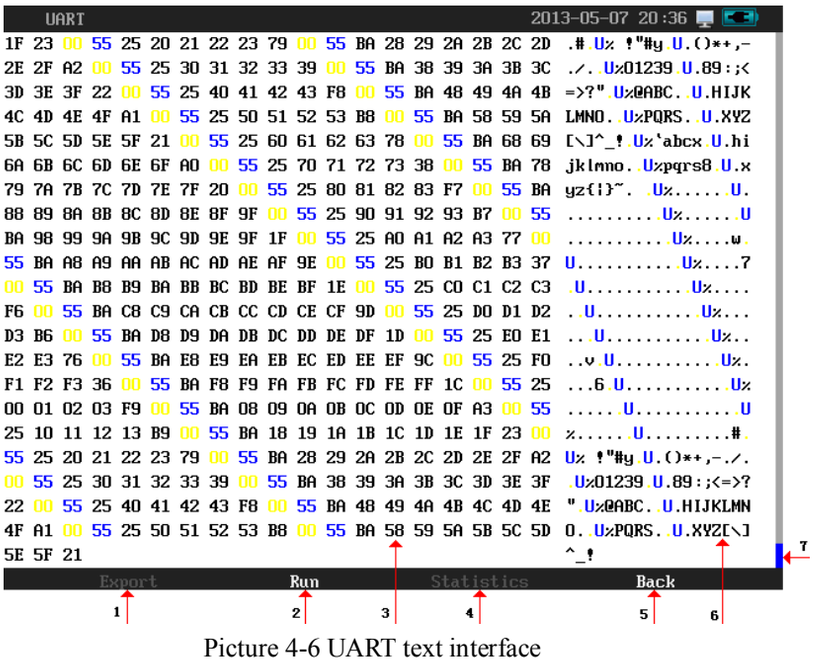
Description of decode content

（1）Decode packet displays real-time data about the bus activities

（2）the Decode data displays as hexadecimal system in white

（3）data bits is 5-8 bits, the decode data displays as two bits of hexadecimal, when data bits is 9, the decode data displays as 3 bits of hexadecimal, the ninth bit displays at the left side.

（4）Decode data appears error, if the error at stop bit, data displays in yellow, if parity error, data displays in red（5）when appear ?, Users need to press s ns to adjust the timescale, and then view the decode results.



Picture 4-6 UART text interface

Descriptions of UART text interface.

1. Export：Export data (after plugging USB device)
2. Run/stop：Run/stop decode
3. Area for decode data
4. Statistics: statistic the frame type, etc., only effective in CAN bus decoding mode
5. Return：Return to upper interface
6. The text data corresponding to ASCII(if the data bits is 9 bit and no parity error, ASCII is corresponding to the low 8 bit in the left side)
7. Roll bar

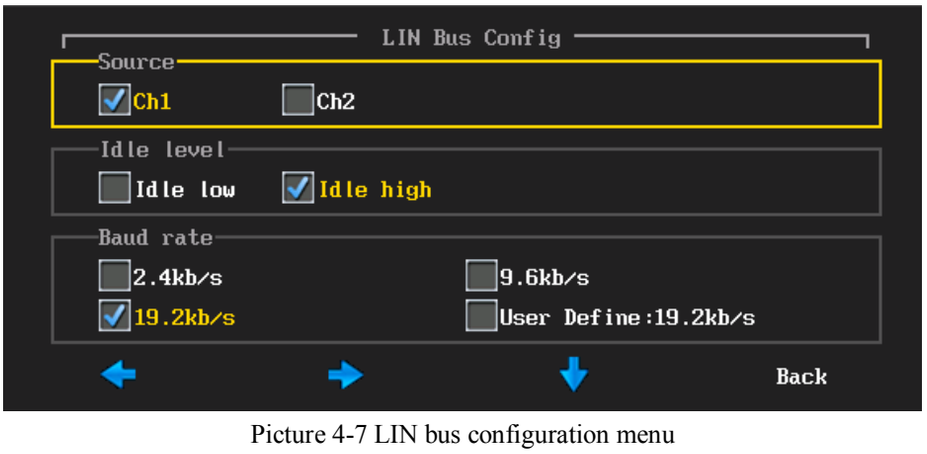
In decode data area, if the data reaches the trigger condition shown as blue ,the missing data at stop bit shown as yellow, the red is error-decode data.

4.2 LIN bus trigger and decode

For the correct decoding LIN bus data and making trigger stable, users need bus configuration, trigger mode configuration, and trigger level adjustment.

- **Bus configuration**

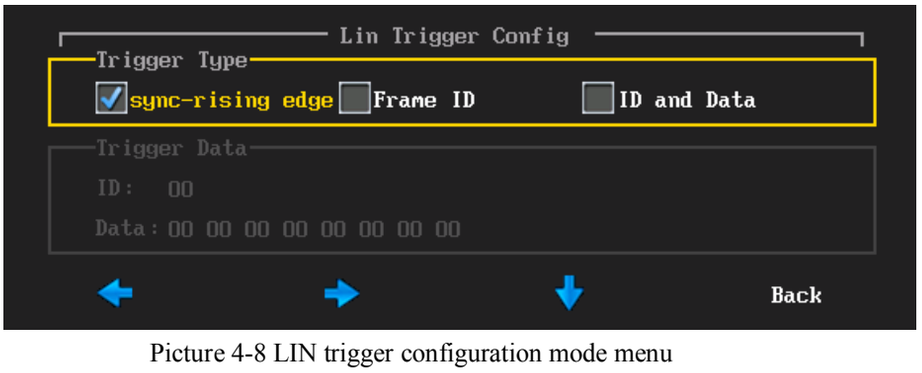
Press F3 to popup bus configuration dialog, set the signal source, the idle level, baud rate, the setting method is the same as the UART. See picture4-7.



Picture 4-7 LIN bus configuration menu

- **Trigger type**

Press F4 to pop-up trigger mode configuration dialog. Trigger types include sync- rising edge, frame ID and ID data, see picture4-8.



Picture 4-8 LIN trigger configuration mode menu

a) Sync-rising edge —when the sync interleaved of LIN bus is over, then appear sync-rising trigger.

b) Frame ID — the detected ID is equal to the frame trigger value. Select frame ID， press or roll the wheel to adjust, or press the data on the touch screen, using the virtual keyboard to modify.

c) Frame ID and data the detected ID and the data is equal to the trigger value. After selecting the frame ID and data, press the ID and data to set the ID and the data values. Connect Ch1to the measured signal, the idle level is high, the baud rate is 19.2 KB/s.

Please follow these steps to sync- rising edge type

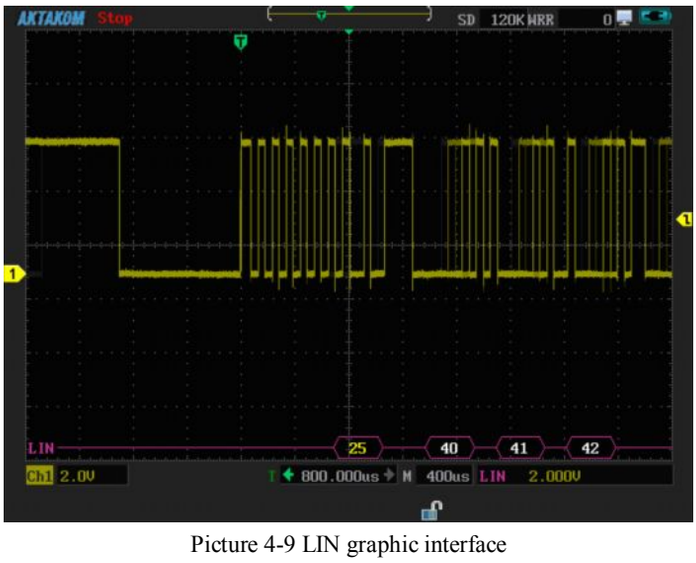
（1） In working mode，press Trigger，then press F1 to select trigger type as serial bus trigger；

（2） press F2 to select bus type as “LIN”；

（3） press F3，then popup bus configuration menu,successively pressCh1,idle high,19.2kb/s，then press F4 to return；

（4） press F4，then popup configuration of trigger type，select sync- rising edge，then press F4 to back.

（5） according signal amplitude to adjust the trigger level, LIN trigger interface as shown in figure4-9，text interface as shown in picture 4-10.



Picture 4-9 LIN graphic interface

Description of LIN decode

（1）Decoding packet displays real-time data contents of bus activities

（2）Decode data displays as hexadecimal

（3）Frame ID displays as yellow, data displays in white and the sum of parity displays in green, red for the sum of parity error.

（4）when appear ?, need press s ns to adjust time scale, and then view the results.

LIN 2013-05-07 20:42

Time (ms)	ID	Data	Check Sum	Trig
7.17	3A	38 39 3A 3B 3C 3D 3E 3F	22	Yes
8.06	25	40 41 42 43	F8	Yes
7.17	3A	48 49 4A 4B 4C 4D 4E 4F	A1	Yes
8.19	25	50 51 52 53	B8	Yes
7.17	3A	58 59 5A 5B 5C 5D 5E 5F	21	Yes
8.19	25	60 61 62 63	78	Yes
7.04	3A	68 69 6A 6B 6C 6D 6E 6F	A0	Yes
8.19	25	70 71 72 73	38	Yes
7.17	3A	78 79 7A 7B 7C 7D 7E 7F	20	Yes
8.19	25	80 81 82 83	F7	Yes
7.17	3A	88 89 8A 8B 8C 8D 8E 8F	9F	Yes
8.06	25	90 91 92 93	B7	Yes
7.17	3A	98 99 9A 9B 9C 9D 9E 9F	1F	Yes
8.19	25	A0 A1 A2 A3	77	Yes
7.17	3A	A8 A9 AA AB AC AD AE AF	9E	Yes
8.19	25	B0 B1 B2 B3	37	Yes
7.17	3A	B8 B9 BA BB BC BD BE BF	1E	Yes
8.06	25	C0 C1 C2 C3	F6	Yes
7.17	3A	C8 C9 CA CB CC CD CE CF	9D	Yes
8.19	25	D0 D1 D2 D3	B6	Yes
7.17	3A	D8 D9 DA DB DC DD DE DF	1D	Yes

Export Run Statistics Back

Picture 4-10 LIN text interface

Description of LIN text interface

（1）Time：Time intervals between the last frames to current frames

（2）ID：Frame ID valu

（3）Data：Frame data

（4） Parity sum： frame parity sum，the sum of parity error displays in red

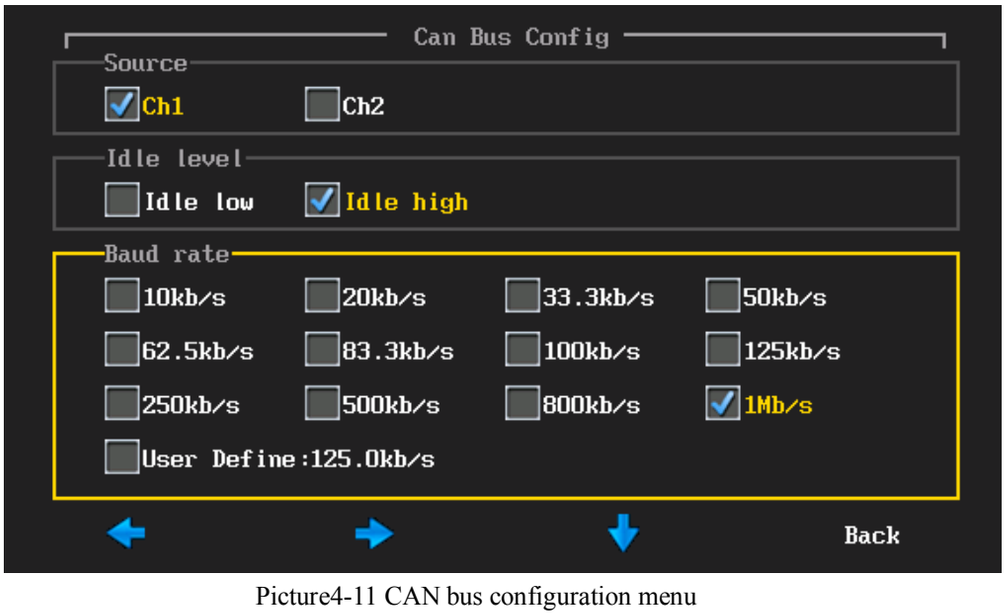
（5）Trigger：Yes means the frame reaches trigger condition

4.3 CAN bus trigger and decode

For the correct decoding CAN bus data and making trigger stable, need bus configuration, trigger configuration type, and adjustment trigger level.

- **Bus configuration**

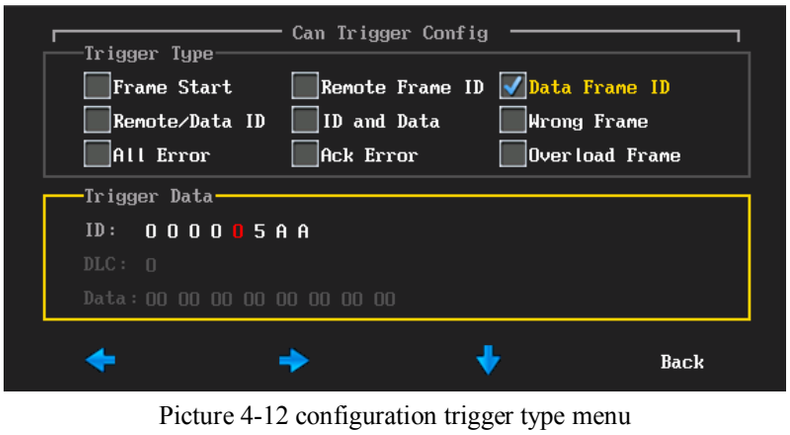
Press F3 to Popup bus configuration menu, users need to set the signal source, idle level, baud rate; Setting method is the same as the UART, picture4-11.



Picture4-11 CAN bus configuration menu

- **Trigger type**

Press F4 to popup trigger typesetting menu，picture 4-12



Picture 4-12 configuration trigger type menu

Description of trigger mode menu

a) frame start— trigger at the start of the frame

b) Remote frame ID — setting the ID matches the remote frame trigger. After selecting the remote frame ID, and then set the ID value at the bottom of the trigger data area.

operation instructions：press F1 to left selection，press F2 to right selection，then press or roll the wheel to set frame ID value, then press F4 to back. Users can press the numbers on the touch screen or use the virtual keyboard to set.

c) Data framed ID — setting ID that matches the data frame trigger. Data frame ID configuration mode with the remote frame ID at the same configuration

d) Remote frame/data frame ID — the frame set ID that matches the remote or data frame. Remote frame/frame ID configuration with the remote data frame ID at the same configuration

e) Data frame ID and data ID — setting the ID data matches data frame ID. The configuration method is the same as remote frame ID configuration;

f) Wrong frame —wrong frame CAN trigger

g) All error—trigger when any error format or activity

h) Ack error— recessive Ack position trigger

i) Over load frame —overload frame CAN trigger

Ch1 connect to measured signal channel, the idle level is high, 1 MB/s baud rate; frame start as the trigger mode, Please follow these steps：

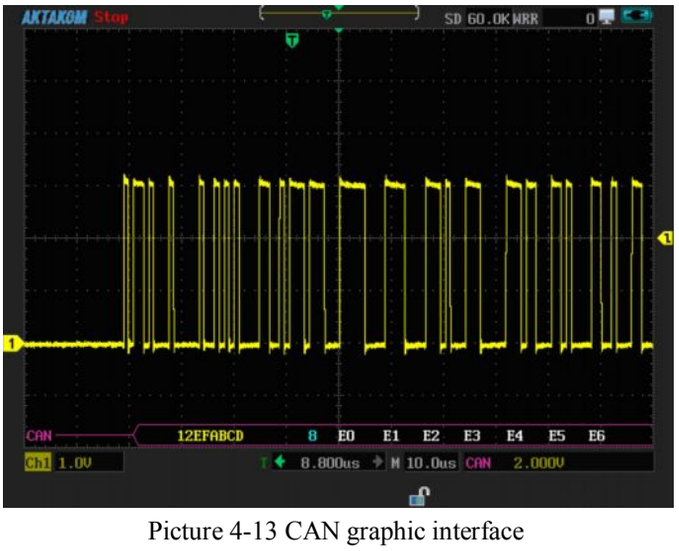
（1） In working mode，press Trigger then F1，select the trigger type as serial bus

（2） press F2 to select bus type as CAN

（3） press F3 to popup the CAN bus configuration menu，successively pressCh1then idle high, 1Mb/s ,press F4 to back

（4） press F4 to popup configuration trigger mode menu，press frame start

（5） Based on signal amplitude to adjust the trigger level.CAN trigger interface is shown in figure 4-13. Text interface is shown in figure 4-14.



Picture 4-13 CAN graphic interface

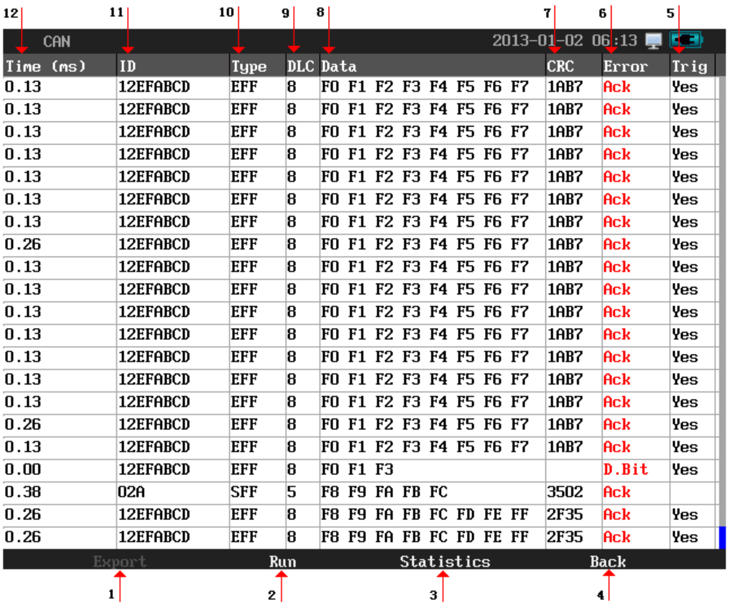
Instruction of CAN decode data packet：

（1）decode packet displays instantaneity data content of bus activity

（2）Decode data displays as hexadecimal.

（3）Frame ID displays in yellow, the data in white , the DLC and CRC code display in green, the frame error displays in red E

（4）when appear ?, need press s ns to adjust time scale，then view the decode results. When appear ! , means the decode packet of the bus waveform is not complete, so data does not display properly.

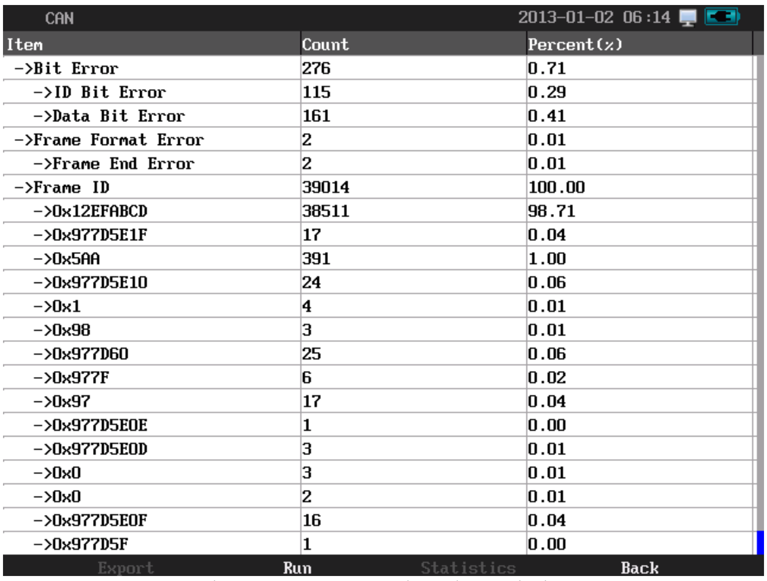


Time (ms)	ID	Type	DLC	Data	CRC	Error	Trig
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.26	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.26	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.13	12EFABCD	EFF	8	F0 F1 F2 F3 F4 F5 F6 F7	1AB7	Ack	Yes
0.00	12EFABCD	EFF	8	F0 F1 F3		D.Bit	Yes
0.38	02A	SFF	5	F8 F9 FA FB FC	3502	Ack	
0.26	12EFABCD	EFF	8	F8 F9 FA FB FC FD FE FF	2F35	Ack	Yes
0.26	12EFABCD	EFF	8	F8 F9 FA FB FC FD FE FF	2F35	Ack	Yes

Picture 4-14 CAN text interface

CAN text interface description:

1. Export: after plugging USB, can export data
2. Run/stop: run/stop decode
3. Statistics: statistic frame type, data bit and trigger count and percentage. As shown in picture4-15
4. Back: back to graphic pattern
5. Trigger: Yes means the frame conforms to trigger condition
6. Error: includes response error, bit stuff error, format error and CRC error
7. CRC: the frame parity code
8. Data: refer to frame data
9. DLC: when the frame send data bit or remote frame， user can ignore this value
10. Type: includes types of the frame， SFF means standard data frame and SRF is standard remote frame , EFF is extension data frame, ERF is the extension of remote fram
11. ID: CAN frame ID value， displays as hex， max is 29 bit
12. Time: means the time interval between the last frames to current frame.



Item	Count	Percent(%)
->Bit Error	276	0.71
->ID Bit Error	115	0.29
->Data Bit Error	161	0.41
->Frame Format Error	2	0.01
->Frame End Error	2	0.01
->Frame ID	39014	100.00
->0x12EFABCD	38511	98.71
->0x977D5E1F	17	0.04
->0x5AA	391	1.00
->0x977D5E10	24	0.06
->0x1	4	0.01
->0x98	3	0.01
->0x977D60	25	0.06
->0x977F	6	0.02
->0x97	17	0.04
->0x977D5E0E	1	0.00
->0x977D5E0D	3	0.01
->0x0	3	0.01
->0x0	2	0.01
->0x977D5E0F	16	0.04
->0x977D5F	1	0.00

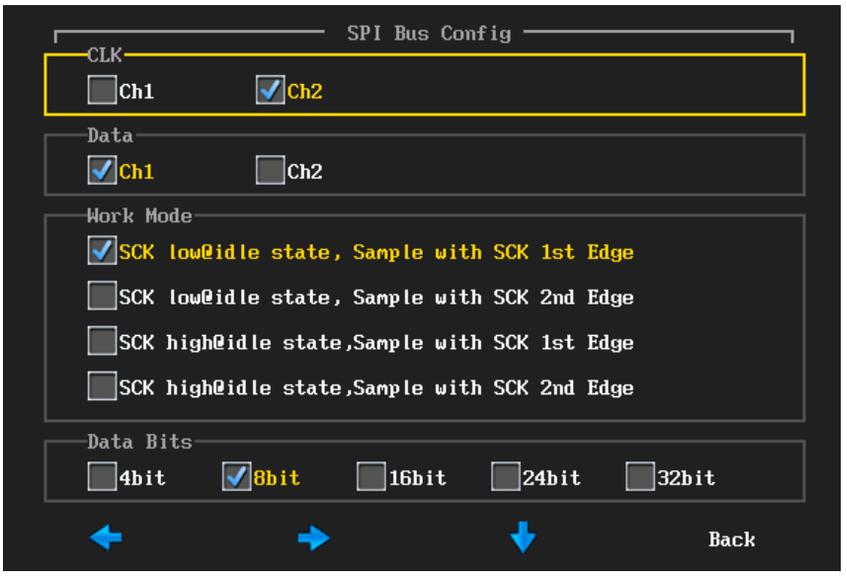
Picture 4-15 CAN decode statistics

4.4 SPI bus trigger and decode

For the correct decoding SPI bus data and making trigger stable, bus configuration, trigger type configuration and trigger level adjustment are needed.

- **Bus configuration**

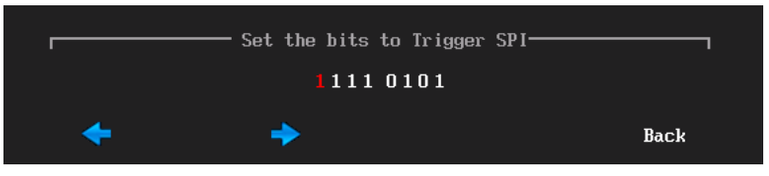
（1）press F3 to popup bus configuration, then user need set the clock source(CLK),data source, work mode and data bits. As shown in figure4-16.



Picture 4-16 SPI bus configuration menu

- **Trigger mode**

press F4, popup trigger mode configuration menu, shown in picture 4-17.



Picture 4-17 SPI matching bit settings menu

The method for operation is same as configuration of CAN and frame ID.

Notes: According the bus decode to set data bits, if the data bits matches the given bits can realize trigger.

Measured signal length is 8 bit; trigger mode matching bit is11110101,Ch2 connect to CLK, Ch1 connect to DATA, bus is idle for low level, Please follow these steps for clock rising sample;

（1）In working mode, press Trigger, then press F1, select the trigger type as serial bus

（2）press F2 to select bus type as SPI

（3）press F3 to enter the bus configuration menu, successively press the CLK of Ch2, data as Ch1, work mode as SCK low idle state, sample with SCK its edge, data bits is 8bit, after finishing set then press F4 to back to upper menu.

（4）press F4 to enter the bit matching menu, press the data on the touch screen, Using the virtual keyboard to set the matching bit is 11110101; According the signal amplitude to adjust the two channels' trigger level; SPI trigger interface is shown in picture4-18.

Picture 4-18 SPI trigger graphic interface

Description of SPI decoding（1） decode packet displays the real-time data content of bus activity

（2）decode data displays as hexadecimal system

（3）data displays in white

（4） when appear?, need to press s ns to adjust time scale，then view the decode results.

SPI 2013-01-02 06:34

Time (ms)	Data	Trig
0.00	C4	
0.00	02	Yes
0.00	30	
0.00	08	
0.00	42	
0.00	97	
0.00	6B	
0.00	AB	
0.00	CD	
0.00	08	
0.00	C0	
0.00	C1	
0.00	C2	
0.00	C3	
0.00	C4	
0.13	C5	
0.00	C6	
0.00	C7	
0.00	02	Yes
0.00	40	
0.00	08	

Export Run Statistics Back

Picture 4-19 SPI text interface

SPI text interface specification：（1）Time: Intervals from the last frame to current frame

（2）Data：According the decode data bits display decode data. Such as, the data bits is 8 bits, can only display 1 byte on data bar. If data bits are 16 bits, the data bar shows 2 bytes; 24 data bits display 3 bytes; Data bits are 32 bits, then 4bytes.

（3）Trigger：Yes means the frame reaches the trigger condition.

Notes：Single frame refers to the measurement of settled data bits; it can meet a data bit code stream

4.5 I2C bus trigger and decode

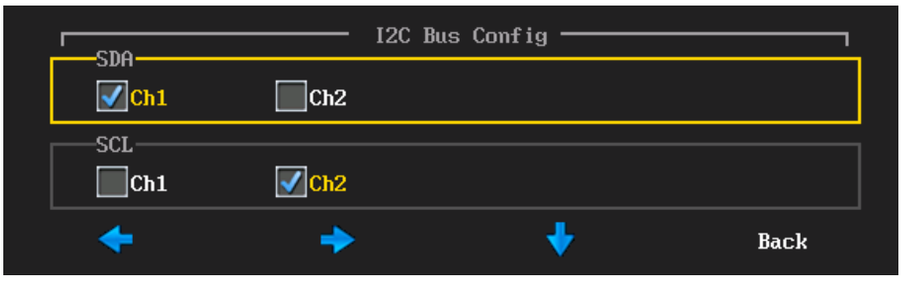
For the correct decoding 12C bus data and making trigger stable, user need adjust bus configuration, trigger mode configuration and trigger level.

- **Bus configuration**

Bus configuration includes the serial clock (SCL) and the serial data (SDA) corresponding to the channel settings.

press F3，then popup bus configuration menu，press the channel on the touch screen or use a

function button to set. As shown in picture 4-20.

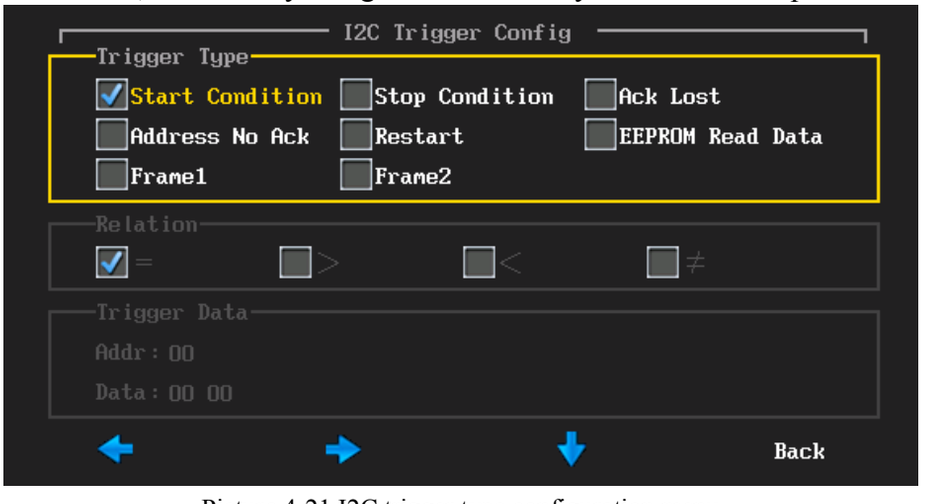


Picture 4-20 I2C bus configuration

Notes: When finish the setting of SCL or SDA channel, the system will automatically set other channels.

- **Trigger type**

press F4 to popup trigger type configuration menu，press the trigger type and trigger relation on touch screen, or select by using the function keys，as shown in picture 4-21.



Picture 4-21 I2C trigger type configuration menu

Specification of trigger type menu:

a) Start condition — when SCL is high, the SDA displays fall trigger(includes restart)

b) Stop condition — when SCL is high, the SDA displays rise trigger

c) Ack Lost —bus Ack high level trigger

d) Address no Ack —trigger at the setting address no Ack(ignoring W/R), select the trigger data address, press or roll the wheel to set data value，users can also press the address or data on touch screen or use the virtual keyboard to set data value.

e) Restart — trigger before the stop condition appears a new restart condition.

f) EEPROM read data — when the read operation which contains 1010xxx control byte of the EEPROM appears on the bus and the ACK is correct, then the instrument can capture the read data, if the capture data and the set data accord with the given relation condition, trigger after data byte confirms the clock edge. After selecting EEPROM read data, then press the relationship by "=" ">" < ", "≠", the methord is same as the address no ACK set.

g) Frame type 1 — start + address 7+ read/write+ confirm +data; If all bits of the frame types match, on the 17th clock edge, trigger at the address 7 frame of read/write

Frame type 1 operation method: select the value behind the address/data, press or roll the wheel to adjust value; Select the value behind the address/data on the virtual keyboard.

h) Frame type 2, start + address7 + read/write + confirm + data1 + data2;

If all bits of the frame type match, then on the 26th clock edges, trigger at the address 7 frame of read/write. The configuration frame type 1 is the same as the operation method of

the 2 frame.

Trigger mode is the start condition，SCL connect to Ch2，SDA connect to Ch1 follow these steps as below：

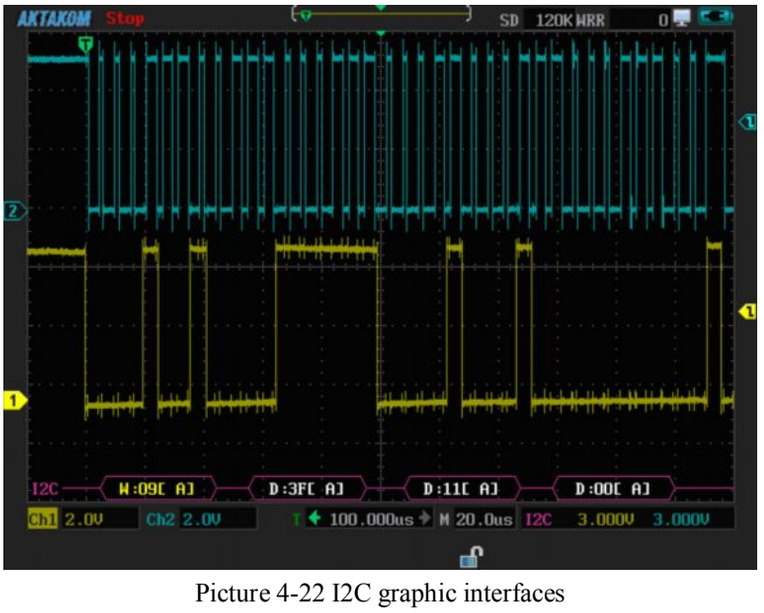
（1） In work mode, press Trigger，then press F1，select the trigger type as serial bus

（2） press F2 to select bus type as I2C

（3） press F3 to popup bus configuration menu，then select the SCL as Ch2，at last press F4 to back to upper menu；

（4） press F4 to popup trigger mode of configuration menu, press start condition on touch screen , the set is finished, then press F4 return to upper menu；

（5） according the signal amplitude to set the two channels' trigger level.I2C trigger interface is shown in picture4-22，text interface is shown in picture4-23.



Picture 4-22 I2C graphic interfaces

Description of I2C decode content（1）Decode packet displays the real-time data content of bus activity

（2） the decode data displays Hexadecimal system

（3）address content shown in yellow, data in white W means work，R means read，D means decode，~A means Ack.

（4） when appear ?, need to press s ns to adjust time scale, then view the decode results.

I2C 2013-01-02 06:42

Time (ms)	Addr	Data	Ack	Trig	ReSet
0.64	50R	43 44 45 46 47 48 49 4A 4B 4C 4D	X	Yes	Yes
14.21	09W	3F 4E 00		Yes	
0.13	09W	3F		Yes	
0.13	09R	4E 4F	X	Yes	
0.13	50W	00 00		Yes	
0.64	50R	50 51 52 53 54 55 56 57 58 59 5A	X	Yes	Yes
14.34	09W	3F 5B 00		Yes	
0.00	09W	3F		Yes	
0.26	09R	5B 5C	X	Yes	
0.13	50W	00 00		Yes	
0.64	50R	5D 5E 5F 60 61 62 63 64 65 66 67	X	Yes	Yes
14.21	09W	3F 68 00		Yes	
0.13	09W	3F		Yes	
0.13	09R	68 69	X	Yes	
0.26	50W	00 00		Yes	
0.64	50R	6A 6B 6C 6D 6E 6F 70 71 72 73 74	X	Yes	Yes
14.21	09W	3F 75 00		Yes	
0.13	09W	3F		Yes	
0.13	09R	75 76	X	Yes	
0.13	50W	00 00		Yes	
0.64	50R	77 78 79 7A 7B 7C 7D 7E 7F 80 81	X	Yes	Yes

Export Run Statistics Back

Picture 4-23 I2C text interface

Description of I2C text interface（1）Time: Intervals between the last read/write operations to current read/write operations

（2）Address in address bar the "R means the read operation, the "W" means write operation

（3）Ack: in Ack bar “x”meansAck lost

（4）Data: data bar

（5）Trigger: Yes means reach trigger condition

（6）Restart: Yes means reach restart condition

Chapter Five Applied Examples

This chapter mainly introduce five common applications：

- Measure simple signal
- Capture single pulse signal
- Analysis signal detail
- trigger on video signal
- use math FFT

Each application example highlights the different characteristics of the oscilloscope; user can get familiar with the operation of oscilloscope through these application examples.

5.1 Measure simple signal

Observe the signal waveform in the circuit and connect to the oscilloscope to quick display signal; Auto-measure frequency, cycle, the average and peak - peak; the cursor is used to measure the peak and decay period.

1.Follow these steps for quick display signal waveform，：

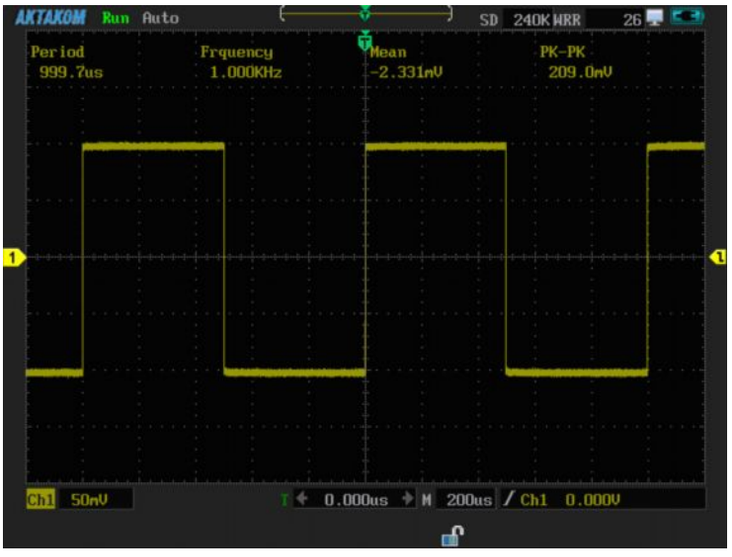
1) connect Ch1to the measured signal;
2) press Ch1 to switch Ch1 as the current channel（if Ch1 is already current, ignore this step）;
3) press AutoSet, then Oscilloscope auto set vertical, horizontal and trigger; Users can also manually adjust the vertical and horizontal gear until the displaying waveform conforms to your requirements.

2. Auto-measurement

Oscilloscope can auto-measurement for most signals, like signal frequency, period, the mean and peak - peak, follow these steps

1) Press Measure, then display the measure type menu.
2) By pressing on the touch screen to select period, frequency, mean，peak-peak there are four measurement options.
3) Press Trigger then F2 then select trigger as Ch1
4) press AutoSet

After finishing auto-measure, the results show on the screen, as shown in picture5-1.

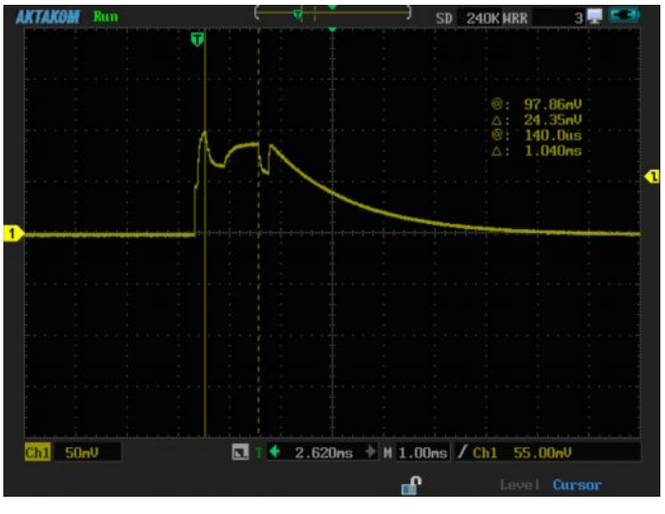


Picture 5-1 auto-measure

3. Cursor measurement

Using the cursor for quick measure waveform， follow these steps to measure burst pulse.

1) press Cursor to open cursor menu
2) press F2 to select the vertical cursor
3) press MENU OFF to close the cursor menu
4) press to move the cursor to the first wave of the first peak（notes：before moving the cursor should test the Cursor brightness on screen， if not， press F4 to switch）
5) press MENU OFF to open cursor menu
6) Press F3 to select the second cursor
7) Press to move cursor to the second waveform attenuation after the second peak; the pulse peak is 9.593 V, decay period is 3.160 us, as shown in picture5-2.



Picture5-2 cursor measure

5.2 Capture single pulse signal

Capturing the pulse, burr and non-periodic signal are the advantage of digital oscilloscope. If you capture a single signal, require some knowledge of signal and then you can correctly set trigger level and trigger. For instance, pulse is a TTL level logic signal, trigger level should be set to 2v, and the trigger mode is set as rising trigger. If you are not sure about the signal, you can identify the trigger level and trigger through the automatic mode.

Capturing single pulse signal should follow these steps.

1) connect Ch1 to signal

2) successively press Scope F2, then select sampling mode as peak

3) press Trigger to open the trigger menu

4) press F1 to select the trigger type as the edge trigger

5) Press F2 to select signal source as Ch1

6) Press F3 to select slope as the rise, then press ∩ ∪ or roll the wheel to adjust the trigger level.

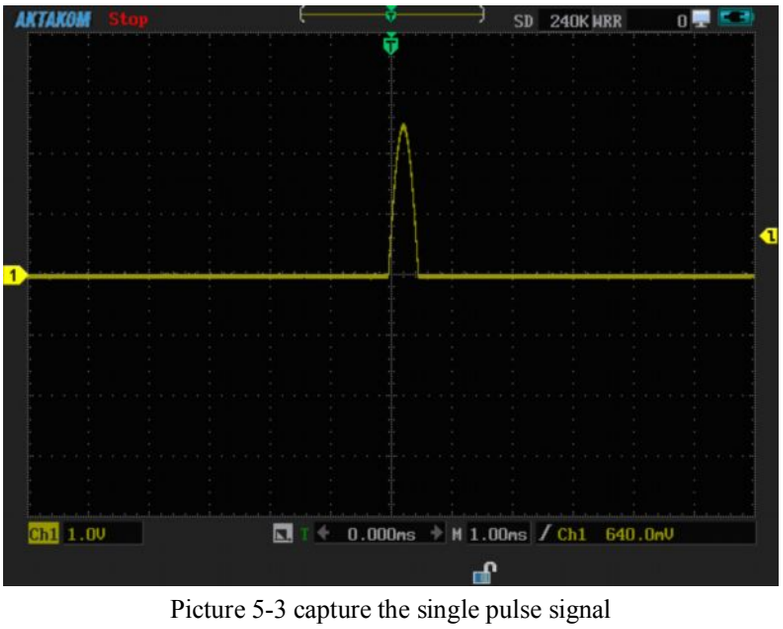
7) Successively press F4 F2 to select the coupling way as DC

8) Press F3 to select the mode as auto

9) Successively press F4 then F2 to set the rejection time as 200ns

10) Press Single SEQ to wait for trigger and capture pulse.(view picture as5-3)

Then you can adjust the vertical scale factor, adjust horizontal time scale and trigger level to a suitable position, which ready to capture in next time.



Picture 5-3 capture the single pulse signal

5.3 Analysis the signal detail

If adding the random noise to the measured signal, which can be set by adjusting the oscilloscope to filter or reduce noise which can interfere the measurement of the original signal.

1. Observe noise signal

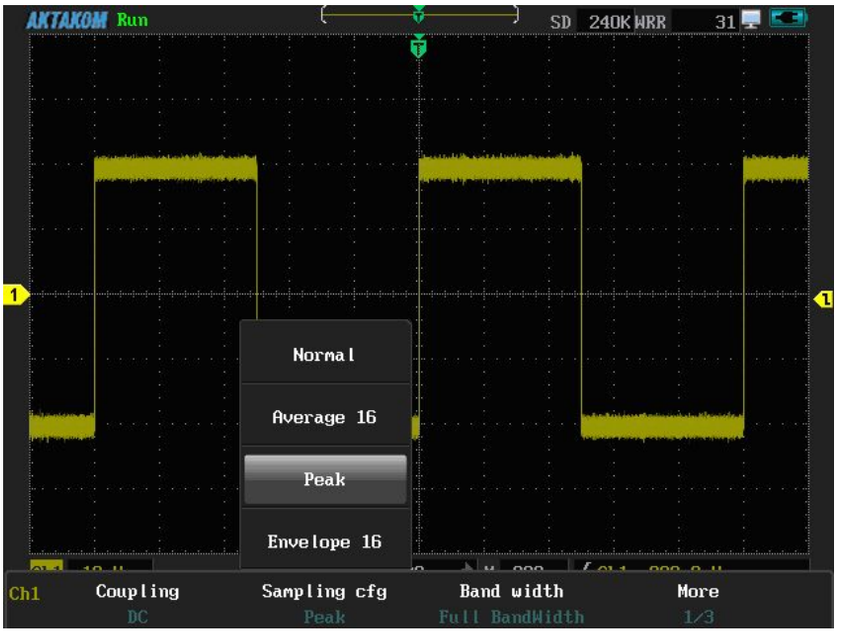
The circuit fault may happen by the interference of noise signal and for a better analysis of the noise, please follow these steps.

1) Connect Ch1 to signal.

2) Press Scope to open the oscilloscope menu.

3) Press F2 to select the sampling cfg as peak.

At this time, the screen displays random noise waveform and from the peak detection can observe the signal with noise peak and burr. See picture5-4.



Picture 5-4 peak sampling cfg

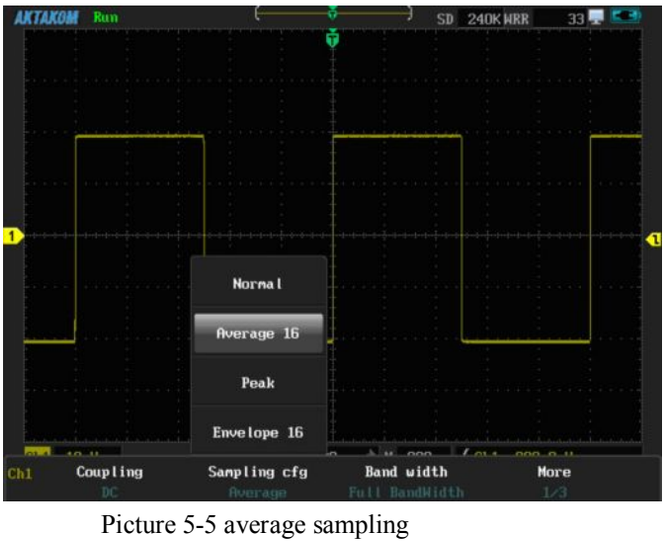
2. Isolate signal from noise

Ignoring the noise while analysis signal, please following these steps to reduce random noise signal rejection.

1）press Scope to open the oscilloscope menu

2）press F2 to select sampling mode as average 16, after averaging can reduce the signal noise and make the original signal easy to observe.

⚠ **Attention: Using average sampling can slow the waveform update rate. This is a normal phenomenon. The larger of the average value, the slower of waveform display.**



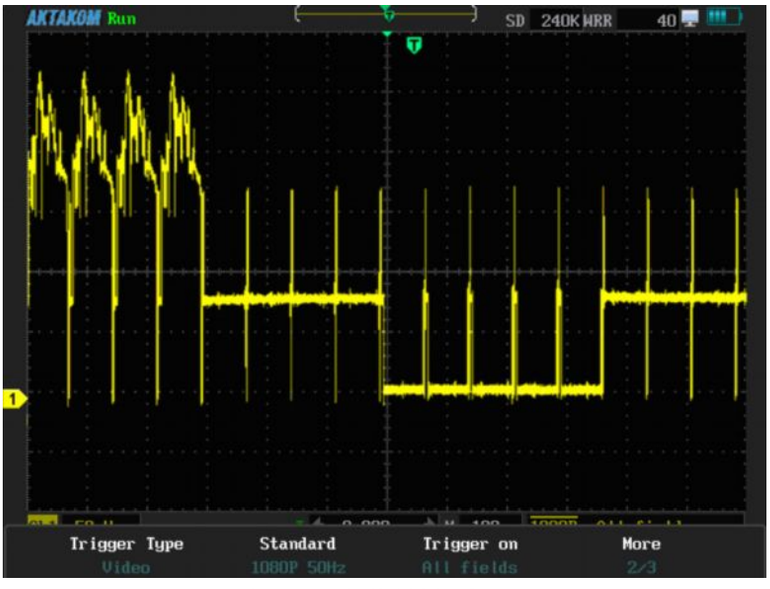
Picture 5-5 average sampling

5.4 Trigger on video signal

To observe high definition 1080P video circuit pattern signal, using video trigger to receive stable video output signal. Please follow these steps to use the default trigger mode and the hold time.

1) Connect Ch1 to measured signal.
2) Successively press Trigger F1 to select the trigger type as the video
3) Press F2 to select the signal source as Ch1.
4) Press F4 then F2 to select the video standard type as 1080P
5) press F3 to select the trigger type as all

6) Adjust the vertical scale factor mV V, vertical ▲ ▼, horizontal time scale s ns for suitable waveform display. As shown in picture5-6.



Picture 5-6 all 1080P format

5.5 Use math FFT

FFT transforms signal from time domain to frequency domain, the oscilloscope displays the waveform signal in frequency domain. Please follow the steps to observe the frequency domain information of the square waveform signal.

1) Connect Ch1to signal

2) Press Math and F1 to select FFT;

3) Press F2 to select the signal source as Ch1

4) Press F3 to select window as Hanning

FFT waveform is shown in picture 5-7.

Picture 5-7 FFT waveform

Chapter Six Use Multimeter

This chapter mainly includes the following contents

- Multimeter safety information
- start the multimeter
- multimeter buttons and their functions
- use multimeter

6.1 Multimeter safety information

- If the instrument damaged, do not use it.
- Check if the test pens are damaged, if yes, please replace them before using the instrument.
- Do not apply overload voltage at the terminal instrument as regulation.
- While using current module to measure current, users should first turn off the power supply of the circuit which is under test, and plug the current module into multimeter jack and then put the pens into the current module and parallel it to the tested circuit.
  Attention: do not directly plug the pen to multimeter jack or parallel it to the tested circuit.
- While using the pen to test, should put your fingers behind the pen protection.
- In order to avoid the readout-error caused by under voltage for battery reason. If the battery displays not enough, it appears（ ）icon，user should replace the battery or use the external power source immediately.
- Under 36V is safe voltage, avoid electric shock while the test above 36V voltage, please test the pens and connections to check whether the insulation is good.
- While measuring, select correct functions
- If need to switch function, the pens should leave away from the test point.

6.2 Start multimeter

First press ⏻ to start the power, and press Meter to enter the working mode, the default function is the DC voltage measurement.

6.3 Multimeter buttons and their functions

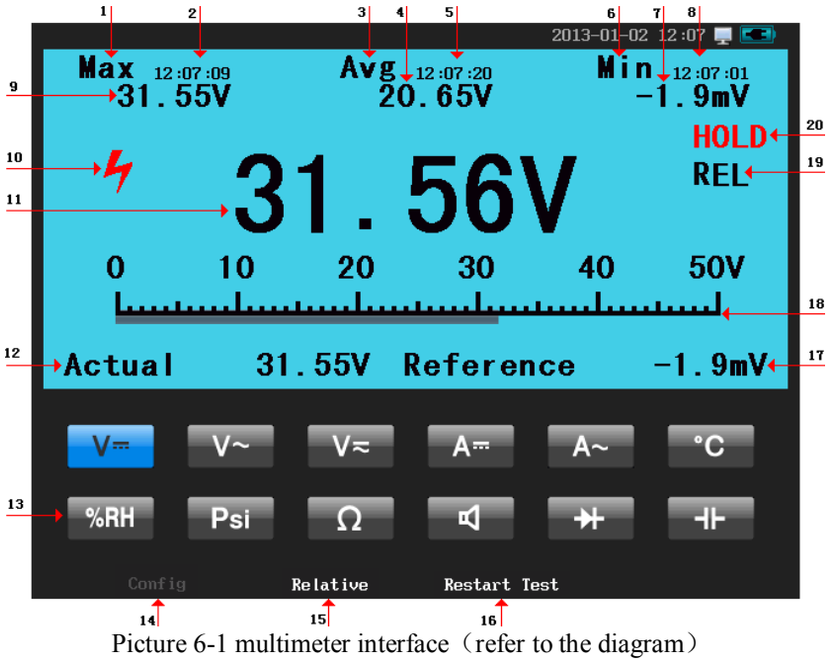
The multimeter functions can operate by using selection buttons or on the touch screen. Instructions are as follows.

Press F1 then F2 then ∩ ∪ or roll the wheel  to select the relative functions. Press F3 to open “relative” function. It refers to the basic value relative to the defined measurements, if the measured values in excess of the range, the others are not allowed to open the “relative “function.

Press F4 to resample the data, which calculates the measurement value. Press Run Stop the multimeter HOLD button to keep or remove current readout on the screen.

Description of multimeter functions

Multimeter can measure voltage, current, resistance, capacitance etc. about 12 kind of physical quantities such as temperature, humidity, frequency and display data, average maximum and minimum value (both with time marks), all measurement processes can automatically adjust the gear. Multimeter interface is shown in picture6-1.



Picture 6-1 multimeter interface（refer to the diagram）

Description of multimeter interface

1. Maximum icon
2. Maximum record time: show the maximum record time.
3. Average icon
4. Average value：show the average data
5. Average record time: the record time of average operation
6. Minimum icon
7. Minimum: show the minimum data
8. The minimum record time: show the minimum record time.
9. Maximum: show the maximum data
10. High voltage icon: if > 30 V DC or AC, this symbol will appear
11. Current measurement value: the measurement result of current signal
12. Actual value: the actual current measurement value shows when "relative" function is open
13. Function menu area: 12 kinds of physical quantities. More details is shown in the function menu area.
14. Left move function button: **left** menu selection function.
15. Right move function button: **right** menu selection function.
16. Relative function button, for open/close the relative function
17. Restart test function button: resample the data and operation
18. Benchmark: the benchmark samples value, the relative function displays when it starts
19. Range scale: shows the range of current gear, according signal to auto- adjust.
20. Start the relative: the relative displays.
21. The HOLD icon：Press Run Stop to start the HOLD function. HOLD is used to display the current data.

Description of function menu

V⎓	DC voltage measurement range:1mV～1000V	%RH	Relative humidity measurement
V~	AC voltage measurement range:1mV～750V	Psi	Pressure measurement
V≂	AC/DC voltage measurement range: 1mV～750V	Ω	Resistance, range: 0～50MΩ
A⎓	DC current measurement		On-off function，<50Ωalarm Max 500Ω
A~	AC current measurement		Diode range: 0～3.5V
°C	Temperature measurement		Capacitance range:100pF～50uF

Use multimeter

1.Measurement of voltage, resistance, capacitance, frequency, diode, on-off etc. firstly insert the black pen to multimeter COM jack, then the red pen inserts into the V/Ω jack, choose the relative function, then connect the pens to the measured circuit to measure.

2. The current measurement requires an external module or current clamp (optional). 1）Use an external module: first choose the relative function, insert the external module to multimeter jack, and then insert the pens and module, finally connect the pens to the measured circuit to measure; 2), using the current clamp: select the relative function, then directly insert the current clamp to multimeter jack, stuck the measured object then can measure.

3. Measurement of the temperature and humidity requires an external sensor module (optional). First select the relative function, insert the external sensor module to the multimeter jack, and then connect the sensor modules, then can measure.

⚠**Attention:** if Voltage over 30 V, the screen will have a high risk identifier hint, at this time user must pay attention to avoid touch the hazardous voltage circuit, personal safety, and prevent electric shock.

4. A pressure measurement requires an external sensor module (optional). Firstly select the relative function, then insert the external sensor module to multimeter jack, and at last connect to the sensor modules, then can measure.

Chapter Seven Use Recorder

This chapter mainly includes the below contents

- Start recorder
- Record
- Playback

7.1 Start recorder

Press ⏻ to turn on the power, and then press Recorder to enter recorder work mode. The recorder mainly includes two functions: recording and playback. Only a part of the function buttons can be used, in recorder work mode. The available functions are the same as in the oscilloscope mode, and the available function buttons will be introduced particularly in the below sections.

7.2 Record

The record contains multimeter record, oscilloscope measurement record, oscilloscope waveform record. Each record type within the oscilloscope can store at most two records, and the USB device can store two records, but can't store the record to the instrument and the USB device simultaneously. After identifying the USB device and the records default stored in the USB device. The oscilloscope cannot delete record results, but cover the results of last record.

Record store mode can be divided into stop when full and cycle store

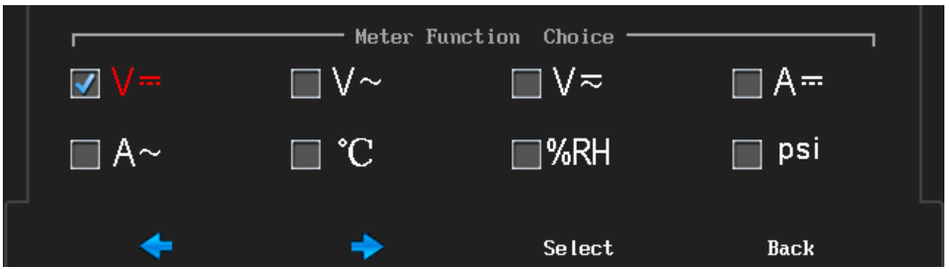
7.2.1 Multimeter record

Eight kinds of measurements (DC voltage, AC voltage, AC/DC voltage, AC current, DC, Temperature, Humidity, and Pressure) can be recorded, each time you select one of these measurement types, the first selection of DC voltage is the default record and the results will be displayed on the screen as waveform.

Please follow these steps to perform record

1) Successively press Recorder F1 to the recording mode.
2) Press F1 to enter the multimeter record mode.
3) Press F1 to the multimeter record type selection menu.

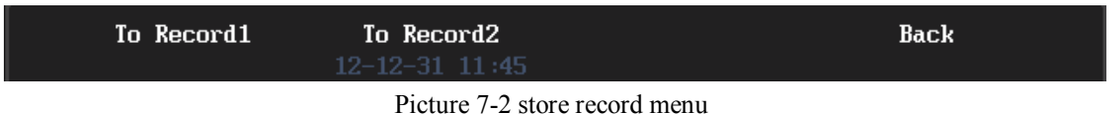
Description of record type selection: press on the touch screen to select the record type or use the menu to select the record type. press F1 to move left and press F2 to move right, then press F3 to confirm choice; Or use ∩ ∪ to quick move. The menu of meter function choice is shown in picture7-1



Picture 7-1 meter function choice

4) Press F4 back to upper menu
5) Press the time scale s ns to select the required gear.
6) Press F2 to prepare starting the multimeter record
7) Press F1 to start the record and store the data To Record 1，or press F2 to start the multimeter record and store the data To Record 2.

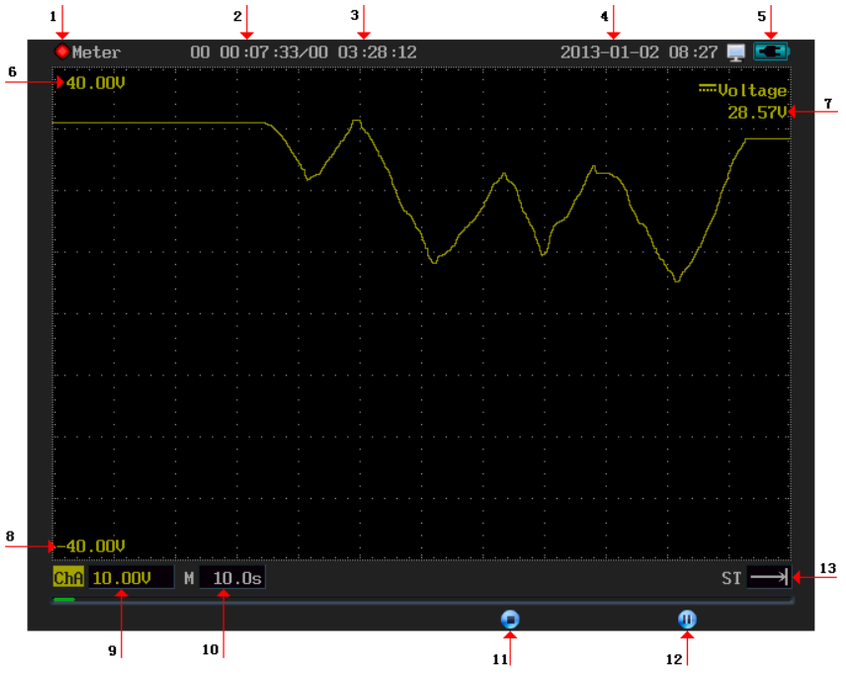
Description of store recording choice menu: if there is no time below the "To Record 1" which means this record is empty and the time below the "To Record 2", is the record time. If add a new record to "To Record 2" which means the record will overwrite the last record.



Picture 7-2 store record menu

Description of available function button: in recording mode, the horizontal time scale adjustment s ns and on/off menu MENU OFF can use, the range of the horizontal timescale is（10s—20min, however, once start the recording, horizontal time scale cannot be adjusted. Press F3 or press on the touch screen to stop recording and return to previous menu. Multimeter DC voltage record is shown in picture7-3.

Notes: Press s ns to adjust the record time scale and press MENU OFF to close the menu, and then press MENU OFF to open the menu, continue for next step.



Picture 7-3multimeter record

Multimeter record interface description

1.record state: ■ Means stop recording or preview mode ● means record is ongoing.

2.record time length

3.the total time length for recording

4.current time

5.power icon

6.corresponding value for record interface edge: Accordingly auto-adjust the record value

7.current record value

8.corresponding value for under the record interface edge: Accordingly auto-adjust the record value

9.Vertical scale factor: Value on each grid represents the voltage value

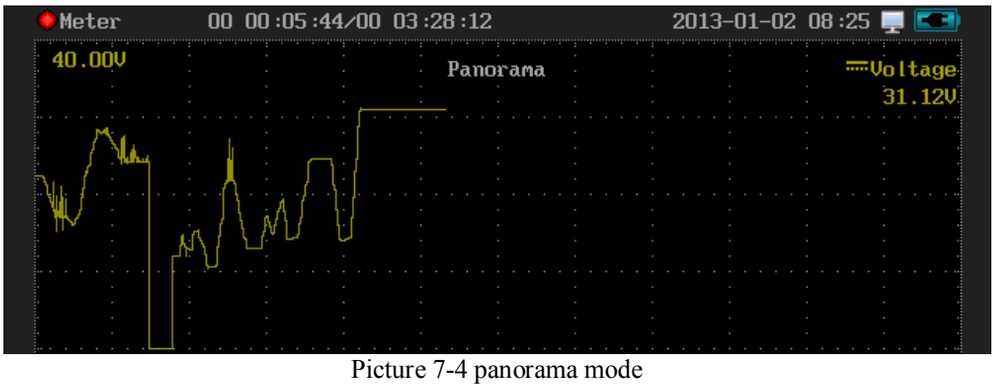
10.Horizontal scale (horizontal time-base) : Per value is represented by the time value, using the horizontal time scale s ns to adjust.

11.stop recording and back to upper menu

12.panoramic mode：When the record fills a full screen or more than one screen at a time, press F4 to open panoramic mode, at this time the recording is in progress, then repress F4 to cancel the panorama mode.

13.storage mode：ST → Stop when full store ST ↻ cycle store.

Panorama mode： Before setting the panorama mode, all the recorded data displaying on the screen, panoramic mode waveform is shown in picture7-4.



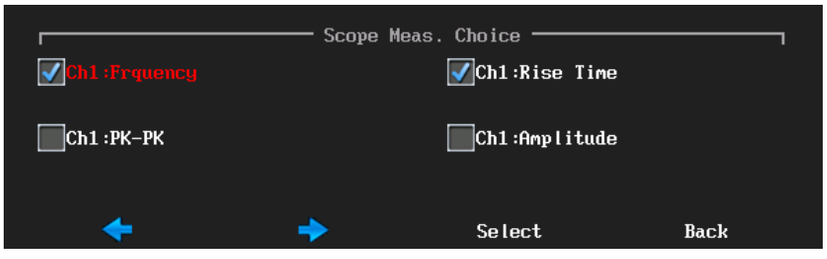
Picture 7-4 panorama mode

7.2.2 Oscilloscope measurement record

There are 31 types of measurements can be recorded in this instrument. In work mode, users should set voltage, time scale gear, phase, trigger source, trigger type, trigger position, and measurement type selection. Select the record type in the recorder work mode, each time can record two types of measurement at most. If more than two kinds of measurement types, users need select the recorder type in work mode, otherwise the default record is the first two records.

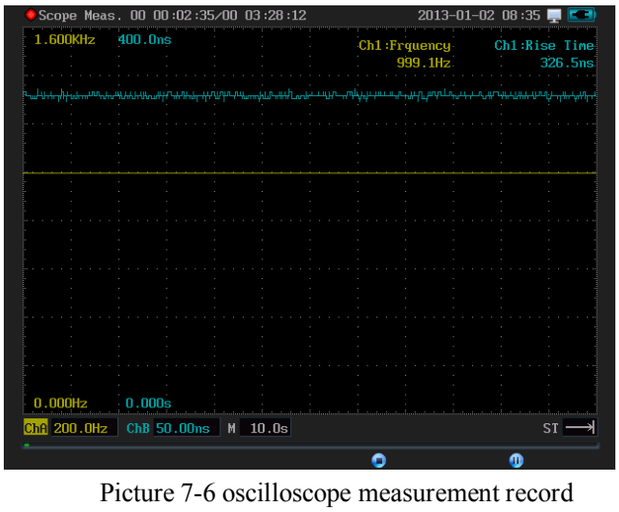
Please follow these steps for measurement record

1) Press Scope to enter the oscilloscope and carries on the related settings, make waveform display normally.
2) Press Measure to choose the type of measure, and user can choose at most four types.
3) Successively press Recorder F1 F2 to enter the oscilloscope record.
4) Press F1 to select measurement type record, record type as frequency and the rise time. As shown in picture7-5.



Picture 7-5 measurement record type to choose

5) Press F4 to return to upper menu.
6) Press horizontal timescale s ns to select required gear.
7) Press F2 to prepare starting the oscilloscope measurement record.
8) Press F1 to start the oscilloscope measurement record and store the data "to record 1"or press F2 to start the oscilloscope measurement record and store the data to record 2. Measurement record for oscilloscope frequency and rise time is shown in picture7-6.



Picture 7-6 oscilloscope measurement record

7.2.3 Oscilloscope waveform record

Oscilloscope waveform can record single channel or dual channels waveform data. Users should set oscilloscope mode, sampling mode, coupling mode phase and then into the recorder mode for recording.

Suggestion: sampling mode set to "peak", when oscilloscope in high sampling rate can capture more signal details.

In recorder mode, you can configure the waveform record start/stop mode; you can set start/stop

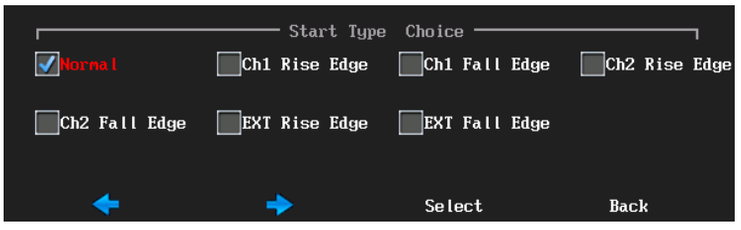
trigger level. Oscilloscope waveform recording level scale (horizontal time-base) the range of adjustment is 10 ms - 2.0 min.

Each has 7 methods to start/stop, respectively set the start/stop mode.

- Normal：manual start/stop recording
- Ch1 rise edge：with Ch1 rise edge start/stop record
- Ch1 fall edge：with Ch1 fall edge start/stop record
- Ch2 rise edge：with Ch2 rise edge start/stop record
- Ch2fall edge：with Ch2 fall edge start/stop record
- EXT rise edge：with EXT rise edge start/stop record
- EXT fall edge：With EXT fall edge start/ stop record.

Start type choice as shown in figure 7-7. Stop type choice is the same

Notes: If use start/stop mode to select rise/fall edge, need press F3 to adjust the start/stop the trigger level.



Picture 7-7start mode selection

Connect Ch1 to sine waveform, period is 10ms, unconnected Ch2 to the signal. Follow these steps for oscilloscope waveform recording.

1) Enter the operation mode and for each configuration to make waveform display normally.

2) Successively press Recorder F1 F3 to enter the oscilloscope waveform recording.

3) Press F1 to related configuration.

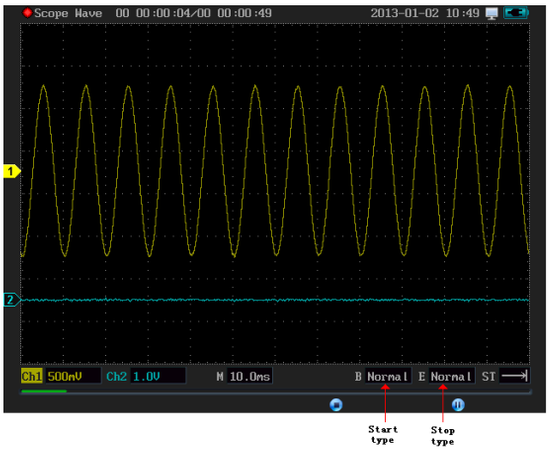
4) press F1 to set start mode as normal then press F2 to set the stop mode as the normal

5) press F4 to return to upper menu

6) Press time scale s ns to required grid.

7) Press F2 to prepare starting the oscilloscope waveform record.

8) press F1 to start the oscilloscope waveform recording and storing the data to record 1；Press F2 to start the oscilloscope waveform to record and store the data to record 2. Waveform record is shown in figure7-8



Picture 7-8 waveform recording

7.2.4 Store mode set

Store mode includes two：stop when full and cycle store ST ⟶|，which means if the internal

storage capacity of the oscilloscope or U device are full, the record will stop automatically. Cycle store ST which means if the internal capacities of the oscilloscope or U device are full, will continuous storing new record and the old data will be covered.

Following these steps to store set

1) Successively press Recorder F1 F4 to enter the store set.
2) press F4 to select the store mode
3) Press MENU OFF to choose the menu, and then finish the set.

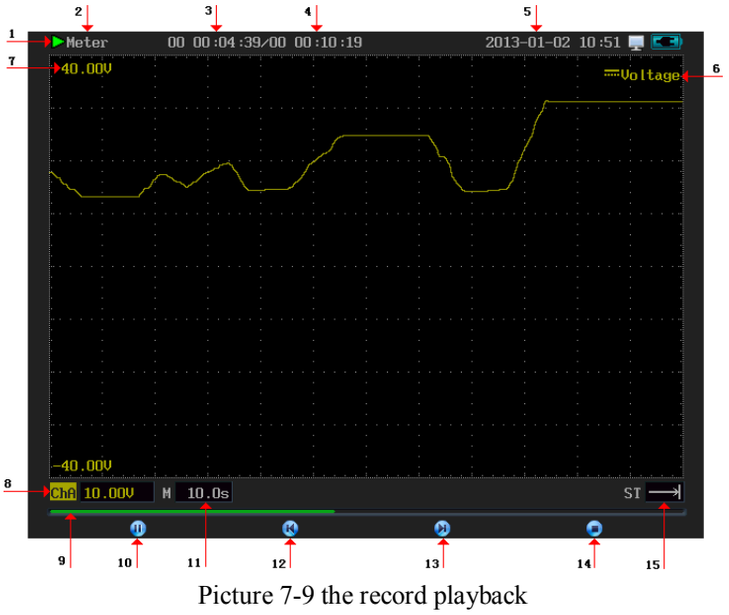
7.3 Playback

Playback contains 1, multimeter record playback, 2, oscilloscope measurement record playback, 3, oscilloscope waveform record playback, 4, the last record playback. After identifying USB device, the playback data is the default USB data.

7.3.1 Multimeter record playback

Please follow these steps to use multimeter record playback.

1) Press Recorder to enter the recorder-working mode.
2) Press F2 to choice menu and enter the playback type.
3) Press F1 to choose multimeter record playback.
4) press F1 to choose the playback to record 1 or press F2 to select the playback to record 2;
5) Press F1 to start playback, the playback is shown in picture7-9.



Picture 7-9 the record playback

Description of the interface of record playback

1. Playback state：▶ in playback ■ stop playback
2. Playback record types: multimeter record
3. Playback time length
4. The total time length of the record
5. Current time
6. The multimeter record types : eight types of records
7. Corresponding values from the bottom to top edge on the screen.

8. Average vertical scale factor is 10.00V
9. Playback progress bar
10. playback/stop and press F1 to switch
11. horizontal scale（horizontal timescale）
12. backward
13. fast forward
14. stop，press F4 to stop replay and then press F4 to return to upper menu.
15. Storage mode

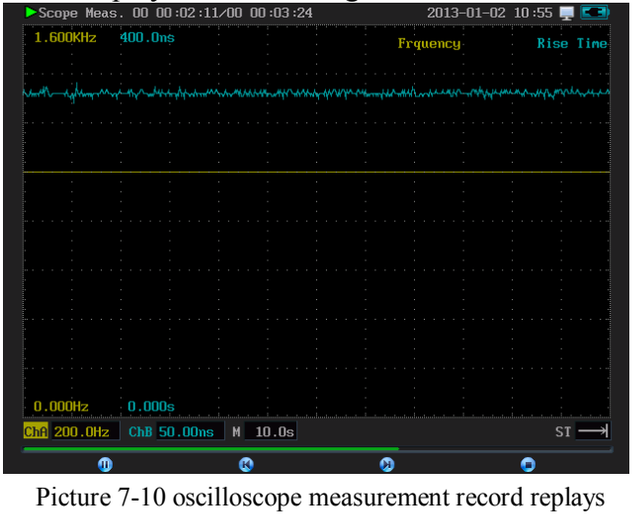
Replay displaying and operating instructions: after selecting replay "record 1"/"record 2" to enter the preview mode then the screen displays waveform data. Press F1 to play mode. If the record waveform data extend out of one screen then can press s ns to adjust timescale, if the data less than one screen, user can't adjust timescale. Press then the waveform will move forward. And press then the waveform will rewind, and press ◄ ► and the waveform can quickly movie forward and backward.

7.3.2 Oscilloscope measurement record replay

Follow these steps to replay the oscilloscope measurement record.

1) Successively press Recorder F2 to enter the recorder replay mode.
2) Press F2 to select the oscilloscope measurement replay.
3) Press F1 to choose replay mode "record 1"and press F2 to choose replay mode "record 2";
4) Press F1 to start replay.

Oscilloscope measurement record replay is shown in figure 7-10.



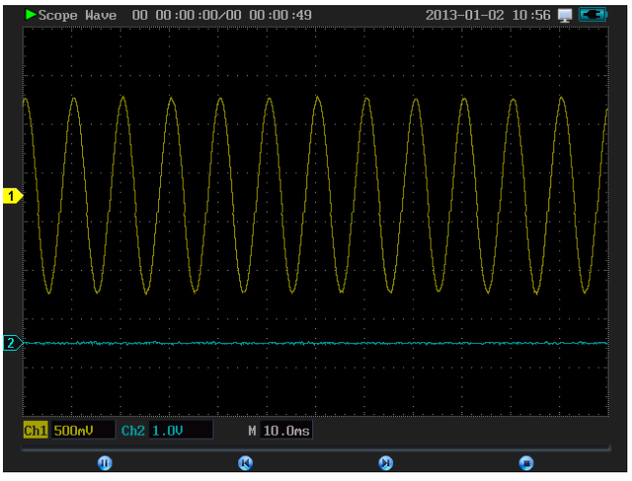
Picture 7-10 oscilloscope measurement record replays

7.3.3 Oscilloscope waveform replay

Follow these steps to replay oscilloscope waveform recorded.

1) Successively press Recorder F2 to enter the recorder replay mode.
2) Press F3 to select the oscilloscope waveform record replay.
3) press F1 to choose replay mode "record 1"and press F2 to choose replay mode "record 2";
4) Press F1 to start replay.

Oscilloscope waveform record replay is shown in picture7-11.



Picture 7-11 oscilloscope waveform record replays

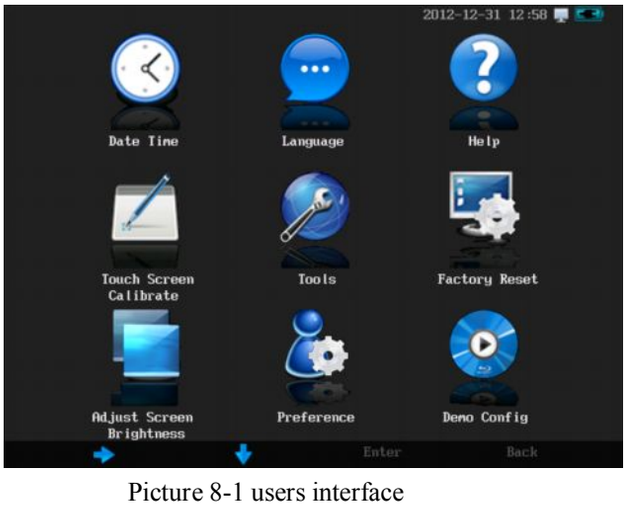
7.3.4 The last record playback

Please follow these steps to playback the last record

1) In record mode, successively press F2 F4 to enter the last record replay mode.
2) Press F1 to start replaying record for the last record.

Chapter Eight Users' section

Users' section includes system config, tools and help. Press User to enter users' page after starting up. The users interface is shown in Figure 8-1.



Picture 8-1 users interface

The users' section includes: date time, language, help, touch screen calibrate, tools, factory reset, adjust screen brightness, preference and demo config.

1.Date time

Please follow the steps below to set the system date and time:

1) Press User and enter the user page;
2) Press "time set" and enter the date and time setting page;
3) Set the year, month and day by pressing the number buttons of "0 to 9";
4) Press "back" or F4 to return to the previous menu l. Then the setting is done.

2. Language

Oscilloscope supports two kinds of languages: Chinese and English. Press "language", and then press "simplified Chinese" or "English". Then the system will automatically return to the user page, and update the language.

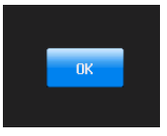
3. Help

Press "help" to enter the help content table. Under the help content table, there are multi-level directory and hyperlinks which make it convenient for users to look for information. You can get to the corresponding help entries by pressing the underlined character, Press F1 to change the page; press F2 to switch the hyperlink item; press F3 to directly jump to the current hyperlink; press the "back" or press F4 to return to the previous help entry; press ∩ to return to the previous hyperlink and press ∪ to go move to the next one.

4. Calibration of the Touch Screen

Press the key User to enter the user page. Press the "touch screen calibrate" to enter the touch screen calibrate mode. Press the icon according to the screen prompts (press on the cross icon of calibration), until the display of “finish”. Press "finish" to end screen calibrate and it will automatically return to the users’ page. Calibration icon is shown in Figure 8-2 and the finish page of calibration is shown in figure 8-3.

Picture 8-2 calibration icon



Picture8-3 finishes the calibration of the page

5. Tools

The tools contain two calculation tools: a scientific calculator and an electronic calculator.

（1）The scientific calculator

Press on the touch screen to import numbers and calculator and get the calculated results. Taking calculate expression (3 + 9) * 8 as an example. Please follow the steps below:

1) Press hex to select the decimal system;
2) Press formula to select formula calculation;
3) Input the formula by clicking "(", "3", "+", "9", ")", "*" and "8" successively;
4) Press "=" to get the calculated result: 96;
5) Press "back" or F4 to return to the tools page.

The interface of scientific calculator is shown in figure 8-4.

Picture 8-4 calculator

（2）Electronic Calculator

The electronic calculator is for calculating of inductive reactance, capacitive impedance, and parallel resistance and LC resonant frequency. Take the calculation of inductive reactance value as an example. Please follow the steps below:

1) Press to enter the users' page;

2) Successively press the tool and the electronic calculator;

3) Press inductive reactance;

4) Press frequency;

5) Input the value of frequency in the input area;

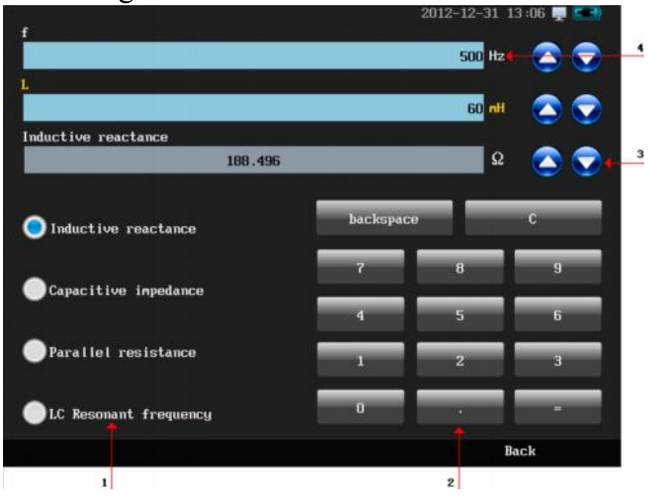
6) Press "inductance";

7) Input the value of inductance in the input area;

8) Press "=" in the input area and the result will be displayed in the display area for the inductive reactance value. The interface of electronic calculator is shown in figure 8-6

Instructions for the interface of electronic calculator:

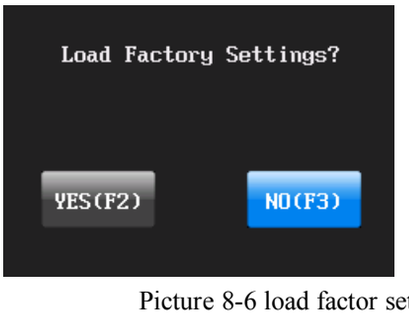
1,Selecting calculation type area, as is shown in figure 8-5 with arrow 1;
2,Value input area, as is shown in figure 8-5 with arrow 2;
3,Units choice area, as is shown in figure 8-5 with arrow 3;
4,Value display area, as is shown in figure 8-5 with arrow 4.



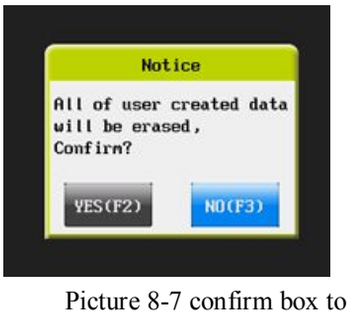
Picture 8-5 the interface of electronic calculator

6. Load factory settings

Press to enter the user page. Press "load factory settings" and the dialog box for load factory settings will pop-up. Press "yes" and the confirming box will pop-up. Press "yes" again and load to factory settings. Factory settings could be seen in Appendix C. The dialog box for load factory settings and confirm box are shown in Figure 8-6 and figure 8-7.



Picture 8-6 load factor set



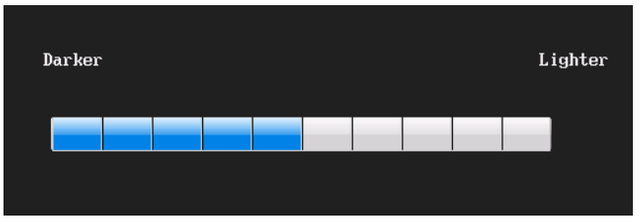
Picture 8-7 confirm box to empty store

⚠ **Warning : after loading factory settings the users can store waveform, the recorded data and other information will be erased**

7. Adjust Screen Brightness

Press to enter the user page. Press "Adjust Screen Brightness" to set the screen brightness. Press

the horizontal bar of brightness or roll the wheel or press to adjust the screen brightness. Press the "back" or F4 back to the users homepage. The adjustment of screen brightness is shown in figure 8-8



Picture 8-8 adjustment of brightness

8. Preference Set

Press User to enter the users' page. Press "Preference" to enter the preference set. The preference set includes:

1) Menu hide time set: the menu auto-hide time, max. 60 seconds.

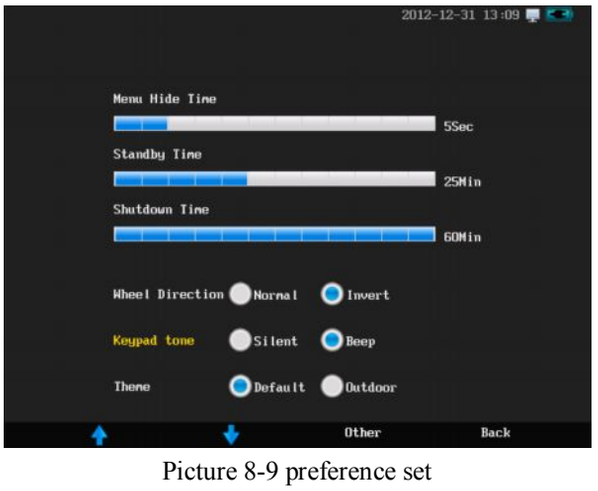
2) Standby time set: interval between the last operation and the oscilloscope enters into the standby state with the max 60 minutes.

3) Shut down time set: the interval time between the last operation and the oscilloscope entering the shutdown state with a maximum of 60 minutes.

4) Wheel direction set: the upward or downward movements for cursor trigger level and wave in vertical position are corresponding to the direction of the wheel.

5) Keypad tone set: turn on or off the button tone.

Preference set is shown in figure 8-9.



Picture 8-9 preference set

Chapter Nine ScopeSuite Software

Standard ScopeSuite software contains only the basic functions, such as oscilloscope firmware upgrade, which are used during service maintenance of the device.

Optionally available ScopeSuite software runs on Windows platform. Through this software, the user can connect his personal computer to the oscilloscope and achieve enhanced functions; usage of the oscilloscope becomes more flexible. ScopeSuite software can implement the following functions: screen shot and record, remote control, display and record of waveform and value of real-time oscilloscope, oscilloscope /USB device data export, data analysis, information retrieval, firmware upgrades and other enhancements. Through these functions, it is able to meet the highest users' requirements for data measurement and analysis.

Chapter Ten Fault Handling

Fault Handling

1) If you get the black screen when press the power key of oscilloscope, please follow steps below:

- Check whether the power joint is ok, or whether the battery is installed in the right place and the power supply is normal.
- Whether you correctly pressed the power button; if you are using the battery, or check whether the battery has electricity.
- Restart the instrument after you finishing the above inspections.
- If this product still cannot work, please contact us

2) If the signal's waveform did not appear on the screen after signal source connecting, please follow the steps below:

- Check whether the probe is connected correctly in the BNC socket
- Check whether the probe is connected correctly in the signal source
- Check whether signal source is working properly
- Check whether the channel in use is opened
- Check whether the vertical scale factor is set correctly
- Check whether trigger source, trigger conditions are set correctly
- Check whether the instruments are in waiting state for trigger
- Press 

to resample signal

3) If the measured voltage amplitude is 10 times greater or 10 times smaller than the practical value:

- Check whether the settled attenuation factor of the channel is in accordance with the attenuation factor of the used probe.

4）The waveform is in display, but not stable:

- Check whether the signal source in triggering menu is identical with the actual signal the used channel.
- Check the trigger type: edge trigger for general signal; video trigger mode for video signal. Only use the correct trigger mode, could display stable waveform.
- Check the noisy signal source. Set the trigger coupling mode to high-frequency inhibition or low-frequency rejection to filter out high frequency or low frequency interference
- Check whether the time setting for trigger rejection is appropriate

5）If there is no any display after pressing 

:

- Check whether the triggering mode is normal, and whether the trigger level is beyond the scope of the waveform. Center the trigger level and set the trigger mode as auto
- check whether the time is too long for level delay
- Test whether the trigger rejection time is too long

6）If the display becomes slow down after setting average times of sampling:

- If the average times are above 32, it is normal for the general speed.
- You can reduce the average times

Appendix

Appendix A：Technical specification

To satisfy the technical specifications, must meet two conditions.

1. The instrument must continuously work more than thirty minutes within the specified working range;

2. If the operating temperature ranges at or above 10°C, "must carry on auto-calibration procedure.

Marked typical parameter of the specification is for theoretical value.

General technical specification

type——bandwidth	MS*10——100MHz MS*20——200MHz	
Isolation voltage between each Channel.	CAT Ⅱ 1000V CAT Ⅲ 600V （MS200 series is non- isolated ）	
BNC refer to ground floating voltage	CAT Ⅱ 1000V CAT Ⅲ 600V（MS200 series is non- isolated ）	
BNC input the maximum voltage	CAT Ⅲ 300V	
Number of channel	two oscilloscope channels, one multi-meter channel	
shell		
design	Dual color injection protection shell design, high intensity, impact resistant	
protection	IP51 protection level	
display		
screen	5.7 inch TFT LCD	
Resolution coefficient display	640*480	
Color display	64Kcolor	
Background light intensity（typical）	500 cd /m^2	
communication		
Communication interface	Standard USB connect to USB device, Mini USB connect to PC	
Power source		
Adapter input	View power adapter	
Adapter output	View power adapter	
Battery	Standard Li-battery capacity Duration of working time（typical） Power off charging time（typical）	7.4V/6000mAh 4.5H 4H
	Equipped with other Li-battery capacity Duration of working time（typical） power off charging time（typical）	7.4V/9000mAh 7h 6h
Environment		
Temperature（work/storage）	-20℃～+50℃ / -20℃～+60℃	
LCD panel temperature（work/storage）	-20℃～+70℃ / -30℃～+80℃	
Humidity（work/store）	< 75%RH / 85%RH （+30℃～+40℃）	
Altitude（work/store）	Max 3000m / 12000m	
Cooling method	Natural convection	
Dimensions		
size （length*width*depth）	254mm*160mm*60mm	
Weight	Oscilloscope（no battery）	1380g
	Standard accessories（typical）	691g
	Standard battery（typical）	276g
	High capacity battery （typical）	381g

Oscilloscope

Max. sample rate	Single channel 1GS/s，dual channel 500MS/s
Max. store depth	Single channel 240K dual channel 120K

Bandwidth limitation			20MHz （-3dB）
Sampling configuration			normal、peak-peak value、envelope、average
Single sequence	Normal, peak-peak		For a sampling, all channels work simultaneously
	Average，envelope		For N times of sampling，all channels work simultaneously. N is set from2 to256（corresponding to the envelope for ∞）
Output voltage of probe compensation (typical)			≥1MΩwhile loading，peak-peak value V
Frequency of probe compensation（typical）			1KHz，square wave
Interpolation method			Sin（x）/x
input			
Input coupling			DC，AC，Ground Connection
Input resistance			1MΩ±1% 5pF±3pF parallel connection
Probes attenuation factor			1X，10X，100X
Horizontal			
Position range			±6grid
Horizontal timescale			4ns/div～10s/div press 1～2～4 enter step by step
Timescale(delay) position adjusting range			-12grid～50s
Timescale accuracy（typical）			±20ppm
verticality			
Vertical scale			5mv/div～50v/div , step by step as the way of 1～2～5
Adjustment of position scope			±4 grid
Vertical resolution			9 bit
Rising time（typical）			100MHz ≤3.5ns
			200MHz ≤1.75ns
DC gain accuracy（typical）			5mv/div～50v/div，±2.0%
DC measurement precision（typical）			5mv/div～50v/div， ±(2.0%×actual readout + 0.04×vertical displacement/div)
trigger			
Trigger source			Ch1、Ch2、EXT
Trigger mode			Automatic、normal、single sequence
Type	Edge triggered		Rise edge、fall edge、dual edge
	Trigger pulse width		Conditions：<、>、=、≠ Polarity：positive、negative
	Logic trigger		Logical calculation：AND、OR 、NAND 、NOR
	Video trigger		Format：PAL、SECAM、NTSC、720P、1080I、1080P type：odd、even、all、all line、assigned line
	Serial bus trigger	UART RS232/RS422/RS485	pattern：parity error、[X：data]、[0：data]、[1：data]、data、stop bit、start bit
		LIN	pattern：frame ID and data、frame ID、sync –rising edge
		CAN	method：start frame、remote frame ID、frame ID data、remote frame/data frame ID、data ID and data、error frame、all error、Ack error、over load frame
		SPI	pattern：match the binary data
		I2C	pattern：start condition、stop condition、Ack lost、block address field no Ack、restart、EEPROM data read、frame type 1、frame type 2
Trigger coupling mode			DC、AC、HF rejection /LF rejection and Noise rejection
Trigger rejection time range			200ns～10s
Measurement			
Measurement type	Period, Frequency, Rise time, Fall time, P Duty cycle, N Duty cycle, Delay, P Pulse width, N Pulse width, P Overshoot, N Overshoot, Phase, Peak-Peak, Amplitude, High, Low, Max ,Min, Average, Cycle average, RMS, RMS cycle		
Cursor type			Horizontal cursor、Vertical cursor、Crossing cursor
Dynamic recording			
time			Max 2h
Replay of forward/backward			support
Record the total frames			support
Replay frames/display frames			support
math			
FFT			Rectangular、hanning、hamming、BlackmanHarris
Dual waveform			+、-、*、/

XY model	
X- axis input/ Y-axis output	(Ch1) / 2 (Ch2)
Storage	
Waveform	Four sets of stored waveforms and can be stored in external U devices.
User settings	Nine slots
display	
Refresh mode	Normal refresh, High refresh
Max refresh rate	ADS-4132/4132D/4232/4232D 190kwfrms /s ADS-4122/4222 can be upgraded to 50kwfms/s ADS-4072/4112/4152/4202 can be upgraded to 50kwfms/s
Afterglow	Automatic , 100ms~10s
Waveform display area	8 × 12 grid
Waveform drawing mode	dot、line
Languages	Simplified Chinese，English

Probe

Working voltage	CAT III 300V,CAT II 600V
Attenuation coefficient	10:1
Input capacitance	13pF
Match range	10pF～30pF
Input impedance	10MΩ±1%
Bandwidth	DC～500MHz
Rise time	1ns
Cable length	1200mm

Multimeter

Measurement accuracy		4 bit
DC voltage（+28℃）	range：1mV～1000V frequency measurement（ADS-4072/4112/4152/4202）	range：1mV～60mV accuracy：±1%（+10℃） range：60mV～1000V accuracy：±1%（+5℃）
	range：1mV～1000V frequency measurement（ADS-4132/4132D/4232/4232D, ADS-4122/4222）	range：1mV～1000V accuracy：±0.5%（+10℃） range：20mV～1000V accuracy：±0.5%（+5℃）
AC voltage（+28℃）	range：1mV～750V frequency measurement range：10.0Hz～20.000KHz （ADS-4072/4112/4152/4202）	range：1mV～60mV accuracy：±2%（+10℃） range：60mV～750V accuracy：±2%（+5℃）
	range：1mV～750V frequency measurement range：10.0Hz～20.000KHz （ADS-4132/4132D/4232/4232D, ADS-4122/4222）	range：1mV～60mV accuracy：±1%（+10℃） range：60mV～1000V accuracy：±1%（+5℃）
Ac/dc voltage（+28℃）	range：1mV～750V frequency measurement range：10.0Hz～20.000KHz （ADS-4072/4112/4152/4202）	range：1mV～60mV accuracy：±2%（+10℃） range：60mV～750V accuracy：±2%（+5℃）
	range：1mV～750V frequency measurement range：10.0Hz～20.000KHz （ADS-4132/4132D/4232/4232D, ADS-4122/4222）	range：1mV～60mV accuracy：±1%（+10℃） range：60mV～1000V accuracy：±1%（+5℃）
Dc		optional modules or current clamp, can be customized
Ac		optional modules or current clamp, can be customized
Resistance	range：0～10MΩ	accuracy：±1%（+28℃）
	range10MΩ～20MΩ	accuracy：±3%（+28℃）
	range20MΩ～50MΩ	accuracy：±5%（+28℃）
On-off test		If <50Ω， system will alarm Max 500Ω
diode		range：Max 3.5V

capacitor	range：100pF～5uF	accuracy：±10%（+28℃）
	range：5uF～50uF	accuracy：±5%（+28℃）
temperature		optional sensor module, can be customized
humidity		optional sensor module, can be customized
pressure		optional sensor module, can be customized
Display measurement		Max、Average、Min，all with a time tag, relative measurement

Recorder

Record content		Measurements for multimeter, oscilloscope, and oscilloscope waveform
Display mode		Panorama screen、normal
Record time scale	multimeter	10s/div～20min/div
	oscilloscope	10s/div～20min/div
	oscilloscope waveform	10us/div～2min/div
Max. recording time		no limit
Replay forward/backward		support
Storage mode		Full then stop、cycle storage
Wave mode		Interior USB device
Display time		Record time：support Replay time：support

Appendix B：Maintenance of oscilloscope

General maintenance

Please do not keep the LCD screen of the instrument under the sunshine.

⚠ **Attention**：Please do not leave spray, liquid or solvent on the instrument and probes, in order to avoid damaging instrument and probes.

Clean oscilloscope

Inspect the instrument and probes usually based on operating frequency. According the following steps to clean outside surface of the instrument:

- Please use soft cloth to wipe external dust of instrument and probes. When clean the LCD screen, be careful not to scratch it.
- With damp soft cloth to wipe the instrument，while doing this please keep the power off. Do not use any chemical corrosive cleaning agent, in order to avoid damaging the instrument or probe.

Store oscilloscope

The battery needs to be charged before using the instrument.

⚠ **Warning** Make sure the instrument is dry before recharging, to avoid electrical short circuit or injury which caused by moisture.

Battery charge

Turning on the oscilloscope for the first time, it must be charging for more than six hours（for saving the charging time ,please turn off the oscilloscope）.while using battery power, the top of the screen will display a battery indicator, possible battery symbol like：  ; while  is flashing，it says only 10 minutes remained.

⚠ **Attention**：avoid charging battery from overheating，do not use beyond the range of environment permit.

Appendix C：Factory default

The following table lists the states of factory resetting or default settings.

Category	Factory resetting（user interface）	Default settings（store/restore

			menu）
Sampling			
Coupling	DC		Factory default
Mode	normal		Factory default
Mean counts	16		Factory default
Envelope counts	16		Factory default
Bandwidth	Full bandwidth		Factory default
Delay	On		Factory default
Phase invert	off		Factory default
Probe coefficient	1X		Factory default
Select channel	Ch1—>Open and default as current channel Ch2—>open		Factory default
Run/stop	run		Factory default
Sampling single sequence	stop		Factory default
Vertical position	middle of screen		Factory default
Vertical scale	5mV		Factory default
Time scale	1.00ms		Factory default
Trigger position readout	0.000ms		Factory default
Trigger position indicator	middle		Factory default
Trigger level	0.000V		Factory default
Current trigger channel	Ch1		Factory default
cursor			
Cursor function		off	Factory default
After opening cursor, F4 current state		cursor	Factory default
Cursor position level 1		from horizontal center + 2.0	Factory default
Cursor position level 2		from horizontal center-2.0	Factory default
Vertical cursor position1		from the vertical center - 3.0	Factory default
Vertical cursor position2		from the vertical center + 3.0	Factory default
Cursor track		off	Factory default
measurement			
Measurement strobe		off	Factory default
delay		（current channel）first rise edge	Factory default
	relative	Ch1	Factory default
		First rise edge	Factory default
phase		（current channel）relative to Ch1	Factory default
Display			
Waveform drawing mode		line	Factory default
Waveform brightness		60%	Factory default
Graticule type		full	Factory default
Graticule intensity		50%	Factory default
Afterglow time		Auto	Factory default
Time scale		YT	Factory default
Refresh rate		normal	Factory default
mathematic			
Mathematical channels	close		Factory default
Mathematical type	dual waveform		Factory default
Source 1	Ch1		Factory default
Operator	+		Factory default
Source 2	Ch2		Factory default
trigger			
Trigger type		edge	Factory default
Trigger coupling type		DC	Factory default
Trigger mode		auto	Factory default
Trigger rejection time		200ns	Factory default

Edge trigger	Source		Ch1	Factory default
	slope		Rise edge	Factory default
Trigger Pulse width	source		Ch1	Factory default
	polarity		positive	Factory default
	condition		≠1.000ms	Factory default
Logic trigger	Ch1 logic		high	Factory default
	Level(Ch1)		0.000 V	Factory default
	Ch2 logic		high	Factory default
	Level(Ch2)		0.000 V	Factory default
	Logical operator		AND	Factory default
	condition		switch to true value	Factory default
video trigger	source		Ch1	Factory default
	polarity		positive	Factory default
	standard		625/PAL	Factory default
	High-definition field		50Hz	Factory default
	Trigger on		Odd field	Factory default
Serial Bus trigger	UART（RS232/RS422/RS485）	Bus configuration	Rx is Ch1, Idle level is High Baud rate is 19.2 KB/s, Parity is no, dat bits is8 bit	Factory default
		Trigger mode	Start bit	Factory default
	LIN	Bus configuration	Source is Ch1, Idle level isHigh Baud rate is 19.2 KB/s	Factory default
		Trigger mode	Sync- rise edge	Factory default
	CAN	Bus configuration	Source is Ch1, Idle level is High Baud rate –is 500 KB/s	Factory default
		Trigger mode	Start frame	Factory default
	SPI	Bus configuration	CLK is Ch1, Data is Ch1, and work mode is SCK low@idle state, sample with SCK 1st edge. Data bits are 8 bit.	Factory default
		Trigger mode	XXXX XXX1	Factory default
	I2C	Bus configuration	SD Ais Ch1,SCL is Ch2	Factory default
		Trigger mode	Start condition	Factory default
Reference waveform				
Reference waveform			off	Factory default
Reference waveform record data			erase	-
storage/recovery				
Storage depth			120.0k	Factory default
User setting storage area			erase	-
multimeter				
multimeter			DC voltage	-
relative			off	-
recorder				
Multimeter record type			DC voltage	-
Oscilloscope measurement type			/	-
Oscilloscope waveform record start mode			normal	-
Oscilloscope waveform record stop mode			normal	-
Storage mode			Stop when full	-
Recorder storage area			erase	-
user				
Time			hold	-
Language			Simplified Chinese	-
Help			homepage	-

Calculator		decimal ,angle, normal	-
Electronic calculator		Inductive reactance	-
Screen brightness		50%	-
set	Hidden time	5s	-
	Standby time	15 minutes	-
	Automatic shutdown time	20 minutes	-
	wheel direction	normal	-
	Buttons beeper	silence	-

Appendix D：Attachment

Standard accessories

1. 10 X CAT Ⅱ300 V Max 600 V, and two safety standard probes (ground lead cap, jaw clip, the calibrate banana jack)
2. Multimeter test pens
3. Power adapter
4. Standard battery（6000mAh）
5. Standard USB cable
6. User's manual
7. Product warranty card
8. Product qualification card
9. Random CD（including Scope demo version software, and instruction）

Optional accessories

1. Oscilloscope suitcase
2. Oscilloscope handbag
3. Oscilloscope hang-strap
4. High-capacity battery（9000mAh）
5. LCD protective film
6. UART（RS232/RS422/RS485）Serial bus decode function module
7. LIN Serial bus decode function module
8. CAN Serial bus decode function module
9. SPI Serial bus decode function module
10. I2C Serial bus decode function module
11. Full functional version of Scope Suite
12. Current module（optional）
13. AC/DC current clamp（optional）
14. Temperature sensor module（optional）
15. Humidity sensor module（optional）
16. Pressure sensor module（optional）
17. Security probe（500MHz,100X）
18. Active probe（1GHz）

If there is any modification of this manual, apologize for no special notice to customer.

The manual contents are believed to be correct, if users find any errors, omissions, etc, please contact us.

We take no responsibility for accident or harm which caused by user error -operating.