Handheld multifunctional oscilloscope

MS200 Serial

User Manual

Shenzhen Micsig Instruments Co., Ltd

To customer,

Micsig MS200 serial handheld multi-functional oscilloscope includes oscilloscope, multimeter and recorder functions in one, which contains the following features:

- 5.7 inch TFT LCD touch screen, 640*480 resolution, 16 bit color depth
- 8 bit AD acquisition. Display and measurement are more precise.
- Touch+Button+Scroll Wheel make handling better.
- 50 k wfms/s waveform refresh rate.
- Quick drag and zoom on touch screen, quick operating response speed
- Serial bus trigger, support UART(RS232/RS422/RS485) /SPI/I2C/CAN/LIN
- 31 kind of automatic measurements
- Support USB Host/Slave interface, which can plug U device or connect to the PC
- Detachable Li-ion battery

Limited warranty and limitation of liability

All Micsig products are fully inspected before delivery and guarantee all comply with test criterion. As for warranty, please refer to product warranty card.

we authorized resellers shall extend this warranty on new and unused products to end user only but have no authority to extend a greater or different warranty on behalf of us. Warranty support is available if product is purchased through an authorized sales outlet or Buyer has paid the applicable international price. We reserve the right to invoice Buyer for importation costs to repair/replacement parts when product purchased in one country is submitted for repair in another country.

Micsig's warranty obligation is limited, in Micsig's opinion, to refund of the purchase price, free of charge repair, or replacement of a defective product, which is returned to an authorized service center within the warranty period.
To obtain warranty service, contact your nearest Micsig authorized service center or sent

the product, with a description of the difficulty, postage and insurance prepaid (FOB destination), to the nearest authorized service center. Micsig assumes no risk for damage in transit. Following warranty repair, the product will be returned to buyer, transportation prepaid (FOB destination). If we determine that the failure was caused by misuse, alteration, accident or abnormal condition of operating or handling, we will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the buyer transportation prepaid, the buyer will be billed for the repair, and return transportation charges (FOB Shipping Point).

This warranty is Buyer's sole and exclusive remedy and is in lieu of all other warranties, express or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. We shall not be liable for any special, indirect, incidental or consequential damages or losses, including loss of data, whether arising from breach of warranty or scaled on contract, tort, reliance or any other theory.

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and

exclusions of this warranty may not apply to every buyer. If any provision of this warranty is held invalid or unenforceable by a court of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision

Preface

Dear customers,

Hello! Firstly thanks for buying our instrument and for your proper use of this instrument, please read this manual before using it and particularly pay attention to "safety formation".

If you have finished readout this manual, we recommend you keep this manual for future reference.

CONTENT

Chapter One Safety Information

Read First

1.1 Safety information

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

- As isolated channel not supported, keep both channels connected to same GND.

- Please make sure the float peak voltage is lower than 42V and effective value is lower than 36V when doing floating measurement.

- Please do not connect USD device when doing floating measurement

- 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.

- Replace the battery in the specified method, choose the specified power adapter and recommended

battery for charging.

■ Charge the battery properly. Please use the specified power adapter and recommended charging period, assure adapter connected to the outlet before connected to 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. Below safety notes and symbols will be seen throughout this manual.

⚠ **Warning** *denotes a hazard. It calls attention to all conditions and actions may result in injury or loss of life..*

⚠️ **Caution** *denotes a hazard. It calls attention to all conditions and actions may result in damage or destruction of the instrument.*

Safety notes on product

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

Warning *means while you are in violation of the provisions of this tag may not immediately cause damage to you.*

Caution *means cause damage to the product or others.*

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, this product can be used in the specified manner only.

⚠️ **Warning**

To avoid electrical shock or fire if input is more than 42Vpp (30 V rms) or connected to the circuit of more than 4800VA

■ *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 which may be damaged, please choose new proper accessories*

■ *Remove all probes, test leads and accessories if you do not want to use them.*

Chapter Two Oscilloscope Quick Start Guide

This chapter will guide you how to operate oscilloscope, it contains the following contents

● General check

● 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, please check the instrument according to the following instruction.

1. **Check if damage caused by transportation**

   Please keep the packaging until the whole instrument and accessories pass through electronic performance and mechanical test.

2. **Check the accessories**

   Each oscilloscope has a packing list. You can refer it to check if the attachment is complete. If the attachment is missing or damaged, please contact Micsig's agent or local office.

3. **Check the instruments**

   If situation happens like, broken of appearance of the oscilloscope, or failure to pass the performance taste, please contact Micsig's agent or local office which is responsible for this business. If the instrument damaged by transportation, 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： From top view of the instrument, you can see the probe input, multimeter test pen line input and two rope connection, see below picture 2-1; The multimeter test pen line input also can apply to external source trigger and probe compensation.
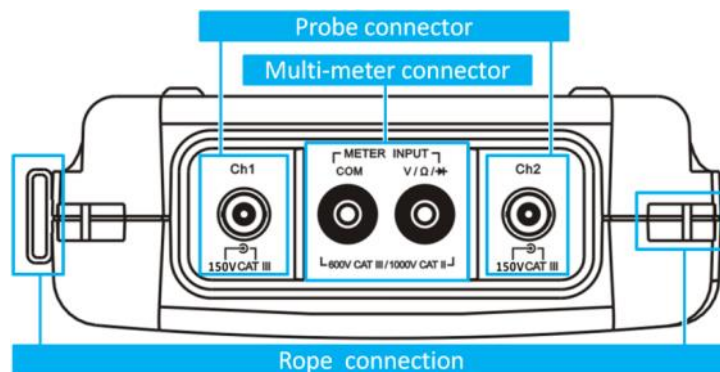
Picture2-1 Top components and connectors

Left components and connectors：The handle and power jack. Refer to picture 2-2. External power jack: by special adapter to convert the alternating current (AC) to direct current (DC), then supply power for oscilloscope.
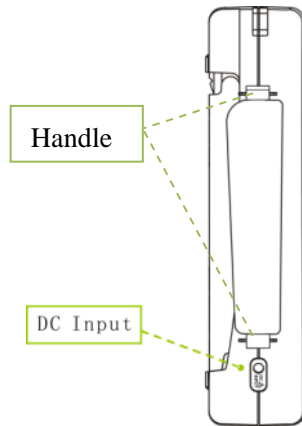
Picture 2-2 left components and connectors   picture2-3 right components
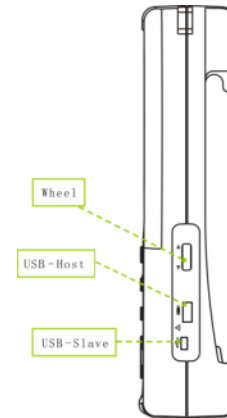
Right components: This includes a wheel and a USB port. Refer to picture 2-3.
Wheel: fast move oscilloscope trigger level, horizontal position, vertical position, the

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

Picture 2-4 front panel

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)
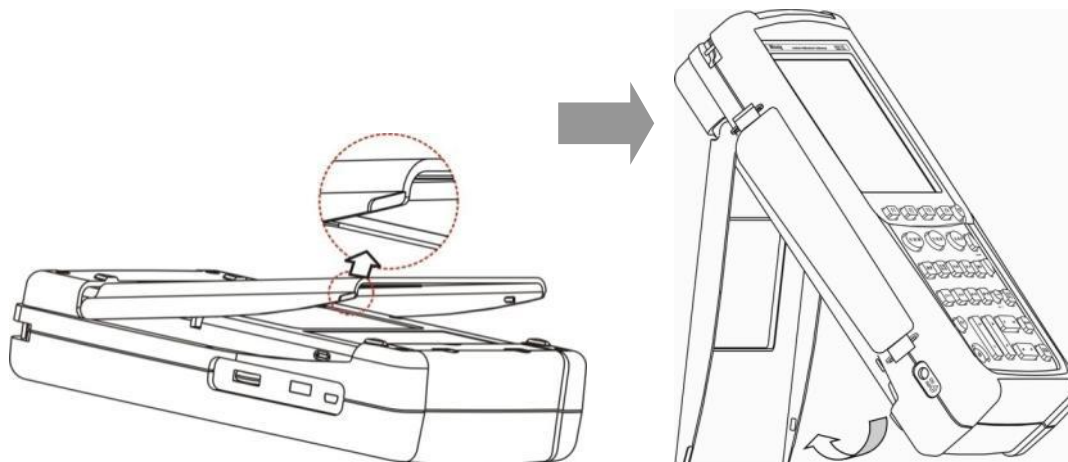
Picture2-5 open bracket

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

Steps for installing battery

1. Open the bracket, refer to picture 2-6①
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 2-6②

3. Insert the battery baffle, refer to picture 2-6③

4. Close the bracket, refer to picture 2-6④
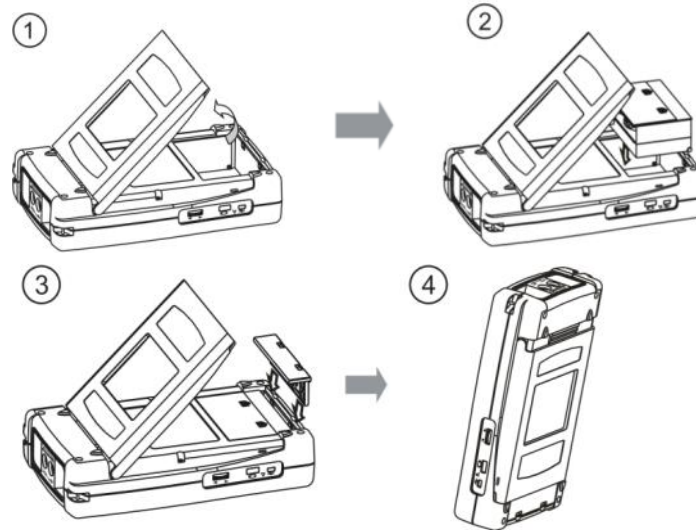
Picture 2-6 Steps for installing battery

Steps for removing battery

1. Open bracket, refer to picture 2-7①

2. Use fingers to dig up the lock chip from each side with some strength to pull up the battery baffle, refer to picture 2-7②

3. Press the battery fingerprint parts down and pull the battery to the bottom of the battery compartment, refer to picture 2-7③

4. Level up the rear panel and the battery automatically slides out under the gravity, refer to picture 2-7④
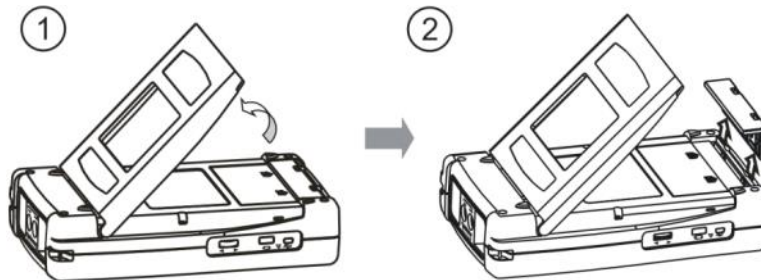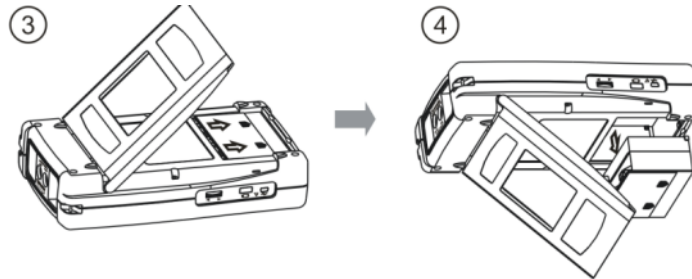
Picture 2-7 Remove battery

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 function and open menu under the oscilloscope

mode (Meter) __Turn on multimeter function

(Recorder) _____Turn on recorder function

[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 to open display menu

Trigger_____Function button to 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 stop,

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 switch to oscilloscope-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, under oscilloscope mode, press (Scope) to open 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 be 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.
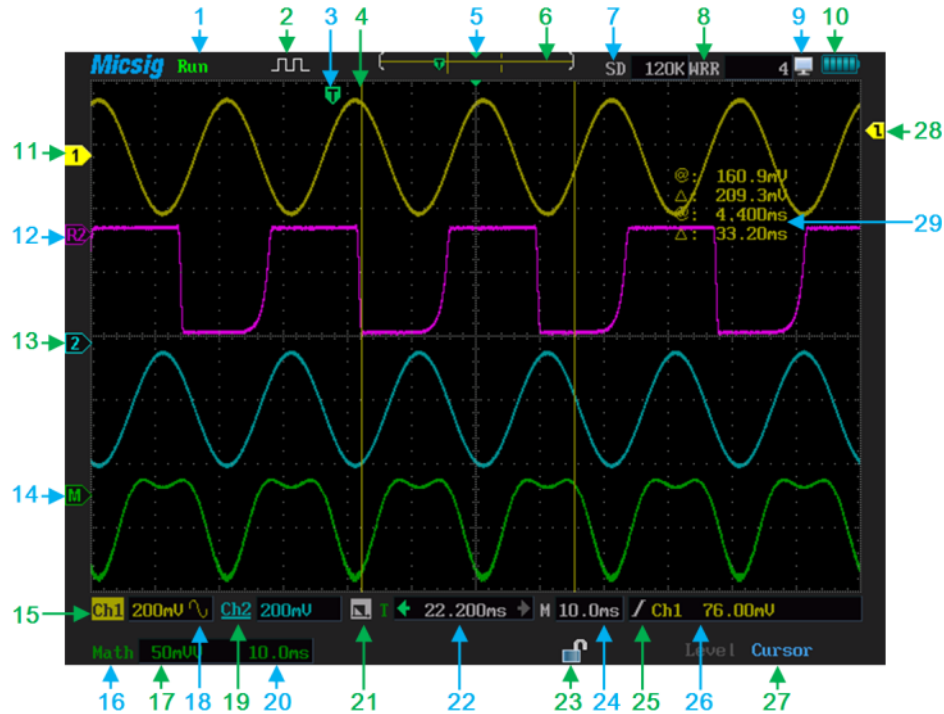
Picture 2-8 Users' interface

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: Acquire waveform data

Stop: Stop acquiring waveform data

Waiting trigger: a transient state just before trigger event occur

Rolling: Acquire 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 current channel memory depth is 120 k

8. Refresh rate, actual 50k wfms/s wfms/s at right value

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

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

    Connected 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 same as the waveform color.

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

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

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

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

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

17. Math channel, the reading 50 mv means vertical scale of math channel

18. 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, it is a DC coupling sample.

19. Ch2, here the underline means this channel inverted open, the reading 200 mV is vertical scale of Ch2.

20. Current in FFT mode, frequency span per grid is 20Hz

21. The bandwidth limit icon that means Bandwidth is limited to 20MHz (3db), no icon if full bandwidth

22. 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

23. Screen lock/unlock, lock screen off the touch function, unlock the screen opening touch function.

24. Horizontal scale (horizontal time base)

25. Trigger condition icons, rise trigger, fall trigger, dual edge trigger

26. Set trigger level value, on the left side of the Ch1 is current trigger source

27. Trigger level, cursor switch indicator

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

29. Value of cursor measurement

2.9 Understand touch screen

1. The touch screen function menu
When the function menu opened, 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 picture 2-9

4) Press ⬭MENU OFF to close function menu then the set is finished.
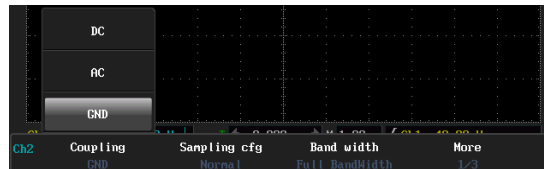
Picture 2-9 Menus on touch screen

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 screentop. 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.
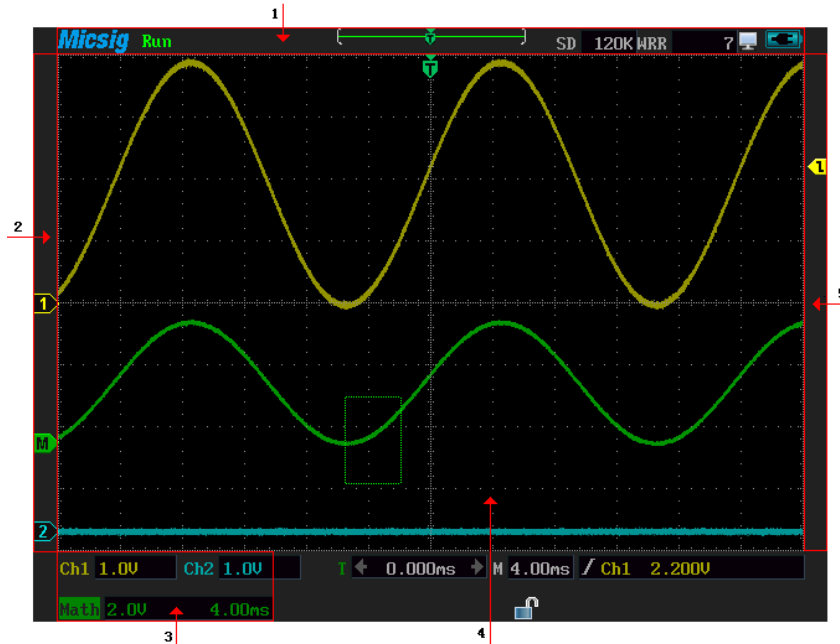
Picture2-10 touch area

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 (10 x) probe to the sine wave signal source (10V, 50 Hz)

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 step 3) and 4). If find the waveform display abnormal during the function test, please refer to the troubleshooting Chapter or contact with Micsig after-sales service center.
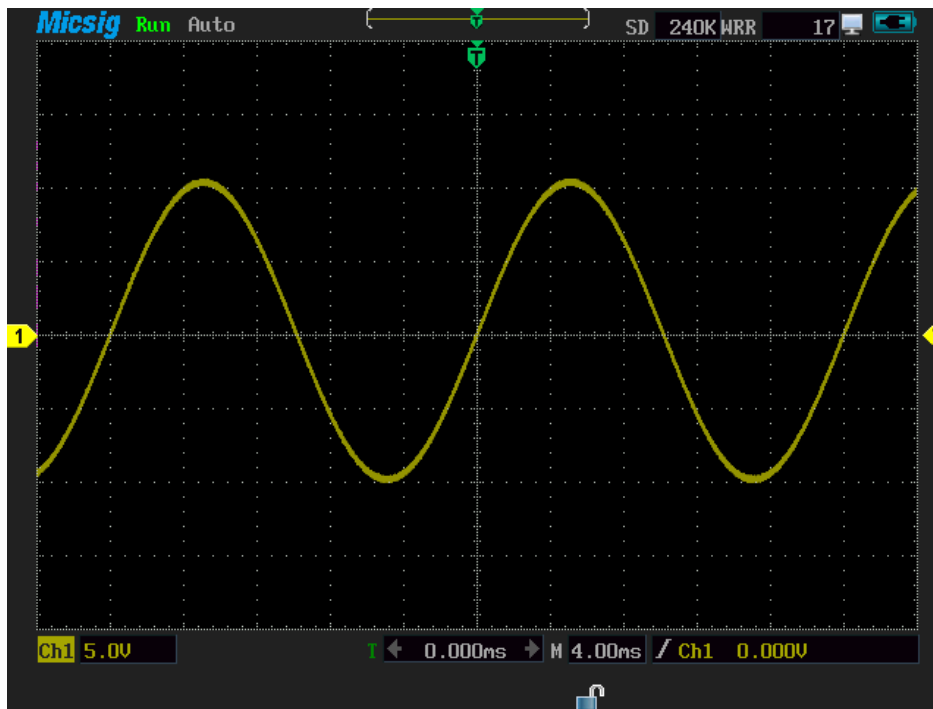
Picture 2-11 Sine waveform (10V, 50Hz)

Chapter Three Use Oscilloscope

This chapter contains the oscilloscope operating details. We recommend you read this chapter carefully, in order to understand abundant functions and specific methods of this instrument.

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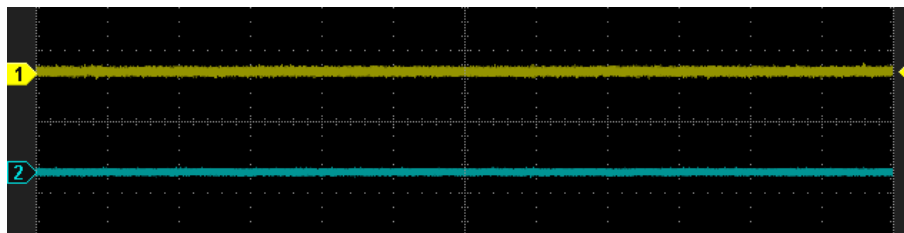
Picture 3-1 The current channel in yellow and the non-current channel in blue

Use buttons: the two buttons $\boxed{\text{Ch1}}$ and $\boxed{\text{Ch2}}$, 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 <kbd>Ch2</kbd> to set Ch2 as current channel.

If Ch2 is in current channel state, press <kbd>Ch2</kbd> to close Ch2.

If Ch2 is in off state, press <kbd>Ch2</kbd> 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 <kbd>Scope</kbd> to enter main menu, press <kbd>F1</kbd> 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

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

1) Press [Scope] to enter main menu set

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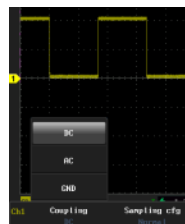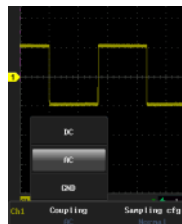
DC	AC	GND

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, CH1 is in coupling GND, CH2 is in coupling AC, and if there is no arrow point means the channel is in 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 kinds of sampling configs

1. Normal oscilloscope samples signal through equivalent time intervals to build waveform,

the default setting is normal mode. Waveform is shown in picture3-5.
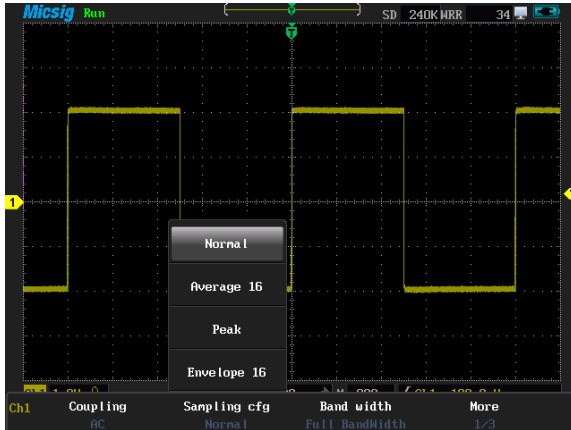
Picture 3-5 Normal sampling config   Picture3-6 Average 16 sampling config
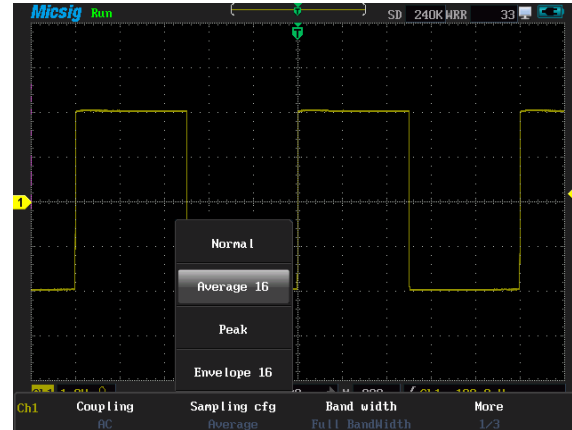
2. Average: waveform does average processing from multiple sampling. You can use the average functions to reject random or uncorrelated noise in the waveform without loss of

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

41

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.
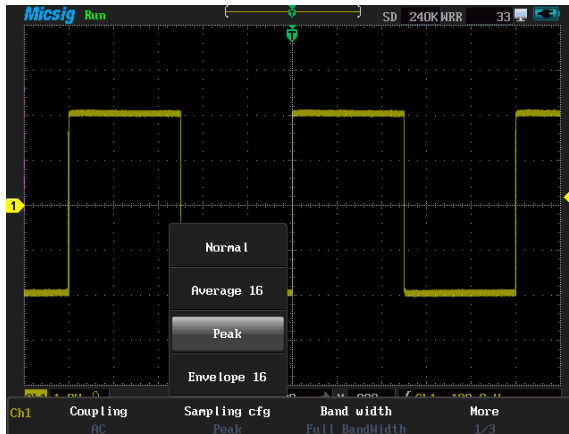
Picture 3-7 peak sampling cfg   Picture 3-8   envelope16 waveform sampling cfg
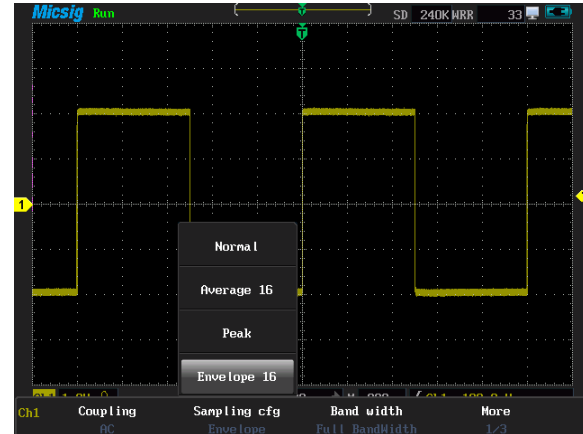
4.Envelope： Here you can see the waveform rejection after several samplings. In the specified N samplings, always display the Mini-Max values at the same acquisition positions.

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.
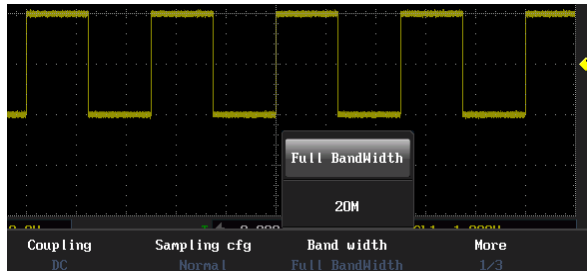
Picture 3-9 Full Bandwidth   picture 3-10 20 MHz Bandwidth
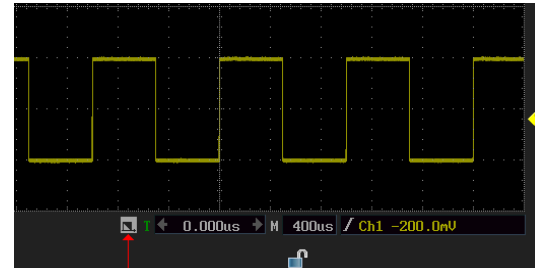
In picture 3-10, the arrow point indicates bandwidth (20MHz).

3.5 Use delay

Delay is to acquire data later than trigger happened.. 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 does delayed acquisition 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,
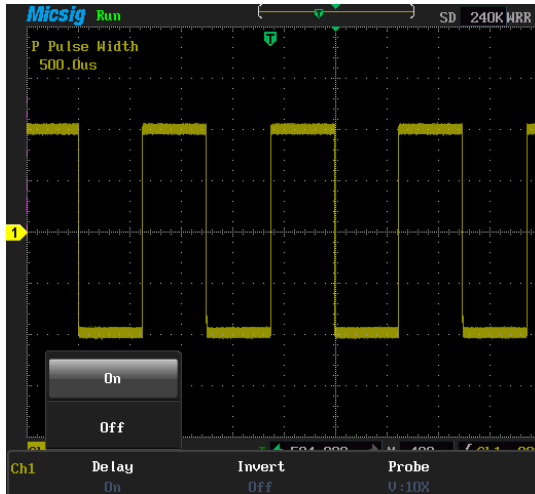
Picture 3-11 On delay menu   Picture 3-12 Delay state
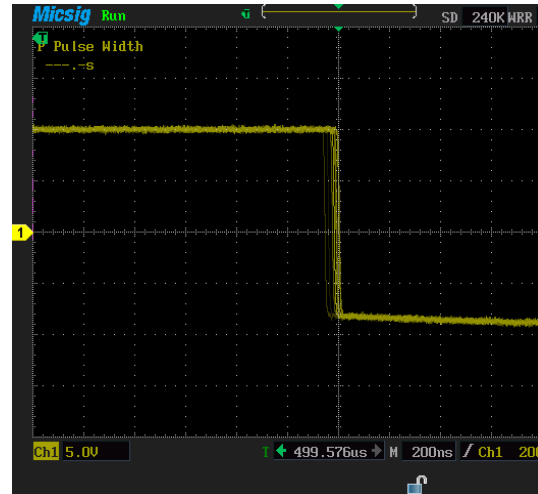
3) Press [s   ns] to enlarge waveform until it jitters significantly, observe the jitter

effect shown as 3-12

When delay is on, 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, waveform zoom is based on center of screen. When Delay off, adjust the time scale, waveform zoom is based on 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 connected 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.
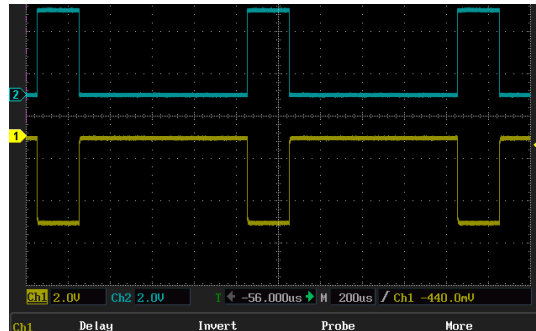
Picture 3-15 invert polarity of the two waveforms

3.7 Set channel attenuation ratio

To coincide with actual probe attenuation radio, it is necessary to adjust channel attenuation factor under the channel menu. Such as probe attenuation radio of 1:1, corresponding input channel attenuation factor set as 1x and step by step as the way of 1～2～5.

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, automatically 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 done 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 applied to Ch1, Ch2, math and reference channel. Before choosing

the measurement type, it 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, it can be calculated using either the min/max or histogram method.
17	Low	The value is used as 0% whenever high reference, it can be calculated using either the min/max or histogram method.

18	Max	Typically the highest positive peak voltage which is measured over the entire waveform or gated region
19	Mini	Typically the lowest negative peak voltage which 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
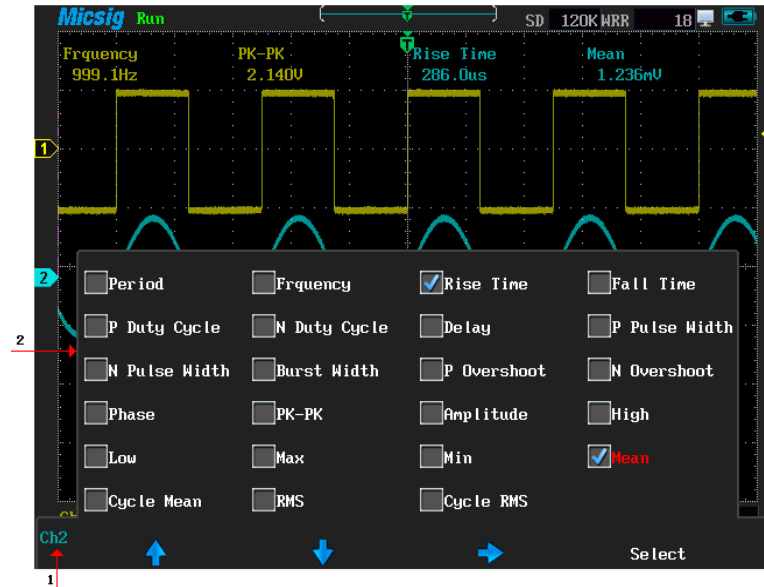
Picture 3-17 Measurement types

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 ⬚ and ⬚ to enter the save waveform menu, to save Ch1/Ch2/math waveform as reference waveform, which marked in color purple. Date and time displayed under the To Ref R*means this memory has already saved waveforms, blank means no waveform saved. Picture 3-18

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, purple one is the waveform after being saved. The two waveforms overlap with each other.
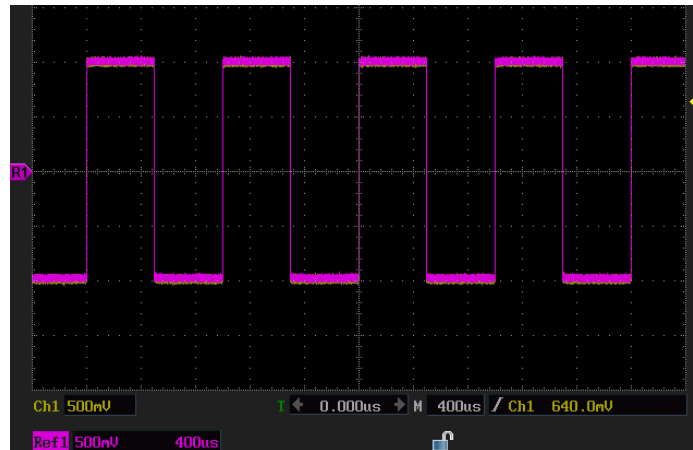
Picture 3-19 Stored waveform to R1

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It can save four reference waveforms (R1/R2/ R3/ R4) at most. If continue repeat saving, 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), please

refer to picture 3-20.
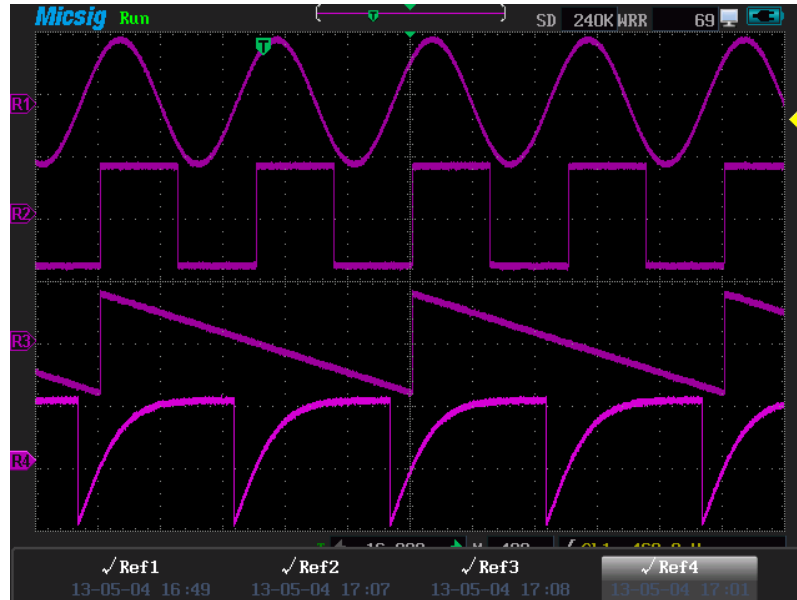
Picture 3-20 restore waveform

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

Note: Need to be updated to get this function.

Dynamic record can easily record the waveform and memory operation steps. Only after identifying the USB device can start dynamic record. U device icon will be displayed at upper right corner if U device is connected and 'Dynamic record' turn white(grey previously)(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.
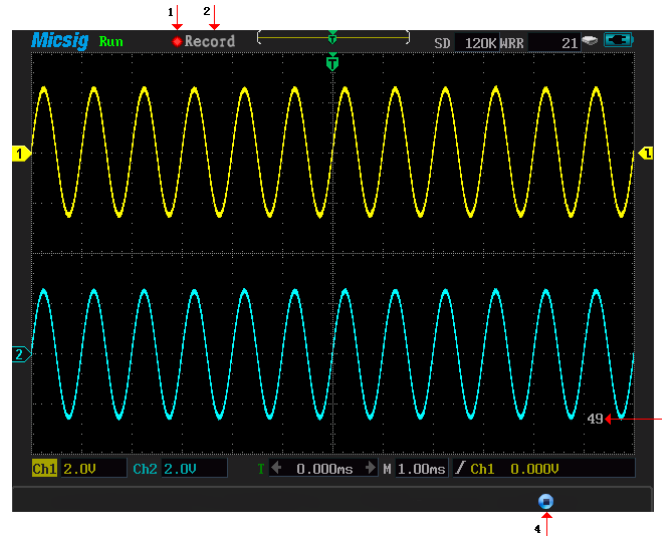
Picture 3-21 Waveform record

Interface descriptions of waveform record

1. Recording ✦ icon, the icon flashes while recording

2. Dynamic record mode, being 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.
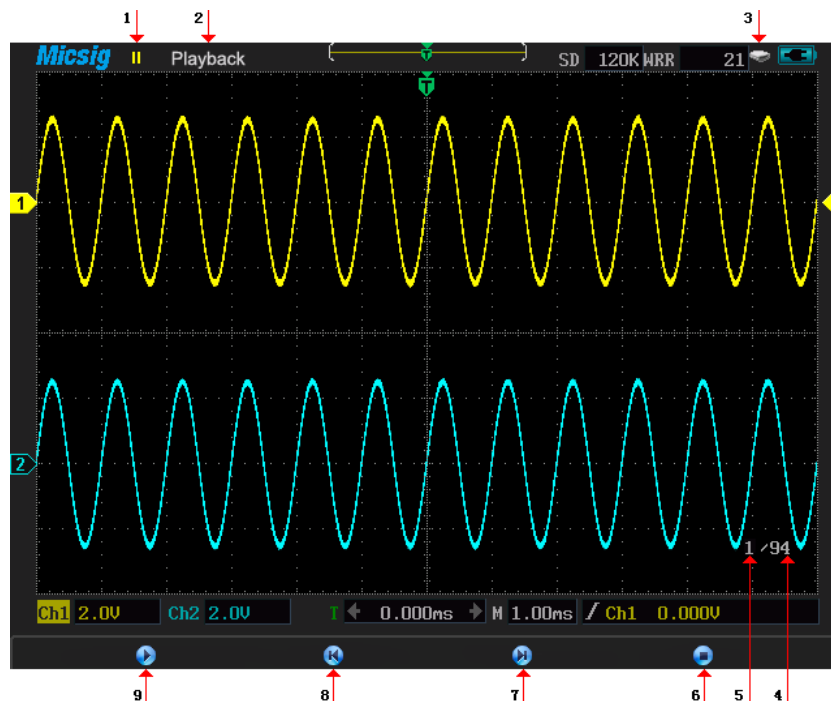
Picture 3-22 Waveform data playback

Interface descriptions of waveform playback

1. Run ▷,timeout ⏸,stop ■, the current state is running.

2. Dynamic record mode, being playback mode

3. External USB device icon

4. Total frames

5. Current playback 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 speed 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

Note: Need to be updated to get this function

After identifying the U device, the menu color of the "screen shot" changes from grey to
white, then the screen shot function is active. 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 horizontal cursor and vertical cursor to open cursor, close the cursor and switch the horizontal or vertical cursor.

Take the vertical cursor for example

- When the vertical cursor is off, press "vertical cursor", correspondingly press [F2] to open vertical cursor. Then vertical cursor is current cursor. Which is marked as [✓].

- 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 picture 3-23.
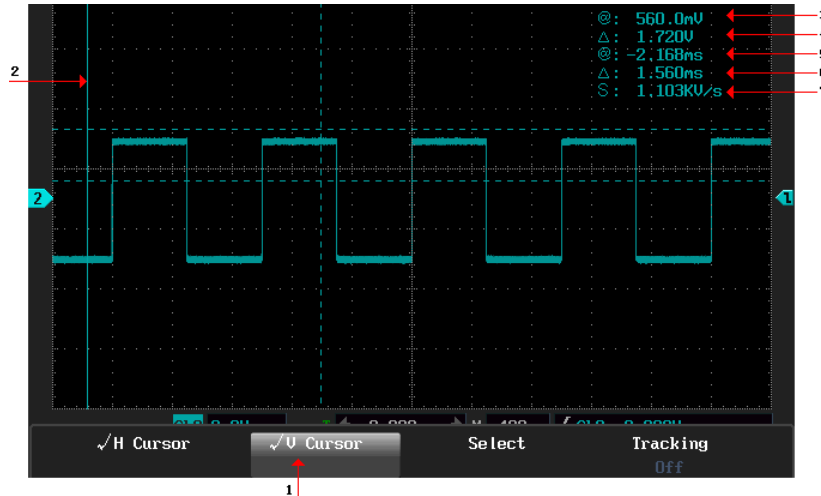
Picture 3-23 H Cursor and V Cursor

Interface descriptions of horizontal and vertical cursor

1: Current cursor

2: Activated cursor

3 @：(1)when only horizontal cursor is opened, it indicates the activated horizontal cursor is

relative to the voltage difference value which is at the zero level.

(2) When only open vertical cursor, it indicates 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 are opened simultaneously, it indicates the last activated horizontal cursor is relative to the zero level of voltage difference value.

4 △:(1)when horizontal cursor is opened, it indicates voltage difference value between two horizontal cursors   (2)when vertical cursor opened alone, it indicates 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

lighted on, the operator is the cursor, see picture 3-25.

Picture 3-24 Trigger level operation
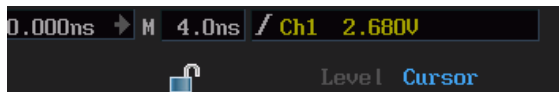
Picture 3-25 Operate the cursor

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 picture 3-26

Picture 3-26 Waveform set menu

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

1) Press to enter the display menu;

2) Press to enter waveform setting;

3) Press to enter draw type set;

4) Press ⬚ F1 ⬚ to choose skeleton pattern as Dots. See picture 3-27.
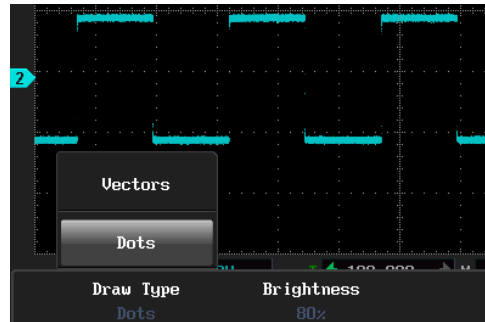
Picture 3-27 point display

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.
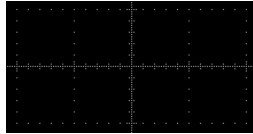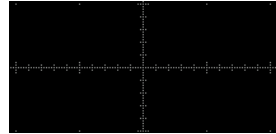
| Full | Crossing line | Grid |

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   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.
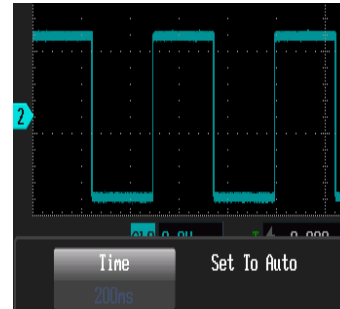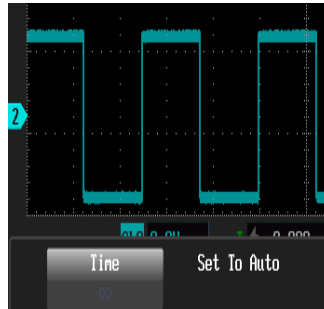
Picture 3-30 persist time ∞   picture 3-31 persist time 200ms

3.12.4 Time base

In the Time base menu, you can set the waveform display as YT or XY mode(need to be updated). YT model shows the relative relationships between vertical voltage and horizontal time; if XY mode, horizontal axis shows as Ch1 and vertical axis shows as Ch2.

1) The following functions are invalid in XY display：

● Reference& math waveform

● Cursor

● Trigger control

● Auto (Waveform display mode switch to YT mode automatically)

2) 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

3.13 Set trigger menu

Press 【Trigger】 and 【F1】 to enter the trigger type choice menu, there are five kinds of

trigger types available

    1.   Edge trigger: When the edge trigger signal reaches a certain given trigger level,

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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 meet a certain logic operation result, then trigger happens.

4. Video trigger: trigger for PAL, NTSC, SECAM, 720P, 1080I, 1080P

5. Serial bus trigger: serial 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).
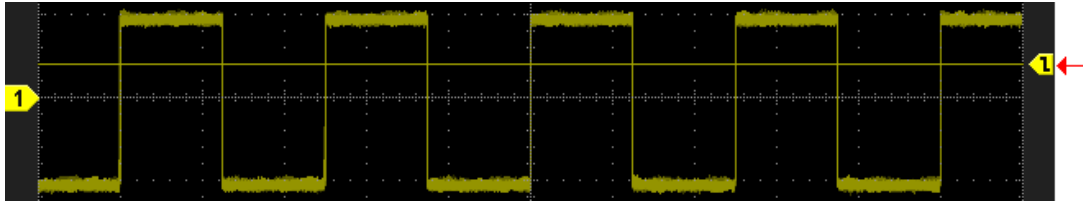
Picture 3-34 trigger level

Trigger coupling mode：

DC	Let signal pass through AC and DC components
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 time.

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	Ch1	Set Ch1 as source trigger
Source	Ch2	set Ch2 as source trigger
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.
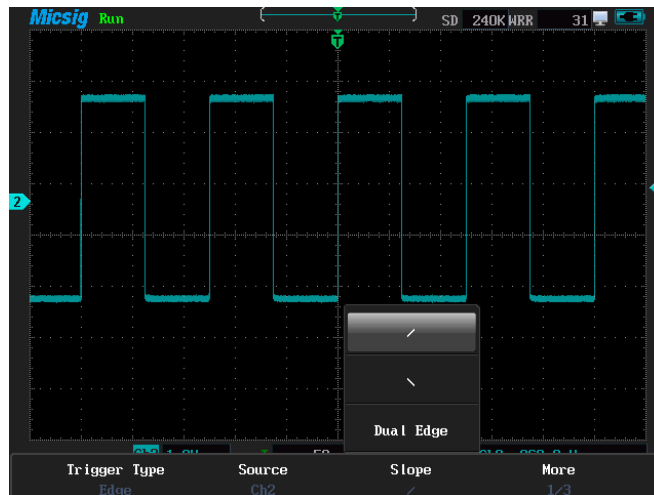
Picture 3-35 The rise (/) waveform

Tips for adjusting rejection time：Singly press ⬠ or ⬡ for precise adjustment; Long

press ⬠ or ⬡ to rough adjustment.

EXT trigger refers to the external source as a trigger source; The external signal source can

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be square waveform, sine waveformetc. Using external trigger, users should firstly 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.
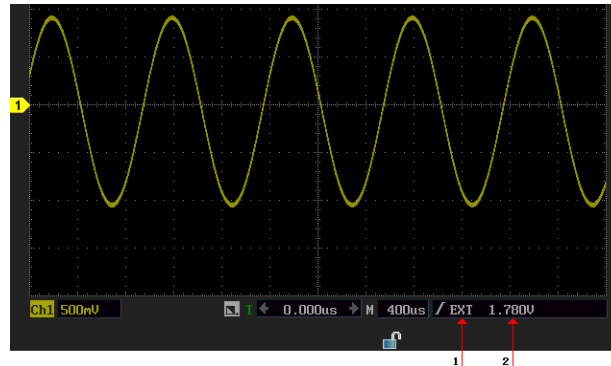

Picture 3-36 （EXT） trigger waveform

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 Ch 2 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 = or ≠, 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.
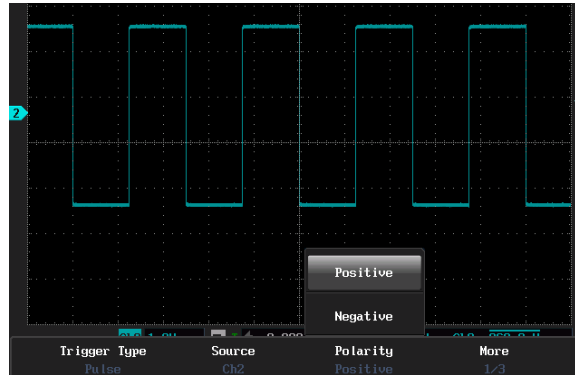
Picture 3-37 Positive polarity pulse width trigger

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, 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 Ch1 as logic high

3) Press F3 to enter Ch1 logic 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.
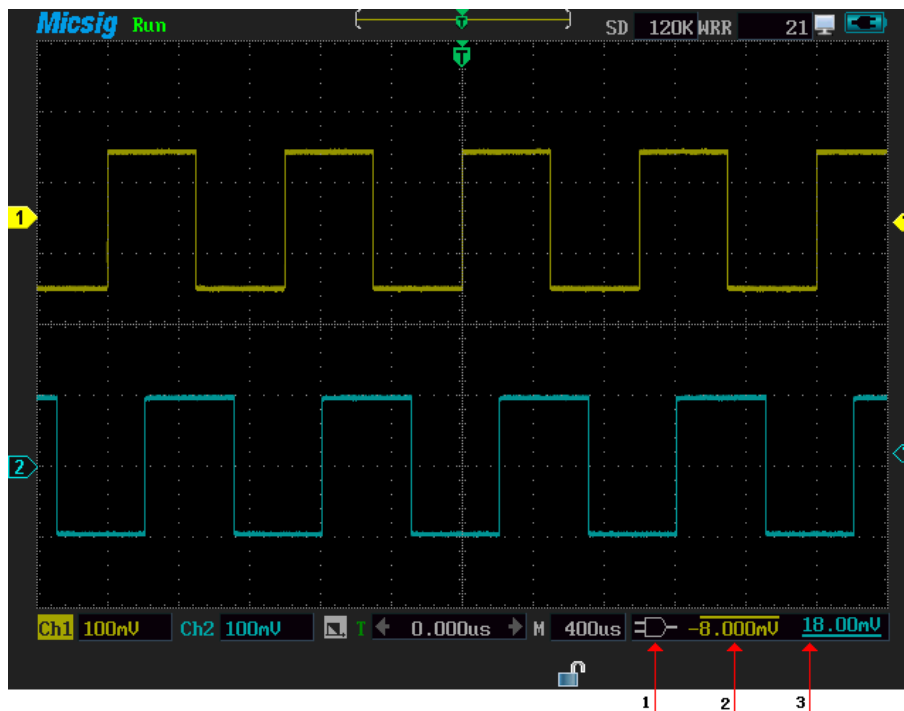
Picture 3-38 Logic trigger

3.13.5 Serial bus trigger

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

3.14 Using the vertical and horizontal button

1. Vertical button

Vertical scale adjustment [mV/V]**:** it can adjust vertical scale factor for all channels' waveform.

Press [mV/V] 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 picture 3-40. (The left upper corner of the screen shows the rolling screen; arrow points the time

scale is 100 ms).
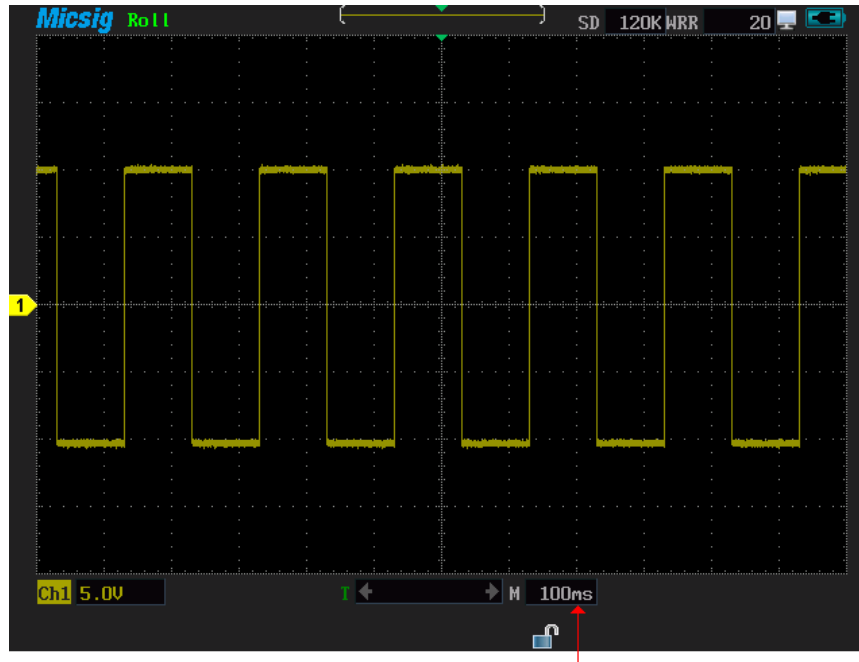
Picture 3-40 Roll mode

Horizontal button ⬔ ： Adjust all channels'horizontal positions, with each pressing, the waveform move one pixel and long pressing can make the waveform quick move. ⬇ on the screen is trigger position, if left/right move the waveform, the ⬇ position move left/right for user's needs. The waveform moves to right is shown in picture 3-41(arrow points trigger position).
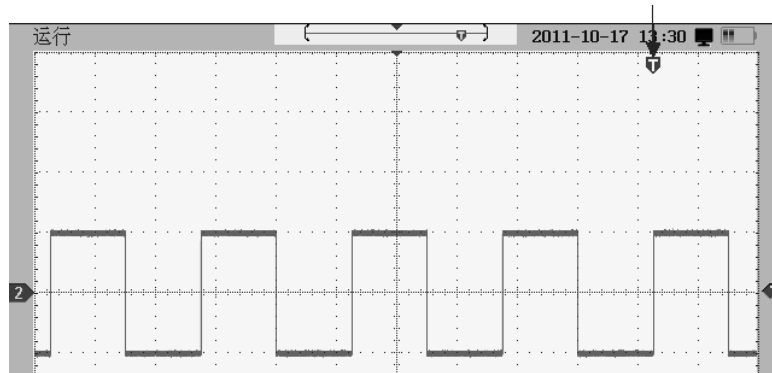
Picture 3-41 waveform moves rightward

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 exit 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. Then auto mode will turn 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 be correct.

Math waveform Ch1 + Ch2, follow the below steps,

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 picture 3-42.
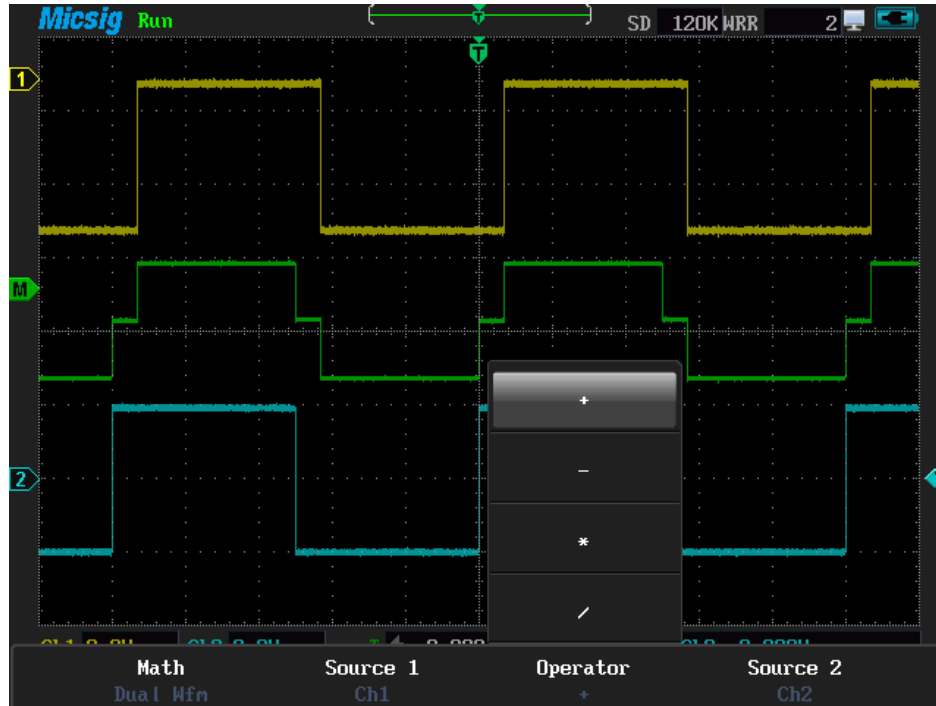
Picture 3-42 Ch1+Ch2 math function

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.
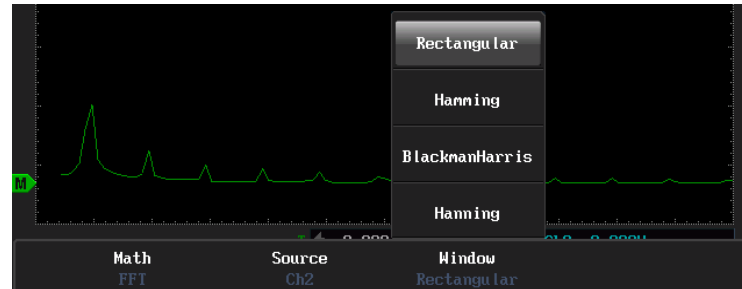
Picture 3-43 FFT windowing

Hanning, **hamming window**：

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 picture 3-44 (the top left corner shows a stop sign), run state is shown in picture3-45(the top left corner shows run).
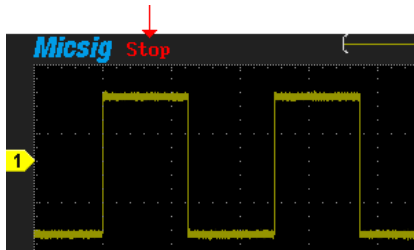
Picture 3-44 stop
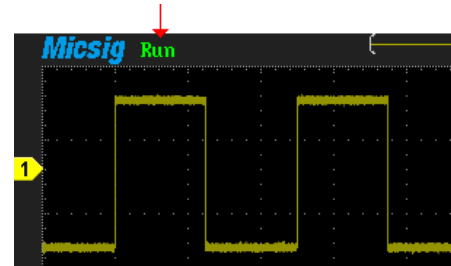
Picture 3-45 run

2. Use single sequence to observe waveform

Press 〔Single SEQ〕, and the signal is triggered after reaching the trigger condition and 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.
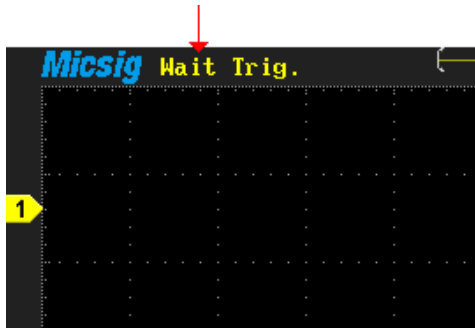
Picture 3-46 Wait trigger   picture 3-47 After trigger
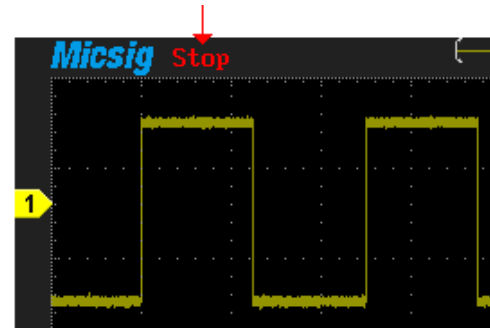
3.18 Reference channel

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 adjust the trigger level, vertical position, trigger position, vertical cursor, horizontal cursor quickly.

1. Quickly 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, after ''To 50%'' is shown in picture3-49.
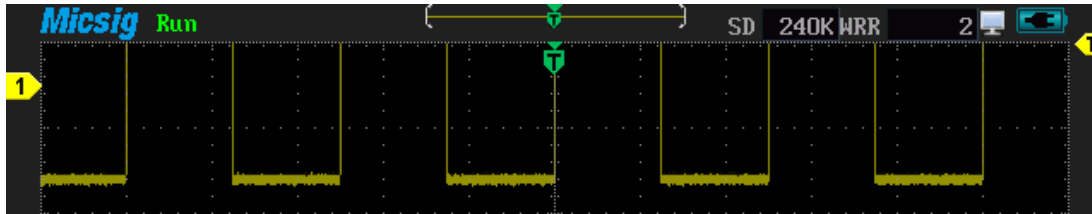
Picture 3-48 Vertically move upward waveform leaking out the screen
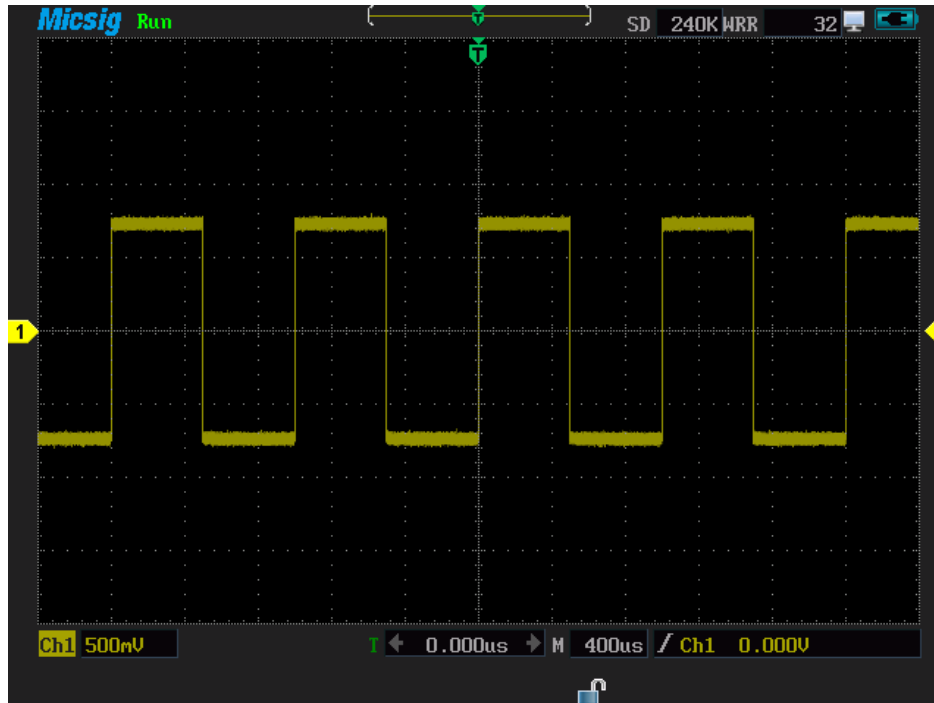
Picture 3-49 After using 50% shortcut

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.
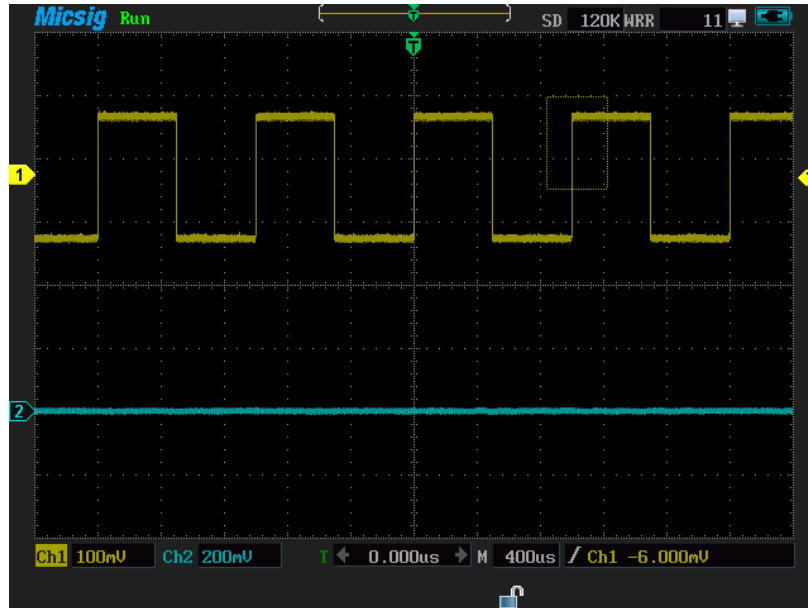
Picture3 -50 Magnify selection area
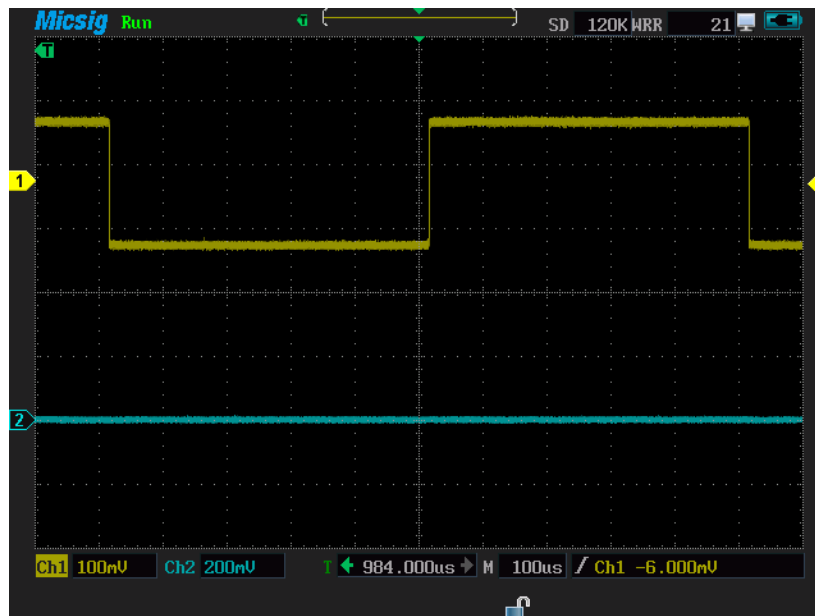
Picture 3-51 Magnified waveform

Chapter Four Serial Bus Trigger

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

This chapter mainly include the below contents：
● UART (RS232/RS422/RS485) bus trigger
● LIN bus trigger
● CAN bus trigger
● SPI bus trigger
● I2C bus trigger

Press ⬭Scope then ⬜Trigger and ⬜F1 to select serial bus

press ⬜F2 to select one kind of bus type, there are UART(RS232/RS422/RS485)

/LIN/CAN/SPI/I2C five kind of types.

The bus type selection dialog is shown in picture4-1
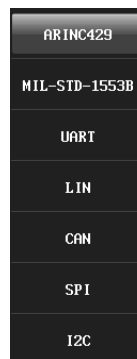
Picture 4-1 The bus type selection dialog

4.1 UART（RS232/RS422/RS485）bus trigger

Below is the bus configuration, trigger mode set and trigger level setting.

● **Bus configuration**

（1） Press F3 and then popup bus configuration dialog, set Rx channel, idle level, baud rate, parity, data bits, see picture 4-2;
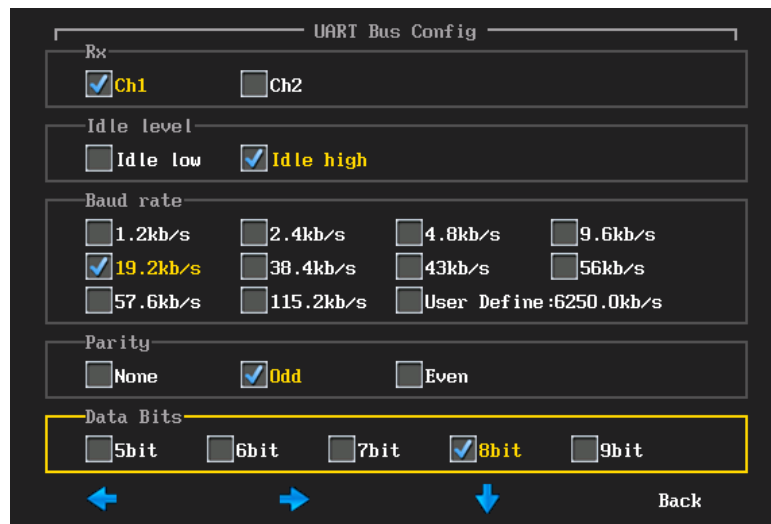
Picture 4-2 UART bus configuration dialog

Note: the yellow rectangle box means the selection is in set, (√) means selected, in the above picture it is setting data bits, the selected are 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 picture 4-3.

Picture 4-3 virtual keyboard

Note: If parity bit, data length equals data bits plus parity bit. If no parity bit, data length is
data bits. For example, data length is 8 bit, total data bit is 8 bit if parity bit exist, If not,

total data bit is 7 bit and 1 parity bit.

- **Trigger mode**

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

relation and trigger data, see picture4-4.
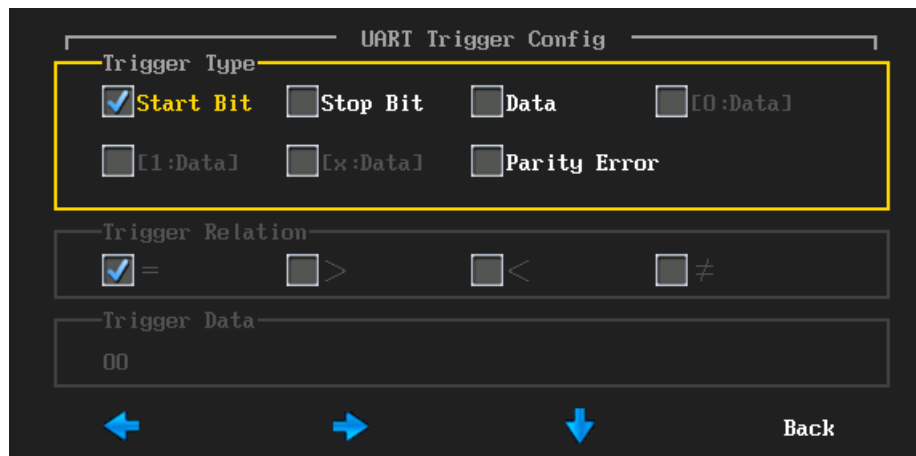
Picture 4-4 UART trigger configuration menu

（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 or 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 picture 4-5.
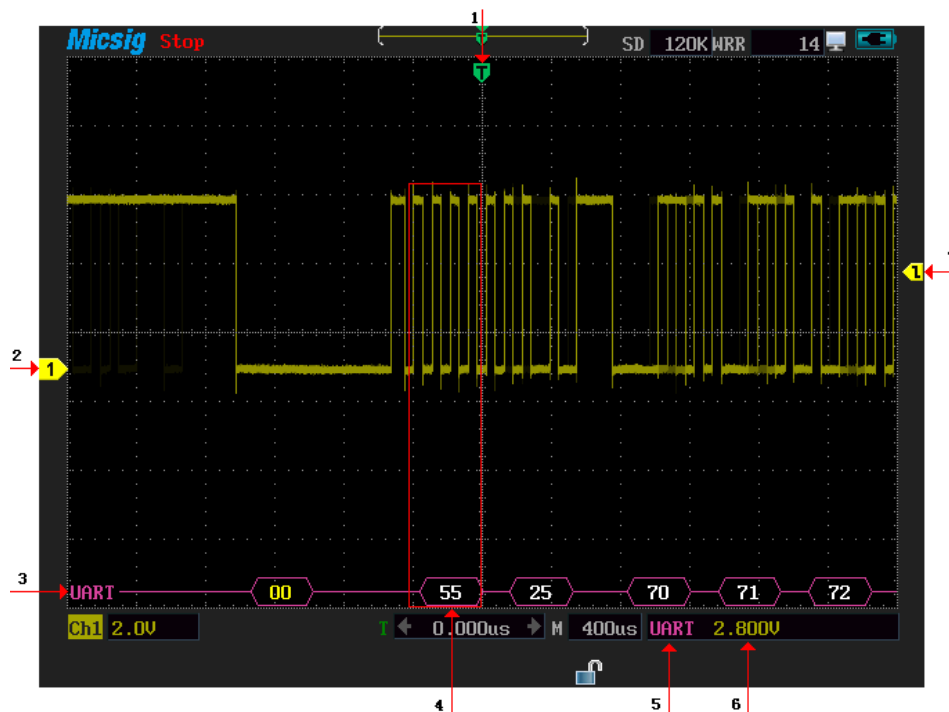
Picture4-5 UART graphic interface

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

4.2 LIN bus trigger

Below is the 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 picture 4-6.
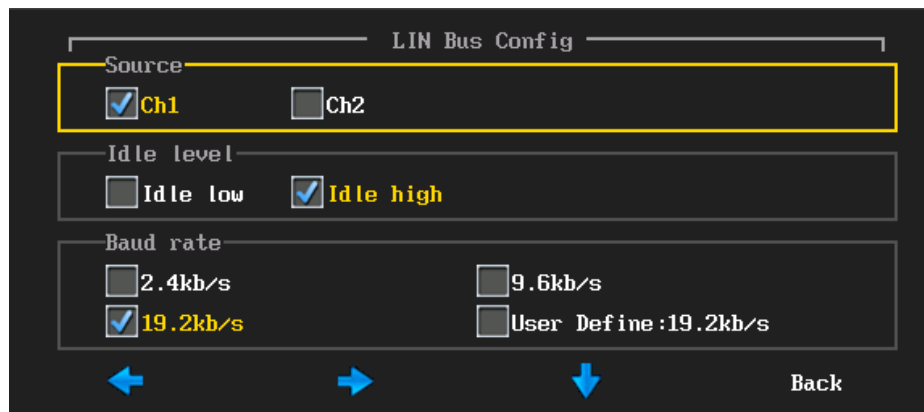
Picture 4-6 LIN bus configuration menu

● **Trigger type**

Press F4 to pop-up trigger mode configuration dialog. Trigger types include sync- rising edge, frame ID and ID data, see picture 4-7.

Picture 4-7 LIN trigger configuration mode menu

a) Sync-rising edge —when the sync interleaved of LIN bus is over, sync-rising trigger begins to work.

b) Frame ID — Triggered once 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— Tiggered once the detected ID and the data are 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 Ch1 to 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 oscilloscope function 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 press Ch1, 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 figure4-8.
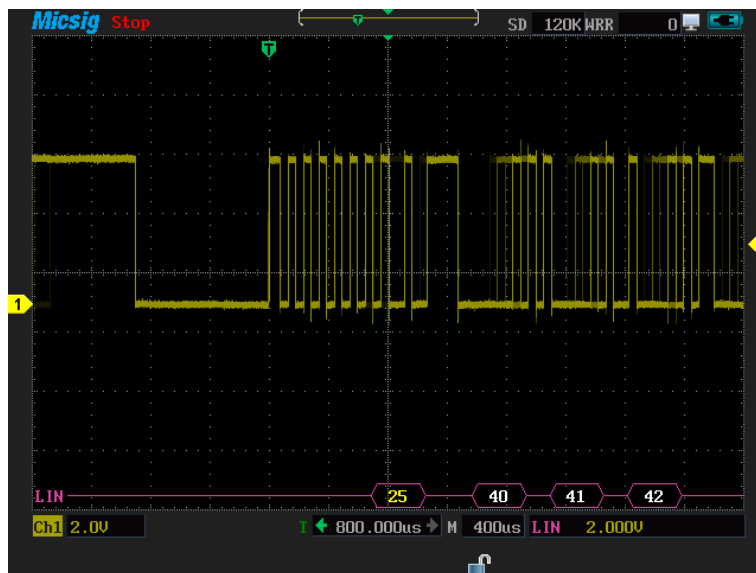
Picture 4-8 LIN graphic interface

4.3 CAN bus trigger

Below is the bus configuration, trigger configuration type and trigger level adjustment.

● **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, picture 4-9.
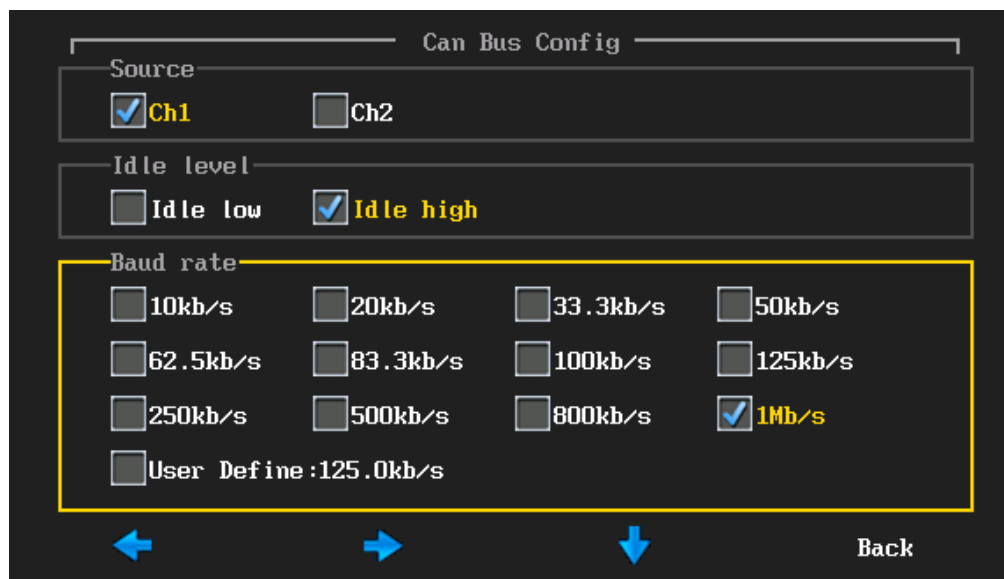
Picture4-9 CAN bus configuration menu

● **Trigger type**

Press F4 to popup trigger type setting menu, picture 4-10
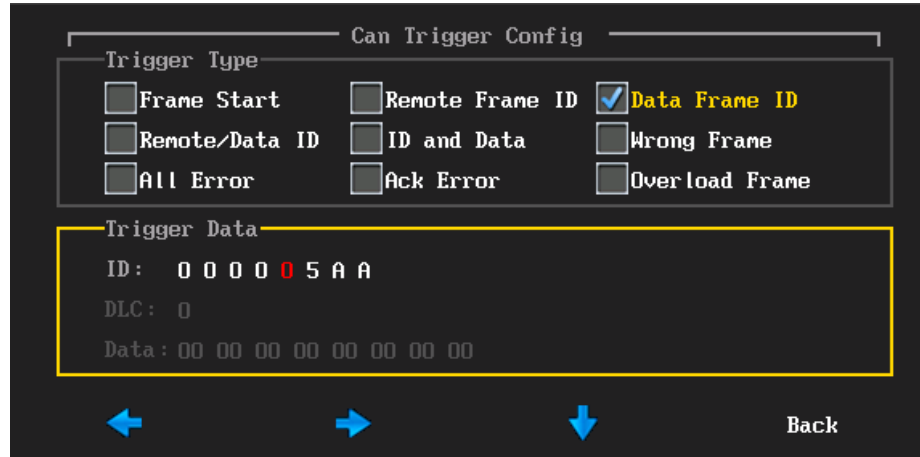
Picture 4-10 Configuration trigger type menu

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 oscilloscope function 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 press Ch1then 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 picture 4-11.
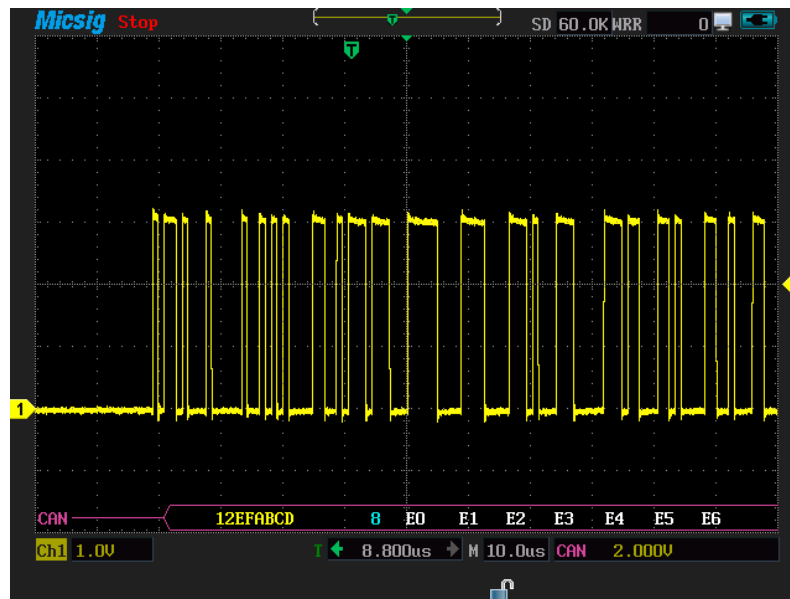
Picture 4-11 CAN graphic interface

4.4 SPI bus trigger

Below is the bus configuration, trigger type configuration and trigger level adjustment.
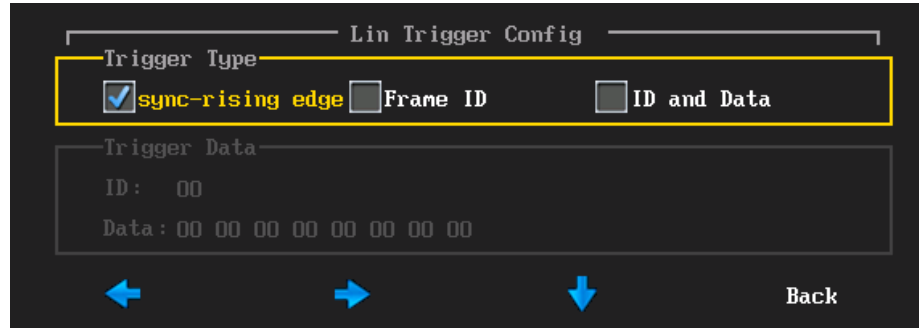
● **Bus configuration**

(1) Press $\boxed{\text{F3}}$ to popup bus configuration, then user need set the clock source(CLK), data

source, work mode and data bits. As shown in figure 4-12.
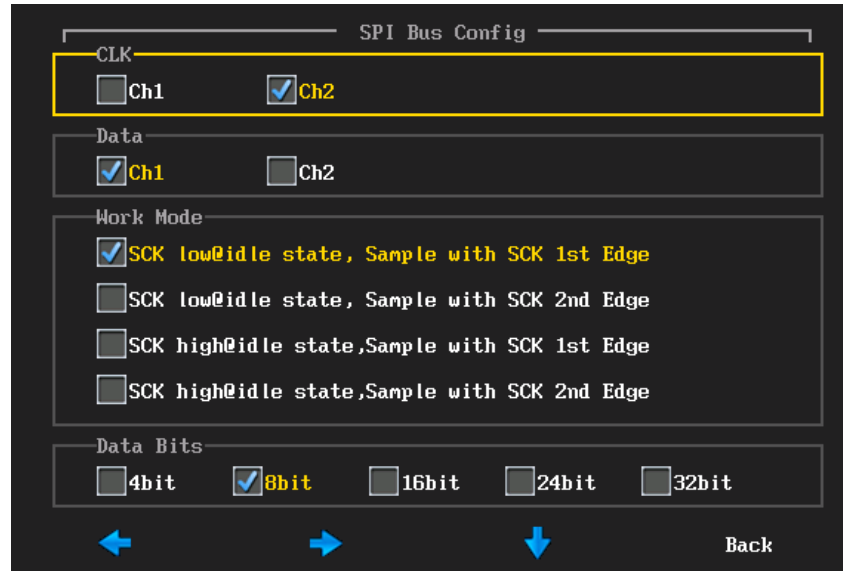
Picture 4-12 SPI bus configuration menu

● **Trigger mode**

Press F4 , popup trigger mode configuration menu, shown in picture 4-13.

Picture 4-13 SPI matching bit settings menu

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

Measured signal length is 8 bit; trigger mode matching bit is 11110101, Ch2 connect to CLK, Ch1 connect to DATA, bus is idle for low level, Please follow these steps for clock rising samples;

（1）In oscilloscope function mode，press , then press select the trigger type as serial bus

（2）press to select bus type as SPI

（3）press 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 is 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;

（5）According the signal amplitude to adjust the two channels' trigger level; SPI

trigger interface is shown in picture 4-14.
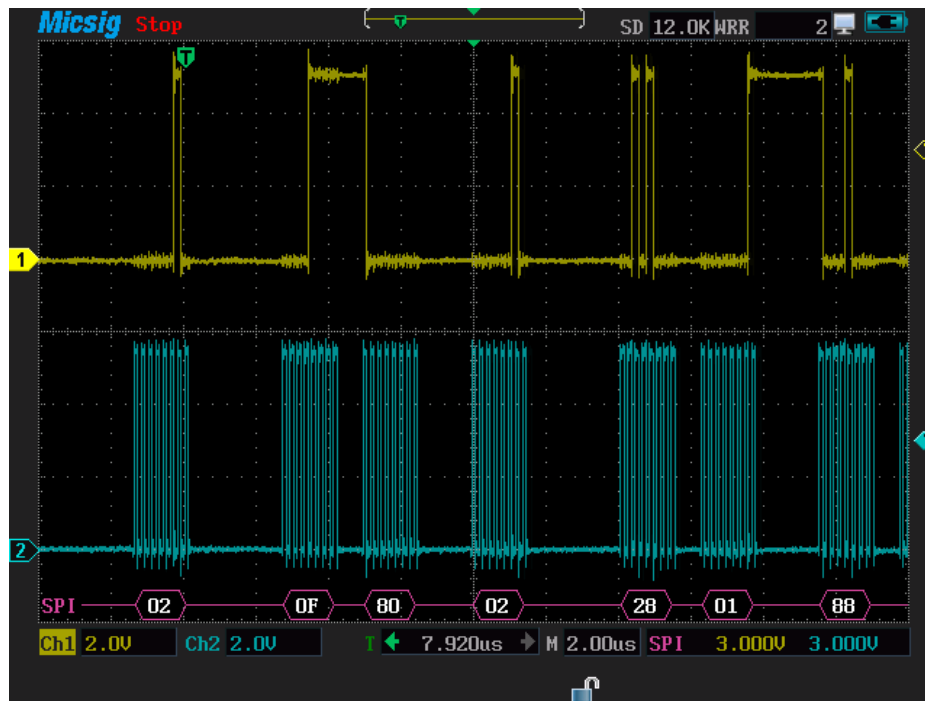
Picture 4-14 SPI trigger graphic interface

4.5 I2C bus trigger

Below is the 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 4-15.
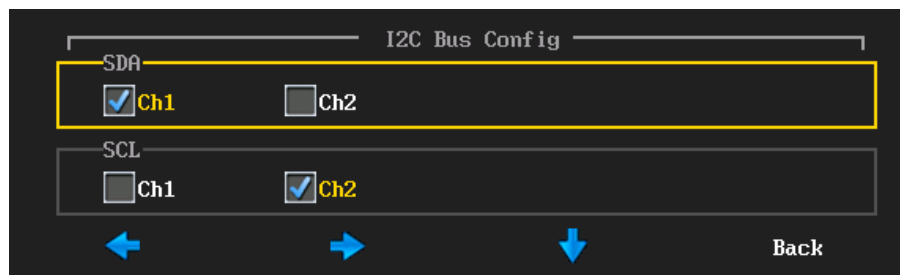
Picture 4-15 I2C bus configuration

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 4-16.
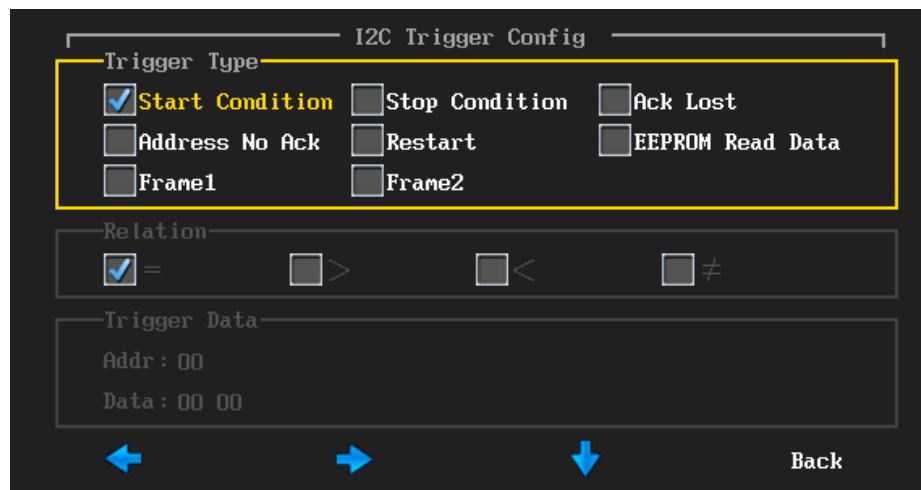
Picture 4-16 I2C trigger type configuration menu

Specification of trigger type menu:

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

b) Stop condition — when SCL is high, the SDA beginsrise 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 $\bigcirc$ $\bigtriangledown$ 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 when new restart condition appears before the stop.

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 picture 4-17.
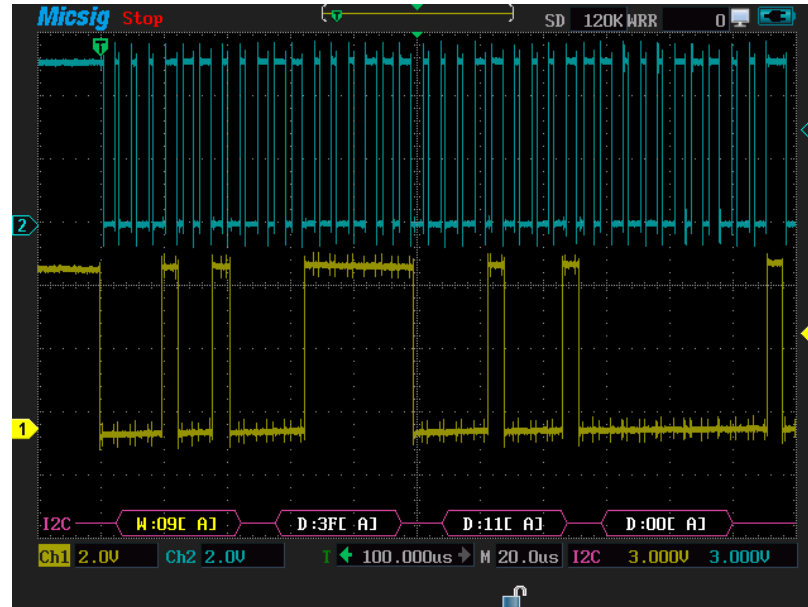
Picture 4-17 I2C graphic interfaces

Chapter Five Application Examples

This chapter mainly introduces five common applications：

● Taking simple measurements

● Capture single pulse signal

● Analyze signal detail

● 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 Taking simple measurement

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

1. Follow these steps to get quick display signal waveform:

1)   connect Ch1 to 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 automatically set vertical, horizontal and trigger; Users can also manually adjust the vertical and horizontal gear until the waveform conforms to your requirements.

2. Auto-measurement

Oscilloscope can automatically measure most signals, like signal frequency, period, the mean and peak-peak, follow these steps

1) Press [Measure], see the measure type menu.

2) By pressing on the touch screen to select period, frequency, mean, peak-peak these four measurement options.

3) Press [Trigger] then [F2] then select trigger as Ch1

4) Press [AutoSet]

After auto-measurement finished, the results show on the screen, as shown in picture 5-1.
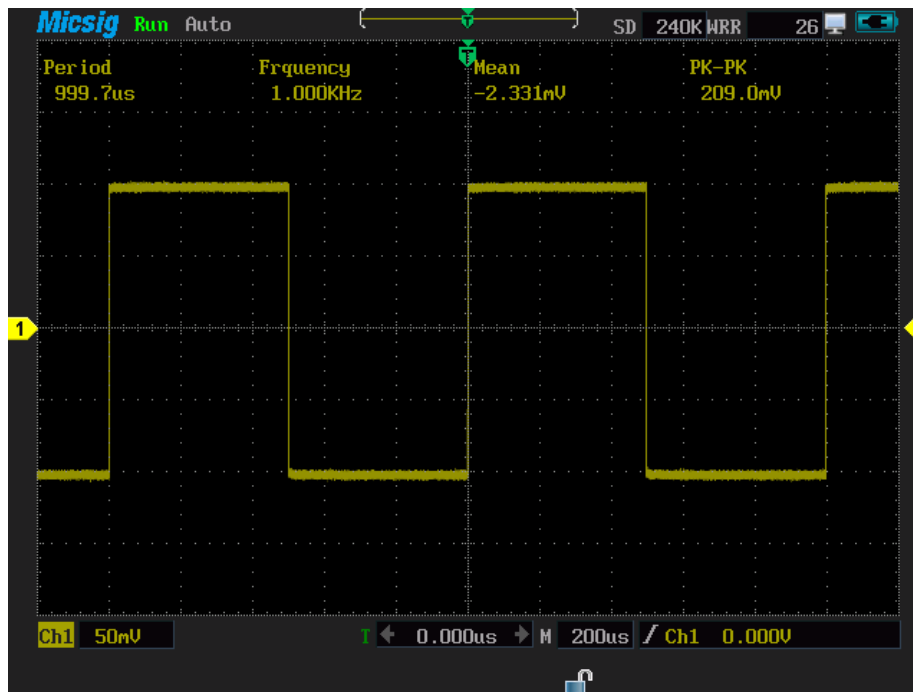
Picture 5-1 Auto-measure

3. Cursor measurement

Using the cursor to quickly 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.
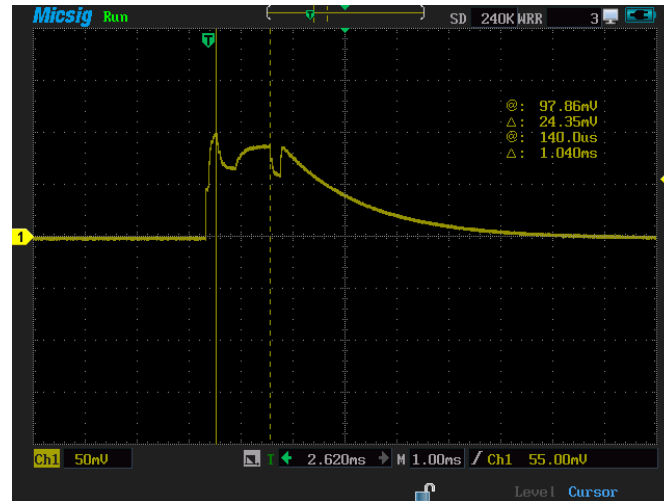
Picture5-2 Cursor measure

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 e 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 is ready to capture in next time.
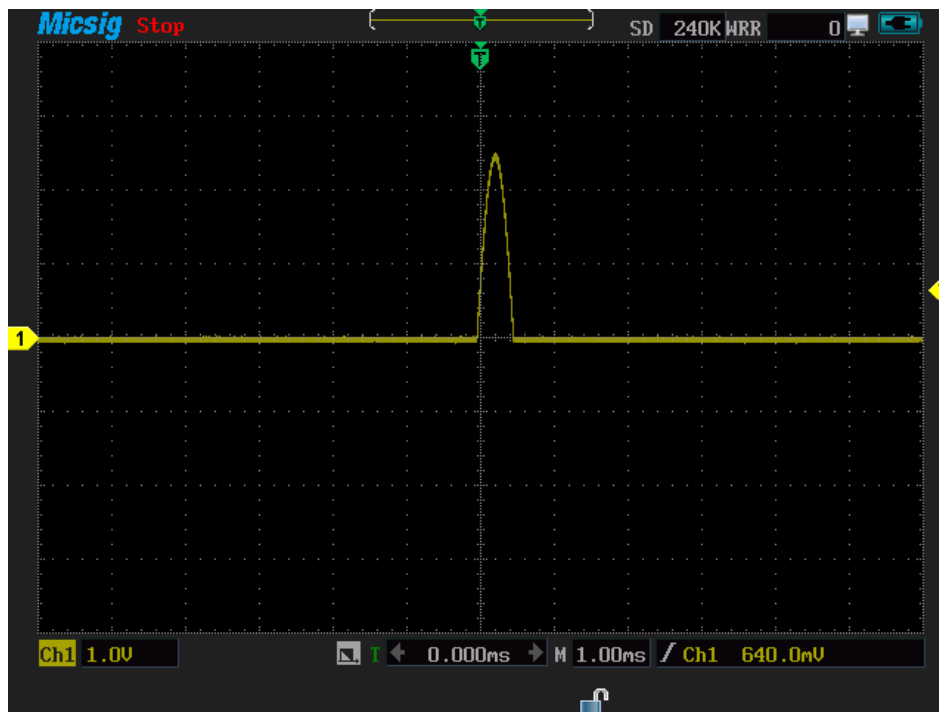
Picture 5-3 Capture the single pulse signal

5.3 Analyze the signal detail

If adding the random noise to the measured signal, you can adjust the settings to eliminate or reduce the noise and then avoid the interference to original signal.

1. Observe noisy 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 $\boxed{\text{Scope}}$ to open the oscilloscope menu.

   3) Press $\boxed{\text{F2}}$ to select the sampling cfg as peak.

At this time, the screen displays random noise waveform and noise peak and burr can be observed with peak sampling. See picture5-4.
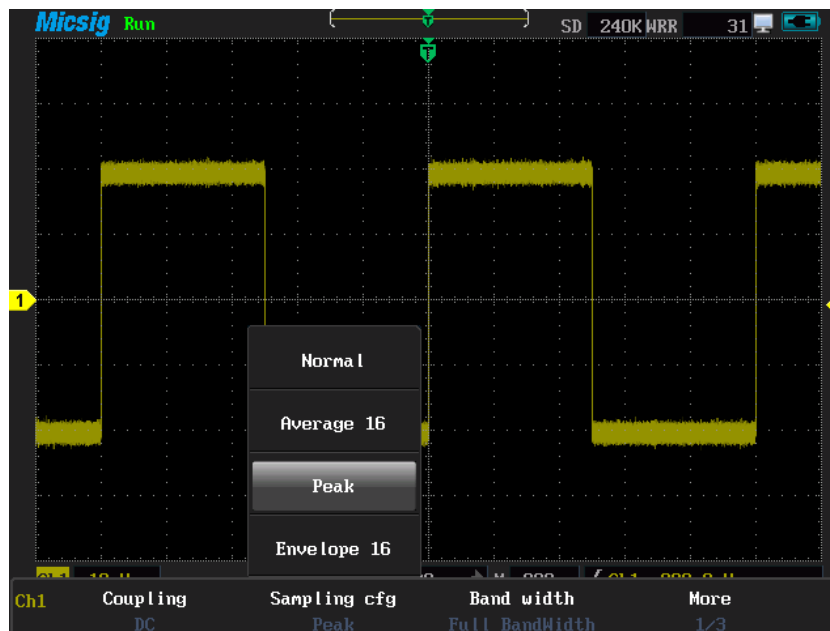
Picture 5-4 Peak sampling cfg

2.   Isolate signal from noise

Ignoring the noise while analyze 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, 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.**
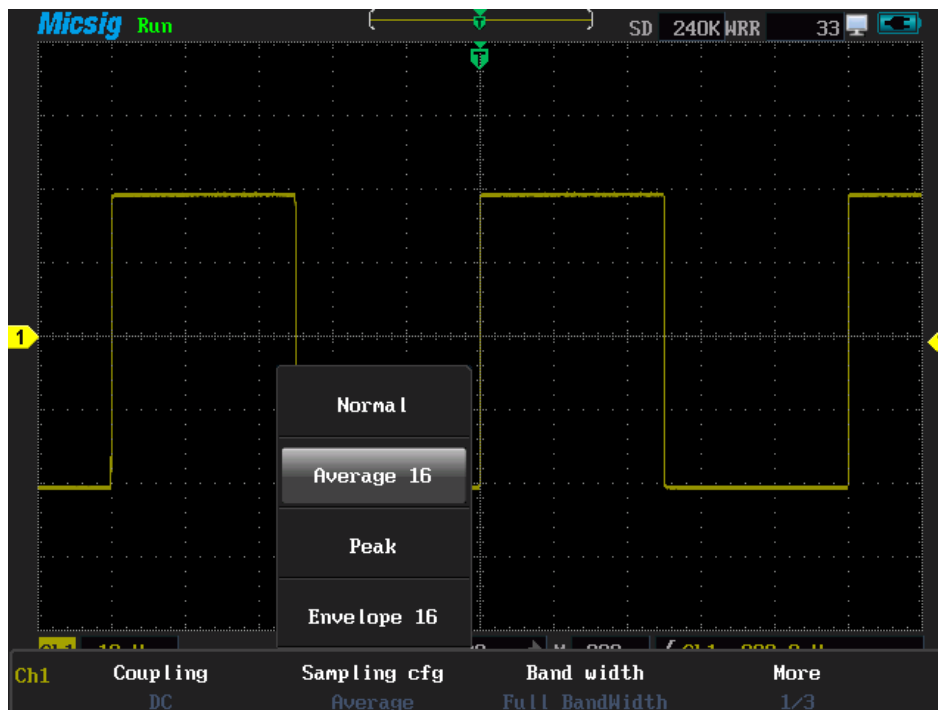
Picture 5-5 average sampling

5.4 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 Ch1 to 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.
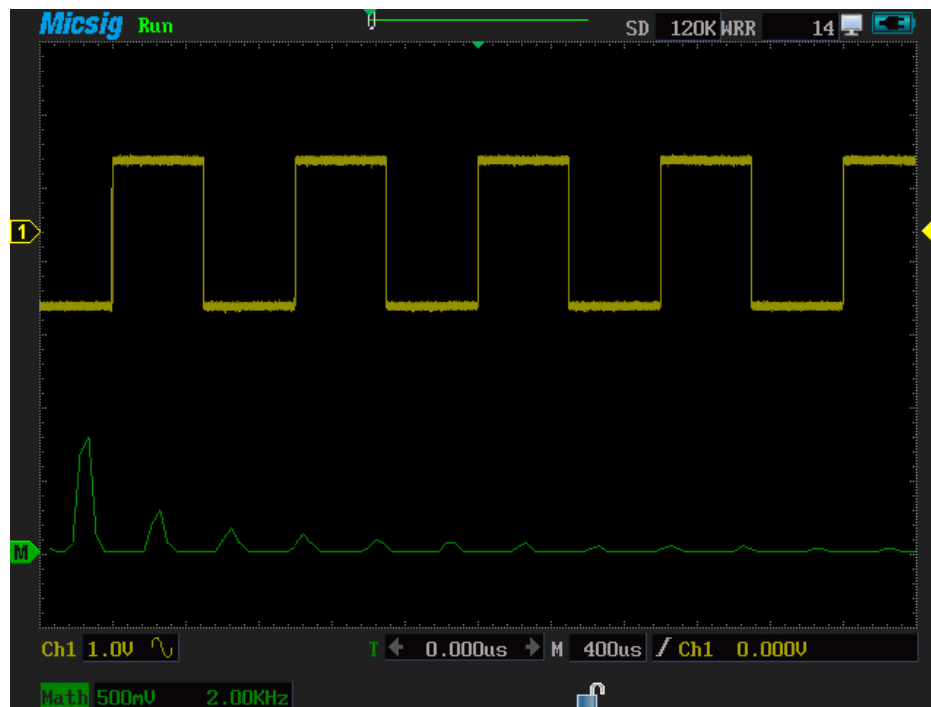
Picture 5-7 FFT waveform

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 to 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 be operated by buttons or touching. 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 re-acquireresample 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 10 kinds of physical quantities such as voltage, current, resistance, capacitance etc.and also average maximum and minimum value (both with time marks), all measurement processes can automatically adjust the gear. Multimeter interfaceis shown in picture6-1.
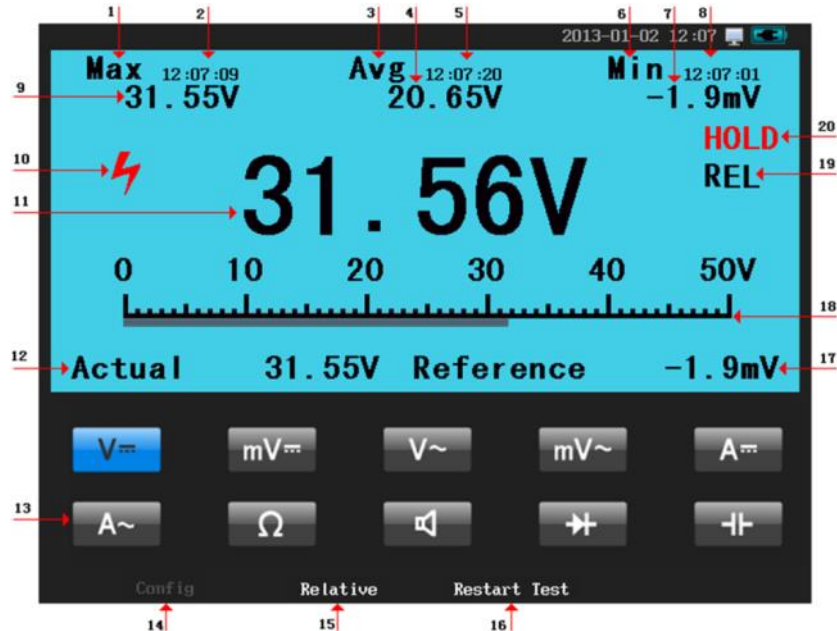
Picture 6-1 Multimeter interface

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: 10 kinds of physical quantities. More details is shown in the function menu area.
14. Config button: the function is only for DC current measurement and DC current measurement.Adjust the gear in Config, which paired with the current clamp.
15. Relative function button, for open/close the relative function

16. Restart test function button: re-acquire the data and operation

17. Benchmark: the benchmark samples value, the relative function displays when it starts

18. Range scale: shows the range of current gear, according signal to auto- adjust.

19. Start the relative: the relative displays.

20. 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:60mV～1000V	mV⎓	DC voltage small gear measurement range:1mV～60mV
V~	AC voltage measurement range:60mV～750V	mV~	AC voltage small gear measurement range:1mV～60mV
A⎓	DC current measurement Optional modules or current clamp, can be customized	A~	AC current measurement Optional modules or current clamp, can be customized
Ω	Resistance, range:0～60MΩ	🔊	On-off function,<50Ωalarm ,Max 500Ω

| | Diode,Range: Max 2Vs | | Capacitance,Range:50nF～1000uF |

6.4 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 is 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 internally 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 will be 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 these two mode.

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
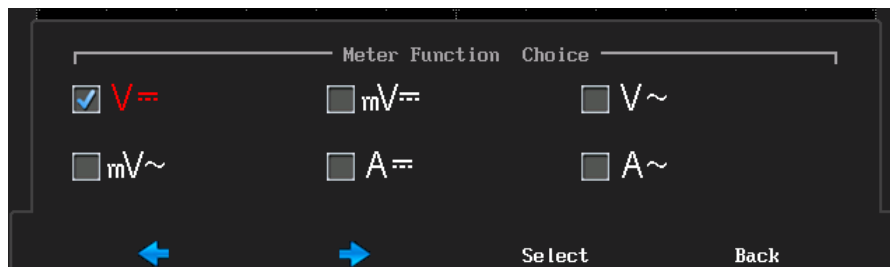
Picture 7-1 meter function choice

4) Press F4 back to upper menu

5) Press the time scale [s ns] to select the required gear.

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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 shown below the "To Record 1", then no record and the time below the "To Record 2"is the record time. If add a new record to "To Record 2", then last record will be replaced.

To Record1	To Record2		Back
	12-12-31 11:45		

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 are active, 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.
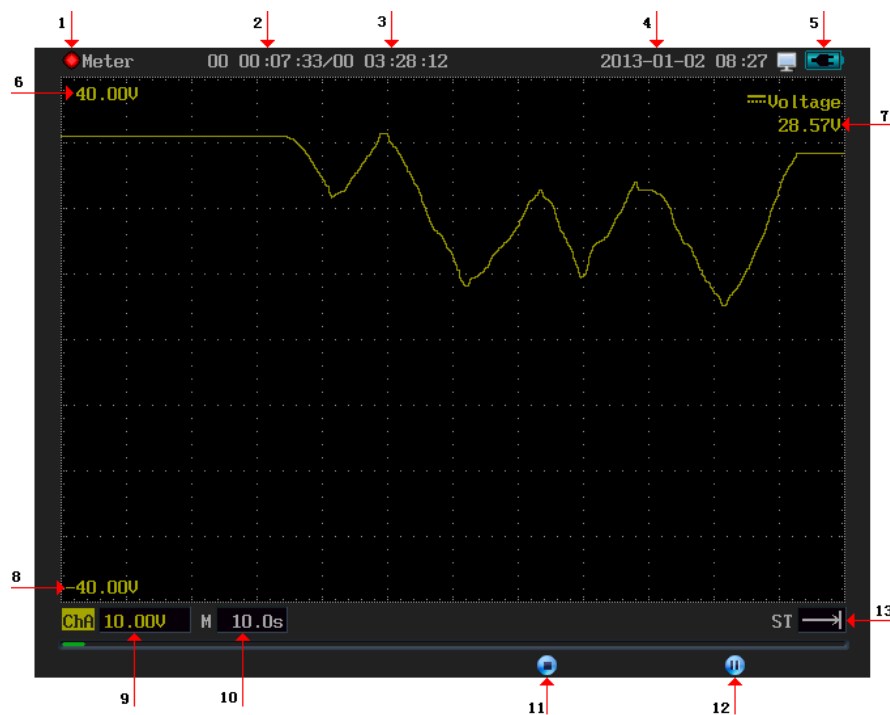
Picture 7-3 Multimeter record

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 of 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 still 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 are displayed on the screen, panoramic mode waveform is shown in picture 7-4.
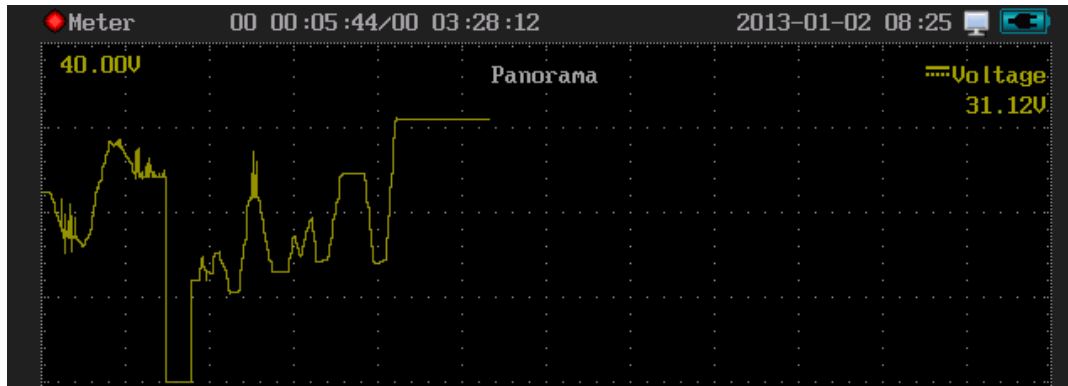
Picture 7-4 Panorama mode

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

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measurement types, users need to select the recorder types 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.
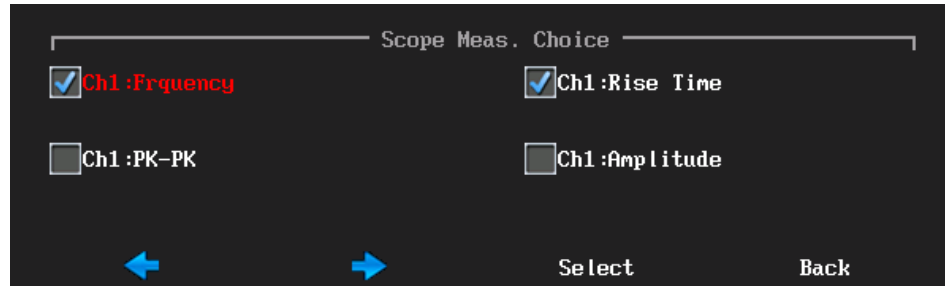
Picture 7-5 measurement record type to choose

5) Press `F4` to return to upper menu.

6) Press horizontal time scale `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.
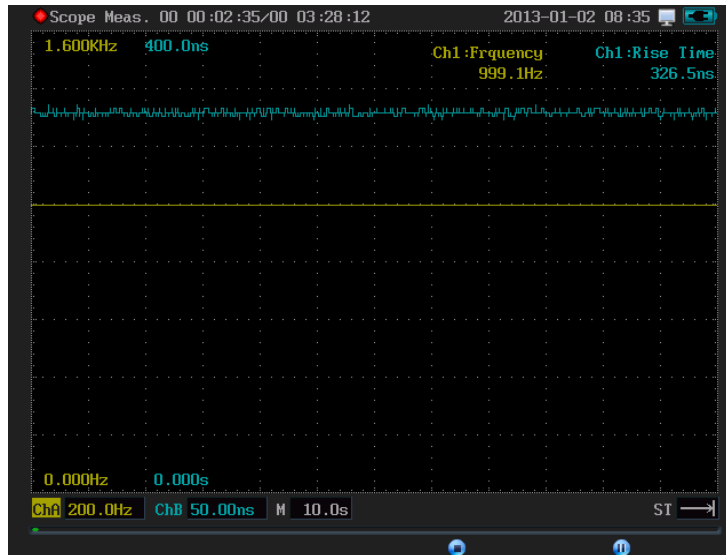
Picture 7-6 Oscilloscope measurement record

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 $\boxed{F3}$ to adjust the start/stop the trigger level.
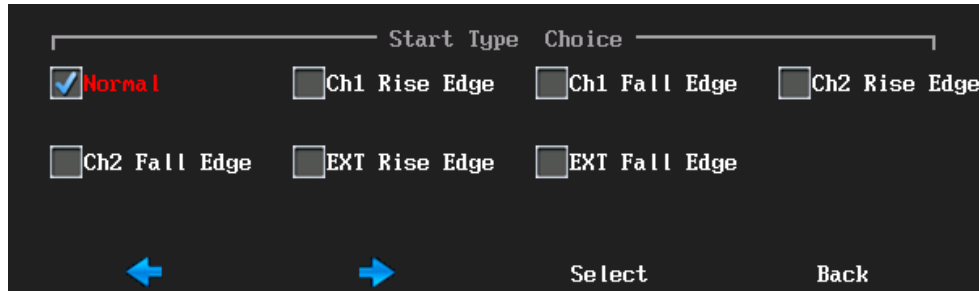
Picture 7-7 Start mode selection

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 gear.

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 picture 7-8.
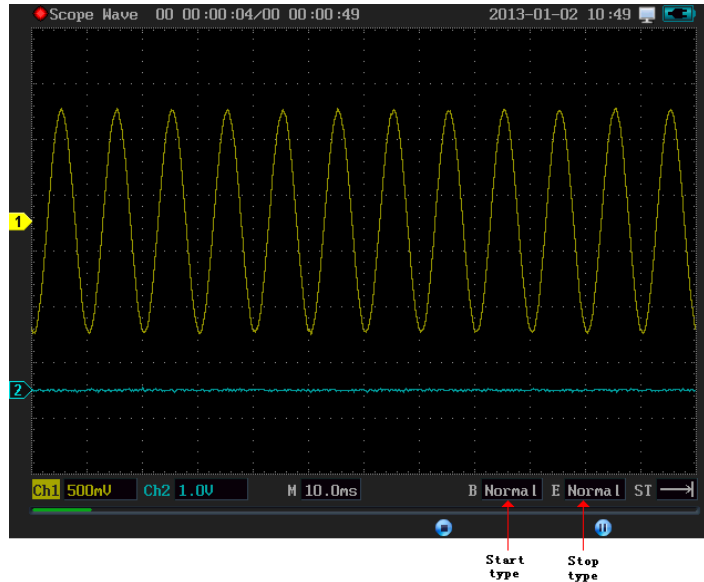
Picture 7-8 Waveform recording

7.2.4 Store mode set

Store mode includes two type: stop when full and cycle store. Stop when full $\boxed{ST \longrightarrow}$,

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 continuously store 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

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 picture 7-9.
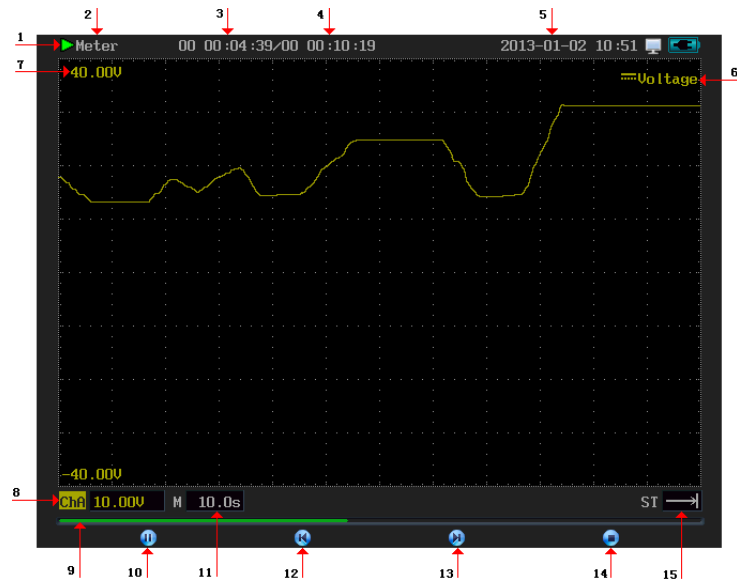
Picture 7-9 The record playback

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 picture 7-11.
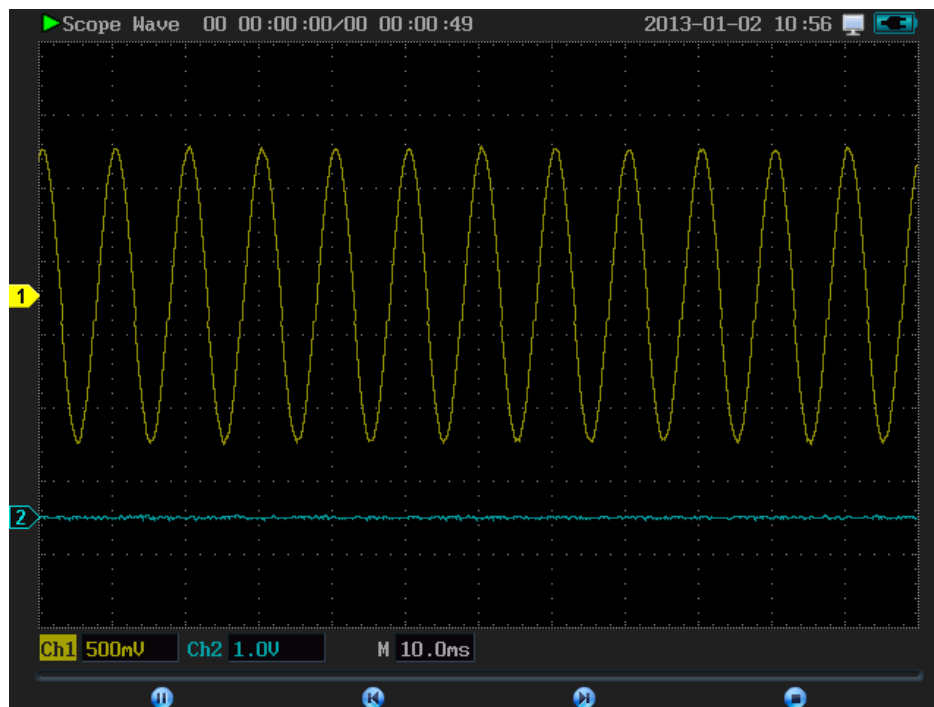
Picture 7-11 Oscilloscope waveform record replays

7.3.4 The last record playback

Please follow these steps to playback the last record

      1) In record mode, successively press $\boxed{\text{F2}}$ $\boxed{\text{F4}}$ to enter the last record replay mode.

      2) Press $\boxed{\text{F1}}$ 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

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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 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 to return to the previous menu l. Then the setting is done.

2. Language

Oscilloscope supports three kinds of languages: Chinese,English and Russia. Press "language", and then press "simplified Chinese" or "English" or "Russia". 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. Touch Screen Calibration

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 it said "finish". Press "finish" to end screen calibration 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
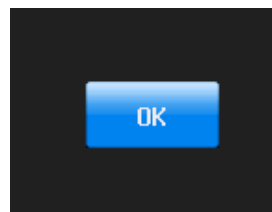
Picture8-3 finishes the calibration of the page

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.
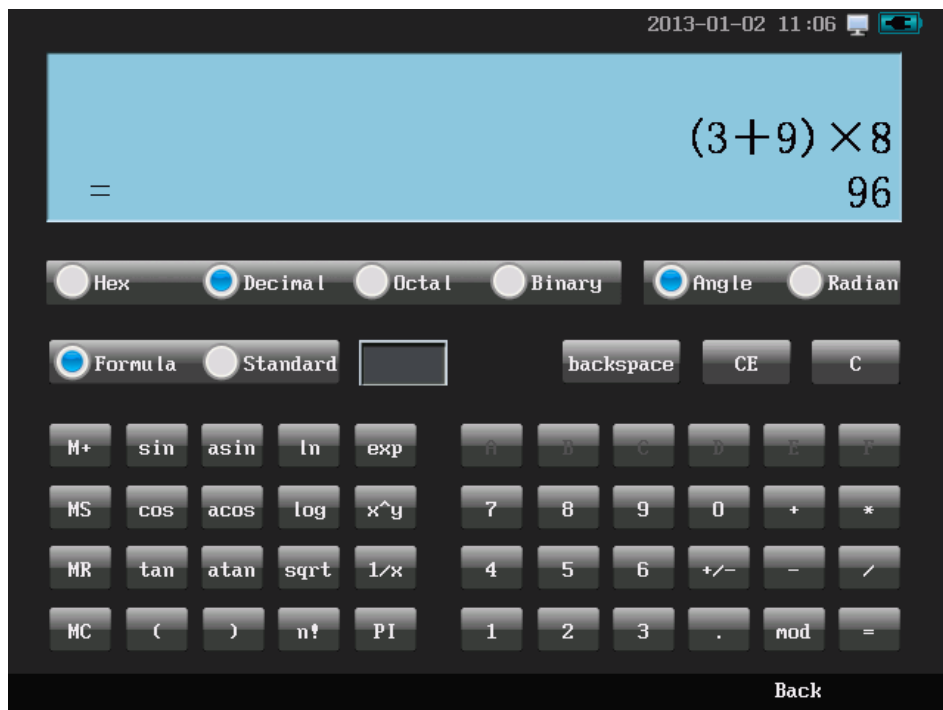
Picture 8-4 Calculator

（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
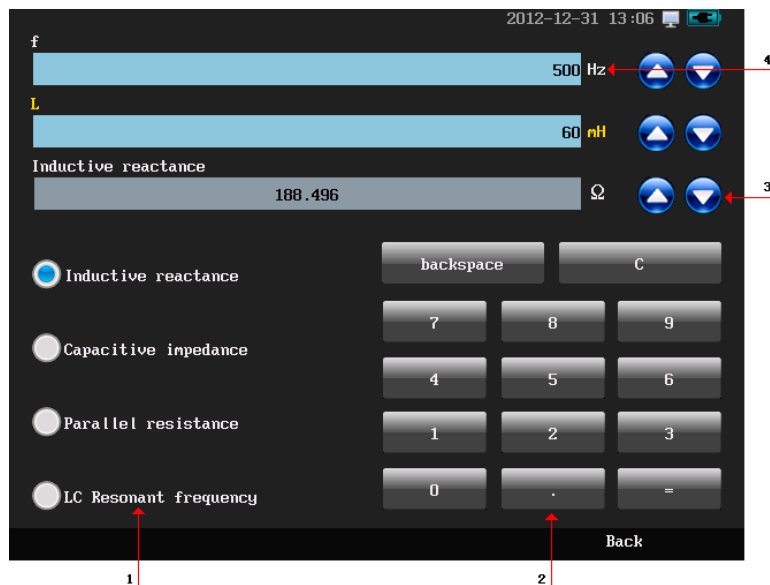
Picture 8-5 The interface of electronic calculator

6. Factory Reset

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.
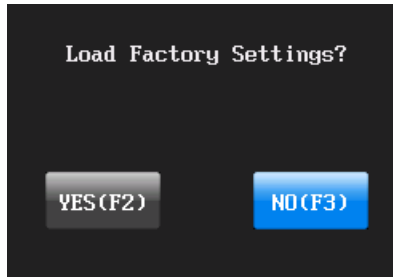
Picture 8-6 Load factor set   Picture 8-7 Confirm box to empty store
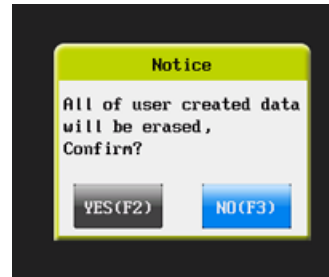
⚠   **Warning：after loading factory settings the users can store waveform, the recorded data and other information will be erased**

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
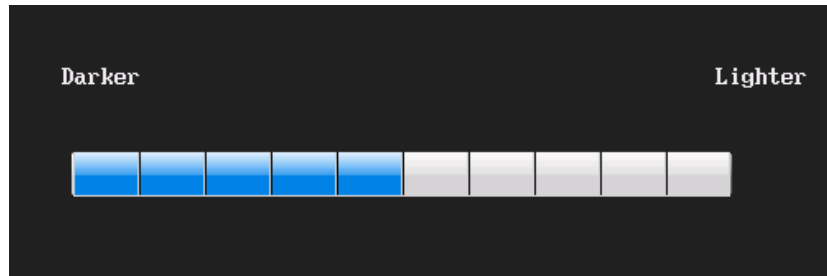
Picture 8-8 adjustment of brightness

8. Preference

Press ⊙ 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.
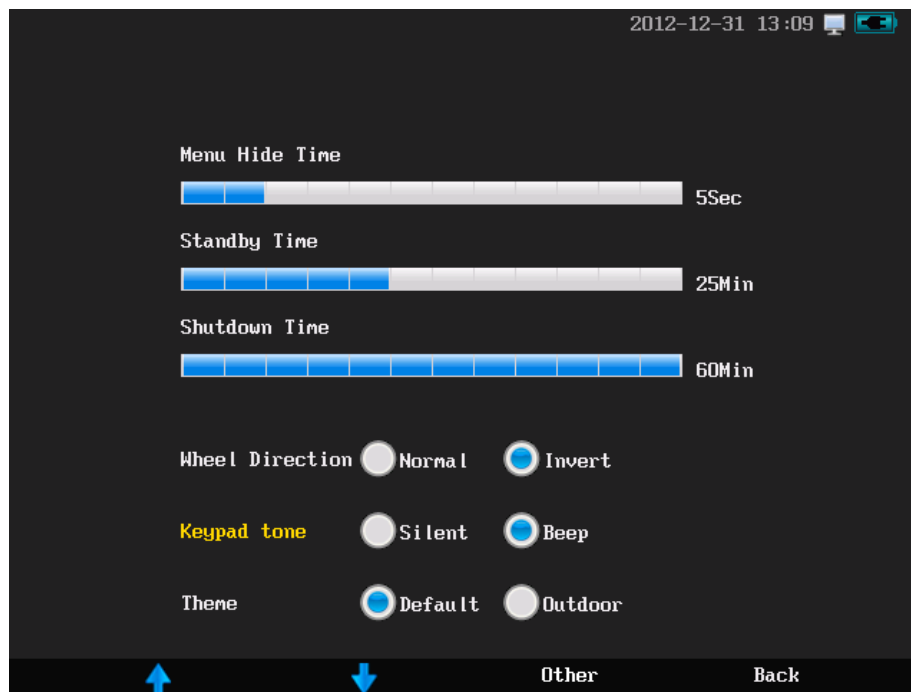
Picture 8-9 Preference set

Chapter Nine ScopeSuite Software

MicsigScopeSuite is the support software for handheld multifunctional oscilloscope based on the Window platform. Through this software, the user can connect his personal computer to the oscilloscope to enhance function and make the using of oscilloscope more flexibly. ScopeSuite software can realize these functions: screen shot and record, remote control, display and record of real-time waveform and measurement value, oscilloscope /USB device data export, analysis of some data, information retrieval, firmware upgrades and other enhancements. Through these functions, it can realize the higher requirements of users for data measurement and analysis.

Standard Micsig ScopeSuite software only contains the basic functions, such as upgrade oscilloscope firmware. Other functions of the ScopeSuite software are optional.
For more instructions about ScopeSuite software, please refer to the PDF of our Scope Suite software instructions.

Chapter Ten Troubleshooting

Troubleshooting

1) **If the oscilloscope does not start up at power on, please follow steps below:**

   ➢ Check the power cord to verify it has been connected properly.

   ➢ Check the power on/off buttons to ensure it has been pushed. if you are using the battery, check whether the battery on good condition.

   ➢ Restart the oscilloscope.

   ➢ Contact Micsig if the problem persists.

2) **If waveforms will not display when the oscilloscope is switched ON, 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 input signal

   ➢ Check whether signal source is working properly

   ➢ Check whether the channel switch (such as CH1,CH2 menu buttons) is turned on

➢   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 ⬚Run/Stop⬚ 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）If the waveform is moving continuously on the screen and cannot be triggered:

➢   Check the trigger source to ensure that it is consistent with the input 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 trigger hold-off time is appropriate

5）**If there is no any display after pressing** Run Stop **:**

➢ 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 hold-off 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

Chapter Eleven Services and Support

Service Commitments

Micsig promises that all products are manufactured and tested according to national standards or enterprise standards. Micsig promises no unqualified products will leave our factory. First-class customer services are provided for all sold products. The warranty periods for products are 3 years since date of shippment, and 90 days for the sold spare parts and maintenance. For the details of warranty service, please read the chapter of "scope of limited warranty and service". Micsig provides lifetime repair and maintenance services for products. In accordance with the relevant provisions of after-sale service of industrial products and the enterprise's own capacities, our commitments are as follows:

Repair commitments: Micsig commits to users that the original factory parts on the returned (warranty repair or repair) and their debugging and testing standards are identical with new products. For non-defective products and products with decreased performance

out of objective causes, we have the obligation to inform the customer, but without any other duties.

Service time limits commitments: Reply the time and cost for repair within 4 working days after receiving the returned product. Repair cost will be informed for products need repaired and Repair time for common problems is 5 working days after the confirmation of the replay and for special fault repair, the period is not more than 10 working days.

Spare parts providing commitments: Micsig has established a perfect store for spare parts to provide long-term (at least ten years) supply of spare parts and technical support for products.

Contact us

Shenzhen Micsig Instruments Co., Ltd

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Appendix A：Technical specifications

To comply with the technical specifications, must meet two conditions.

1. The oscilloscope must have undergone a half an hour warm-up period under the specific operating temperature;

2. The 'Do Self Cal' operation must be performed through the Utility menu if the operating temperature changes by

   more than 5℃.

All specifications are guaranteed unless noted 'typical'.

General technical specification

Type——bandwidth	MS207T——70MHz MS210T——100MHz MS215T——150MHz MS220T——200MHz
BNC Max voltage input	CAT III 150V
Number of channel	Two oscilloscope channels, one multi-meter channel
Shell	

Design	Dual color injection protection shell design, high intensity, impact resistant
Display	
Screen	5.7 inch TFT touch LCD
Resolution coefficient display	640*480
Color display	64K color
Background light intensity (typical)	200 cd/m^2 ~500 cd/m^2
Communication	
Communication interface	USB Host connect to USB storage device USB Device connect to PC
Power	
Adapter input	100 to 240V AC, 50/60Hz
Adapter output	12V DC, 5A

Battery	Standard Li-battery capacity	7.4V/6000mAh
	Duration of working time (typical)	4.5H
	Power off charging time (typical)	4H
	Optional Li-battery capacity	7.4V/9000mAh
	Duration of working time (typical)	7H
	Power off charging time (typical)	6H
Environment		
Temperature (work/storage)		-20℃～+50℃ / -20℃～+60℃
LCD panel temperature (work/storage)		-20℃～+70℃ / -30℃～+80℃
Humidity (work/storage)		< 75%RH / 85%RH (+30℃～+40℃)
Altitude (work/storage)		Max 3000m / 12000m
Cooling method		Natural convection
Mechanical		
Size (length*width*depth)		254mm*160mm*60mm

Weight	Oscilloscope (no battery)	1300g
	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. memory 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 from 2 to 256 (corresponding envelope is ∞)
Interpolation method		Sin(x)/x
Input		

Input coupling	DC，AC，Ground Connection
Input resistance	1MΩ±1%　15pF±3pF　parallel connection
Probes attenuation factor	1mX～1KX,step by step as the way of 1、2、5
Horizontal	
Position range	±6div
Horizontal timescale	4ns/div～10s/div press 1～2～4 step by step
Timescale(delay) position adjusting range	-12div～50s
Timescale accuracy (typical)	±20ppm
Verticality	
Vertical scale	5mv/div～20v/div , step by step as the way of 1～2～5
Adjustment of position scope	±4 div
Vertical resolution	8 bit
Rising time (typical)	70MHz　≤5ns
	100MHz　≤3.5ns

Rising time (typical)	150MHz ≤2.4ns
	200MHz ≤1.8ns
DC gain accuracy (typical)	5mv/div～20v/div, ±2.0%
DC measurement precision (typical)	5mv/div～20v/div, ±(2.0%×actual readout + 0.04×vertical displacement/div)
Trigger	
Trigger source	Ch1, Ch2.
Trigger mode	Automatic, normal, single

Type	Edge triggered		Rise edge, fall edge, dual edge
	Trigger pulse width		Conditions: <, > , =, ≠ Polarity: positive, negative
	Logic trigger		Logical calculation: AND, OR , NAND, NOR
	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, overload 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(need to be updated)	
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 / Ch2
Storage	
Waveform	Four sets of stored waveforms and can be stored in external USB storage device.
Screenshot	Support(Connect USB storage device or PC connected)

User settings	Nine choices
Display	
Refresh mode	Normal refresh/high refresh
Max refresh rate	50k wfms/s
Afterglow	Automatic , 100ms-10s, ∞
Waveform display area	8 × 12 div
Waveform drawing mode	Dot, line
Languages	Simplified Chinese, English, Russian

Probe（Below is the example of MC probe. Take the probe instructions as the priority）

Working voltage	CAT III 600V
Attenuation coefficient	10:1
Input capacitance	16pF
Match range	10pF～30pF

Input impedance	10MΩ±1%
Bandwidth	DC～250MHz
Rise time	1ns
Cable length	1200mm

Multimeter

Measurement accuracy		5000 counts
DC voltage (+28℃)	Range: 1mV-1000V	Range: 1mV-500mV,accuracy: ±1.5%±10counts Range: 500mV-1000V, accuracy: ±1.5%±5 counts
AC voltage (+28℃)	Range: 1mV-750V frequency range: 10.0Hz-20.000KHz	Range:1mV-500mV, accuracy: ±3%±10 counts Range: 500mV-750V, accuracy: ±3%±5 counts
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℃)
	Range: 10MΩ～20MΩ	Accuracy：±3% (+28℃)
	Range: 20MΩ～60MΩ	Accuracy：±5% (+28℃)
On-off test		If <50Ω , system will alarm Max 500Ω
Diode		Range: Max 2V
Capacitor	Range：5nF～40nF	Accuracy：±15%±10counts (+28℃)
	Range：5nF～1000uF	Accuracy：±10% ±5counts (+28℃s)
Measurement Display		Max, Average, Min in total, 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 (Connect USB storage device)
Max. recording time		No limit (Connect USB storage device)
Replay forward/backward		Support
Storage mode		Stop when full, cycle storage
Data save mode		Interior, USB device
Time display		Record time: support Replay time: support

Appendix B：Maintenance of oscilloscope

General maintenance

Do not put or leave the device in a place where the LCD display will be exposed to direct sunlight for long period.

⚠ **attention：** To avoid damage to the oscilloscope or probes, do not expose them to sprays, liquids, or solvents.

Clean oscilloscope

Examine the oscilloscope and probes as often as operating conditions require. To clean the exterior surface, perform the following steps:

- Use a lint-free cloth to remove floating dust on the outside of the oscilloscope and probes. Take care to avoid scratching the glabrous display filter.

- Use a soft cloth dampened with water to clean the oscilloscope while doing this please keep the power off. Do not use any chemical or corrosive cleaning agent, in order to avoid damaging the oscilloscope or probe.

Store oscilloscope

The battery needs to be full charged before store the oscilloscope

⚠ **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		+2.0 from horizontal center	Factory default
Cursor position level 2		-2.0 from horizontal center	Factory default
Vertical cursor position1		-3.0 from the vertical center	Factory default
Vertical cursor position2		+3.0 from the vertical center	Factory default
Cursor track		Off	Factory default
Measurement			
Measurement strobe		Off	Factory default
Delay		First rise edge (current channel)	Factory default
	Relative	Ch1	Factory default
		First rise edge	Factory default
Phase		Relative to Ch1 (current channel)	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 hold-off time		200ns	Factory default
Edge trigger	Source	Ch1	Factory default
	Slope	Rise edge	Factory default
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

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 none, date bits is 8 bit	Factory default
		Trigger mode	Start bit	Factory default
	LIN	Bus configuration	Source is Ch1, Idle level is High 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, data bits are 8 bit.	Factory default
		Trigger mode	XXXX XXX1	Factory default

	I2C	Bus configuration	SDA is Ch1, SCL is Ch2	Factory default
		Trigger mode	Start condition	Factory default
Reference waveform				
Reference waveform			Off	Factory default
Reference waveform record data			Erase	retain
Storage/Recovery				
Memory depth			120.0k	Factory default
User setting storage area			Erase	retain
Multimeter				
Multimeter measurement type			DC voltage	retain
Relative			Off	retain
Recorder				
Multimeter record type			DC voltage	retain
Oscilloscope measurement type			/	retain

Oscilloscope waveform record start mode		Normal	retain
Oscilloscope waveform record stop mode		Normal	retain
Storage mode		Stop when full	retain
Recorder storage area		Erase	retain
User			
Time		hold	retain
Language		English	retain
Help		Homepage	retain
Calculator		Decimal, angle, normal	retain
Electronic calculator		Inductive reactance	retain
Screen brightness		50%	retain
	Hidden time	5s	retain
	Standby time	15 minutes	retain
Set	Automatic shutdown time	20 minutes	retain

	Wheel direction	Normal	retain
	Buttons beeper	Silence	retain

Appendix D：Attachment

Standard accessories

1. Probe, 2pc, bandwidth depend on model

2. Multimeter test pens, 1 pair

3. Calibration banana jack, 1 pair(MS300, MS500 series. MS 200 without)

4. Power adapter, 1 pc

5. Power cord, 1 pc (suitable for customer local)

6. Removable Li-ion Battery (7.4V6000mAh), 1 pc

7. MiniUSB data cable, 1 pc

8. Quick Start, 1pc

9. Calibration Certificate, 1pc

10. Packing List, 1pc

11. ScopeSuit software registration key, 1pc

12. User Guide (download from official website)

13. ScopeSuite software (download from official website)

Optional accessories

1. Oscilloscope suitcase
2. Oscilloscope handbag
3. High-capacity battery (9000mAh)
4. P4100 high voltage probe
5. UART（RS232/RS422/RS485）Serial bus decode function module(MS510S, MS520S exlusive)
6. LIN Serial bus decode function module(MS510S, MS520S exlusive)
7. CAN Serial bus decode function module(MS510S, MS520S exlusive)
8. SPI Serial bus decode function module(MS510S, MS520S exlusive)
9. I2C Serial bus decode function module(MS510S, MS520S exlusive)
10. 1553B serial bus decode function module(MS510S, MS520S exlusive)
11. 429 serial bus decode function module(MS510S, MS520S exlusive)

Contact us

Thank you for your support! To obtain service, warranty or technical help, pls contact us by the following information.

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