Handheld multifunctional oscilloscope

MS300 and MS500 serial

User Manual

Shenzhen Micsig Instruments Co., Ltd

Version information

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To customer,

Micsig MS300 and MS500 serial handheld multi-functional oscilloscopes includes oscilloscope, multimeter and recorder functions, which contains the following features:

- Complete electrical isolation between channels, with function of floating measurement
- Up to 190 k wfms/s waveform refresh rate (MS500 series)
- 5.7 inch TFT LCD 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
- Quick drag and zoom on touch screen, quick operating response speed
- Serial bus trigger and decode (optional except MS510S, MS520S) support UART(RS232/RS422/RS485) /SPI/I2C/CAN/LIN
- Dynamic recording
- HDTV trigger for PAL,NTSC,SECAM,720P,1080I,1080P
- 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.
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Chapter One Safety Information
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.

- Regarding MS200 serial which isolated channel not supported, keep both channels connected to same GND.
- Regarding MS200 serial, 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 a product input is connected to more than 42Vpp (30 Vrms) or on 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.

![Picture 2-1 Top components and connectors](image)
Introduce the names of instrument’s parts

**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.

**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
Introduce the names of instrument’s parts

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)
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
Install and replace battery

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
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
Install and replace 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
Know the buttons and their functions

- **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 trigger level forward, adjust the parameters in the current menu item or move the cursor etc.
- **Adjust trigger level backward** Adjust trigger level backward, adjust the parameters of the menu options and move the cursor etc.
- **System function button** System function button, for system configuration and etc.
- **Power button** Power button, turn on/off oscilloscope
- **Function button** Function button, open the auto-measurement menu
Know the buttons and their functions

Function button can turn on store& recall menu

Turn on cursor menu

Function button to open display menu

Function button to turn on trigger menu

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

Function button trigger and capture one single waveform then sop, press button to escape this mode

Function button, which can automatically adjust the vertical scale, vertical position and horizontal time base, making the waveform display as the best effect.
Know the buttons and their functions

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.
Know the buttons and their functions

- **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 \[\text{on}\] 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 \[\text{Scope}\] 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 \[\text{Scope}\] 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.
General knowledge of users’ interface

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. Date and time.
8. USB connection icon, which means connect it to PC currently.
9. User can view the battery charge status in the following ways
Connected to external power,  power capacity remaining battery full,  battery under-voltage

10. Display Ch1 zero position, the point is solid, which indicates Ch1 as current channel, and the pointer color is same as the waveform color.
11. 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.
12. Reference waveform icon: When the pointer is solid, indicating the reference waveform is current waveform.
13. 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 500 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
General knowledge of users’ interface

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 1.00 V is vertical scale of Ch2.

20. Current in FFT mode, frequency span per grid is 2.5 KHz

21. Memory depth, the current channel memory depth is 120 k

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

23. Refresh rate, actual wfms/s at right value

24. The value indicates the relative trigger position of current channel, the green arrow next to the readout means the trigger position deviating from the center to the left or right

25. Horizontal scale (horizontal time base)

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

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

28. Trigger level, cursor switch indicator

29. Value of cursor measurement
2.9 Understand touch screen

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 $\text{Scope}$ to open the main menu
2) Press "coupling"
3) Press touch screen to select coupling as GND; As shown in picture2-9
4) Press $\text{MENU OFF}$ 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 screen top. You can move waveform horizontally in this area.
2. Vertical drag and the current channel selection area: where the waveform displays from the left frame to the right frame. Press the channel icon switch to the current channel, vertical drag only applies to the current channel.
3. Current channel switch area: press the frame corner at Ch1, Ch2, Math, or Ref and users can switch one of them to the current channel.
4. Waveform zoom area: the whole waveform display area can be used as waveform zoom in/out area.
5. Trigger level and drag the cursor area: the area between waveform window's right edge and screen’s right edge where users can move the trigger level or drag the cursor.
Understand touch screen

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 \( \text{\textcircled{\text{on}}} \) 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 \( \text{\text{AutoSet}} \) 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.
Function test

Picture 2-11 Sine waveform (10V, 50Hz)
2.11 Probe compensation

Before connecting to any channels, users should make a probe compensation to insure the probe match the input channel. The probe without compensation will lead to larger errors or mistakes, and probe compensation optimizes the signal path and makes measurement more precise. If the temperature is 10 degree centigrade or above, this progress must be done to insure the accuracy of the measurement. See picture 2-12

![Probe Compensation Menu](image)

Picture 2-12 Probe compensation menu

Procedures of probe compensation as follow

1) Connect the oscilloscope probe to Ch1. If you are using a hook head, users should ensure the good connection with the probe.
2) Press \textbf{Scope} then \textbf{F4} then \textbf{F4} and \textbf{F2}, set the probe calibration signal output as start, then at the top left corner the square wave screen icon is flashing, indicate square wave signal is output, see figure 2 to 13;

![Picture 2-13 signal output of probe compensation](image)

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

Picture 2-14 Probe compensation connection
If the waveform on the screen is shown as under-compensation or over-compensation, please adjust the probe until the waveform shown as correct-compensation.
Probe compensation

Picture 2-18 Probe adjustment
⚠️ **Warning** in any case using the probe should follow these steps

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

- 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.

![Figure 3-1](image)

*Figure 3-1* The current channel in yellow and the non-current channel in blue

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

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

(a) Open channel  (b) Close channel  (c) Set the channel as current channel

Taking Ch2 for example

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

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

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

Use the touch screen: the left side of the screen is vertical drag and current channel selection area. Press the arrow-pointing channel or press the channel icon under the current channel selection area can set the non-current channel to current channel. But user can’t close the channel here.

3.2 Set channel coupling mode

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

**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](image1)
![AC](image2)
![GND](image3)

Picture3-2 coupling
Set channel coupling mode

**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.

![Coupling icon](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.

![Sampling config menu](image)

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,
Set channel sampling mode

the default setting is normal mode. Waveform is shown in picture 3-5.

![Picture 3-5 Normal sampling config](image1)

![Picture3-6 Average 16 sampling config](image2)

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
Set channel sampling mode

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 picture 3-7.

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 ‹ sparing › 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.

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,
Use delay

3) Press $s_{\text{ns}}$ 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
Use delay

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 1 x.

When probe attenuation factor is changed, users need to enter this menu to set the corresponding attenuation factor, only the set matches, can display waveform’s amplitude rightly. Probe attenuation radios and attenuation factors are shown in the table below,

<table>
<thead>
<tr>
<th>Probe attenuation radio</th>
<th>Attenuation radio menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:1</td>
<td>1X</td>
</tr>
<tr>
<td>10:1</td>
<td>10X</td>
</tr>
<tr>
<td>100:1</td>
<td>100X</td>
</tr>
</tbody>
</table>
**Set channel attenuation factor**

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 picture 3-16.

![Probe attenuation factor menu](image)

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 \( \text{Scope} \) then \( \text{F4} \) then \( \text{F4} \) and \( \text{F1} \) 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 °C, we recommended users perform the auto-calibration

3.9 Set auto measurement type

Press \( \text{Measure} \) can open auto-measurement menu and there are 31 kinds of
Set auto measurement type

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.

<table>
<thead>
<tr>
<th>Serial</th>
<th>Type</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Period</td>
<td>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.</td>
</tr>
<tr>
<td>2</td>
<td>Rate</td>
<td>Reciprocal period time</td>
</tr>
<tr>
<td>3</td>
<td>Rise time</td>
<td>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</td>
</tr>
<tr>
<td>4</td>
<td>Fall time</td>
<td>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</td>
</tr>
</tbody>
</table>
### Set automatic measurement type

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>P duty cycle</td>
<td>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</td>
</tr>
<tr>
<td>6</td>
<td>N duty cycle</td>
<td>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</td>
</tr>
<tr>
<td>7</td>
<td>Delay</td>
<td>The time between the mid reference (default 50%) amplitude point of two different waveforms</td>
</tr>
<tr>
<td>8</td>
<td>P pulse width</td>
<td>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</td>
</tr>
<tr>
<td>9</td>
<td>N pulse width</td>
<td>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</td>
</tr>
</tbody>
</table>
## Set automatic measurement type

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Burst width</td>
<td>The duration of a burst (a series of transient events) and is measured over the entire waveform or gated region</td>
</tr>
<tr>
<td>11</td>
<td>P overshoot</td>
<td>This is measured over the entire waveform or gated region and is expressed as ( P_{overshoot} = \frac{(\text{max} - \text{high})}{\text{amplitude}} \times 100% )</td>
</tr>
<tr>
<td>12</td>
<td>N overshoot</td>
<td>This is measured over the entire waveform or gated region and is expressed as ( N_{overshoot} = \frac{(\text{low} - \text{mini})}{\text{amplitude}} \times 100% )</td>
</tr>
<tr>
<td>13</td>
<td>Phase</td>
<td>The amount of time that one waveform leads or lags another waveform, expressed in degrees where 360° comprises one waveform cycle.</td>
</tr>
<tr>
<td>14</td>
<td>Peak-peak</td>
<td>The absolute difference between the max. and min. amplitude in the entire waveform or gated region</td>
</tr>
<tr>
<td>15</td>
<td>Amplitude</td>
<td>The high value less the low value measured over the entire waveform or gated region</td>
</tr>
<tr>
<td>16</td>
<td>High</td>
<td>The value is used as 100% whenever high reference, it can be calculated using either the min/max or histogram method.</td>
</tr>
<tr>
<td>17</td>
<td>Low</td>
<td>The value is used as 0% whenever high reference, it can be calculated using</td>
</tr>
</tbody>
</table>
Set automatic measurement type

<table>
<thead>
<tr>
<th>Measurement Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>Typically the highest positive peak voltage which is measured over the entire waveform or gated region</td>
</tr>
<tr>
<td>Mini</td>
<td>Typically the lowest negative peak voltage which is measured over the entire waveform or gated region</td>
</tr>
<tr>
<td>Mean</td>
<td>The arithmetic mean over the entire waveform or gated region</td>
</tr>
<tr>
<td>Cycle mean</td>
<td>The arithmetic mean over the first cycle in the waveform or the first cycle in the gated region</td>
</tr>
<tr>
<td>RMS</td>
<td>The true Root Mean Square voltage over the entire waveform or gated region</td>
</tr>
<tr>
<td>Cycle RMS</td>
<td>The arithmetic mean over the first cycle in the waveform or the first cycle in the gated region</td>
</tr>
</tbody>
</table>

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
Set automatic measurement type

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
Set auto measurement type

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](image)

Please follow these steps to save Ch1 waveform to R1,

1) Connect probe to Ch1 and connect it to the signal source.
2) Press \text{Save} and \text{F1} to enter the save waveform menu.

3) Press \text{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
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

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 and F3 to enter the adjustment menu of store depth, if it is a single channel, it can be set to 2.4K, 24k, 240k, and a dual channel can be set to 1.2k, 12K, 120k, and press ▲ ◀ to adjust the value of store depth.

3.10.4 Dynamic record
Note: MS300 serial need to be updated to get this function; MS500 serial have 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.
**Set store/restore menu**

**Interface descriptions of waveform record**

1. Recording 📊 icon, the icon flashes while recording
2. Dynamic record mode, being record
Set store/restore menu

3. Frame number for the current record

4. Stop recording, press F4 to record waveform and return to the previous menu.

- Playback waveform data

Press F1 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.
Set store/restore menu

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/backward 10 frames, and long pressing this button means quick forward/backward
3.10.5 Store settings

To store current setting, press \text{Save/Recall} then \text{F4} and \text{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 \text{Save/Recall} then \text{F4} and \text{F3} to restore settings menu, press \text{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: MS300 serial need to be update to get this function; MS500 serial have 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 \[\text{Save}\] then \[F4\] and \[F1\] to complete screen shot.

**3.11 Cursor measurement**

Press \[\text{Cursor}\] 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 picture3-23.
Cursor measurement

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
**Cursor measurement**

**Instructions of the cursor or trigger level switch operation:** After opening the cursor menu, press 🔄 to close the menu, the bottom right corner of the screen displays Level and Cursor, then press 🈴️ or press the touch screen to switch. When the Level is active, press 🎉 or roll the wheel can adjust trigger level, see picture 3-24, while the Cursor is lighted on, the operator is the cursor, see picture 3-25.

![Picture 3-24 Trigger level operation](image1)

Picture 3-24 Trigger level operation

![Picture 3-25 Operate the cursor](image2)

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

<table>
<thead>
<tr>
<th>Draw Type</th>
<th>Brightness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vectors</td>
<td>70%</td>
</tr>
</tbody>
</table>

Picture 3-26 Waveform set menu

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

1) Press Display to enter the display menu;

2) Press F1 to enter waveform setting;

3) Press F1 to enter draw type set;
Set display menu

4) Press $F_1$ 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 $Display$ $F_1$ $F_2$ to choose brightness set

2) Press $\bigcirc$ $\bigcirc$ 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

![Graticule set menu]

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.
3.12.3 Persist adjustment

Active persist to delay waveform illumination’s attenuation, the Time can be set as 100ms-10s, $\infty$, or auto. Keep all the waveform illumination spots, until toggle the control setting to remove persist display.

**Tips for adjusting afterglow time:** Singly press □ or △ for precise adjustment and long press ◀ or ▲ for rough adjustment

**Following these steps for persistence settings**

1) Press [Display] and [F3] to enter persist set;
Set display menu

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 $\infty$ shown in picture 3-30, persist time is 200ms shown in picture 3-31.

![Waveform Display](image)

**3.12.4 Time base**

In the Time base menu, you can set the waveform display as YT or XY mode (MS300 serial 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.
Set display menu

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.
3.12.5 Adjusting refresh rate

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

Please follow the steps for setting refresh rate
Press \( \text{Display} \) then \( \text{F4} \) and \( \text{F2} \) to adjust the refresh rate, high refresh, and normal refresh which are shown in picture 3-33.

![High refresh rate](image1)

High refresh rate

![Normal refresh rate](image2)

Normal refresh rate

**Picture 3-33 Refresh rate**

### 3.13 Set trigger menu

Press \( \text{Trigger} \) and \( \text{F1} \) to enter the trigger type choice menu, there are five kinds of
Set trigger menu

trigger types available

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

2. Pulse width trigger: When signal of the pulse width reaches a certain given trigger condition and the signal voltage reaches the given trigger level, then trigger happens.

3. Logic trigger: When two channel levels meet a certain logic operation result, then trigger happens.


5. Serial bus trigger: Serial decode and trigger for UART (RS232/RS422/RS485) /SPI/I2C/CAN/LIN.

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

Trigger coupling mode:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>Let signal pass through AC and DC components</td>
</tr>
<tr>
<td>AC</td>
<td>Filter DC component from trigger signal</td>
</tr>
<tr>
<td>HF rejection</td>
<td>Reject the trigger signal which is higher than 35Khz</td>
</tr>
<tr>
<td>LF rejection</td>
<td>Reject trigger signal which is below 90KHz</td>
</tr>
<tr>
<td>Noise rejection</td>
<td>Reject high-frequency noise from trigger signal</td>
</tr>
</tbody>
</table>

Trigger mode:
**Set trigger menu**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto</td>
<td>No matter whether meet the trigger condition waveform displays. In a period if the instrument cannot reach the trigger condition, it can trigger automatically.</td>
</tr>
<tr>
<td>Normal</td>
<td>Only display When effective trigger event happens.</td>
</tr>
<tr>
<td>Single sequence</td>
<td>Trigger only signal time.</td>
</tr>
</tbody>
</table>

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.
## Set trigger menu

<table>
<thead>
<tr>
<th>Trigger Source</th>
<th>Set</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch1</td>
<td></td>
<td>Set Ch1 as source trigger</td>
</tr>
<tr>
<td>Ch2</td>
<td></td>
<td>Set Ch2 as source trigger</td>
</tr>
<tr>
<td>EXT</td>
<td></td>
<td>Set external signal as trigger signal source</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>slope</th>
<th></th>
<th>Set trigger on rising edge “/”</th>
</tr>
</thead>
<tbody>
<tr>
<td>\</td>
<td></td>
<td>Set the signal trigger \</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Set the signal in the rising and falling edge trigger</th>
</tr>
</thead>
</table>

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 $F_4$ $F_2$ to select coupling mode as DC;

5) Press $F_3$ to select trigger mode as normal;

6) Press $F_4$ and $F_2$ to set the hold-off time and press $\square \square$ or roll the wheel to adjust time, rise trigger(\(#) waveform is shown in picture 3-35.
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
be square waveform, sine waveform etc. 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.

![Waveform Image](image)

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:
**Set trigger menu**

<table>
<thead>
<tr>
<th>Trigger configure item</th>
<th>Options</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger source</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch1</td>
<td>Set the Ch1 as trigger signal source</td>
<td></td>
</tr>
<tr>
<td>Ch2</td>
<td>Set the Ch 2 as trigger signal source</td>
<td></td>
</tr>
<tr>
<td>EXT</td>
<td>Set external signal as trigger signal source</td>
<td></td>
</tr>
<tr>
<td>Polarity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>Set signal as positive polarity pulse width trigger</td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>Set signal as negative polarity pulse width trigger</td>
<td></td>
</tr>
<tr>
<td>Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; T</td>
<td>Trigger if the pulse width is less than T</td>
<td></td>
</tr>
<tr>
<td>&gt; T</td>
<td>Trigger if the pulse width is more than T</td>
<td></td>
</tr>
<tr>
<td>= T</td>
<td>Trigger if the pulse width equals to T</td>
<td></td>
</tr>
<tr>
<td>≠T</td>
<td>Trigger if the pulse width not equals to T</td>
<td></td>
</tr>
</tbody>
</table>

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
Set trigger menu

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.
Set trigger menu

Waveform is shown in picture 3-37.

![Waveform Image]

**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.
<table>
<thead>
<tr>
<th>Trigger config items</th>
<th>Options</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trigger source</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch1 logic</td>
<td>Low</td>
<td>If Ch1 lower than trigger level, set Ch1 as 1</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>If Ch1 higher than trigger level, set Ch1 as1</td>
</tr>
<tr>
<td>Ch2 logic</td>
<td>Low</td>
<td>If Ch2 lower than trigger level, set Ch2 as 1</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>If Ch2 higher than trigger level, set Ch2 as1</td>
</tr>
<tr>
<td><strong>Logic operator</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AND</td>
<td></td>
<td>The logic of two trigger sources as AND</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td>The logic of two trigger sources as OR</td>
</tr>
<tr>
<td>NAND</td>
<td></td>
<td>The logic of two trigger sources as “NAND”</td>
</tr>
<tr>
<td>NOR</td>
<td></td>
<td>The logic of two trigger sources as “NOR”</td>
</tr>
<tr>
<td><strong>Conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change to true value</td>
<td></td>
<td>Trigger if the logic changes to true value</td>
</tr>
<tr>
<td>Change to false value</td>
<td></td>
<td>Trigger if the logic changes to false value</td>
</tr>
<tr>
<td>&gt;, &lt;, =, ≠, T</td>
<td></td>
<td>If logic status for hold time as &gt;, &lt;, =, ≠, then trigger</td>
</tr>
</tbody>
</table>

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
Set trigger menu

2) Press $F_2$ to set Ch1 as logic high

3) Press $F_3$ to enter Ch1 logic level setting mode, then press $\bigcirc \bigcirc$ or roll the wheel to adjust

4) Press $F_4$ and $F_2$ to set Ch2 logic low

5) Press $F_3$ to set Ch2 logic level, press $\bigcirc \bigcirc$ or roll the wheel for adjustment

6) Press $F_4$ and $F_2$ to set logic operator as AND

7) Press $F_3$ to set trigger condition as true-value

8) Press $F_4$ and $F_2$ to select trigger mode as normal

9) Press $F_3$ to select rejection time, then press $\bigcirc \bigcirc$ or roll the wheel to
Set trigger menu

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 CH1 logic as high.
3. Ch2 logic trigger level, the readout above the underline means CH2 logic as low.
Set trigger menu

Picture 3-38 Logic trigger
3.13.4 Video trigger

Triggering on video signal field or line supports PAL, SECAM, NTSC, 720P, or 1080P standard. It can trigger on different voltage scale, and users can adjust voltage gear to view waveform. Video trigger menu descriptions are shown in the table below:

<table>
<thead>
<tr>
<th>Trigger selections</th>
<th>Setting</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger source</td>
<td>Ch1</td>
<td>Set Ch1 as trigger signal source</td>
</tr>
<tr>
<td></td>
<td>Ch2</td>
<td>Set Ch2 as trigger signal source</td>
</tr>
<tr>
<td>Polarity</td>
<td>Positive</td>
<td>Set signal positive polarity trigger</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Set signal negative polarity trigger</td>
</tr>
<tr>
<td>Standard</td>
<td>625/PAL</td>
<td>Base on PAL standard</td>
</tr>
<tr>
<td></td>
<td>SECAM</td>
<td>Base on SECAM signal trigger</td>
</tr>
<tr>
<td></td>
<td>525/NTSC</td>
<td>Base on NTSC signal trigger</td>
</tr>
<tr>
<td></td>
<td>720P (50Hz, 60Hz)</td>
<td>Base on 720P(50Hz, 60Hz) signal trigger</td>
</tr>
<tr>
<td></td>
<td>1080I (50Hz, 60Hz)</td>
<td>Base on 1080I (50Hz, 60Hz) signal trigger</td>
</tr>
<tr>
<td></td>
<td>1080P (24Hz, 25Hz)</td>
<td>Base on 1080P (24Hz, 25Hz, 30Hz, 50Hz, 60Hz) signal</td>
</tr>
</tbody>
</table>
**Set trigger menu**

<table>
<thead>
<tr>
<th>Trigger on</th>
<th>30Hz, 50Hz, 60Hz</th>
<th>trigger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odd fields</td>
<td>Interlaced scanning signal trigger in odd fields</td>
<td></td>
</tr>
<tr>
<td>Even fields</td>
<td>Interlaced scanning signal triggered in even fields</td>
<td></td>
</tr>
<tr>
<td>All fields</td>
<td>Interlaced or non-interlaced scanning signal trigger in any fields</td>
<td></td>
</tr>
<tr>
<td>All lines</td>
<td>Trigger on line of signal.</td>
<td></td>
</tr>
<tr>
<td>Line</td>
<td>Signal trigger in a specified line</td>
<td></td>
</tr>
</tbody>
</table>

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

1) Press \( \text{Trigger} \) and \( \text{F1} \) to select trigger type as video trigger;

2) Press \( \text{F2} \) to select signal source as Ch2;

3) Press \( \text{F3} \) to select polarity as positive;

4) Press \( \text{F4} \) and \( \text{F2} \) to select video standard as 625/PAL;
5) Press F3 to select trigger on as odd fields;

6) Press F4 and F2 to select trigger mode as “abnormal”

7) Press F3 to select rejection time, press □ or roll the wheel to adjust rejection time; Video standard PAL odd fields trigger is shown in 3-39.

**Picture 3-39 arrow descriptions:**

1. Video standard, upper-line means positive trigger, and under-line means negative trigger.
2. Indicating trigger condition mode
Set trigger menu

Picture 3-39 Standard PAL odd fields trigger
3.13.5 Serial bus trigger

Refer to Chapter Four Serial Bus Trigger and Decode.

3.14 Using the vertical and horizontal button

1. Vertical button

Vertical scale adjustment: it can adjust vertical scale factor for all channels’ waveform.

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

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 to 100 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
Use vertical and horizontal button

scale is 100 ms).
Horizontal button 画像: 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).

![Waveform moves rightward](image.png)

Picture 3-41 waveform moves rightward
3.15 Use auto set

Pressing \( \text{AutoSet} \) 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 \( \text{AutoSet} \), at the upper left corner of the screen appears auto icon, indicates the instrument is in auto mode, re-pressing \( \text{AutoSet} \) 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 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.

<table>
<thead>
<tr>
<th>Operator</th>
<th>Operation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>Source1 + Source2</td>
</tr>
<tr>
<td>-</td>
<td>Source1 - Source2</td>
</tr>
<tr>
<td>*</td>
<td>Source1 * Source2</td>
</tr>
<tr>
<td>/</td>
<td>Source1 / Source2</td>
</tr>
</tbody>
</table>

**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”;
Use math menu

3) Press $F_3$ to select function as "+";

4) Press $F_4$ to select signal source as "Ch2"; Then view the math waveform operation is shown in picture 3-42.
Use math menu

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

2. Use single sequence to observe waveform
**Run/stop button and single sequence**

Press the run/stop button and single sequence, 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 picture3-46; After triggering, display stop, shown as 3-47. Repress to enter a state of continuous sampling.

![Picture 3-46 Wait trigger](image1)

![picture 3-47 After trigger](image2)
Run/stop button and single sequence

3.18 Reference channel

Press \[\text{Ref}\] 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 \[\text{To 50}\] 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 \[\text{or}\] , then press \[\text{To 50}\], 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 \( \downarrow \) then press \( \rightarrow \) 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 \( \leftarrow \rightarrow \) then \( \rightarrow \) 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 \( \text{Cursor} \) to choose vertical cursor, then press \( \rightarrow \) 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 \( \text{Cursor} \) to choose horizontal cursor, then press \( \rightarrow \) to adjust the horizontal cursor at left/right half screen to the middle.
Use 50% shortcut

Move the waveform out of range the screen shown in picture3-48, after “To 50%” is shown in picture -49.

Picture 3-48 Vertically move upward waveform leaking out the screen
Use 50% shortcut

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.
Use touch screen zoom waveform

Picture3 -50 Magnify selection area
Use touch screen zoom waveform

Picture 3-51 magnified waveform
Chapter Four Serial Bus Trigger& Decode
This chapter contains the detailed information of serial bus decoding. Recommend you read this chapter carefully to understand the setting and operation of a handled multi-function oscilloscope bus trigger and decode.

**Note:** MS300 Serial, MS510IT and MS520IT need be updated to get decode function; MS510S and MS520S have serial bus decode function;

**This chapter mainly include the below contents:**
- UART（RS232/RS422/RS485）bus trigger and decode
- LIN bus trigger and decode
- CAN bus trigger and decode
- SPI bus trigger and decode
- I2C bus trigger and decode
Press \( \text{Scope} \) then \( \text{Trigger} \) and \( F1 \) to select serial bus, enter serial bus decode mode, press \( F2 \) to select one kind of bus type, there are UART(RS232/RS422/RS485) /LIN/CAN/`/I2C five kind of types. Each one has two kind of display mode: graphic and raw text modes. Press \( \text{Display} \) to switch.

In serial bus decode mode, below is the default settings:

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

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

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

● 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.

![UART bus configuration dialog](image)

Picture 4-2 UART bus configuration dialog
**Note:** the yellow rectangle box means the selection is in set, (v) 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.
UART (RS232/RS422/RS485) bus trigger and decode

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 picture 4-4.
**UART (RS232/RS422/RS485) bus trigger and decode**

(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 (RS232/RS422/RS485) bus trigger and decode**

**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, text interface is shown in figure 4-6.
UART (RS232/RS422/RS485) bus trigger and decode

Picture 4-5 UART graphic interface
UART (RS232/RS422/RS485) bus trigger and decode

UART interface:
1. Trigger position
2. Signal source Ch1
3. Decode packets
4. Decode the data and the corresponding waveform
5. Bus type
6. Trigger level value
7. Trigger level

Description of decode content
(1) Decode packet displays real-time data about the bus activities
(2) the Decode data displays as hexadecimal system in white
(3) data bits is 5-8 bits, the decode data displays as two bits of hexadecimal, when data bits is 9, the decode data displays as 3 bits of hexadecimal, the ninth bit displays at the left side.
(4) when decode data is error, if the error is at stop bit, data displays in yellow, if parity error,
data displays in red

(5) when appear ?, users need to press \( \text{s ns} \) to adjust the timescale, and then view the decode results.
### UART (RS232/RS422/RS485) bus trigger and decode

<table>
<thead>
<tr>
<th>UART</th>
<th>2013-05-07 20:36</th>
</tr>
</thead>
<tbody>
<tr>
<td>1F 23 00 55 25 20 21 22 23 79 00 55 BA 20 29 2A 2B 2C 2D</td>
<td>.Ux &quot;Wy U.()**,-</td>
</tr>
<tr>
<td>2E 2F A2 00 55 25 30 31 32 33 39 00 55 BA 30 39 3A 3D 3C</td>
<td>./. Ux01239 U.09;:&lt;</td>
</tr>
<tr>
<td>3D 3E 3F 22 00 55 25 40 41 42 43 F8 00 55 BA 48 49 4A 4B</td>
<td>=&gt;?&quot; Ux@ABC. U.HIJK</td>
</tr>
<tr>
<td>4C 4D 4E 4F A1 00 55 25 50 51 52 53 8B 00 55 BA 58 59 5A</td>
<td>LMMO. UxPQRS. U.XYZ</td>
</tr>
<tr>
<td>5B 5C 5D 5E 5F 21 00 55 25 60 61 62 63 78 00 55 BA 68 69</td>
<td>{}_{11}.Ux__abc_x U.hi</td>
</tr>
<tr>
<td>6A 6B 6C 6D 6E 6F A0 00 55 25 70 71 72 73 38 00 55 BA 78</td>
<td>jklmno. Ux{pqrs}_8 U.x</td>
</tr>
<tr>
<td>79 7A 7B 7C 7D 7E 7F 20 00 55 25 80 81 82 83 F7 00 55 BA</td>
<td>yz(t)&quot;. Ux,....U.</td>
</tr>
<tr>
<td>0B 09 0A 0B 0C 0D 0E 0F 0G 00 55 25 90 91 92 93 D7 00 55</td>
<td>........................ Ux,....U</td>
</tr>
<tr>
<td>BA 99 9A 9B 9C 9D 9E 9F 1F 00 55 25 A0 A1 A2 A3 77 00</td>
<td>........................ Ux,....U</td>
</tr>
<tr>
<td>55 BA BA BA BA BA BA AC AD AE AF 9E 00 55 25 BD A1 B2 B3 37</td>
<td>U. U........... Ux,....7</td>
</tr>
<tr>
<td>00 55 BA BA BA BA BA BA BA BD BE BE BF 1E 00 55 25 CO C1 C2 C3</td>
<td>.U. U........... Ux,....</td>
</tr>
<tr>
<td>F6 00 55 BA CB C9 CA CB CC CD CE CF 9D 00 55 25 D0 D1 D2</td>
<td>.U. U........... Ux,....</td>
</tr>
<tr>
<td>D3 B6 00 55 BA BA BA BA BA BA BD DC DE DF 1D 00 55 25 E1 E2</td>
<td>U. U........... Ux,....</td>
</tr>
<tr>
<td>E2 E3 76 00 55 BA EA EB EA EB EC ED EE EF 9C 00 55 25 F0</td>
<td>.U. U........... Ux,....</td>
</tr>
<tr>
<td>F1 F2 F3 36 00 55 BA FA FA FA FA FA FC FD FE FF 1C 00 55 25</td>
<td>.U. U........... Ux,....</td>
</tr>
<tr>
<td>00 01 02 03 F9 00 55 BA 00 09 0A 0B 0C 0D 0E 0F A3 00 55</td>
<td>U........... U........... U</td>
</tr>
<tr>
<td>55 25 20 21 22 23 79 00 55 BA 28 29 2A 2B 2C 2D 2E 2F A2</td>
<td>Ux &quot;Wy U.()**,-_/</td>
</tr>
<tr>
<td>00 55 25 30 31 32 33 39 00 55 BA 3B 39 3A 3B 3C 3D 3E 3F</td>
<td>.Ux01239 U.09;:&lt;</td>
</tr>
<tr>
<td>22 00 55 25 40 41 42 43 F8 00 55 BA 49 49 4A 4B 4C 4D 4E</td>
<td>* Ux@ABC. U.HIJKNN</td>
</tr>
<tr>
<td>4F A1 00 55 25 50 51 52 53 DD 00 55 BA 58 59 5A 5B 5C 5D</td>
<td>0. UxPQRS. U.XYZ;CJ</td>
</tr>
<tr>
<td>5E 5F 21</td>
<td>^_!</td>
</tr>
</tbody>
</table>

Picture 4-6 UART text interface
Descriptions of UART text interface.

1. **Export**: Export data (workable after USB device connected)
2. **Run/stop**: Run/stop decode
3. **Area for decode data**
4. **Statistics**: statistic the frame type, etc., only effective in CAN bus decoding mode
5. **Return**: Return to upper interface
6. The text data corresponding to ASCII (if the data bits is 9 bit and no parity error, ASCII is corresponding to the low 8 bit in the left side)
7. **Roll bar**: In decode data area, data reaching the trigger condition is shown as blue, the missing data at stop bit is shown as yellow, the red is error-decode data.

### 4.2 LIN bus trigger and decode

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

- **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 4-7.

![Picture 4-7 LIN bus configuration menu](image)

- **Trigger type**

Press F4 to pop-up trigger mode configuration dialog. Trigger types include sync- rising
edge, frame ID and ID data, see picture 4-8.

![Picture 4-8 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 — Triggered 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 to the signal amplitude, adjust the trigger level. The LIN trigger interface as shown in Figure 4-9, the text interface as shown in Picture 4-10.

Picture 4-9 LIN graphic interface
Description of LIN decode

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

(2) Decode data is based on hexadecimal

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

(4) When appear ?, need press $s \text{ ns}$ to adjust time scale, and then view the results.
**LIN bus trigger and decode**

<table>
<thead>
<tr>
<th>Time (ms)</th>
<th>ID</th>
<th>Data</th>
<th>Check</th>
<th>Trig</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.17</td>
<td>3A</td>
<td>30 39 3A 3B 3C 3D 3E 3F</td>
<td>22</td>
<td>Yes</td>
</tr>
<tr>
<td>8.06</td>
<td>25</td>
<td>40 41 42 43</td>
<td>F8</td>
<td>Yes</td>
</tr>
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<td>3A</td>
<td>48 49 4A 4B 4C 4D 4E 4F</td>
<td>A1</td>
<td>Yes</td>
</tr>
<tr>
<td>8.19</td>
<td>25</td>
<td>50 51 52 53</td>
<td>D8</td>
<td>Yes</td>
</tr>
<tr>
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<td>3A</td>
<td>58 59 5A 5B 5C 5D 5E 5F</td>
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</tr>
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<td>70</td>
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<td>30</td>
<td>Yes</td>
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<td>25</td>
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<td>3A</td>
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<td>9F</td>
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<td>25</td>
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<td>B7</td>
<td>Yes</td>
</tr>
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</tr>
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<td>9E</td>
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</tr>
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<td>25</td>
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<td>3A</td>
<td>B8 B9 BA BB BC BD BE BF</td>
<td>1E</td>
<td>Yes</td>
</tr>
<tr>
<td>8.06</td>
<td>25</td>
<td>C0 C1 C2 C3</td>
<td>F6</td>
<td>Yes</td>
</tr>
<tr>
<td>7.17</td>
<td>3A</td>
<td>C8 C9 CA CB CC CD CE CF</td>
<td>9D</td>
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</tr>
<tr>
<td>8.19</td>
<td>25</td>
<td>D0 D1 D2 D3</td>
<td>B6</td>
<td>Yes</td>
</tr>
<tr>
<td>7.17</td>
<td>3A</td>
<td>D8 D9 DA DB DC DD DE DF</td>
<td>1D</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Picture 4-10 LIN text interface
Description of LIN text interface

(1) Time: Time intervals between the last frames to current frames
(2) ID: Frame ID value
(3) Data: Frame data
(4) Parity sum: Frame parity sum, the sum of parity error displays in red
(5) Trigger: Yes means the frame reaches trigger condition

4.3 CAN bus trigger and decode

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

- **Bus configuration**

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

Picture 4-11 CAN bus configuration menu

- **Trigger type**

Press **F4** to popup trigger type setting menu, picture 4-12
**CAN bus trigger and decode**

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
CAN bus trigger and decode

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 \[ \text{Trigger} \] 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 \[ \text{Ch1} \] then idle high, 1Mb/s, press \[ F4 \] to back

(4) Press \[ F4 \] to popup configuration trigger mode menu, press frame start

(5) Based on signal amplitude to adjust the trigger level. CAN trigger interface is shown in figure 4-13, Text interface is shown in picture 4-14.
Instruction of CAN decode data packet:
(1) Decode packet displays instantaneous data content of bus activity
(2) Decode data is based on hexadecimal.
(3) Frame ID displays in yellow, the data in white, the DLC and CRC code display in green, the
CAN bus trigger and decode

Frame error displays in red E

(4) When appear ?, need press \text{ns} \text{s} to adjust time scale, then view the decode results. When appear !, means the decode packet of the bus waveform is not complete, so data does not displayed properly.
## CAN bus trigger and decode

### Table 4-14 CAN text interface

<table>
<thead>
<tr>
<th>Time (ns)</th>
<th>ID</th>
<th>Type</th>
<th>DLC</th>
<th>Data</th>
<th>CRC</th>
<th>Error</th>
<th>Trig</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
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<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
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<tr>
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<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.13</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
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<td>Ack</td>
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</tr>
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<td>Yes</td>
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<td>EFF</td>
<td>0</td>
<td>F0 F1 F2 F3 F4 F5 F6 F7</td>
<td>1AB7</td>
<td>Ack</td>
<td>Yes</td>
</tr>
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<td>SFF</td>
<td>5</td>
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<td></td>
</tr>
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<td>0</td>
<td>F0 F9 F9 F8 F9 FC F9 FC F9 FE FF</td>
<td>2F35</td>
<td>Ack</td>
<td>Yes</td>
</tr>
<tr>
<td>0.26</td>
<td>12EFABCD</td>
<td>EFF</td>
<td>0</td>
<td>F0 F9 F9 F8 F9 FC F9 FC F9 FE FF</td>
<td>2F35</td>
<td>Ack</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Picture 4-14 CAN text interface**
CAN text interface description:
1. Export: after USB connected, data can be exported
2. Run/stop: run/stop decode
3. Statistics: statistic frame type, data bit and trigger count and percentage. As shown in picture4-15
4. Back: back to graphic pattern
5. Trigger: Yes means the frame conforms to trigger condition
6. Error: includes response error, bit stuff error, format error and CRC error
7. CRC: the frame parity code
8. Data: refer to frame data
9. DLC: when the frame send data bit or remote frame, user can ignore this value
10. Type: includes types of the frame, SFF means standard data frame and SRF is standard remote frame, EFF is extension data frame, ERF is the extension of remote frame
11. ID: CAN frame ID value, displays as hex, max is 29 bit
12. Time: means the time interval between the last frames to current frame.
### CAN bus trigger and decode

<table>
<thead>
<tr>
<th>Item</th>
<th>Count</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit Error</td>
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<td>ID Bit Error</td>
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</tr>
<tr>
<td>Data Bit Error</td>
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<td>0.41</td>
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<td>Frame Format Error</td>
<td>2</td>
<td>0.01</td>
</tr>
<tr>
<td>Frame End Error</td>
<td>2</td>
<td>0.01</td>
</tr>
<tr>
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<td>100.00</td>
</tr>
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<td>&gt;0x12EFA0BCD</td>
<td>38511</td>
<td>98.71</td>
</tr>
<tr>
<td>&gt;0x977D5E1F</td>
<td>17</td>
<td>0.04</td>
</tr>
<tr>
<td>&gt;0x5A0</td>
<td>391</td>
<td>1.00</td>
</tr>
<tr>
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<td>0.06</td>
</tr>
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<td>17</td>
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Picture 4-15 CAN decode statistics
4.4 SPI bus trigger and decode

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

- **Bus configuration**

(1) Press **F3** to popup bus configuration, then user need set the clock source (CLK), data source, work mode and data bits. As shown in figure 4-16.
**Trigger mode**

Press `F4`, popup trigger mode configuration menu, shown in picture 4-17.
**SPI bus trigger and decode**

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

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

Measured signal length is 8 bit; trigger mode matching bit 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 \(\text{Trigger}\), then press \(\text{F1}\) select the trigger type as serial bus

2. Press \(\text{F2}\) to select bus type as SPI
(3) press F3 to enter the bus configuration menu, successively press the CLK of Ch2, data as Ch1, work mode as SCK low idle state, sample with SCK 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 4-18.
SPI bus trigger and decode

Picture 4-18 SPI trigger graphic interface
Description of SPI decoding
(1) Decode packet displays the real-time data content of bus activity
(2) Decode data displays as hexadecimal system
(3) Data displays in white
(4) When appear?, need to press $\text{ns}$ to adjust time scale, then view the decode results.
### SPI bus trigger and decode

<table>
<thead>
<tr>
<th>Time (ns)</th>
<th>Data</th>
<th>Trig</th>
</tr>
</thead>
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<td>0.00</td>
<td>C4</td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
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<td>30</td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>08</td>
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<td>0.00</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>6B</td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>AB</td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>CD</td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>08</td>
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<td>0.00</td>
<td>CD</td>
<td></td>
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<td>C2</td>
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<td></td>
</tr>
<tr>
<td>0.00</td>
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<tr>
<td>0.13</td>
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<tr>
<td>0.00</td>
<td>C6</td>
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<td>0.00</td>
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<td>Yes</td>
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<td>0.00</td>
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</tr>
<tr>
<td>0.00</td>
<td>08</td>
<td></td>
</tr>
</tbody>
</table>

*Picture 4-19 SPI text interface*
SPI text interface specification:
(1) Time: Intervals from the last frame to current frame
(2) Data: According the decode data bits display decode data. Such as, the data bits is 8 bits, can only display 1 byte on data bar. If data bits are 16 bits, the data bar shows 2 bytes; 24 data bits display 3 bytes; Data bits are 32 bits, then 4 bytes.
(3) Trigger: Yes means the frame reaches the trigger condition.
Notes: Single frame refers to the measurement of settled data bits; it can meet a data bit code stream

4.5 I2C bus trigger and decode

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

- **Bus configuration**

Bus configuration includes the serial clock (SCL) and the serial data (SDA) corresponding to the channel settings.
Press F3, then popup bus configuration menu, press the channel on the touch screen or use a function button to set. As shown in picture 4-20.

**Picture 4-20 I2C bus configuration**

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

- **Trigger type**

Press F4 to popup trigger type configuration menu, press the trigger type and trigger relation on touch screen, or select by using the function keys, as shown in picture 4-21.
**I2C bus trigger and decode**

**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 begins rise trigger
- **c)** Ack Lost — bus Ack high level trigger
d) Address no Ack — trigger at the setting address no Ack (ignoring W/R), select the trigger data address, press \( \Delta \) 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 method 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 , then press , select the trigger type as serial bus

(2) Press 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 4-22, text interface is shown in picture4-23.
I2C bus trigger and decode

Description of I2C decode content

(1) Decode packet displays the real-time data content of bus activity
(2) The decode data displays Hexadecimal system
(3) Address content shown in yellow, data in white W means work, R means read, D means decode, ~A means Ack.

(4) When appear ?, need to press \( s \text{ns} \) to adjust time scale, then view the decode results.
### Description of I2C text interface

<table>
<thead>
<tr>
<th>Time (ns)</th>
<th>Addr</th>
<th>Data</th>
<th>Ack</th>
<th>Trig</th>
<th>ReSet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.64</td>
<td>50R</td>
<td>43 44 45 46 47 48 49 4A 4B 4C 4D</td>
<td>X</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>14.21</td>
<td>09W</td>
<td>3F 4E 00</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.13</td>
<td>09W</td>
<td>3F</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.13</td>
<td>09R</td>
<td>4E 4F</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.13</td>
<td>50W</td>
<td>00 00</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.64</td>
<td>50R</td>
<td>50 51 52 53 54 55 56 57 58 59 5A</td>
<td>X</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>14.34</td>
<td>09W</td>
<td>3F 5B 00</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>09W</td>
<td>3F</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.26</td>
<td>09R</td>
<td>5B 5C</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.13</td>
<td>50W</td>
<td>00 00</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.64</td>
<td>50R</td>
<td>5D 5E 5F 60 61 62 63 64 65 66 67</td>
<td>X</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>14.21</td>
<td>09W</td>
<td>3F 68 00</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.13</td>
<td>09W</td>
<td>3F</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.13</td>
<td>09R</td>
<td>68 69</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.26</td>
<td>50W</td>
<td>00 00</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.64</td>
<td>50R</td>
<td>6A 6B 6C 6D 6E 6F 70 71 72 73 74</td>
<td>X</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>14.21</td>
<td>09W</td>
<td>3F 75 00</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.13</td>
<td>09W</td>
<td>3F</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.13</td>
<td>09R</td>
<td>75 76</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.13</td>
<td>50W</td>
<td>00 00</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>0.64</td>
<td>50R</td>
<td>77 78 79 7A 7B 7C 7D 7E 7F 80 81</td>
<td>X</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
I2C bus trigger and decode

(1) Time: Intervals between the last read/write operations to current read/write operations
(2) Address in address bar the "R" means the read operation, the "W" means write operation
(3) Ack: In Ack bar “x” means Ack lost
(4) Data: Data bar
(5) Trigger: Yes means reach trigger condition
(6) Restart: Yes means reach restart condition
Chapter Five Application Examples
This chapter mainly introduces five common applications:

- Taking simple measurements
- Capture single pulse signal
- Analyze signal detail
- Trigger on video signal
- Use math FFT

Each application example highlights the different characteristics of the oscilloscope; user can get familiar with the operation of oscilloscope through these application examples.
5.1 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 \(\text{Ch1}\) to switch Ch1 as the current channel (if Ch1 is already current, ignore this step)
   3) press \(\text{AutoSet}\), 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.
Measure simple signal

Picture 5-1 auto-measure
Measure simple signal

3. Cursor measurement

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

1) Press \text{Cursor} to open cursor menu
2) Press \text{F2} to select the vertical cursor
3) Press \text{F2} to close the cursor menu
4) Press \text{Cursor} \text{Cursor} 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 \text{F4} to switch)
5) Press \text{Cursor} to open cursor menu
6) Press \text{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.
5.2 Capture single pulse signal

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

Capturing single pulse signal should follow these steps.

1) connect Ch1 to signal
2) successively press Scope F2, then select sampling mode as peak
3) press Trigger to open the trigger menu
4) press F1 to select the trigger type as the edge trigger
Capture single pulse signal

5) Press $F_2$ to select signal source as Ch1

6) Press $F_3$ to select slope as the rise, then press $\bigcirc$ or roll the wheel to adjust the trigger level.

7) Successively press $F_4$ then $F_2$ to select the coupling way as DC

8) Press $F_3$ to select the mode as auto

9) Successively press $F_4$ then $F_2$ to set the rejection time as 200ns

10) Press $\text{Single SEQ}$ to wait for trigger and capture pulse.(view picture as 5-3)

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.
Capture single pulse signal

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 \text{Scope} to open the oscilloscope menu.

3) Press \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.
Analysis the signal detail

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.
Analysis the signal detail

Picture 5-5 average sampling
5.4 Trigger on video signal

To observe high definition 720P video circuit pattern signal, using video trigger to receive stable video output signal. Please follow these steps to use the default trigger mode and the hold-off time.

1) Connect Ch1 to measured signal.

2) Successively press [Trigger] [F1] to select the trigger type as the video

3) Press [F2] to select the signal source as Ch1.

4) Press [F4] then [F2] to select the video standard type as 1080P

5) press [F3] to select the trigger type as all

6) Adjust the vertical scale factor [mV], vertical position [v], horizontal time scale
Trigger on video signal for suitable waveform display. As shown in picture 5-6.

Picture 5-6 All 720P format
5.5 Use math FFT

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

1) Connect 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
Use math FFT
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 (〇) 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.
**Multimeter safety information**

- If need to switch function, the pens should leave away from the test point.

**6.2 Start multimeter**

First press [power] 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
Multimeter buttons and their functions

measurements, if the measured values in excess of the range, the others are not allowed to open the “relative” function.

Press F4 to re-acquire the data, which calculates the measurement value.

Press the multimeter HOLD button to keep or remove current readout on the screen.

Description of multimeter functions

Multimeter can measure 12 kinds of physical quantities such as voltage, current, resistance, capacitance, temperature, humidity, frequency etc. and also average maximum and minimum value (both with time marks), all measurement processes can automatically adjust the gear. Multimeter interface is shown in picture 6-1.
Description of multimeter interface
Multimeter buttons and their functions

1. Maximum icon
2. Maximum record time: show the maximum record time.
3. Average icon
4. Average value: show the average data
5. Average record time: the record time of average operation
6. Minimum icon
7. Minimum: show the minimum data
8. The minimum record time: show the minimum record time.
9. Maximum: show the maximum data
10. High voltage icon: if > 30 V DC or AC, this symbol will appear
11. Current measurement value: the measurement result of current signal
12. Actual value: the actual current measurement value shows when "relative" function is open
13. Function menu area: 12 kinds of physical quantities. More details is shown in the function menu area.
14. Left move function button: left menu selection function.
15. Right move function button: right menu selection function.
**Multimeter buttons and their functions**

16. Relative function button, for open/close the relative function
17. Restart test function button: re-acquire the data and operation
18. Benchmark: the benchmark samples value, the relative function displays when it starts
19. Range scale: shows the range of current gear, according signal to auto-adjust.
20. Start the relative: the relative displays.
21. the HOLD icon: Press Run Stop to start the HOLD function. HOLD is used to display the current data.

**Description of function menu**

<table>
<thead>
<tr>
<th>Icon</th>
<th>Function</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="DC voltage" /></td>
<td>DC voltage measurement</td>
<td>1mV~1000V</td>
</tr>
<tr>
<td><img src="image" alt="AC voltage" /></td>
<td>AC voltage measurement</td>
<td>1mV~750V</td>
</tr>
<tr>
<td><img src="image" alt="AC/DC voltage" /></td>
<td>AC/DC voltage measurement</td>
<td>1mV~750V</td>
</tr>
<tr>
<td><img src="image" alt="Relative humidity" /></td>
<td>Relative humidity measurement</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Pressure" /></td>
<td>Pressure measurement</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Resistance" /></td>
<td>Resistance, range: 0~50MΩ</td>
<td></td>
</tr>
</tbody>
</table>
**Multimeter buttons and their functions**

<table>
<thead>
<tr>
<th></th>
<th>DC current measurement</th>
<th>AC current measurement</th>
<th>Temperature measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>A〜</td>
<td>On-off function, &lt;50Ω alarm Max 500Ω</td>
<td>Diode, Range: 0〜3.5V</td>
<td>Capacitance, Range: 100pF〜50uF</td>
</tr>
<tr>
<td>A=}</td>
<td>DC current measurement</td>
<td>AC current measurement</td>
<td>Temperature measurement</td>
</tr>
</tbody>
</table>

### 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
Use multimeter

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
**Start record**

### 7.1 Start recorder

Press [power] 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 \[\text{Recorder} \quad \text{F1}\] to the recording mode.

2) Press \[\text{F1}\] to enter the multimeter record mode.

3) Press \[\text{F1}\] to the multimeter record type selection menu.
**Record**

**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

![Meter Function Choice](image)

**Picture 7-1 meter function choice**

4) Press **F4** back to upper menu

5) Press the time scale **s ns** to select the required gear.
6) Press F2 to prepare starting the multimeter record

7) Press F1 to start the record and store the data To Record 1, or press F2 to start the multimeter record and store the data To Record 2.

**Description of store recording choice menu:** if there is no time 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.

![Picture 7-2 store record menu](image)

**Description of available function button:** in recording mode, the horizontal time scale adjustment $s\text{--}ns$ and on/off menu $\text{Menu Off}$ 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 picture 7-3.

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

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,
Record

using the horizontal time scale 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 \text{F4} to open panoramic mode, at this time the recording is still in progress, then repress \text{F4} to cancel the panorama mode.

13. Storage mode: \text{ST} \to \text{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.
7.2.2 Oscilloscope measurement record

There are 31 types of measurements can be recorded in this instrument. In work mode, users should set voltage, time scale gear, phase, trigger source, trigger type, trigger position, and measurement type selection. Select the record type in the recorder work mode, each time can record two types of measurement at most. If more than two kinds of
measurement types, users need 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 to enter the oscilloscope and carries on the related settings, make waveform display normally.

2) Press to choose the type of measure, and user can choose at most four types.

3) Successively press  to enter the oscilloscope record.

4) Press  to select measurement type record, record type as frequency and the rise time. As shown in picture7-5.
5) Press F4 to return to upper menu.

6) Press horizontal time scale $s$ \text{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 picture 7-6.

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
Record

- Ch2 rise edge: with Ch2 rise edge start/stop record
- Ch2 fall edge: with Ch2 fall edge start/stop record
- EXT rise edge: with EXT rise edge start/stop record
- EXT fall edge: With EXT fall edge start/stop record.

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

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

![Start mode selection](Image)
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 to enter the oscilloscope waveform recording.

3) Press to related configuration.

4) Press to set start mode as normal then press to set the stop mode as the normal.

5) Press to return to upper menu.

6) Press time scale 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.
7.2.4 Store mode set

Store mode includes two type: stop when full and cycle store. Stop when full
which means if the internal storage capacity of the oscilloscope or U device are full, the record will stop automatically. Cycle store 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 to enter the store set.

2) Press to select the store mode

3) Press to choose the menu, and then finish the set.
7.3 Playback

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

7.3.1 Multimeter record playback

Please follow these steps to use multimeter record playback.

1) Press \(\text{Recorder}\) to enter the recorder-working mode.

2) Press \(\text{F2}\) to choose menu and enter the playback type.

3) Press \(\text{F1}\) to choose multimeter record playback.

4) Press \(\text{F1}\) to choose the playback to record 1 or press \(\text{F2}\) to select the playback to record 2;
5) Press F1 to start playback, the playback is shown in picture 7-9.

Description of the interface of record playback
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 key F1 to switch
11. Horizontal scale (horizontal timescale)
12. Backward
13. Fast forward

14. Stop, press \textit{F4} to stop replay and then press \textit{F4} to return to upper menu.

15. Storage mode

\textbf{Replay displaying and operating instructions:} After selecting replay “record 1”/“record 2” to enter the preview mode then the screen displays waveform data. Press \textit{F1} to play mode. If the record waveform data extend out of one screen then can press \textit{s ns} to adjust timescale, if the data less than one screen, user can’t adjust timescale. Press \textit{ then the waveform will move forward. And press \textit{ then the waveform will rewind, and press \textit{ and the waveform can quickly movie forward and backward.

\textbf{7.3.2 Oscilloscope measurement record replay}

Follow these steps to replay the oscilloscope measurement record.
Playback

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 picture 7-10.
Playback

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.
Playback

Picture 7-11 oscilloscope waveform record replays
7.3.4 The last record playback

Please follow these steps to playback the last record

1) In record mode, successively press F2 F4 to enter the last record replay mode.

2) Press F1 to start replaying record for the last record.
Chapter Eight Users’ section
Users’ section includes system config, tools and help. Press 🔄 to enter users’ page after starting up. The users interface is shown in Figure 8-1.

![Picture 8-1 users interface](image-url)
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 \( \text{User} \) and enter the user page;

2) Press "time set" and enter the date and time setting page;

3) Set the year, month and day by pressing the number buttons of "0 to 9";

4) Press "back" or \( \text{F4} \) to return to the previous menu. Then the setting is done.
2. Language

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

3. Help

Press "help" to enter the help content table. Under the help content table, there are multi-level directory and hyperlinks which make it convenient for users to look for information. You can get to the corresponding help entries by pressing the underlined character, Press \( F_1 \) to change the page; press \( F_2 \) to switch the hyperlink item; press \( F_3 \) to directly jump to the current hyperlink; press the "back" or press \( F_4 \) to return to the previous help entry; press \( \triangle \) to return to the previous hyperlink and press \( \triangledown \) to go move to the next one.

4. Calibration of the Touch Screen
Press the key \[ \text{User} \] 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](image)

Picture 8-2 calibration icon

![Picture8-3 finishes the calibration of the page](image)

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.
Tools

Picture 8-4 calculator

(3 + 9) × 8 = 96
（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 \[ \text{User} \] to enter the users’ page;
2) Successively press the tool and the electronic calculator;
3) Press inductive reactance;
4) Press frequency;
5) Input the value of frequency in the input area;
6) Press "inductance";
7) Input the value of inductance in the input area;
8) Press "=" in the input area and the result will be displayed in the display area for the inductive reactance value. The interface of electronic calculator is shown in figure 8-6
Instructions for the interface of electronic calculator:
1. Selecting calculation type area, as is shown in figure 8-5 with arrow 1
2. Value input area, as is shown in figure 8-5 with arrow 2
3. Units choice area, as is shown in figure 8-5 with arrow 3
4. Value display area, as is shown in figure 8-5 with arrow 4
Picture 8-5 the interface of electronic calculator

6. Load factory settings

Press User 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.

⚠️ 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 back to the users homepage. The adjustment of screen brightness is shown in figure 8-8

Picture 8-8 adjustment of brightness
8. Preference Set

Press \text{User} to enter the users’ page. Press "Preference" to enter the preference set. The preference set includes:

1) Menu hide time set: the menu auto-hide time, max. 60 seconds.
2) Standby time set: interval between the last operation and the oscilloscope enters into the standby state with the max 60 minutes.
3) Shut down time set: the interval time between the last operation and the oscilloscope entering the shutdown state with a maximum of 60 minutes.
4) Wheel direction set: the upward or downward movements for cursor trigger level and wave in vertical position are corresponding to the direction of the wheel.
5) Keypad tone set: turn on or off the button tone.

Preference set is shown in figure 8-9.
Preference set

Menu Hide Time: 5Sec
Standby Time: 25Min
Shutdown Time: 60Min
Wheel Direction: Normal, Invert
Keypad tone: Silent, Beep
Theme: Default, Outdoor

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
Fault handling

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 is in 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 the signal source is working properly.
   - Check whether the channel switch (such as CH1, CH2 menu buttons) is turned on.
Fault handling

- 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 \( \text{Run/Stop} \) 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.
Fault handling

- 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 shipment, 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 2 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.
Services and support

Contact us
Shenzhen Micsig Instruments Co., Ltd
Direct: 400-060-8550
Web: www.micsig.com
Email: sales@micsig.com
Appendix
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

<table>
<thead>
<tr>
<th>Type —— bandwidth</th>
<th>MS310IT, MS510IT, MS510S —— 100MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MS320IT, MS520IT, MS520S —— 200MHz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Isolated voltage between Channel.</th>
<th>CAT II 1000V CAT III 600V (MS200 series is non-isolated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNC refer to ground floating voltage</td>
<td>CAT II 1000V CAT III 600V</td>
</tr>
<tr>
<td>BNC input the maximum voltage</td>
<td>CAT III 300V (MS300, MS500 series)</td>
</tr>
<tr>
<td>Number of channel</td>
<td>Two oscilloscope channels, one multi-meter channel</td>
</tr>
</tbody>
</table>
## Technical specification

<table>
<thead>
<tr>
<th>Shell</th>
<th>Design</th>
<th>Dual color injection protection shell design, high intensity, impact resistant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Screen</td>
<td>5.7 inch TFT touch LCD</td>
</tr>
<tr>
<td></td>
<td>Resolution coefficient display</td>
<td>640*480</td>
</tr>
<tr>
<td></td>
<td>Color display</td>
<td>64K color</td>
</tr>
<tr>
<td></td>
<td>Background light intensity (typical)</td>
<td>200/m² - 500 cd/m²</td>
</tr>
<tr>
<td>Communication</td>
<td>Communication interface</td>
<td>Standard USB connect to USB device, Mini USB connect to PC</td>
</tr>
<tr>
<td>Power</td>
<td>Adapter input</td>
<td>View power adapter</td>
</tr>
<tr>
<td></td>
<td>Adapter output</td>
<td>View power adapter</td>
</tr>
</tbody>
</table>
### Technical specification

<table>
<thead>
<tr>
<th>Battery</th>
<th>Standard Li-battery capacity</th>
<th>7.4V/6000mAh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Duration of working time (typical)</td>
<td>4.5H</td>
</tr>
<tr>
<td></td>
<td>Power off charging time (typical)</td>
<td>4H</td>
</tr>
<tr>
<td></td>
<td>Optional Li-battery capacity</td>
<td>7.4V/9000mAh</td>
</tr>
<tr>
<td></td>
<td>Duration of working time (typical)</td>
<td>7H</td>
</tr>
<tr>
<td></td>
<td>Power off charging time (typical)</td>
<td>6H</td>
</tr>
</tbody>
</table>

| Environment |  |
|-------------|------------------|------------------|
| Temperature (work/storage) | -20°C～+50°C / -20°C～+60°C |
| LCD panel temperature (work/storage) | -20°C～+70°C / -30°C～+80°C |
| Humidity (work/storage) | < 75%RH / 85%RH (+30°C～+40°C) |
| Altitude (work/storage) | Max 3000m / 12000m |
| Cooling method | Natural convection |

| Mechanical |  |
|------------|------------------|------------------|
| Size (length*width*depth) | 254mm*160mm*60mm |
### Technical specification

#### Weight

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscilloscope (no battery)</td>
<td>1380g</td>
<td></td>
</tr>
<tr>
<td>Standard accessories (typical)</td>
<td>691g</td>
<td></td>
</tr>
<tr>
<td>Standard battery (typical)</td>
<td>276g</td>
<td></td>
</tr>
<tr>
<td>High capacity battery (typical)</td>
<td>381g</td>
<td></td>
</tr>
</tbody>
</table>

#### Oscilloscope

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. sample rate</td>
<td>Single channel 1GS/s, dual channel 500MS/s</td>
</tr>
<tr>
<td>Max. memory depth</td>
<td>Single channel 240K dual channel 120K</td>
</tr>
<tr>
<td>Bandwidth limitation</td>
<td>20MHz (-3dB)</td>
</tr>
<tr>
<td>Sampling configuration</td>
<td>Normal, peak-peak value, envelope, average</td>
</tr>
<tr>
<td>Single Sequence</td>
<td></td>
</tr>
<tr>
<td>Normal, peak-peak</td>
<td>For a sampling, all channels work simultaneously</td>
</tr>
<tr>
<td>Average, envelope</td>
<td>For N times of sampling, all channels work simultaneously. N is set from 2 to 256 (corresponding envelope is ∞)</td>
</tr>
<tr>
<td>Output voltage of probe compensation (typical)</td>
<td>≥1MΩ while loading, peak-peak value is 2V</td>
</tr>
<tr>
<td>Frequency of probe compensation (typical)</td>
<td>1KHz, square wave</td>
</tr>
</tbody>
</table>
### Technical specification

<table>
<thead>
<tr>
<th>Interpolation method</th>
<th>Sin(x)/x</th>
</tr>
</thead>
</table>

#### Input

<table>
<thead>
<tr>
<th>Input coupling</th>
<th>DC, AC, Ground Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input resistance</td>
<td>1MΩ±1%  15pF±3pF  parallel connection</td>
</tr>
<tr>
<td>Probes attenuation factor</td>
<td>1X, 10X, 100X</td>
</tr>
</tbody>
</table>

#### Horizontal

<table>
<thead>
<tr>
<th>Position range</th>
<th>±6grid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal timescale</td>
<td>4ns/div<del>10s/div press 1</del>2~4 step by step</td>
</tr>
<tr>
<td>Timescale(delay) position adjusting range</td>
<td>-12grid~50s</td>
</tr>
<tr>
<td>Timescale accuracy (typical)</td>
<td>±20ppm</td>
</tr>
</tbody>
</table>

#### Verticality

<table>
<thead>
<tr>
<th>Vertical scale</th>
<th>5mv/div<del>50v/div , step by step as the way of 1</del>2~5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustment of position scope</td>
<td>±4 grid</td>
</tr>
<tr>
<td>Vertical resolution</td>
<td>8 bit</td>
</tr>
</tbody>
</table>
## Technical specification

<table>
<thead>
<tr>
<th>Rising time (typical)</th>
<th>100MHz ≤3.5ns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200MHz ≤1.75ns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DC gain accuracy (typical)</th>
<th>5mv/div～50v/div, ±2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC measurement precision (typical)</td>
<td>5mv/div～50v/div, ±(2.0%×actual readout + 0.04×vertical displacement/div)</td>
</tr>
</tbody>
</table>

### Trigger

<table>
<thead>
<tr>
<th>Trigger source</th>
<th>Ch1, Ch2, EXT (MS200 series only support CH1, CH2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger mode</td>
<td>Automatic, normal, single sequence</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Edge triggered</th>
<th>Rise edge, fall edge, dual edge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trigger pulse width</td>
<td>Conditions: &lt;, &gt;, =, ≠</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Polarity: positive, negative</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Logic trigger</th>
<th>Logical calculation: AND, OR, NAND, NOR</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Video trigger</th>
<th>Format: PAL, SECAM, NTSC, 720P, 1080I, 1080P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type: odd, even, all, all line, assigned line</td>
</tr>
</tbody>
</table>

| Serial | UART (RS232/RS422/RS485) | Pattern: parity error, [X: data], [0: data], [1: data], data, |
### Technical specification

<table>
<thead>
<tr>
<th>Bus trigger</th>
<th>Stop bit, start bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIN</td>
<td>Pattern: frame ID and data, frame ID, sync – rising edge</td>
</tr>
<tr>
<td>CAN</td>
<td>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</td>
</tr>
<tr>
<td>SPI</td>
<td>Pattern: match the binary data</td>
</tr>
<tr>
<td>I2C</td>
<td>Pattern: start condition, stop condition, Ack lost, block address field no Ack, restart, EEPROM data read, frame type 1, frame type 2</td>
</tr>
</tbody>
</table>

**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, |
### Technical specification

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average, Cycle average, RMS, RMS cycle</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cursor type</strong></td>
<td>Horizontal cursor, Vertical cursor, Crossing cursor</td>
</tr>
<tr>
<td><strong>Dynamic recording(U device connected)</strong></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Max  2h</td>
</tr>
<tr>
<td>Replay of forward/backward</td>
<td>Support</td>
</tr>
<tr>
<td>Record the total frames</td>
<td>Support</td>
</tr>
<tr>
<td>Replay frames/display frames</td>
<td>Support</td>
</tr>
<tr>
<td><strong>Math</strong></td>
<td></td>
</tr>
<tr>
<td>FFT</td>
<td>Rectangular, hanning, hamming, BlackmanHarris</td>
</tr>
<tr>
<td>Dual waveform</td>
<td>+, -, *, /</td>
</tr>
<tr>
<td><strong>XY model</strong></td>
<td></td>
</tr>
<tr>
<td>X- axis input/ Y-axis output</td>
<td>Ch1 / Ch2</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td></td>
</tr>
<tr>
<td>Waveform</td>
<td>Four sets of stored waveforms and can be stored in</td>
</tr>
</tbody>
</table>
## Technical specification

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Support (U device or PC connected, MS300 need to be updated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>User settings</td>
<td>Nine choices</td>
</tr>
</tbody>
</table>

### Display

<table>
<thead>
<tr>
<th>Refresh mode</th>
<th>Normal refresh, High refresh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max refresh rate</td>
<td>MS500 series 190k wfrms /s</td>
</tr>
<tr>
<td></td>
<td>MS300 series can be upgraded to 50k wfrms /s</td>
</tr>
<tr>
<td>Afterglow</td>
<td>Automatic, 100ms~10s, ∞</td>
</tr>
<tr>
<td>Waveform display area</td>
<td>8 × 12 grid</td>
</tr>
<tr>
<td>Waveform drawing mode</td>
<td>Dot, line</td>
</tr>
<tr>
<td>Languages</td>
<td>Simplified Chinese, English</td>
</tr>
</tbody>
</table>

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

| Working voltage       | CAT III 600V                                              |
**Technical specification**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuation coefficient</td>
<td>10:1</td>
</tr>
<tr>
<td>Input capacitance</td>
<td>13pF</td>
</tr>
<tr>
<td>Match range</td>
<td>10pF~30pF</td>
</tr>
<tr>
<td>Input impedance</td>
<td>10MΩ±1%</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>DC~250MHz</td>
</tr>
<tr>
<td>Rise time</td>
<td>1ns</td>
</tr>
<tr>
<td>Cable length</td>
<td>1200mm</td>
</tr>
</tbody>
</table>

**Multimeter**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DC voltage (+28℃)</strong></td>
<td></td>
</tr>
<tr>
<td>Range: 1mV~1000V</td>
<td>±0.5%±10bit</td>
</tr>
<tr>
<td>Range: 60mV~1000V accuracy: ±0.5%±5bit</td>
<td></td>
</tr>
<tr>
<td><strong>AC voltage (+28℃)</strong></td>
<td></td>
</tr>
<tr>
<td>Range: 1mV~700V frequency range:</td>
<td>±1%±10bit</td>
</tr>
<tr>
<td>10.0Hz~20.000KHz</td>
<td>Range: 60mV~700V accuracy: ±1% ±5bit</td>
</tr>
</tbody>
</table>
## Technical specification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ac/dc voltage</strong></td>
<td>1mV ~ 700V</td>
<td>±1% ±10bit</td>
</tr>
<tr>
<td><strong>DC</strong></td>
<td>Optional modules or current clamp, can be customized</td>
<td></td>
</tr>
<tr>
<td><strong>AC</strong></td>
<td>Optional modules or current clamp, can be customized</td>
<td></td>
</tr>
<tr>
<td><strong>Resistance</strong></td>
<td>0 ~ 10MΩ</td>
<td>±1% (+28°C)</td>
</tr>
<tr>
<td></td>
<td>10MΩ ~ 20MΩ</td>
<td>±3% (+28°C)</td>
</tr>
<tr>
<td></td>
<td>20MΩ ~ 50MΩ</td>
<td>±5% (+28°C)</td>
</tr>
<tr>
<td><strong>On-off test</strong></td>
<td>If &lt;50Ω, system will alarm</td>
<td>Max 500Ω</td>
</tr>
<tr>
<td><strong>Diode</strong></td>
<td>Range: Max 3.5V</td>
<td></td>
</tr>
<tr>
<td><strong>Capacitor</strong></td>
<td>100pF ~ 5uF</td>
<td>±10% (+28°C)</td>
</tr>
<tr>
<td></td>
<td>5uF ~ 50uF</td>
<td>±5% (+28°C)</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>Optional sensor module, can be customized</td>
<td></td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>Optional sensor module, can be customized</td>
<td></td>
</tr>
<tr>
<td><strong>Pressure</strong></td>
<td>Optional sensor module, can be customized</td>
<td></td>
</tr>
</tbody>
</table>
## Technical specification

<table>
<thead>
<tr>
<th>Measurement Display</th>
<th>Max, Average, Min in total, all with a time tag. Relative measurement</th>
</tr>
</thead>
</table>

### Recorder

<table>
<thead>
<tr>
<th>Record content</th>
<th>Measurements for multimeter, oscilloscope and oscilloscope waveform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display mode</td>
<td>Panorama screen, normal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Record time scale</th>
<th>Multimeter</th>
<th>10s/div～20min/div</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oscilloscope</td>
<td>10s/div～20min/div</td>
</tr>
<tr>
<td></td>
<td>Oscilloscope waveform</td>
<td>10us/div～2min/div (MS300 need to be updated)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max. recording time</th>
<th>No limit (MS300 serial need to be updated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replay forward/backward</td>
<td>Support</td>
</tr>
<tr>
<td>Storage mode</td>
<td>Stop when full, cycle storage</td>
</tr>
<tr>
<td>Data save mode</td>
<td>Interior, USB device</td>
</tr>
<tr>
<td>Time display</td>
<td>Record time: support</td>
</tr>
</tbody>
</table>
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: [battery icons]. while [battery icon] 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.

<table>
<thead>
<tr>
<th>Category</th>
<th>Factory resetting (user interface)</th>
<th>Default settings (store/restore menu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coupling</td>
<td>DC</td>
<td>Factory default</td>
</tr>
<tr>
<td>Mode</td>
<td>Normal</td>
<td>Factory default</td>
</tr>
<tr>
<td>Mean counts</td>
<td>16</td>
<td>Factory default</td>
</tr>
<tr>
<td>Envelope counts</td>
<td>16</td>
<td>Factory default</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>Full bandwidth</td>
<td>Factory default</td>
</tr>
<tr>
<td>Delay</td>
<td>On</td>
<td>Factory default</td>
</tr>
<tr>
<td>Phase invert</td>
<td>Off</td>
<td>Factory default</td>
</tr>
<tr>
<td>Probe coefficient</td>
<td>1X</td>
<td>Factory default</td>
</tr>
<tr>
<td>Parameter</td>
<td>Default Setting</td>
<td>Factory default</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| Select channel                    | Ch1—>Open and default as current channel  
|                                   | Ch2—>open             |                 |
| Run/stop                          | Run                   |                 |
| Sampling single sequence          | Stop                  |                 |
| Vertical position                 | Middle of screen      |                 |
| Vertical scale                    | 5mV                   |                 |
| Time scale                        | 1.00ms                |                 |
| Trigger position readout          | 0.000ms               |                 |
| Trigger position indicator        | Middle                |                 |
| Trigger level                     | 0.000V                |                 |
| Current trigger channel           | Ch1                   |                 |
| **Cursor**                        |                       |                 |
| Cursor function                   | Off                   |                 |

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### Factory default

<table>
<thead>
<tr>
<th>After opening cursor, F4 current state</th>
<th>Cursor</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor position level 1</td>
<td>+2.0 from horizontal center</td>
<td>Factory default</td>
</tr>
<tr>
<td>Cursor position level 2</td>
<td>-2.0 from horizontal center</td>
<td>Factory default</td>
</tr>
<tr>
<td>Vertical cursor position1</td>
<td>-3.0 from the vertical center</td>
<td>Factory default</td>
</tr>
<tr>
<td>Vertical cursor position2</td>
<td>+3.0 from the vertical center</td>
<td>Factory default</td>
</tr>
<tr>
<td>Cursor track</td>
<td>Off</td>
<td>Factory default</td>
</tr>
</tbody>
</table>

#### Measurement

<table>
<thead>
<tr>
<th>Measurement strobe</th>
<th>Off</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay</td>
<td>First rise edge (current channel)</td>
<td>Factory default</td>
</tr>
<tr>
<td>Relative</td>
<td>Ch1</td>
<td>Factory default</td>
</tr>
<tr>
<td></td>
<td>First rise edge</td>
<td>Factory default</td>
</tr>
<tr>
<td>Phase</td>
<td>Relative to Ch1 (current channel)</td>
<td>Factory default</td>
</tr>
</tbody>
</table>

#### Display

<table>
<thead>
<tr>
<th>Waveform drawing mode</th>
<th>Line</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feature</td>
<td>Setting</td>
<td>Default</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Waveform brightness</td>
<td>60%</td>
<td>Factory default</td>
</tr>
<tr>
<td>Graticule type</td>
<td>Full</td>
<td>Factory default</td>
</tr>
<tr>
<td>Graticule intensity</td>
<td>50%</td>
<td>Factory default</td>
</tr>
<tr>
<td>Afterglow time</td>
<td>Auto</td>
<td>Factory default</td>
</tr>
<tr>
<td>Time scale</td>
<td>YT</td>
<td>Factory default</td>
</tr>
<tr>
<td>Refresh rate</td>
<td>Normal</td>
<td>Factory default</td>
</tr>
<tr>
<td><strong>Mathematic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematical channels</td>
<td>Close</td>
<td>Factory default</td>
</tr>
<tr>
<td>Mathematical type</td>
<td>Dual waveform</td>
<td>Factory default</td>
</tr>
<tr>
<td>Source 1</td>
<td>Ch1</td>
<td>Factory default</td>
</tr>
<tr>
<td>Operator</td>
<td>+</td>
<td>Factory default</td>
</tr>
<tr>
<td>Source 2</td>
<td>Ch2</td>
<td>Factory default</td>
</tr>
<tr>
<td><strong>Trigger</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trigger type</td>
<td>Edge</td>
<td>Factory default</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------</td>
<td>--------------------------</td>
</tr>
<tr>
<td><strong>Trigger coupling type</strong></td>
<td>DC</td>
<td>Factory default</td>
</tr>
<tr>
<td><strong>Trigger mode</strong></td>
<td>Auto</td>
<td>Factory default</td>
</tr>
<tr>
<td><strong>Trigger hold-off time</strong></td>
<td>200ns</td>
<td>Factory default</td>
</tr>
<tr>
<td><strong>Edge trigger</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>Ch1</td>
<td>Factory default</td>
</tr>
<tr>
<td>Slope</td>
<td>Rise edge</td>
<td>Factory default</td>
</tr>
<tr>
<td><strong>Pulse width</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>Ch1</td>
<td>Factory default</td>
</tr>
<tr>
<td>Polarity</td>
<td>Positive</td>
<td>Factory default</td>
</tr>
<tr>
<td>Condition</td>
<td>≠1.000ms</td>
<td>Factory default</td>
</tr>
<tr>
<td><strong>Logic trigger</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch1 logic</td>
<td>High</td>
<td>Factory default</td>
</tr>
<tr>
<td>Level(Ch1)</td>
<td>0.000 V</td>
<td>Factory default</td>
</tr>
<tr>
<td>Ch2 logic</td>
<td>High</td>
<td>Factory default</td>
</tr>
<tr>
<td>Level(Ch2)</td>
<td>0.000 V</td>
<td>Factory default</td>
</tr>
<tr>
<td>Logical Operator</td>
<td>AND</td>
<td>Factory default</td>
</tr>
<tr>
<td>Condition</td>
<td>Switch to true value</td>
<td>Factory default</td>
</tr>
<tr>
<td></td>
<td>Source</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>--------</td>
<td>------------------</td>
</tr>
<tr>
<td>Video trigger</td>
<td>Ch1</td>
<td>Factory default</td>
</tr>
<tr>
<td>Polarity</td>
<td>Positive</td>
<td>Factory default</td>
</tr>
<tr>
<td>Standard</td>
<td>625/PAL</td>
<td>Factory default</td>
</tr>
<tr>
<td>High-definition field</td>
<td>50Hz</td>
<td>Factory default</td>
</tr>
<tr>
<td>Trigger on</td>
<td>Odd field</td>
<td>Factory default</td>
</tr>
</tbody>
</table>

|                  | UART(  |                  |                  |
|                  | RS232/ | Bus configuration | Rx is Ch1, Idle level is High |
|                  | RS422/ | Baud rate is 19.2 KB/s, Parity is none, date bits is 8 bit | Factory default |
|                  | RS485) |                  |                  |
| Serial           |        | Trigger mode     | Start bit         |
| Bus trigger      |        |                  |                  |
| LIN              |        | Bus configuration | Source is Ch1, Idle level is High |
|                  |        | Baud rate is 19.2 KB/s | Factory default |
|                  |        | Trigger mode     | Sync- rise edge   |
| CAN              |        | Bus configuration | Source is Ch1, Idle level is High |
|                  |        | Baud rate –is 500 KB/s | Factory default |
## Factory default

<table>
<thead>
<tr>
<th></th>
<th>Trigger mode</th>
<th>Start frame</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus configuration</td>
<td></td>
<td>CLK is Ch1, Data is Ch1, and work mode is SCK low idle state, data bits are 8 bit.</td>
<td>Factory default</td>
</tr>
<tr>
<td>Trigger mode</td>
<td></td>
<td>XXXX XXX1</td>
<td>Factory default</td>
</tr>
<tr>
<td><strong>I2C</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus configuration</td>
<td></td>
<td>SDA is Ch1, SCL is Ch2</td>
<td>Factory default</td>
</tr>
<tr>
<td>Trigger mode</td>
<td></td>
<td>Start condition</td>
<td>Factory default</td>
</tr>
</tbody>
</table>

### Reference waveform

<table>
<thead>
<tr>
<th>Reference waveform</th>
<th>Off</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference waveform record data</td>
<td>Erase</td>
<td>-</td>
</tr>
</tbody>
</table>

### Storage/Recovery

<table>
<thead>
<tr>
<th>Memory depth</th>
<th>120.0k</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>User setting storage area</td>
<td>Erase</td>
<td>-</td>
</tr>
</tbody>
</table>

### Multimeter
<table>
<thead>
<tr>
<th>Multimeter measurement type</th>
<th>DC voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative</td>
<td>Off</td>
</tr>
</tbody>
</table>

**Recorder**

<table>
<thead>
<tr>
<th>Multimeter record type</th>
<th>DC voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscilloscope measurement type</td>
<td>/</td>
</tr>
<tr>
<td>Oscilloscope waveform record start mode</td>
<td>Normal</td>
</tr>
<tr>
<td>Oscilloscope waveform record stop mode</td>
<td>Normal</td>
</tr>
<tr>
<td>Storage mode</td>
<td>Stop when full</td>
</tr>
<tr>
<td>Recorder storage area</td>
<td>Erase</td>
</tr>
</tbody>
</table>

**User**

<table>
<thead>
<tr>
<th>Time</th>
<th>hold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>English</td>
</tr>
<tr>
<td>Help</td>
<td>Homepage</td>
</tr>
<tr>
<td>Calculator</td>
<td>Decimal, angle, normal</td>
</tr>
<tr>
<td>Feature</td>
<td>Value</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Electronic calculator</td>
<td>Inductive reactance</td>
</tr>
<tr>
<td>Screen brightness</td>
<td>50%</td>
</tr>
<tr>
<td>Set</td>
<td></td>
</tr>
<tr>
<td>Hidden time</td>
<td>5s</td>
</tr>
<tr>
<td>Standby time</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Automatic shutdown time</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Wheel direction</td>
<td>Normal</td>
</tr>
<tr>
<td>Buttons beeper</td>
<td>Silence</td>
</tr>
</tbody>
</table>
Appendix D: Attachment

Standard accessories

1. Probe
   MS500  2pcs  250MHz probe (2 P2300B blue probe optional)
   MS300  2pcs  P2300B blue probe (2 250MHz probe optional)
2. Multimeter test pens 1 pair
3. Calibration banana jack 1 pair
4. Power adapter 1 pc
5. Power cord 1 pc (suitable for customer local)
6. Standard battery (6000mAh) 1 pc
7. Standard USB cable, Mini USB 1 pc
8. Random CD（Including user manual, ScopeSuite demo version software, oscilloscope driver and instruction）
Optional accessories

1. Oscilloscope suitcase
2. Oscilloscope handbag
3. High-capacity battery (9000mAh)
4. LCD protective film
5. UART (RS232/RS422/RS485) Serial bus decode function module (MS510S, MS520S exclusive)
6. LIN Serial bus decode function module (MS510S, MS520S exclusive)
7. CAN Serial bus decode function module (MS510S, MS520S exclusive)
8. SPI Serial bus decode function module (MS510S, MS520S exclusive)
9. I2C Serial bus decode function module (MS510S, MS520S exclusive)
10. 1553B serial bus decode function module (MS510S, MS520S exclusive)
11. 429 serial bus decode function module (MS510S, MS520S exclusive)
12. Full functional version of Scope Suite
13. 50k wfms/s refresh rate (MS300 serial optional)
14. XY mode (MS300 serial optional)
15. U device function (MS300 serial optional)
16. EXT trigger (MS300 serial optional)
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