ADO102 \ ADO104 automotive oscilloscope manual

ADO102 \ ADO104 automotive oscilloscope is a portable device developed and produced by JH Company. This product is compact, portable, and flexible operation; Using color TFTLCD and pop-up menus to display; to achieve its ease of use, greatly improving the user productivity.

In addition, this product has superior performance and it is powerful, affordable, high cost. The real-time sampling rate can be as high as 100MSa/S,can meet the capture speed, market demand for complex signals and auto repair market; Support for USB storage devices, users can upgrade via USB, Special test project and Universal oscilloscope to meet different levels of customer needs.

Characteristic:

Model	Bandwidth
ADO 102	Dual channel
ADO 104	Four channel

—New ultra-thin design, small volume, light weight, convenient carrying

—Color TFTLCD display, 320*240 resolution, waveform display more clearly, stability

—Four analog channel (ADO102 for Dual channel)

—Can be convenient to realize the car corresponding module features one-button operation

—Any interface screenshot (press F2 screenshot)

—Screenshot can preview

—Support for USB storage device

—Have the edge trigger function, under universal oscilloscope mode can automatically detect the support (20Hz - 10MHz)

—Support time and voltage cursors

—Support A variety of waveforms mathematical sum

—Adding a variety of waveform math functions

—Support Chinese and English menu display

—A variety of display styles

—Backlight brightness can be adjusted

—Long standby: single cell battery can work continuously for 5 hours

—With a digital multimeter functions

General safety requirements:

The following safety precautions to avoid injury; And to prevent the product or any other products connected from the damage. To avoid possible danger, be sure to use the product in accordance with the provisions.

⚠ **Attention: Do not using this oscilloscope (or multimeter) measurements while connecting USB, as this may damage the instrument!**

Only trained personnel should perform service procedures.

1. Avoid fire and personal injury

- Correct plug

When the probe or test leads are connected to a voltage source Do not plug.

- Properly connected probe

The same probe wire and the ground potential，Do not connect the ground wire to a high voltage. And during the test, do not touch exposed contacts and components.

- View all terminal ratings

In order to avoid the fire and impact of excessive current, Please check all rated the product value and marking instructions. Please refer to the product description before connect the products for more information about ratings.

- Do not open lid

If the cover or panel has been removed, do not operate this product.

- Avoid circuit exposed

After the boot, Do not touch exposed connections and components.

- Suspected product failure, do not operate

If you suspect that the product has failed, you can ask a qualified service personnel.

- To maintain adequate ventilation
- Do not operate in wet conditions
- Do not operate in the flammable, explosive environment
- Please keep the product surface is clean and dry

2. Security terminology and labeling

Terminology in this manual. The following terms may appear in this manual:

WARNING: Warning statements indicate conditions and behavior which might endanger the safety of life .

Note: Note Statement Pointed out conditions and behaviors that may cause this product and other property damage .

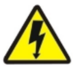
Terms on the Product: These terms may appear on the product

DANGER: Indicates that there is a direct risk of harm exists near the mark.

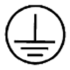
WARNING: Indicates a potential risk of injury near the mark.

Note: indicate a potential danger to the products and other property.

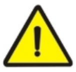
Symbols on the Product: These symbols may appear on the product



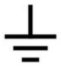
High voltage



Protective ground



Attention



Measurement of ground

Summary：

This manual describes the operation of ADO Series Handheld Digital Oscilloscope.
Manual includes the following chapters:

◆ Getting started: a brief introduction to digital handheld oscilloscope's front panel user interface, functional check and probe compensation.
◆ Features and Operation: a detailed presentation for functions and operations of universal oscilloscope and automotive oscilloscope and multimeter.
◆ The application example: provide some measurement example, for reader reference.
◆ System Tips and Troubleshooting.
◆ Service and Support
◆ Appendix

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Chapter 1 Getting Started

ADO handheld digital storage oscilloscope is a small, lightweight portable instrument，To provide users with a convenient and easy to operate front panel, you can perform basic tests.

This chapter explains how to perform the following tasks:

△ Preliminary understanding ADO front panel and user interface

△ Probe Compensation

△ Match the probe attenuation factor

1.1 Preliminary understanding ADO front panel and user interface

Before using ADO, We must first understand the operation panel. Following is a easy description and presentation for the ADO series front panel operation and function, To make use of you in the shortest possible time familiar with the oscilloscope.

ADO provide users with a clear and simple front panel, To facilitate the user to perform basic operations. On the left and right side of the display panel is marked with various function keys. Key to set the different options up and down through the menu. The red substrate power button, press it, you can open the oscilloscope or shutdown. The other pushbuttons are function buttons, through them, you can enter different function menus or obtain a specific function application. As shown in Figure 1-1 and Figure 1-2.

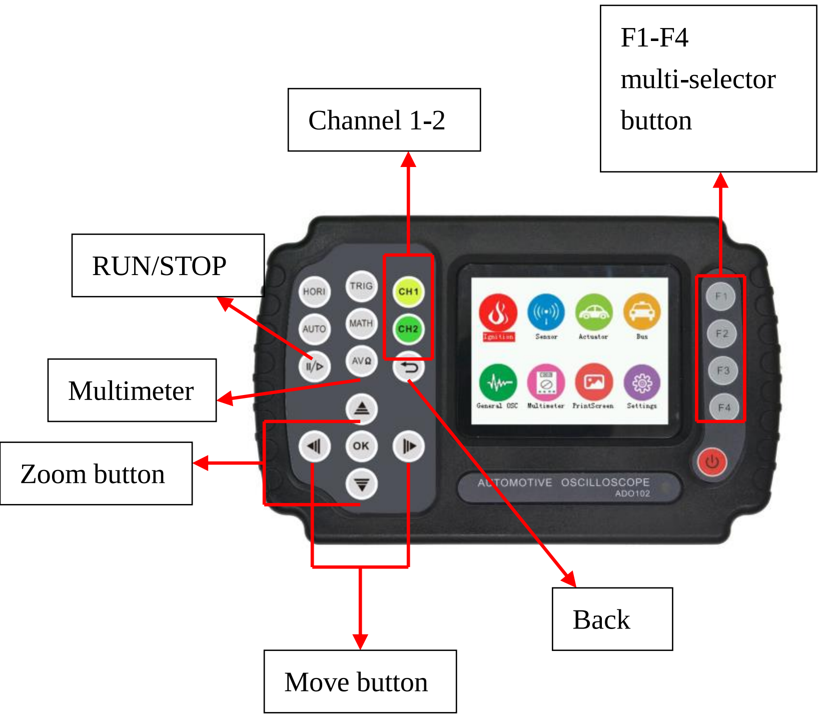

F1-F4
multi-selector
button
Channel 1-2
RUN/STOP
Multimeter
Zoom button
Back
Move button
AUTOMOTIVE OSCILLOSCOPE
ADO102

Figure 1-1 ADO102

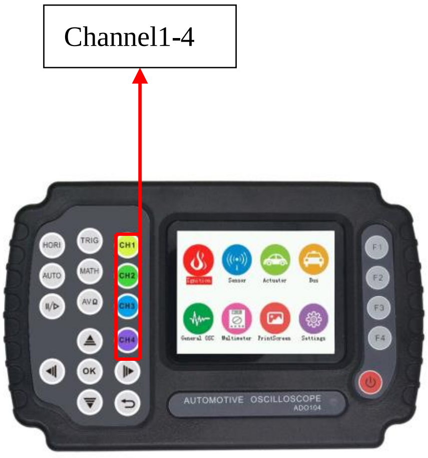

Channel1-4
AUTOMOTIVE OSCILLOSCOPE
ADO104

Figure 1-2ADO104

Trigger status display

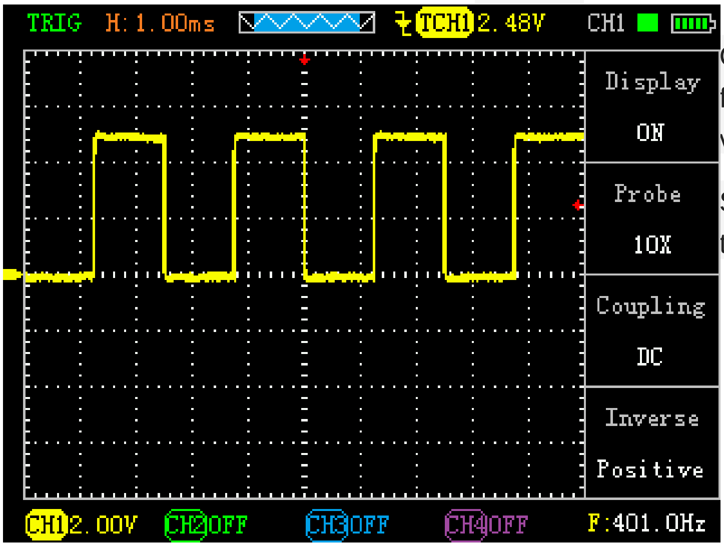
Show horizontal time / div

Horizontal displacement

Display level Trigger position

Channel operation status

Display power



Corresponds to a different function keys, menus will vary

Show the amount of the trigger position

Channel 1 mark

Show vertical volts / division

Frequency waveform display

Figure 1-3 Interface is shown in Figure

1.2 Probe

1 Safety of probe

Set around the probe body protection to protect your fingers to prevent electric shock. Before taking any measurements, make sure the probe is connected to the oscilloscope and the ground terminal to ground.(Note: The oscilloscope probe and the attenuation must be set the same gear)

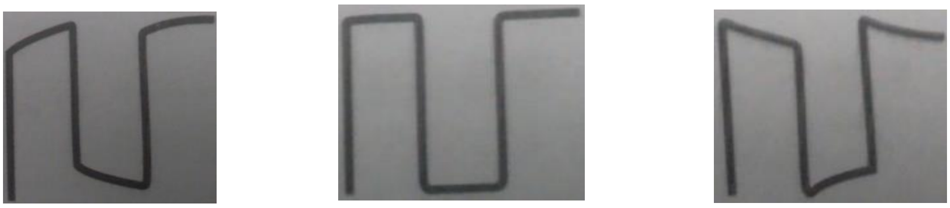
2 Probe compensation (see probe manual)

In the first probe with any input channel connection, this needs to be adjusted to match the probe to the input channel. Uncompensated probe calibration can cause measurement error or errors. If you adjust the probe compensation, as follows:

(1) Set the Probe option attenuation to 10X in the channel menu, The switch on the probe is also set to 10X,And oscilloscope probe connected to channel 1.If using the probe hook-tip, ensure reliable contact with the probe.

(2)Connect the probe tip and the signal generator output connector, Grounding clip and signal generator is connected to the ground connector, Display Channel, Then press the "AUTO" (automatic) button.

(3)Check the shape of the waveform display. As Figure 1-4



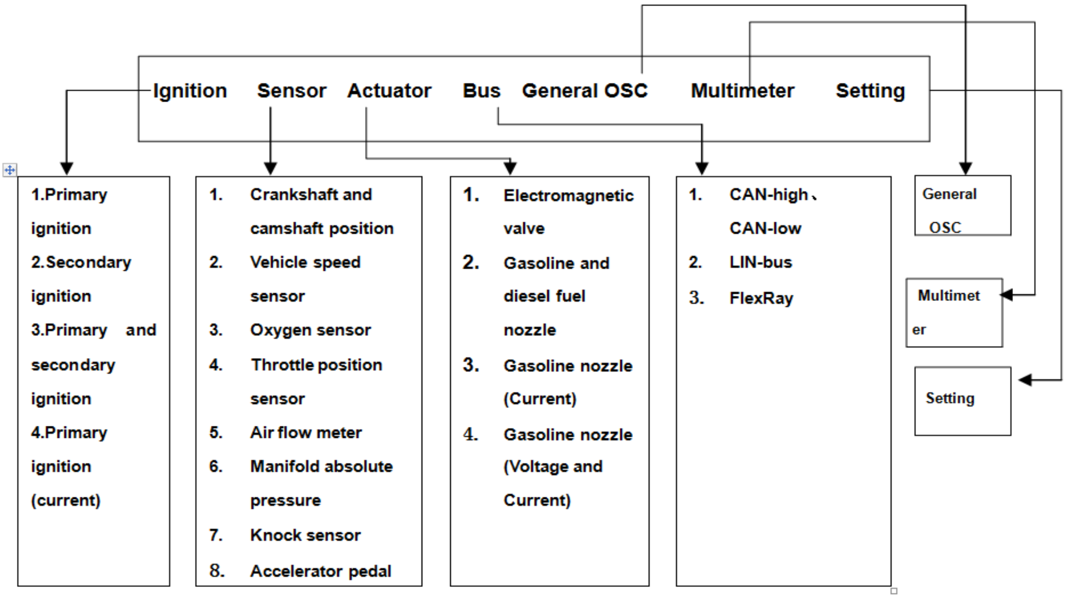
Under compensation Appropriate compensation over compensation

Figure 1-4

(4) If necessary, adjust the probe and repeat the operation if necessary.

Chapter 2 Describes of the function and operation

In order to use ADO Series oscilloscope effectively, you need to understand the main functional framework of the oscilloscope.


Ignition
Sensor
Actuator
Bus
General OSC
Multimeter
Setting
1.Primary ignition
2.Secondary ignition
3.Primary and secondary ignition
4.Primary ignition (current)
1. Crankshaft and camshaft position
2. Vehicle speed sensor
3. Oxygen sensor
4. Throttle position sensor
5. Air flow meter
6. Manifold absolute pressure
7. Knock sensor
8. Accelerator pedal
1. Electromagnetic valve
2. Gasoline and diesel fuel nozzle
3. Gasoline nozzle (Current)
4. Gasoline nozzle (Voltage and Current)
1. CAN-high、CAN-low
2. LIN-bus
3. FlexRay
General OSC
Multimeter
Setting

This chapter is divided into three modules to introduce oscilloscope according to the functional framework: automotive oscilloscope, general oscilloscope, multimeter.

2.1 Automotive oscilloscope

This section function of automotive oscilloscope is described below:

Ignition	Sensor	Actuator	Bus
1.Primary ignition	1. Crankshaft and camshaft position	1. Electromagnetic valve	1. CAN-high、CAN-low
2.Secondary ignition	2. Vehicle speed sensor	2. Gasoline and diesel fuel nozzle	2. LIN-bus
3.Primary and secondary ignition	3. Oxygen sensor	3. Gasoline nozzle (Current)	3. FlexRay
4.Primary ignition (current)	4. Throttle position sensor	4. Gasoline nozzle (Voltage and Current)	
	5. Air flow meter		
	6. Manifold absolute pressure		
	7. Knock sensor		
	8. Accelerator pedal		

NOTE: When signal voltage of measured signal is not clear, you can use multimeter first (this series oscilloscopes are with multimeter), according to the measured value of the multimeter, set the attenuation ratio of the oscilloscope and probe. The waveform pictures of each functional test in text are from Dodge. Journey 2.4 L model cars, different models measured different waveforms, so there will be differences.

1. Quick Operation Guide

Setting essentials：

1）Wave height adjustment (amplitude)：Press the corresponding channel, and adjust through the up and down keys

2）Waveform overall move：Press the corresponding channel, and then adjust through the left and right keys

3）Waveform density adjustment (time base)：Press time base key, and then adjust through the up and down keys

4）Waveform shaking elusive：Press the trigger button, and then by moving left and right keys, and then control the trigger arrow in the right of the screen, move red trigger arrow to the appropriate location of waveform until the waveform stabilizes

5）Waveform freeze playback view: Press the start / stop button, then press the time base key, and finally by moving left and right key to see if crankshaft has missing teeth phenomenon

2. Ignition function

（1）Ignition introduction

1）Ignition System Category

Partakers boards conventional ignition system used on the car has a long history, now has gradually been replaced by direct ignition system (DIS)

Direct ignition system is divided into three types：

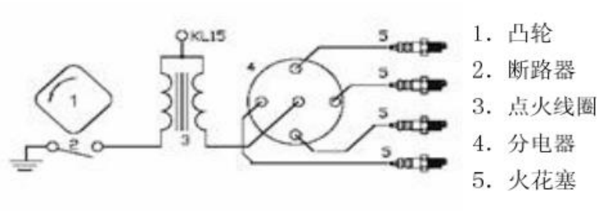
▲dual ignition system using double-ended output ignition coil (DEC).

▲single ignition system using single-ended output ignition coil (CPC).

▲Integrated ignition system using the integrated spark plug (COP).

The common feature of these three is the output of the ignition coil pass directly to the spark plug without passing through the distributor plate

2）Traditional ignition system

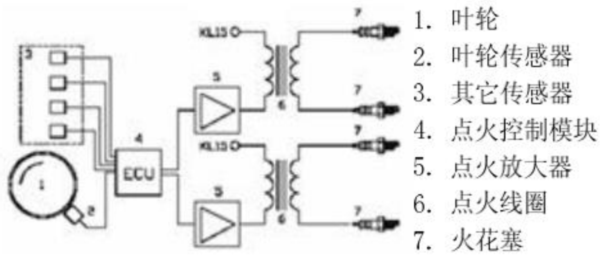


1. Cam
2. Breaker
3. Ignition coil
4. Distributor
5. Spark plugs

Traditional ignition system consists of a battery, cam, breaker, ignition coil, distributor, spark plugs. The effect of battery is to supply power of the ignition system require, cam and the circuit breaker turn on or off ignition system power. Ignition coil store ignition energy and turn battery voltage to ignition high voltage. The role of the circuit breaker is turned on or off ignition primary circuit. The role of the distributor is to delivery ignition high voltage produced by ignition coil to each spark plugs according to working order of engine. Spark plugs lead ignition high voltage to cylinder combustion chamber, and produce spark between the electrodes, Igniting the combustible mixture.

The advantage of this ignition system is relatively easy for detection service, one of the disadvantage is mechanical parts and electrical contacts easy to wear, short life. And the high-voltage connector portion also easily damaged.

3）Dual ignition system (DEC)

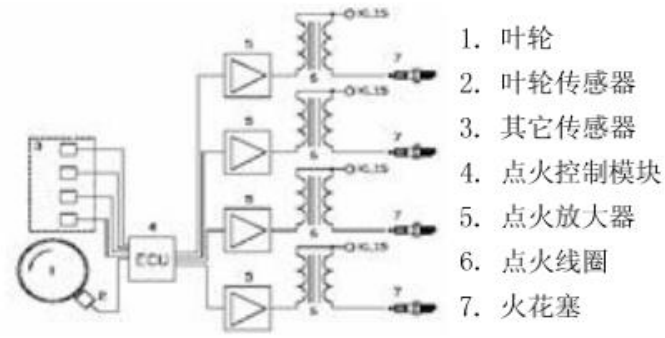


1. Impeller
2. Impeller sensor
3. Other sensor
4. Ignition control module
5. Ignition amplifier
6. Ignition coil

Dual ignition system entirely by electronics, with no mechanical parts. Each two cylinder shared a ignition coil, two electrodes of coil secondary connect to a spark plug respectively. It means that there are always two spark plugs igniting at the same time, one of the cylinders in the normal ignition, the other cylinder is at the exhaust process (Ignition spark "waste" in the exhaust gas), the pressure of cylinder in exhaust close air pressure, only need very low ignition voltage, wasted little energy.

One of the advantages of dual ignition system is fewer faults, virtually no maintenance. Another advantage is the good adjustability of the ignition system; wave radiation emitted small, low fuel consumption. The disadvantage is still required high voltage and spark plug connector, these places is very easy to go wrong.

4）Single Ignition System (CPC)and Integrated ignition system (COP)

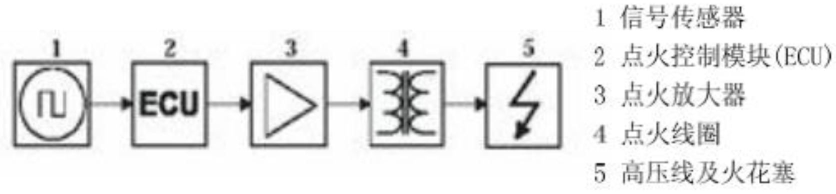


1. Impeller
2. Impeller sensor
3. Other sensor
4. Ignition control module
5. Ignition amplifier
6. Ignition coil
7. Spark plugs

Each cylinder has a separate ignition coil, is today's most advanced ignition system. This ignition system is divided into two types: Single Ignition System (CPC), integrated ignition system (COP). Integrated ignition system integrated ignition coil in the spark plug, single ignition system is connecting ignition coil to spark plug with a high voltage wire.

5）Ignition principle

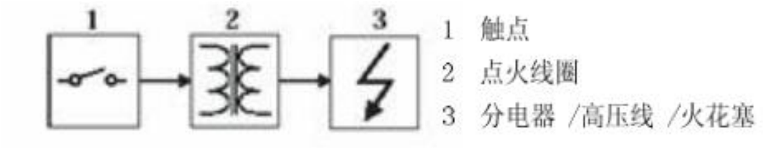
▲The electronic ignition



1. Signal sensor
2. Ignition control module (ECU)
3. Ignition amplifier
4. Ignition coil
5. High voltage line and spark plugs

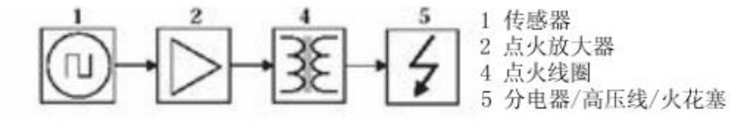
The electronic ignition system collect information related to the engine with a set of sensors, such as speed, cooling temperature and engine load, etc. Position sensor and speed sensor is the most important information required for the ignition system, the information from the wheel sensors or camshaft sensor. Ignition control module calculates ignition time and charging time based on the collected information, If a sensor is not working properly, it will cause the output signal is incorrect, so modern control module have to check whether the signal sent by the sensor is authentic, when there are untrusted signal, it may not output any signal. Ignition control module output signal can not directly drive the ignition coil, have to amplify by ignition amplifier. In fact, ignition amplifier is mounted in ignition coil generally，in this case the primary ignition signal is undetectable；Or mounted in the ignition control module，in this case the ignition control module output signal is undetectable. Thus, detecting engine fault and performance through the secondary ignition signal is important.

▲Mechanical ignition system



1. Electric shock
2. Ignition coil
3. Distributor / high voltage line / spark plugs

Contact-driven



1. Sensor
2. Ignition amplifier
4. Ignition coil
5. Distributor / high voltage line / spark plugs

Sensor-driven

In the mechanical ignition system, the charging time and the ignition time is controlled by the distributor camshaft. Electrical sensor (Hall or magnetic) or contacts is as the role of the sensor. Contacts can directly drive the ignition coil, but telex can only drive the ignition coil by ignition enlarge. In fact, ignition amplifier is mounted in ignition coil generally，in this case the primary ignition signal is undetectable.

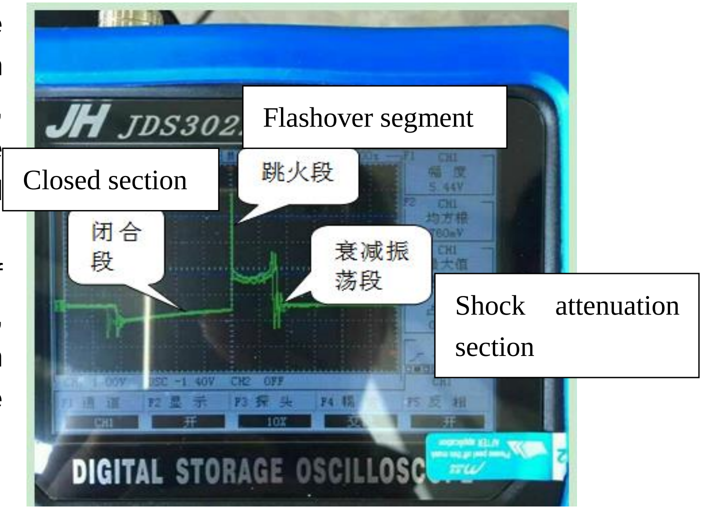
6）Sensor

Hall devices and magnetic induction coil are commonly used sensors.
Hall device output square wave 0-5 volts or 0-12 volts.
Magnetic induction coil output sine wave, the amplitude is related to rotational speed. Ignition control signal.
Ignition control module output control signal 0-5 V or 0-12 V square wave.

7）Secondary ignition

When ignition, coil secondary generates a high voltage，when the voltage is gradually increased to a certain value，the spark plug produce sparks，this voltage is the ignition voltage. The voltage then drops rapidly to another voltage value and maintained for some time，this voltage is the combustion voltage, combustion time is the time of voltage maintained at a combustion voltage value. At the end of the burning time, ignition coil energy is almost exhausted, the remaining energy is formed damped oscillation on the coil.

Observing this picture can analysis of operation of the vehicle from details. Ideally, this pattern is very stable, showing each voltage of ignition combustion processes are

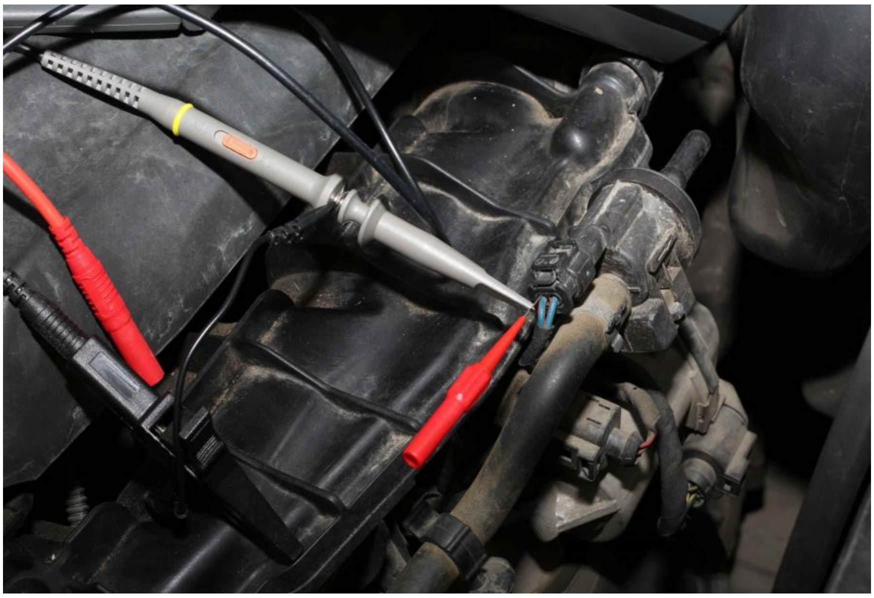


the same. Each cylinder pattern should be roughly the same. However, the actual situation is not ideal, graphics assembly will be large or small jitter，such as ignition or breakdown voltage fluctuated，combustion times may vary in length，these do not necessarily indicate the engine failure. These may need us have experience cumulation by time, combined with a comprehensive analysis of other graphics，but it can be said, the ideal graphics may not been seen.

Ignition or breakdown voltage：If the ignition voltage is too high, even more than the range of the screen, indicating that the resistance value is too high in secondary ignition circuit. Open line，spark plug damaged，high-voltage or spark plug gap is too large may have resulted in the phenomenon of high breakdown voltage，Conversely, if the breakdown voltage is too low，It indicates that the resistance value in ignition secondary circuit is lower than normal，spark plugs may be dirty or rupture, high-voltage leakage and other reasons caused.

Combustion line and combustion time：if combustion line has too much clutter，It represents cylinder misfire. Or due to premature ignition, injectors damaged, spark plugs dirt and other reasons. The length of the combustion line duration is related to mixed gas concentration in the cylinder. Typically, it means that the combustion time exceeding 2ms gas mixture is too thick. Conversely, if combustion time is less than 0.75ms indicates too lean mixture.

8）Correct broken-line by broken wire needle.（all need to break the wire for measurements except for secondary ignition）

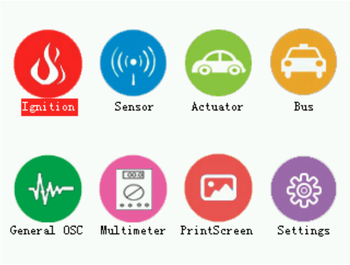


（2）Ignition test

cross section of ignition coil（inside is secondary coil outside is primary coil）

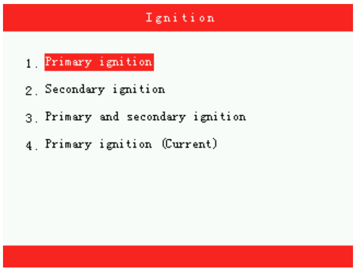
1）Primary ignition

①After the oscilloscope installed batteries，long press red power button“⏻”， let it go until you hear the buzzer，at this time oscilloscope enter the main menu interface，as picture-1


Ignition
Sensor
Actuator
Bus
General OSC
Multimeter
PrintScreen
Settings

Picture-1

②After entering the main menu interface，can select the instrument operation mode through the up and down buttons, then press “OK” button，default select the "ignition" into the ignition function selection interface，then you can enter the user interface through up and down keys to select the "primary ignition", as picture-2


Ignition
1．Primary ignition
2．Secondary ignition
3．Primary and secondary ignition
4．Primary ignition (Current)

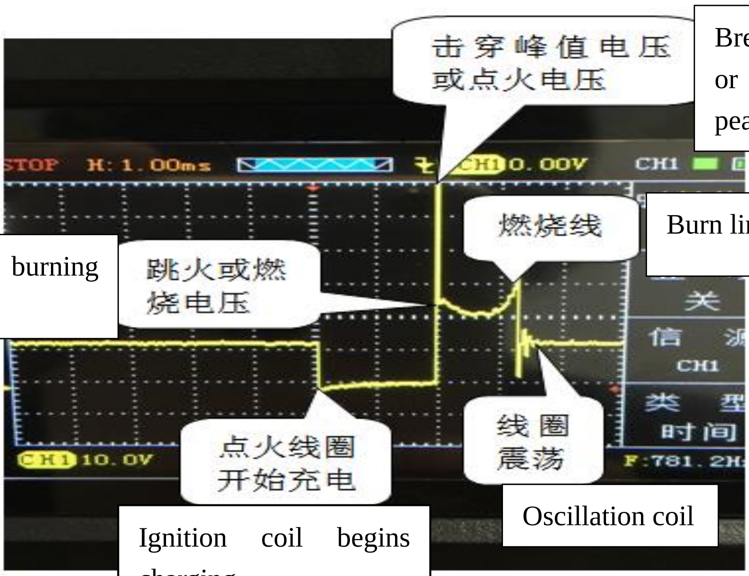
Picture-2

③Connect the probe to CH1 and probe set to 10X，then connect grounding clip to the signal ground or grounding.

④Since the primary ignition of oscilloscope has default settings（Probe 10X，time base 1ms），Simply connect the ignition coil to the probe needles can display waveform. As picture-1（when the waveform shaking too fast to capture, you can set the trigger Mode to single-shot then detect again）

⑤Press“CH1”，can view the values and configuration（configuration has default）

⑥Waveform display can be adjusted based on their own through the vertical volts / division and trigger ways to meet your needs（Time base, vertical volts / division and other specific operations, please refer to the operation of general oscilloscope）



Breakdown voltage or ignition voltage peak

Burn line

arcing or burning voltage

Oscillation coil

Ignition coil begins charging

Pic-1 Primary ignition

2）Secondary ignition

①Same as Primary ignition step 1

②After entering the main menu select "Ignition"，then enter the sub-menu press the up and down keys to select "secondary ignition"，It will prompt "use professional ignition probe" before entering the operating interface, wait a few seconds to enter the oscilloscope interface.

③Independent ignition to be equipped with an ignition extension cord and high voltage ignition probe must ignition sensing probe, connect ignition probe to CH1.

④Since the secondary ignition of oscilloscope has default settings（Probe 10X，time base 1ms）ignition system with sub-cylinder line, probe with capacitor (small black squares)side is sandwiched with sub-cylinder line, the other side connected to the ground or battery negative. If the car is an independent ignition system，you need to buy "independent ignition extension cord"（one side connect to ignition coil, one side connect to spark plug, the role is to replace the sub-cylinder line）ignition probe in independent ignition extension cord, Step as above.

⑤Same as Primary ignition step 5

⑥Same as Primary ignition step 6

3）Primary and secondary ignition

This function let the primary ignition, secondary ignition be realized through CH1 and CH2，observed and compared two waveforms more intuitively. Select” Primary ignition, secondary ignition” Before entering into operation interface, it will prompt“CH1: standard probe for primary use，CH2：Ignition probe for secondary use” Wait a few seconds to enter the oscilloscope interface，other details, please refer to the above primary, secondary ignition function.

Note:CH1 is primary ignition, CH2 is secondary ignition pay attention to the probe connected to the channel

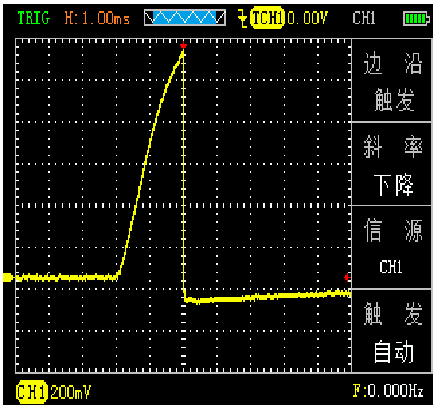
4）Primary ignition (current)

①Same as Primary ignition step 1

②After entering the main menu select "Ignition"，then enter the sub-menu press the up and down keys to select the "primary ignition (current)"，before entering the operating interface, it will prompt "must comply with the current clamp using" wait a few seconds to enter the oscilloscope interface.

③Connect current clamp to the oscilloscope CH1, since the primary ignition oscilloscope is default setting (probe 1X, time base 1ms), simply connect the current clamp to ignition coil, then waveform can be visually displayed. As pic-2.

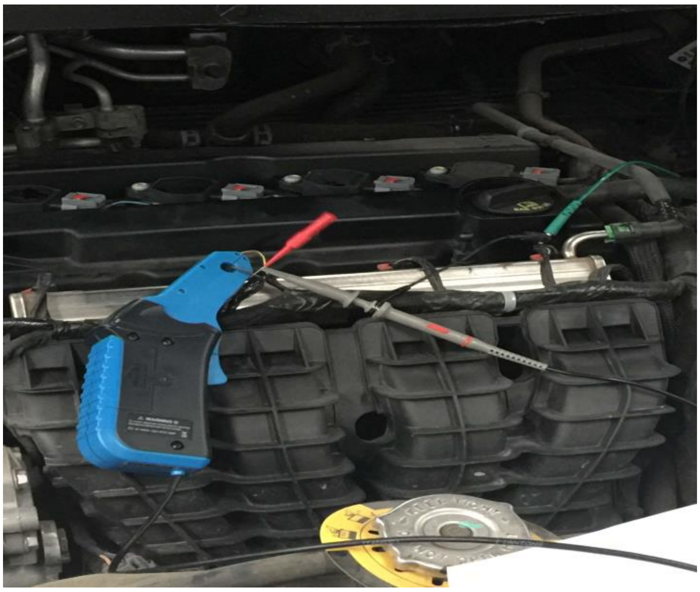
④Press“CH1”， you can view the value and configuration (configuration has default)



Pic-2 **Primary ignition current**

⑤Displayed waveform can be realized through the self-regulating group, vertical volts / division and trigger their needs (time base, vertical volts / division and other specific operations, please refer to the general oscilloscope operation)

Note: If the measured waveform inversed, change the direction of current clamp as pic-3, the specific use of current clamp, please refer to the purchase Instructions of the current clamp (To purchase current clamp can contact the manufacturer for recommended)



Pic-3 use of current clamp

3. The function of sensor

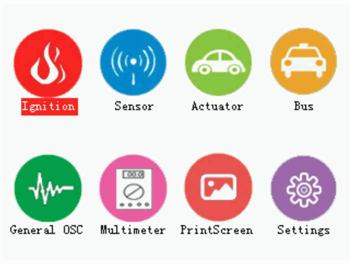
1）Crankshaft and camshaft position sensor(magnetic-electric, Hall)

①After the oscilloscope installed batteries，long press red power button“⏻”，let it go until you hear the buzzer，at this time oscilloscope enter the main menu interface，as picture-1

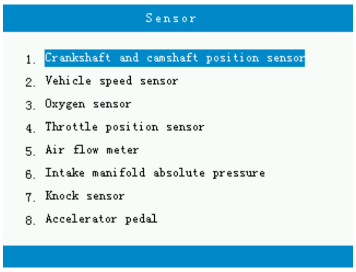
②After entering the main menu interface select “Sensor”, then enter the sub-menu press the up and down keys to select "Crankshaft and camshaft position sensor"(as picture-2),

enter the second sub-menu press the up and down keys to select "Magnetic Electric"or" Hall ", press “OK”,

it will separately prompt "Amplitude with the speed of change" and "0-5v or 0-12v" before entering operation interface, will enter into oscilloscope interface after waiting several seconds.(Note: Channels should be correspond with functions. CH1: Crankshaft position sensor, CH2: Camshaft position sensor)



Picture-1


Sensor

1. Crankshaft and camshaft position sensor
2. Vehicle speed sensor
3. Oxygen sensor
4. Throttle position sensor
5. Air flow meter
6. Intake manifold absolute pressure
7. Knock sensor
8. Accelerator pedal

Picture-2

③Connect two probes to CH1 and CH2 separately, and set probe to 1X, then connect grounding clip to signal ground or grounding.

④Since the "magnetic-electric" and "Hall" function of oscilloscope has default settings (probe 1X,time base 10ms),just need to connect two probes to corresponding signals, then the waveforms can be displayed, as pic-4.(measured waveform is under 800 rpm)

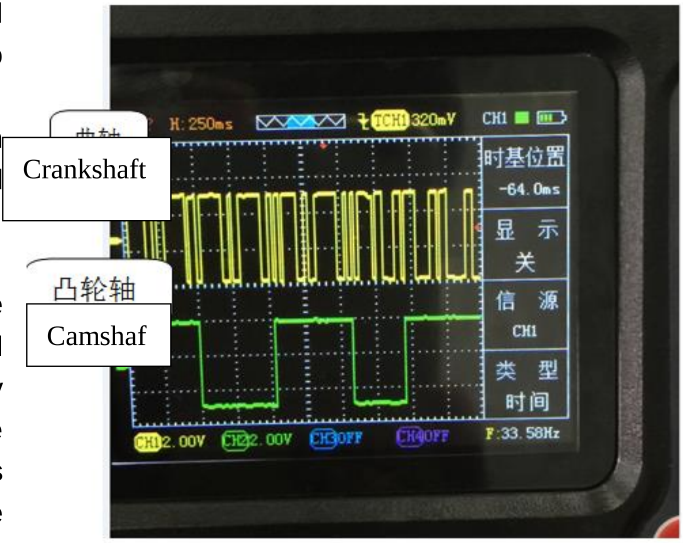
⑤Press“CH1”or“CH2”， can view the values and configuration（configuration has default）

⑥Displayed waveform can be realized the need through the self-regulating time base, vertical volts / division and trigger type (time base, vertical volts / division and other specific operations, please refer to the general oscilloscope operation)

Note: Considerations when measuring magnetic-electric and Hall waveforms

① Measuring range : Magnetic-electric type time base 1ms-500ms（Horizontal ruled）; voltage 500mv-50v（vertical ruled）; Hall type time base 1-500ms（Horizontal ruled）voltage 1v-10v（vertical ruled）

② The amplitude and frequency of magnetic-electric type

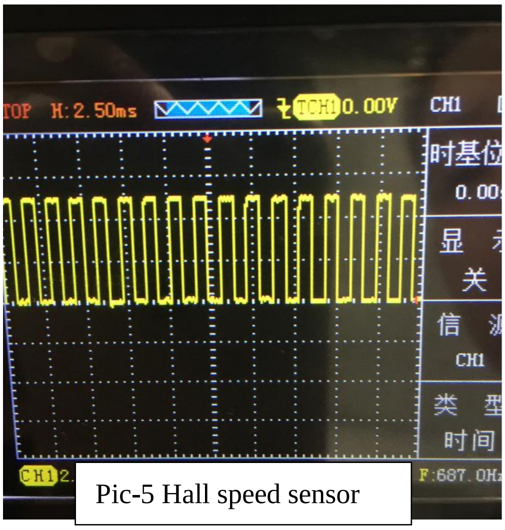


pic-4 Crankshaft, camshaft position sensor（Hall） changes with the speed（Similar with the principles of the generator）, the amplitude with fixed frequency of Hall type changes with the speed.

2) The vehicle speed sensor (magnetic, Hall, photoelectric)

①The same as the crankshaft, camshaft position sensor Step 1.

②Select "Sensor" after entering the main menu, then enter the sub-menu press the arrow keys to select "speed sensor" into the second sub-menu press the arrow keys to select "magnetic-electric", "Hall" or "photoelectric", press "OK" button to confirm to enter the oscilloscope user interface (Note: before entering the electric and magnetic Hall oscilloscopes prompts are "amplitude variation with speed" and "0-5v or 0-12v" wait a few seconds to enter the user interface)



Pic-5 Hall speed sensor

③Connect the CH1 probe to the oscilloscope and set probe to 1X file transfer, then connect the grounding clip to the signal ground or grounding.

④Since the oscilloscope "magneto electric", "Hall" and "photoelectric" function has already default settings (magneto electric and HALL: Probe file 1X, time base 5ms, photoelectric probe file 1X, time base 25ms), Just probe to the corresponding signal, To intuitive display waveforms, as shown in Figure 5.

⑤Press "CH1", you can view the value and configuration (by default)

⑥waveform can be self-fulfilling their needs by adjusting the time base, vertical volts / division and trigger mode (time base, vertical volts / division and other specific operations, please refer to the Universal oscilloscope operation)

3) The oxygen sensor (zirconium-type, titanium type)

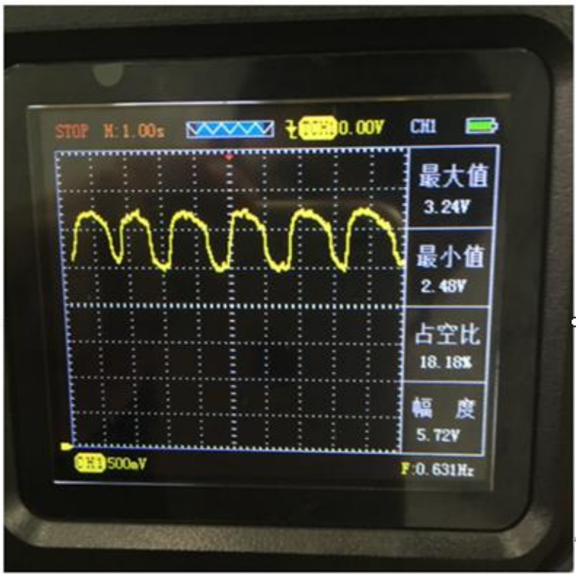
①The same as the crankshaft, camshaft position sensor Step 1.

②Select "Sensor" after entering the main menu, then enter the sub-menu press the arrow keys to select "oxygen sensor" into the second sub-menu press the arrow keys to select "zirconium-type” or "titanium type", press "OK" button to confirm to enter the oscilloscope user interface.

③Connect the CH1 probe to the oscilloscope and set probe to 1X file transfer, then connect the grounding clip to the signal ground or grounding.

④Since the oscilloscope "Zirconium" and "titanium" function has default settings (profiles probe 1X, time base range 1s), just probe to the corresponding signal, To intuitive display waveforms, as shown in Figure 6. (Note: As in the "SCAN" scan mode requires patience waveform scanned)

⑤Press "CH1", you can view the value and configuration (by default)



Pic-5 Titanium oxygen sensor (idle condition)

⑥waveform can be self-fulfilling their needs by adjusting the time base, vertical volts / division and trigger mode (time base, vertical volts / division and other specific operations, please refer to the Universal oscilloscope operation)

Note:

The oxygen sensor, also known as the exhaust gas sensor, is a very important role in the exhaust emission control of a vehicle equipped with a catalytic converter.

The oxygen sensor is arranged on the exhaust pipe and in front of catalytic converter. The variation range of the voltage of the zirconium oxygen is 0-1V, and the voltage variation range of titanium oxide is 0-5V, because the titanium oxygen sensor needs the power supply voltage. A vehicle equipped with an oxygen sensor is referred to as a "closed loop", meaning that the sensor will analyze the exhaust gas and re adjust the engine oil supply according to the results after the fuel is burned.

No matter how many connection lines between the oxygen sensor and the engine control module, the sensor output is always a black line.

Single Line: This line is used to produce the output voltage of the sensor itself, usually black.

Two lines: one output line output and a ground line.

Three lines: one output line and two-line heating device (power line and ground line). Interior heating means to raise the temperature at cold start to make the cars quickly brought under control.

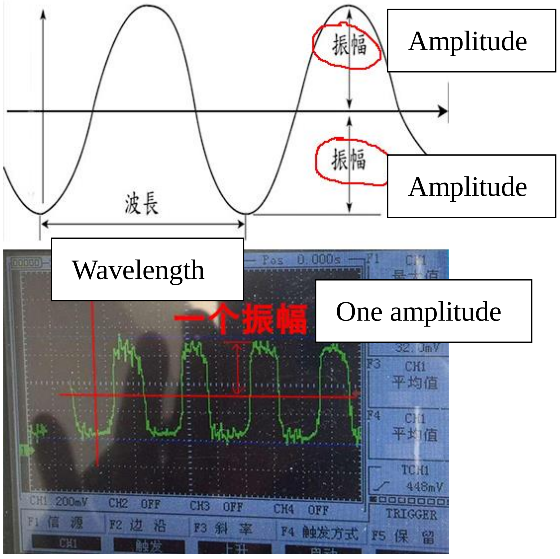
Four-wire: a signal line and a signal ground. Two other heating device lines.

Zirconium oxygen sensor needs to reach more than 300 degrees Celsius temperature in order to work properly, this kind of oxygen sensor normal output feedback voltage change between 0 ~ 1V. 0.5V above the output indicates that the mixture is too thick; 0.5V output indicates that the appropriate balance between lean and too thick; 0.5V the following output indicates that the mixed gas is too thin. The output voltage variation indicates that the engine control module changes the air fuel ratio (the ratio of air to fuel, the concentration of the mixture).

Normal zirconia’s oxygen sensor output voltage waveform should meet the 3 elements: the maximum voltage, the minimum voltage, response time (voltage from high to low change of time). In general, the allowable range is the maximum voltage value > 850mV, the minimum voltage is 75 ~ 175mV, and the response time is less than 100ms. For the change of the amplitude of the waveform is in the idle state of the 10s amplitude of the waveform is not less than 8 times as shown in figure 7.

Start the engine and keep the engine speed 1500-2000rpm, after 3 minutes, until the engine reaches normal working temperature, because the engine must reach normal working temperature and into the closed loop, oxygen sensor signal readout instrument is correct.

Note: 1、The axis is a peak-to-amplitude
2、Peak to trough for the two amplitudes，not one



Pic-7 Zirconia oxygen sensor

If the oxygen sensor is detected, the oxygen sensor has power supply, but not see the waveform change, then the cause of the failure may be as follows:

- poor connection
- oxygen-sensor fault
- engine vacuum leak
- poor fuel mixture ratio control

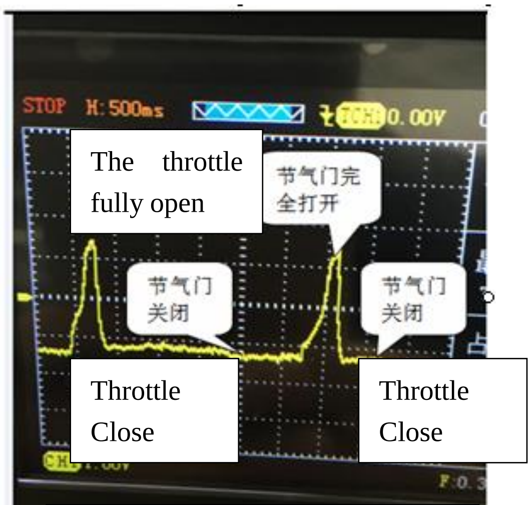
4) Throttle Position Sensor

①The same as the crankshaft, camshaft position sensor Step 1.

②Select "Sensor" after entering the main menu, then enter the sub-menu press the arrow keys to select "Throttle Position Sensor", press "OK" button to confirm to enter the oscilloscope user interface.

③Connect the CH1 probe to the oscilloscope and set probe to 1X file transfer, then connect the grounding clip to the signal ground or grounding.

④Since the oscilloscope "throttle position sensor" function has already default settings (profiles probe 1X, time base range 500ms), just probe to the corresponding signal, to intuitive display waveforms, as shown in Figure 8. (Note: As in the "SCAN" scan mode requires patience waveform scanned)



Pic-8 Throttle Position Sensor

⑤Press "CH1", you can view the value and configuration (by default)

⑥waveform can be self-fulfilling their needs by adjusting the time base, vertical volts / division and trigger mode (time base, vertical volts / division and other specific operations, please refer to the Universal oscilloscope operation).

Note:

Open the ignition switch, do not start the engine, to detect the throttle position sensor signal, slowly open to close the throttle, observe the waveform has no sudden or irregular changes in the situation. When the throttle position sensor is analyzed, it is possible to find out the abnormal signal waveform in any signal waveform, for example, the instantaneous voltage drop may indicate the error of the sensor itself, damage, or dirty. And this abnormal signal waveform, but also easy to cause the error of the oscilloscope, so that the vehicle fault. Most of the solar term door position sensor, when idling, the voltage value should be all below 1.25V, and the throttle valve is fully open, the voltage value should be more than 3.4V, and the voltage should be smooth without any change, or surge voltage drop situation.

When the ignition switch is turned on, the engine does not start, detecting the throttle position sensor signal, if not see the waveform with the throttle opening variation, the failure may be as follows:

- poor connection
- bad sensor itself

5) Air flow meter sensor

①The same as the crankshaft, camshaft position sensor Step 1.

②Select "Sensor" after entering the main menu, then enter the sub-menu press the arrow keys to select "air flow meter sensor" into the second sub-menu press the arrow keys to select "high frequency" or "low frequency", press "OK" button to confirm to enter the oscilloscope user interface.

③Connect the CH1 probe to the oscilloscope and set probe to 1X file transfer, then connect the grounding clip to the signal ground or grounding.

④Since the oscilloscope "air flow meter sensor" function has already default settings (High Frequency: Probe file 1X, time base range 100us, low frequency: probe profiles 1X, time base range 10ms),Just probe to the corresponding signal, To intuitive display waveforms, as shown in Figure 8. (note: As in the "SCAN" scan mode requires patience waveform scanned)

⑤Press "CH1", you can view the value and configuration (by default)

⑥waveform can be self-fulfilling their needs by adjusting the time base, vertical volts / division and trigger mode (time base, vertical volts / division and other specific operations, please refer to the Universal oscilloscope operation).

Note:

air flow meter is generally divided into analog air flow meter and digital air flow meter:

●Analog air flow meter

The function of the air flow meter is to measure the air flow into the throttle valve. The air flow into the throttle valve is different with the speed of the engine. Analog air flow meter will detect the flow of air into the change of 0-5V between the voltage signal transmitted to the oscilloscope. Start the engine, step on the accelerator pedal, then the air flow signal, should be with the throttle valve opening bigger and the higher the value.

In the idle speed should be kept stable, when the throttle valve is fully open, the signal will be increased to the maximum value.

Watch the waveform signal in the abnormal phenomenon, such as: if the waveform smoothly, no surge occurred suddenly, waveform distortion, usually said oscilloscope between sensor and circuit, has the situation bad, bad line or the sensor itself.

Sensor voltage output signal, usually at idle speed when the minimum and with the increase of the engine load, the average idle speed is about 800mv, when the throttle valve is fully open, about 4.5V.

● Digital air flow meter

The function of digital air flow meter is to measure the air flow into the throttle body. Air flow into the throttle body varies with the speed of the engine. Digital air flow meter converts the detected air flow into the frequency signal. When the higher frequency signal, the greater the amount of air. Start the engine, at this time will be displayed on the screen square wave graphics, without any waveform display. You may have entered the analog air flow meter.

The observed signal waveform anomalies, for example, whether a square wave at right angles to change, or whether the surge occurs and the like. Sensor signal waveform sudden change in frequency usually indicates that there is a bad contact between the oscilloscope and the sensor, or the sensor itself is poor.

Digital waveform generated by air flow meter square wave signal neat, when the ignition key is turned on and tap the sensor when the engine does not start, this time waveform if a difference, said air flow meter sensor itself is bad, or there is a short circuit or line breaking situation.

Air flow meter sensor generates a signal to a frequency signal, the frequency of the number of so-called square-wave signal appears every second, the normal air flow meter sensor fixed to the engine speed signal values to produce little change in frequency, if the fluctuation range is too large, it means that poor air flow meter sensor. If the detected air flow meter, air flow meter power supply, but the changes seen in the waveform, the failure may be as follows:

●The oscilloscope has not received the signal transmitted from the air flow meter

●sensor itself is unstable

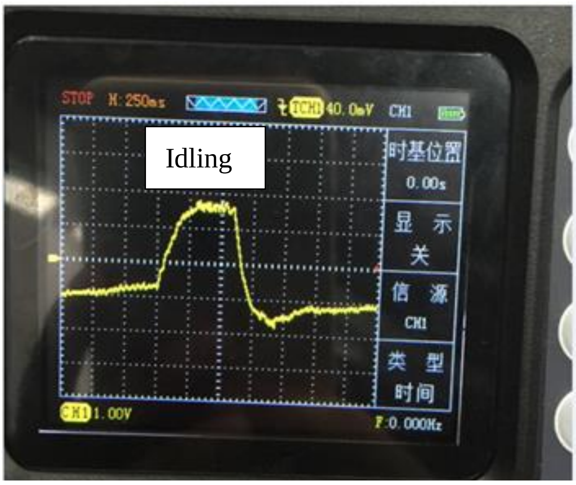
6) Intake manifold absolute pressure sensor

①The same as the crankshaft, camshaft position sensor Step 1.

②Select "Sensor" after entering the main menu, then enter the sub-menu press the arrow keys to select "intake manifold absolute pressure sensor" ,press "OK" button to confirm to enter the oscilloscope user interface .

③Connect the CH1 probe to the oscilloscope and set probe to 1X file transfer, then connect the grounding clip to the signal ground or grounding.

④Since the oscilloscope "intake manifold absolute pressure sensor" function has already default settings (profiles probe 1X, time base range 500ms), just probe to the corresponding signal, to intuitive display waveforms, as shown in Figure 9. (Note: As in the "SCAN" scan mode requires patience waveform scanned)



Pic-9 Intake manifold absolute pressure sensor

⑤Press "CH1", you can view the value and configuration (by default)

⑥waveform can be self-fulfilling their needs by adjusting the time base, vertical volts / division and trigger mode (time base, vertical volts / division and other specific operations, please refer to the Universal oscilloscope operation).

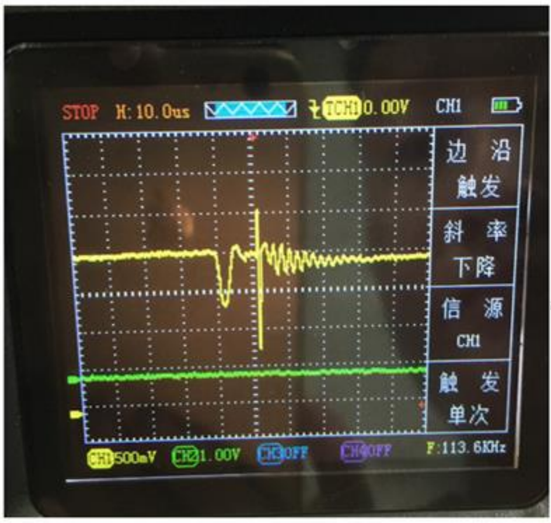
7) Knock sensor

①The same as the crankshaft, camshaft position sensor Step 1.

②Select "Sensor" after entering the main menu, then enter the sub-menu press the arrow keys to select "knock sensor”, press "OK" button to confirm to enter the oscilloscope user interface.

③Connect the CH1 probe to the oscilloscope and set probe to 1X file transfer, then connect the grounding clip to the signal ground or grounding.

④Since the oscilloscope "knock sensor" function has



Pic-10 Knock Sensor

already default settings (profiles probe 1X, time base range 500us),Just probe to the corresponding signal and then use a small stick percussion cylinder, To intuitive display waveforms, as shown in Figure 10. (note: As in the "scan" scan mode requires patience waveform scanned)

⑤Press "CH1", you can view the value and configuration (by default)

⑥waveform can be self-fulfilling their needs by adjusting the time base, vertical volts / division and trigger mode (time base, vertical volts / division and other specific operations, please refer to the Universal oscilloscope operation).

8) Accelerator pedal

①The same as the crankshaft, camshaft position sensor Step 1.

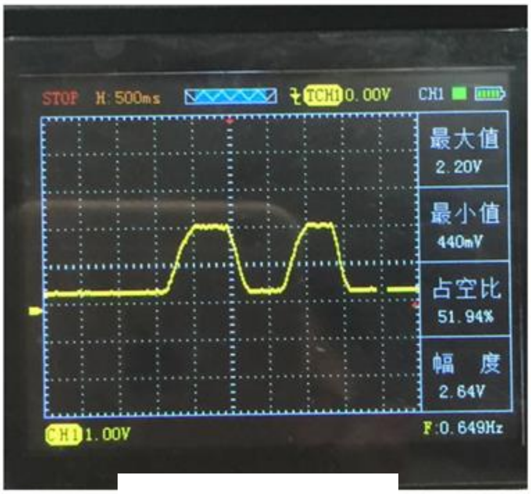
②Select "Sensor" after entering the main menu, then enter the sub-menu press the arrow keys to select "accelerator pedal" ,press "OK" button to confirm to enter the oscilloscope user interface .

③Connect the CH1 probe to the oscilloscope and set probe to 1X file transfer, then connect the grounding clip to the signal ground or grounding.

④Since the oscilloscope "accelerator pedal" function has already default settings (profiles probe 1X, time base range 250ms), just probe to the corresponding signal, to intuitive display waveforms, as shown in Figure 11. (Note: As in the "SCAN" scan mode requires patience waveform scanned)

⑤Press "CH1", you can view the value and configuration (by default)

⑥waveform can be self-fulfilling their needs by adjusting the time base, vertical volts / division and trigger mode (time base, vertical volts / division and other specific operations, please refer to the Universal oscilloscope operation).

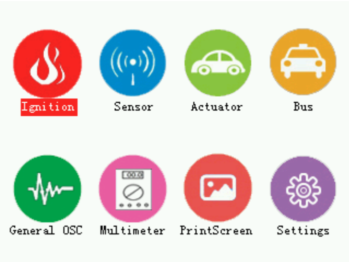

STOP
H:500ms
TCH1 0.00V
CH1
最大值
2.20V
最小值
440mV
占空比
51.94%
幅 度
2.64V
CH1 1.00V
F:0.649Hz

Pic-11 Accelerator

4. The Function of Actuator

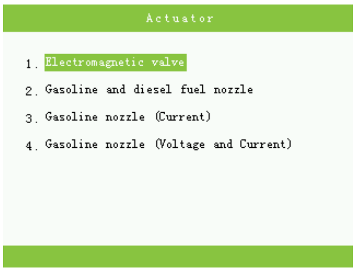
1）Electromagnetic valve

①After the oscilloscope installed batteries，long press red power button“⏻”， let it go until you hear the buzzer，at this time oscilloscope enter the main menu interface， as picture-1


Ignition
Sensor
Actuator
Bus
General OSC
Multimeter
PrintScreen
Settings

Picture-1

②After entering the main menu interface select “Actuator”， then enter the sub-menu press the up and down keys to select " Electromagnetic valve "，press “OK” button, after confirmation, entering oscilloscope operation interface, as picture -2


Actuator
1. Electromagnetic valve
2. Gasoline and diesel fuel nozzle
3. Gasoline nozzle (Current)
4. Gasoline nozzle (Voltage and Current)

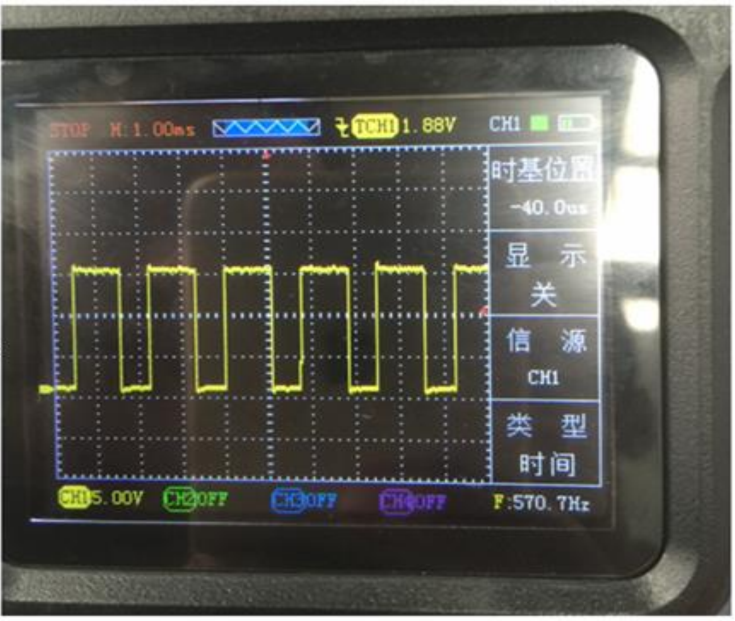
Picture-2

③Connect the probe to CH1 and probe set to 1X，then connect grounding clip to the signal ground or grounding.

④Since the “Electromagnetic valve” Function of oscilloscope has default settings （Probe 1X，time base 25ms）,simply connect the probe to the corresponding signal can display waveform. As picture-12

⑤Press“CH1”，can view the values and configuration（configuration has default）

⑥Waveform display can be adjusted based on their own through the vertical volts / division and trigger ways to meet your needs（Time base, vertical volts / division and other specific operations, please refer to the operation of general oscilloscope）



Pic-12 Electromagnetic valve

2）Gasoline and diesel fuel nozzle

①Same as Electromagnetic valve step 1

②After entering the main menu interface select “Actuator”， then enter the sub-menu press the up and down keys to select " Gasoline and diesel fuel nozzle "，press “OK” button, after confirmation, entering oscilloscope operation interface

③Connect the probe to CH1 and probe set to 10X，then connect grounding clip to the signal ground or grounding.

④Since the “Gasoline and diesel fuel nozzle” Function of oscilloscope has default settings （Probe 10X，time base 1ms）,simply connect the probe to the corresponding signal can display waveform.

⑤Press“CH1”，can view the values and configuration（configuration has default）

⑥Waveform display can be adjusted based on their own through the vertical volts / division and trigger ways to meet your needs（Time base, vertical volts / division and other specific operations, please refer to the operation of general oscilloscope）

Note: there is a rectangular concave on waveform, the width of the rectangle is the actual fuel injection pulse width, after the engine entering the closed-loop control, fuel injection pulse width is generally 1.5ms-2.9ms. If bigger than this value, there are clogging or excessive intake and other issues of nozzle.

3）Gasoline nozzle (Current)

①Same as Electromagnetic valve step 1

②After entering the main menu interface select “Actuator”， then enter the sub-menu press the up and down keys to select " Gasoline nozzle (Current) "，press “OK” button, after confirmation, before entering oscilloscope operation interface, it will prompt "must comply with the current clamp using " Wait a few seconds to enter the oscilloscope interface

③Connect current clamp to CH1,since the “Gasoline nozzle (Current)” Function of oscilloscope has default settings （Probe 1X，time base 1ms）,simply connect the probe to the corresponding signal can display waveform.

④Press“CH1”，can view the values and configuration（configuration has default）

⑤Waveform display can be adjusted based on their own through the vertical volts / division and trigger ways to meet your needs（Time base, vertical volts / division and other specific operations, please refer to the operation of general oscilloscope）

4）Gasoline nozzle (Voltage and Current)

①Same as Electromagnetic valve step 1

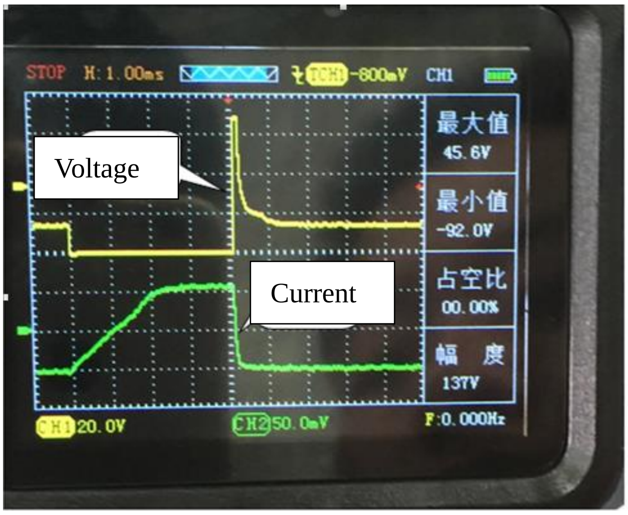
②After entering the main menu interface select “Actuator”， then enter the sub-menu press the up and down keys to select " Gasoline nozzle (Voltage and Current) "，press “OK” button, after confirmation, before entering oscilloscope operation interface, it will prompt " CH1:using probe，CH2:using current clamp" Wait a few seconds to enter the oscilloscope interface

③Connect the probe to CH1 and probe set to 10X，then connect grounding clip to the signal ground or grounding. Connect the current clamp to CH2

④Since the “Gasoline nozzle (Voltage and Current)” of oscilloscope has default settings （CH1:Probe 10X，time base 1ms; CH2: Probe 1X，time base 1ms）,simply connect the probe to the corresponding signal can display waveform, as picture 13

⑤Press“CH1” and “CH2”，can view the values and configuration（configuration has default）

⑥Waveform display can be adjusted based on their own through the vertical volts / division and trigger ways to meet your needs（Time base, vertical volts / division and other specific operations, please refer to the operation of general oscilloscope）



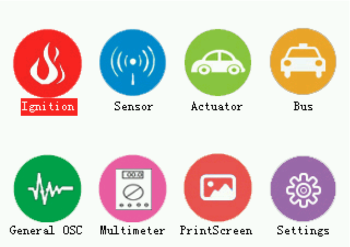
Pic-13 Gasoline nozzle (Voltage and Current)

5. Bus

1）CAN-high、CAN-low

①After the oscilloscope installed batteries，long press red power button“⏻”, let it go until you hear the buzzer，at this time oscilloscope enter the main menu interface，as picture-1

②After entering the main menu interface select “Bus”， then enter the sub-menu press the up and down keys to select " CAN-high、CAN-low "，press “OK” button, after confirmation, entering oscilloscope operation interface, as picture -2


Ignition
Sensor
Actuator
Bus
General OSC
Multimeter
PrintScreen
Settings

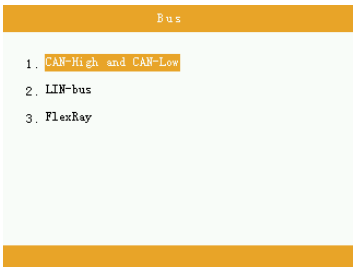
Picture-1

③Connect the two probes to CH1 and CH2, probe set to 1X，then connect grounding chipotle signal ground or grounding

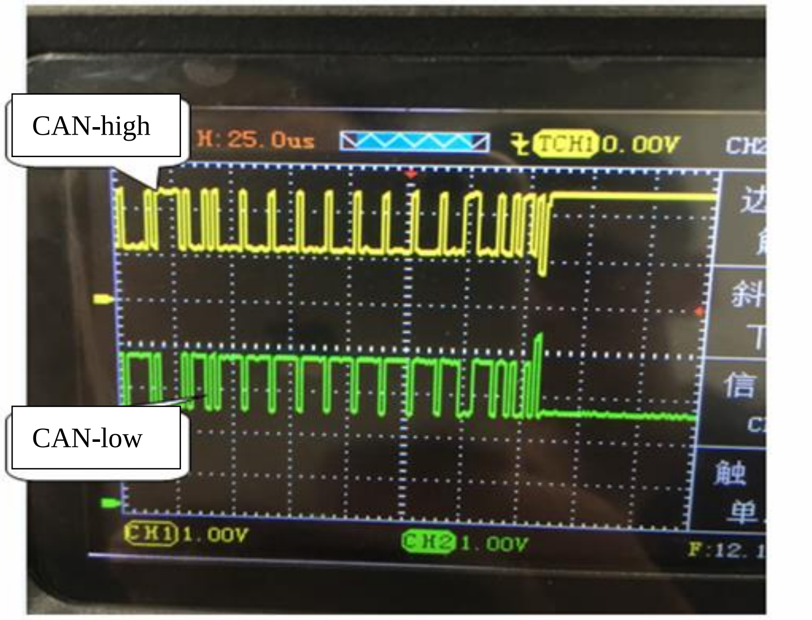
④Since the “CAN-high、CAN-low” function of oscilloscope has default settings （CH1,CH2:Probe 1X，time base 25us）,simply connect the probe to the corresponding signal can display waveform, as picture 14

⑤Press“CH1” and “CH2”，can view the values and configuration （configuration has default）

⑥Waveform display can be adjusted based on their own through the vertical volts / division and trigger ways to meet your needs （Time base, vertical volts / division and other specific operations, please refer to the operation of general oscilloscope）


Bus
1. CAN-High and CAN-Low
2. LIN-bus
3. FlexRay

Picture-2


CAN-high
CAN-low
H:25.0us
TCH1 0.00V
CH1 1.00V
CH2 1.00V

Pic-14 CAN-high, CAN-low

2) LIN-bus

①Same as CAN-high、CAN-low step 1

②After entering the main menu interface select “Bus”，then enter the sub-menu press the up and down keys to select " LIN-bus "，press “OK” button, after confirmation, entering oscilloscope operation interface

③Connect the probe to CH1 and probe set to 1X，then connect grounding clip to the signal ground or grounding

④Since the “LIN-bus” Function of oscilloscope has default settings （CH1:Probe 1X，time base 500us）,simply connect the probe to the corresponding signal can display waveform.

⑤Press“CH1” and “CH2”，can view the values and configuration（configuration has default）

⑥Waveform display can be adjusted based on their own through the vertical volts / division and trigger ways to meet your needs（Time base, vertical volts / division and other specific operations, please refer to the operation of general oscilloscope）

3) FlexRay

①Same as CAN-high、CAN-low step 1

②After entering the main menu interface select “Bus”，then enter the sub-menu press the up and down keys to select " FlexRay "，press “OK” button, after confirmation, entering oscilloscope operation interface

③Connect the two probes to CH1 and CH2, probe set to 1X，then connect grounding clip to the signal ground or grounding

④Since the “FlexRay” Function of oscilloscope has default settings （CH1,CH2:Probe 1X，time base 10us）,simply connect the probe to the corresponding signal can display waveform.

⑤Press“CH1” and “CH2”，can view the values and configuration（configuration has default）

⑥Waveform display can be adjusted based on their own through the vertical volts / division and trigger ways to meet your needs（Time base, vertical volts / division and other specific operations, please refer to the operation of general oscilloscope

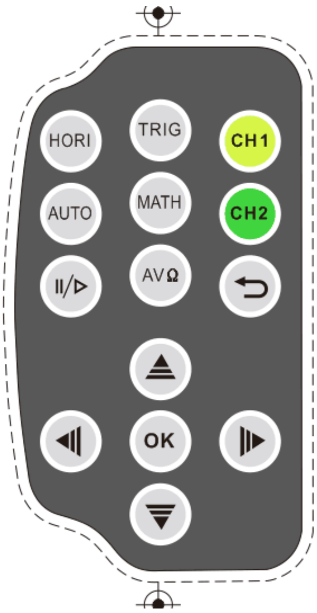
2.2 Universal Oscilloscope this section features are described

Below:

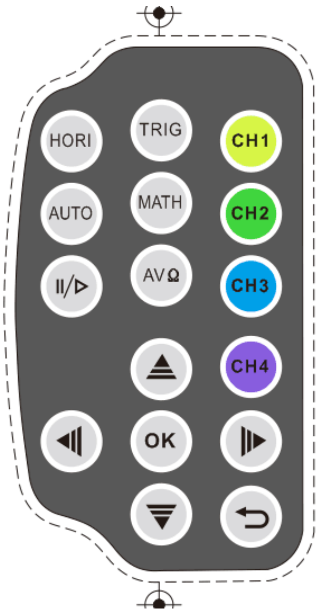
▲ Menus and control systems
▲ Connector
▲ automatically set
▲ The default setting
▲ Vertical System
▲ Horizontal System
▲ Trigger system
▲ Math system
▲ System Settings
▲ Storage System

1. Menus and Control buttons

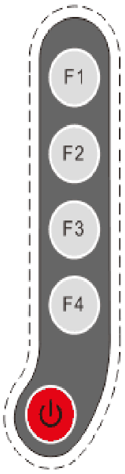
As shown in the following figure:



ADO102 control button



ADO104 control button



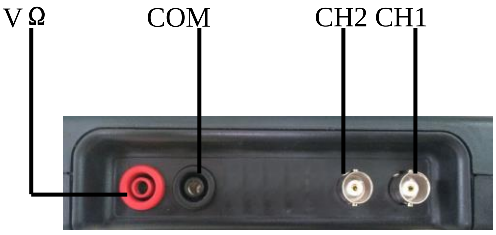
ADO General Button

All models

CH1、CH2 CH3、CH4	Channel 1, Channel 2 , Channel 3, Channel 4 settings menu
↩	Press the "Return" to return to the previous menu
AVΩ	Press the "Multimeter" mode to enter the multimeter
⏻	On / Off
AUTO	Automatically sets the oscilloscope controls, press this key to achieve 20HZ-10MHZ a key trigger function, Channel 1-Channel 4 can be used
TRIG	Show "Trigger" control menu
HORI	Show "Horizontal" control menu
II/▷	Continuously acquires waveforms or stops the acquisition. Note: In the stop mode, the waveform vertical scale and horizontal base can be adjusted within a certain range, equivalent to extend the signal on the horizontal or vertical direction.
MENU	Function menu interface, the first press of waveform storage interface, the second press to display settings interface, press three times for the system setup interface
▲ ▼	To enlarge, shrink waveform, or move the displayed cursor in oscilloscope mode. Used to adjust the range, in the multimeter functions.
◀ ▶	Can be used to move the waveform display or move the cursor in oscilloscope mode；select the type of test used in the multimeter functions.

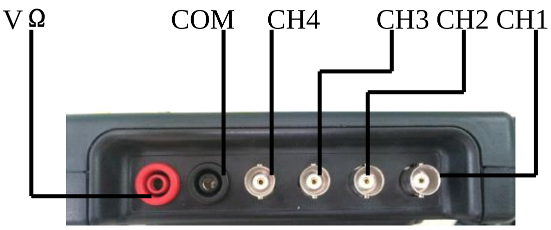
OK	Function Confirm
F1、F2、F3、F4	Corresponding to the selected setting in the Options menu 1,2,3,4

2. Connector



ADO102

Figure 2-1



ADO104

Figure 2-1

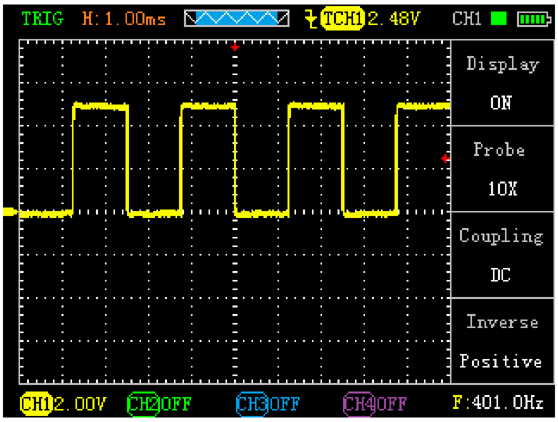
Figure 2-1 CH1-CH2: Input connectors for waveform display, the left is CH1, the right is CH2, "COM" and "VΩ" is used to connect the black and red pen.
Figure 2-2 CH1-CH4: used to display the input waveform connection. "COM" and "VΩ" is used to connect the black and red pen.

3. Automatically set

ADO has an automatic setting function. According to the input signal, automatically adjusting the voltage stall, time base, and triggering the best way to form display.
"AUTO" for automatically setting.

● If there is more than one channel signal, the channel with the lowest frequency signal as the trigger source.

● Found no signal, connect the channel 1 to a signal, press "AUTO" button. As shown in figure 2-3:



Display ON
Probe 10X
Coupling DC
Inverse Positive

CH1 2.00V CH2 OFF CH3 OFF CH4 OFF F:401.0Hz

Figure 2-3

4. Default settings

The oscilloscope is set at the factory for routine operations, which is the default setting. There oscilloscope main menu "System Settings" in the "factory restore mode" operation by the arrow keys to select "Factory" and press the "OK" button to confirm, the instrument off to save and restore the factory settings, the instrument can be used after restart.

5. Vertical Systems

Channel and its settings

Operation menu of the channel, indicating Table 2-1 below: **Table 2-1**

Coupling	AC DC	Blocking the DC component of the input signal. The ac and dc component of the signal.
Probes	1X 10X 100X	According to the probe attenuation factor to select one of the values in order to maintain the correct reading of the vertical deflection factor. There are three types: 1X, 10X, 100X
Display	Open Close	Open display waveforms Close display waveforms
Frequency	/	Automatically displays the current input signal frequency
peak-to-peak value	/	Automatically displays the current waveform peak-to-peak value.
Duty Cycle	/	automatically displays the current input signal duty
Cycle	/	automatically displays the current input signal cycle

1). Set the channel coupling

To signal applied to the oscilloscope channel, for example, the measured signal is a square wave signal containing AC component.

●Main menu, select "Universal oscilloscope" press "OK" button to enter the oscilloscope screen. Press "CH1" → "Coupling DC", press “F3”set to DC coupling. DC and AC components of the input signal to pass through.

As Figure 2-4

● Press "CH1" → "Coupling AC", press “F3” set to AC coupling. DC component of the input signal is blocked. As Figure 2-5

● Press "CH1" → "Inverse" and press the SELECT function key "F4" to anti opposite way. Inverting the signal display. Figure 2-6

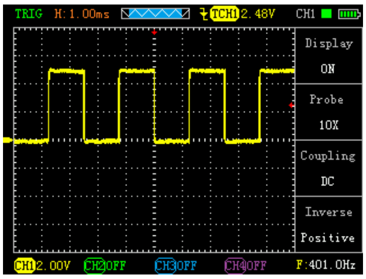

TRIG H:1.00ms TCH1 2.48V CH1
Display ON
Probe 10X
Coupling DC
Inverse Positive
CH1 2.00V CH2 OFF CH3 OFF CH4 OFF F:401.0Hz

Figure 2-4

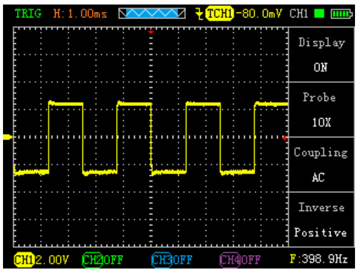

TRIG H:1.00ms TCH1 -80.0mV CH1
Display ON
Probe 10X
Coupling AC
Inverse Positive
CH1 2.00V CH2 OFF CH3 OFF CH4 OFF F:398.9Hz

Figure 2-5

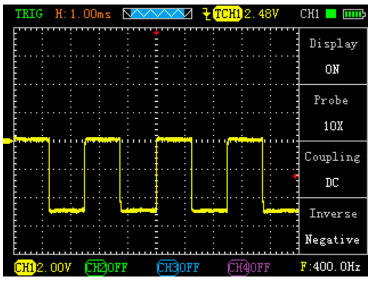

TRIG H:1.00ms TCH1 2.48V CH1
Display ON
Probe 10X
Coupling DC
Inverse Negative
CH1 2.00V CH2 OFF CH3 OFF CH4 OFF F:400.0Hz

Figure 2-6

2).Probe scale setting

To cope with the attenuation factor of the probe set, User need adjust the probe attenuation scale factor in channel operation menu. If the probe attenuation coefficient ratio is 10:1, Oscilloscope input channel ratio should be set to 10X, and so on. To avoid the display of information and measurement data errors occur. Take the CH1 for example:

● Press "CH1" → "F2" to set the probe ratio for 10X.

3).Vertical volts/division adjustment setting

When adjusting the vertical volts/div, the range is 100mV/div-50V/div (probe 10X), Stepping way to 1-2.5-5, or 10mV/div-5V/div (probe 1X), 1V/div-500V/div (probe 100X). Take the CH1 for example:

● If you set the vertical direction 2.00V/div,press"CH1"→ " ▲"or "▼" to adjust the vertical volts / division, press " ◀" or " ▶ "to move up and down the entire waveform. As Figure 2-7

● If you set the vertical direction 1.00V/div, the steps in the above example. As Figure 2-8

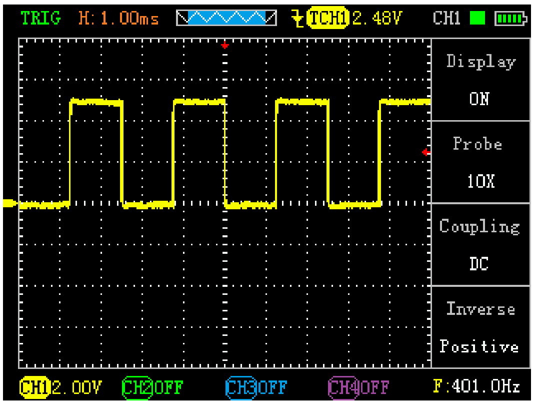

TRIG H:1.00ms
TCH1 2.48V
CH1
Display
ON
Probe
10X
Coupling
DC
Inverse
Positive
CH1 2.00V
CH2 OFF
CH3 OFF
CH4 OFF
F:401.0Hz

Figure 2-7

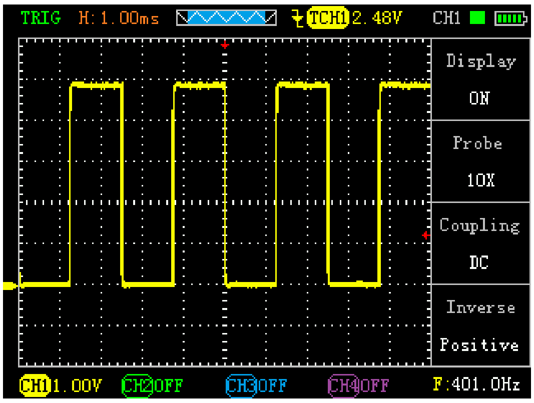

TRIG H:1.00ms
TCH1 2.48V
CH1
Display
ON
Probe
10X
Coupling
DC
Inverse
Positive
CH1 1.00V
CH2 OFF
CH3 OFF
CH4 OFF
F:401.0Hz

Figure 2-8

6. Horizontal Systems

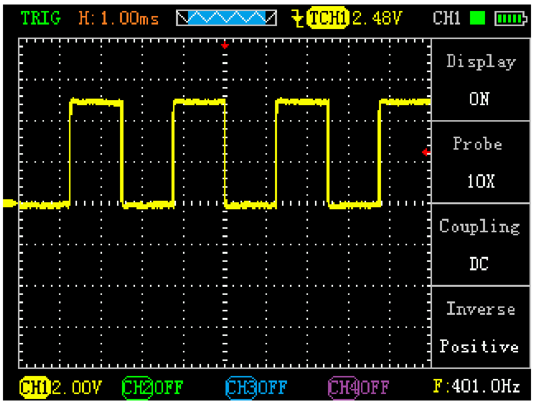
Use the control buttons to change the level of the horizontal scale (time base), trigger horizontal position (trigger position) in memory. Changing the horizontal scale causes the waveform relative to the screen center expansion or contraction, Change the horizontal position relative to the change point of the waveform trigger position.

Table 2-2 Main Menu of horizontal time base

Master time base	Horizontal main time base setting is used to display the waveform	
Master time base cursor state	Display	Set cursor display or not display
	Source	Select cursor measurement signal source (CH1-CH4)
	Type	There are two types of time and voltage
Cursor display	Cursor1 Cursor 2	Time base offset relative to the main vector

	Incremental	Cursor 2 - Cursor 1

- Horizontal scale: Adjust the main group; press the "HORI" button, Press"▲ "or" ▼" to change the scale of the level. To zoom in or out waveform. If you want to stop waveform acquisition, press the "RUN" key can be realized. As Figure 2-9, Figure 2-10



TRIG H:1.00ms TCH1 2.48V CH1

Display ON

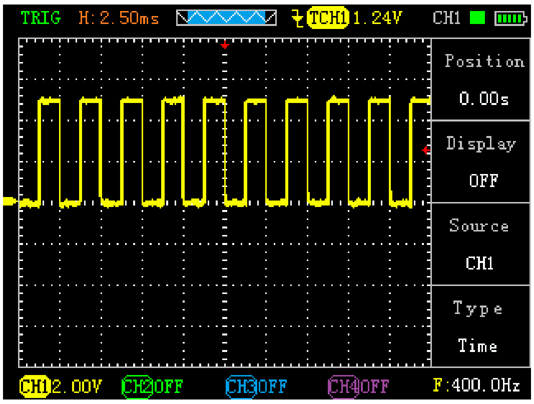
Probe 10X

Coupling DC

Inverse Positive

CH1 2.00V CH2 OFF CH3 OFF CH4 OFF F:401.0Hz

Figure 2-9



TRIG H:2.50ms TCH1 1.24V CH1

Position 0.00s

Display OFF

Source CH1

Type Time

CH1 2.00V CH2 OFF CH3 OFF CH4 OFF F:400.0Hz

Figure 2-10

- Horizontal Position: adjust the horizontal position of the waveform (trigger position relative to the center of the screen).Press the "HORI" button, Through " ◀ " or " ▶ "to move the waveform left or right. The key resolution varies according to time base. Press "AUTO" key can make the horizontal position return to zero.
- Cursor measurement: adjust the measurement, press the "time base" keys, press "F2-F4" to select the corresponding function (display, source, type), and then press the "time base" on the cursor key to enter the display interface, and then " ◀ " " ▶ " or " ▲ ", " ▼ " key to adjust the cursor position.

7. Trigger system

The trigger determines when the oscilloscope starts to acquire data and display waveforms. Once the trigger is set up correctly, it can convert the unstable display into meaningful waveforms. Trigger Control menu button" TRIG".

- Trigger Control

Trigger: The oscilloscope trigger mode is edge triggered.

- Edge Trigger: When the edge of the trigger signal reaches a given level,

Trigger occurs. Edge trigger is triggered on the input signal edge trigger threshold. When "Edge”, that is input at the rising edge, falling edge triggered.

Table 2-3 Edge trigger function menu

Source	oscilloscope	Set CH1 as trigger source. (CH2-CH4 empathy)
Slope	UP DOWN	Select the trigger signal to trigger on the rising edge Select the trigger signal to trigger on the falling edge

Trigger mode	Auto	Set in the absence of detectable also can collect waveform trigger conditions
	Normal	Set only a triggering condition is satisfied only waveform
	Single	Set capture a waveform when a trigger is detected, then stop

Instructions:

Set the source:

1).Main menu, select "Universal oscilloscope" press "OK" button to enter the oscilloscope screen. Press the "TRIG" button to display the trigger menu, according to the signal input, press the "F3" key to select CH1-CH4.

2).Press "CH1", then press"◀"or" ▶"adjusts channel 1 mark. Press the "TRIG", then press"▲ ""▼"or"◀"" ▶"adjust the trigger flag arrow, According trigger flag each cell voltage value represents the relative position and the current channel a flag vertically to set the trigger level size.

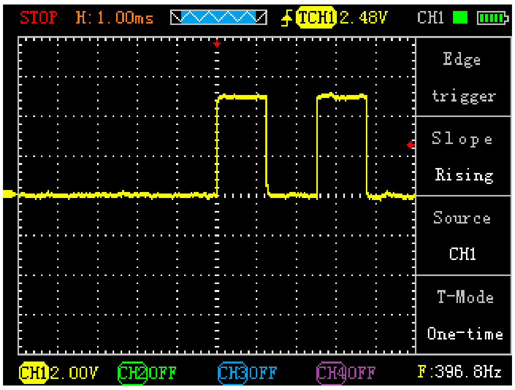
Set slope:

3).Press the "F2" key to select slope "up" or "down."

Set trigger mode:

4).Press the "F4" key to select "Auto", "normal" or "single."

Auto: Set in the absence of detectable also can collect waveform trigger conditions Normal: Set only a triggering condition is satisfied only waveform Single: Set capture a waveform when a trigger is detected, then stop As Figure 2-11


STOP H:1.00ms TCH1 2.48V CH1

Edge trigger

Slope Rising

Source CH1

T-Mode One-time

CH1 2.00V CH2 OFF CH3 OFF CH4 OFF F:396.8Hz

Figure 2-11

8. Math System

Math function is to display CH1, CH2, CH3, CH4 two two-channel waveform additions, subtraction functions

Table 2-4 Math Functions

Menu Settings Comments	**Setting**	**Description**
Arithmetic Functions	/	
Source A	Settings Source CH1-CH4	Set CH1, CH2, CH3, CH4 as source B

Source B	Settings Source CH1-CH4	Set CH1, CH2, CH3, CH4 as source B
Operation	A+B、A-B or NULL	Be A + B or A-B operation according to the source A, Source B is set above

▲Press the "operation" button then press the "F4" select operation mode and turn on the display.

9. System Setup

Table 2-5 System Functions menu

Menu Settings Comments	**Setting**	**Description**
Sound	Sound	Set sound to "ON" or "OFF"
Display brightness	Brightness	Can be set from 1-5
Language	/	Chinese or English
Color	System theme	four styles to choose "default", "style one"、" style two", " style three "
Location History	On / Off	Minutes of the last open position
Version Information	/	Check the software version of the oscilloscope
Restore Factory	/	Reset

System Settings

1) Sound settings: the main menu, select "System Settings" button, press the "OK" button to enter the settings interface, via the arrow keys to select "Sound" press "OK" button, enter the change, left and right keys to select On or Off and then press "OK "button to confirm.

2) brightness setting: the main menu, select "System Settings" button, press the "OK" button to enter the settings interface, via the arrow keys to select "Brightness" press "OK" button to enter modify, add brightness left minus right then press "OK" key to confirm; the machine can be set brightness 1-5.

3) language setting: the main menu, select "System Settings" button, press the "OK" button to enter the settings interface, via the arrow keys to select "Language" press "OK" button, enter the change, left and right keys to select the language and then press the "OK" button confirm; the unit provided in both Chinese and English display interface.

4) Color settings: language setting: the main menu, select "System Settings" button, press the "OK" button to enter the settings interface, via the arrow keys to select "System risers"

press "OK" button, enter the change, up and down keys to select a topic style and then press "OK" button to confirm, the unit provides four display style theme.

5) to restore the factory: the main menu, select "System Settings" button, press the "OK" button to enter the settings interface, via the arrow keys to select "Factory" press "OK" button, enter the change, left and right keys to select OK or Cancel, then press "OK" button to confirm the WTR.

10. The storage system

ADO Series can store two reference waveforms, 20 groups of shots (depending on memory size oscilloscope decision) to the oscilloscope internal memory.

ADO Series provides USB interface, you can save waveform memory shots to the U disk, the common image BMP image file can be opened by computer software. In addition, two sets of waveform parameters are stored and can be produced by "reference waveform" were transferred out, displayed on the screen.

To save a reference waveform:

1) Main menu, select "Universal oscilloscope" (Automotive Oscilloscope select the corresponding module), press the "OK" key to enter the user interface

2) Press the "time base", "trigger" or "operator" to any of these options, press "F1" to enter the reference waveform

3) press "F2" to select the source, then press the "F2" Reference Waveform (each source can save two set of reference waveform Ref1, Ref2), press the "F4" key to save the reference waveform and displayed by pressing the "F2 "button selected as the reference" NULL "to close the reference waveform

Store pictures steps:

Any Screenshots:

1) Oscilloscope and automotive modules interface, long press "F2" operating status (battery indicator on the left side) will be blinking green to being shot, wait a few seconds, the name of the successful bomb box prompts screenshots and screenshots will appear.

2) Multimeter screenshot will be prompted "is being shot”, will appear successful bomb box prompts screenshot success.

3) Other interfaces will be prompted being shot, after a successful theme screenshot bomb box prompt success.

Note: The screenshot function can save 20 or so maps, depending on memory size of the decision, if prompted screenshot fails, re-theme look, or not, then you see the next memory to delete a few pictures.

View storage oscilloscope image method:

1) First off the oscilloscope, and then use the data cable to connect the oscilloscope and the computer, and then press the "F3" key and the "on / off" button until the screen to let go when the light; this time, the computer will prompt U disk insert, open U disk to see the pictures taken. After the operation, you must first click Exit U disk mode on the computer, then disconnect the cable, press the power button to reboot to use it again.

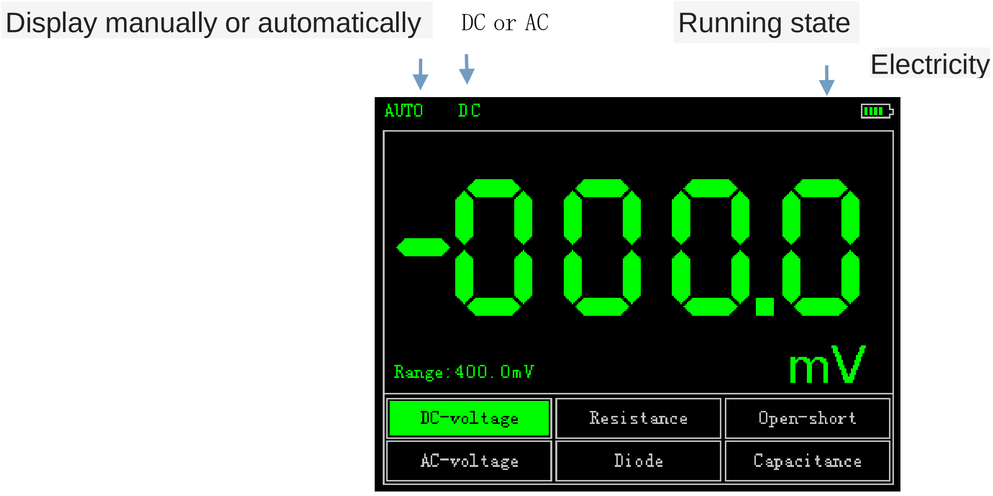
2) to enter the main menu, select the screenshot function, go to theme preview feature to view screenshots. After the arrow keys can be selected theme, select press "OK" button to view, press any key to return to the list of shots, "F3" key means to delete the currently selected theme, "F4" button to remove all screenshots.

Waring: Please don’t use any measure function when the USB cable is connecting with other devices, or this Instrument Will Be Damaged.

2.3 **Multimeter function and operation**

This device can be used as a Multimeter or OSC; can be used for measuring DC and AC voltage, resistance, capacitance, diode, buzzer-off. This device uses TFT full color display, and has a range display, polarity display, overload display, battery power display.

Measure Type	**Range**					
DC Voltage	400.0mV	4.000V	40.00V	400.0V	1000V	
AC Voltage	400.0mV	4.000V	40.00V	400.0V	750V	
Resistance	400.0Ω	4.000KΩ	40.00KΩ	400.0KΩ	4.000MΩ	40.00MΩ
Capacitance	51.2nF	512.0nF	5.120uF	51.20uF	100uF	
Diode	0V-1.5V					
Buzzer-off	Below 60Ω ,buzzer alarm					


Display manually or automatically
DC or AC
Running state
Electricity
AUTO
DC
-000.0
Range:400.0mV
mV
DC-voltage
Resistance
Open-short
AC-voltage
Diode
Capacitance

Meter Interface

Measure Method:

Table2-7 Multimeter Operation Key Function

Key	Description
Multimeter	Press this key to enter Multimeter Mode.
◀ ▶	Press “◀ ” or “ ▶” to select Mesure Type
▲ ▼	Press “▲ ” or “▼ ” to tune the Range
II/▷	Multimeter’s RUN/HOLD key.

Note 1: Multimeter’s default range is "Auto" position, for manually setting the range, first predicted your Measurements..

Note 2: Display screen show flashing “🔋”means Multimeter is running;” MANU” means manually set the range.

1. DC and AC Voltage measuring

① The Black Pen connect to the COM interface on the top of the device(the black interface),and the Red Pen connect to VΩ interface(the red interface)

② Press “ON/OFF” key until the system is started, then press “Multimeter” key to switch to Multimeter Function.

③ Press “ ◀” or “ ▶” to select “DC voltage” or “AC Voltage” measuring.”DC Voltage” has a Shortcut,”F1”.

④ Connect the test pen to the measured voltage, the device will read the value and show on the screen (it can also read negative value.).AC Voltage has no polarity. This device’s default Range is “Auto”, you can ▲ess “▼ ” or “ ” to change the Range.

2. Resistance measuring

① Press “ ◀” or “ ▶” to select Resistance mesuare.it has a shortcut,”F2”.

② Put the pen on the two side of the resistor, device can read it’s value. Maybe you should set the Range manually.

3. Capacitance measuring

① Press “◀” or “▶ ” to select Capacitance mesuare.

② put the pen on the two side of the capacitance, device can read it’s value.

Note: Capacitance measuring can’t set Range.

4.Diode and Buzzer-off measuring

①Press “ ◀” or “ ▶” key to select “Diode” or “Buzzer-off” measuring. Buzzer-off measuring has a shortcut ,”F3”.

②Put the pen on the two side of the Diode or the line, device can read it’s value.(The value when measuring diode, it’s diode Conduction voltage drop)

③When mesuareing resistance is below 60Ω, buzzer alams.

Attention:

a. The device has forward and reverse voltae, when the diode connected reversed, the value is negative.

b.Diode and Buzzer-off mearusing only have “Auto” Range.

c.When measuring,must keep “Sound” On, or the Buzzer can’t alarm.

Ways to setup:

1、press the "back" button, until the main menu through the arrow keys to select the "Settings", click "OK" button to enter the setting

2、using the arrow keys select "sound", click "OK" button appears bomb box, through the left and right button to select the open and click "OK" button to confirm

5、 Data Hold Function

"Run / Stop" button is pressed on the instrument, the data will remain being displayed on the display even if the input signal changes, or eliminate, the value is not changed

Waring 1: When using Multimeter, the OSC dector must not connect to GROUND.

Waring 2: Please select the appropriate Range before measure object.

Waring 3: When the USB cable is connect to other devices, must not measur, or the device will be damaged.

Chapter3 Application Examples

3.1 Singal measure

Measure an unknown signalman show it’s value immediately.

- If you want show the value immediately ,please do as fllows:

① Enter the "Universal oscilloscope”. Set the probe menu attenuation coefficient as 10X, and switch the probe to 10X.

② Connect the CH1 probe to the test point.

③Press “AUTO” key.

The OSC will automatically set the optimum waveform display. Then you can adjust the Vertical or Horizontal scale, until the waveform meets your requirements.

- Automatic measure signal’s voltage and time parameter.

The OSC can automatic measure most signals. To measure the frequency and peak-peak,follw the steps:

① Enter the "Universal oscilloscope”. Press “AUTO” key, show current waveforms.

②Press "CH1" button to turn pages can be observed maximum, minimum, duty cycle, amplitude. (CH2-CH4 similar operations)

In this case, the signal parameter measurements are shown in F1-F4 corresponding to the location, you can display the signal parameter values by pressing the corresponding F1-F4 function key to select. Figure 3-1

3.2 Cursor measure

This OSC can automatic measure a variety of waveform parameters. All measurement parameters can be measured by the cursor.Use the cursor, can measure the waveform parameters quickly.

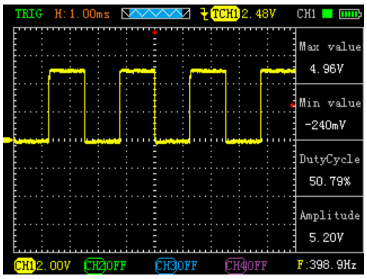


Figure 3-1

- Measuring the peak voltage of square wave signal.

Take the CH1 for example. if you want to measure the peak voltage of a square wave signal, do as follows:

① Press “HORI” key to enter the main base cursor state setting.

②Press “F2” key to set the cursor “ON”; Press “F2” key to set the source as “CH1-CH4”; press “F4” key to set the type of the cursor “Voltage”.

③Press “HORI” key again to see location of cursor 1 and cursor 2(relative to the intermediate zero volate reference level) and increment (V_cursor2-V_cursor1)

④Press “▲” and “ ▼ to tune the position of cursor 2,“ ◀ ” and “ ▶’ to tune the position of cursor 1;and there position and increment will updating on the screen in Real-time. See Pic 3-2 and Pic 3-3.

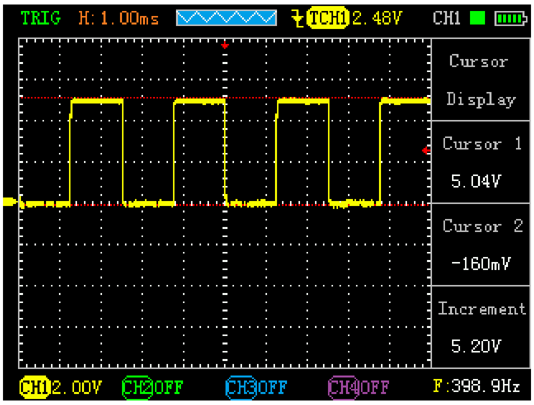

TRIG H:1.00ms
TCH1 2.48V
CH1
Cursor Display
Cursor 1 5.04V
Cursor 2 -160mV
Increment 5.20V
CH1 2.00V
CH2 OFF
CH3 OFF
CH4 OFF
F:398.9Hz

Figure 3-2

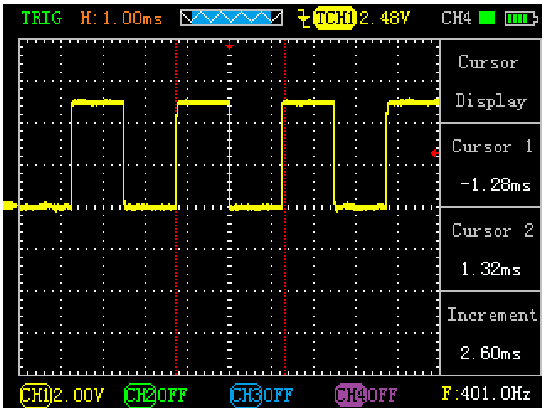

TRIG H:1.00ms
TCH1 2.48V
CH4
Cursor Display
Cursor 1 -1.28ms
Cursor 2 1.32ms
Increment 2.60ms
CH1 2.00V
CH2 OFF
CH3 OFF
CH4 OFF
F:401.0Hz

Figure3-3

3.3 Capture the Single Signal

Digital storage oscilloscope advantages and features that could easily capture the periodic signal pulses, glitches, etc. To capture a single signal, this signal first needs to have some prior knowledge, in order to set the trigger level along. If the case of a signal of uncertainty, you can automatically trigger mode or normal first observation to determine the trigger level along.

Steps are as follows:

1、As aforementioned, set the attenuation coefficient of probe and CH1 channel to 10X.

2、Trigger settings:

① Press "CH1” key → press "F3" key to set the coupling to "DC."

② Press the "TRIG" button to display the edge trigger menu settings.

③ In this menu, press “F1” key to set the edge type “slope down”,press “F2” key to set the source “CH1”,press “F3” key to set the trigger mode to “single”.

④Press “RUN” key, the left corner of the display screen will displays “SIGL”,waiting for the signal meets the trigger condition occurs. If the trigger signal reaches the ertain conditions, it will displays on the screen. With this feature

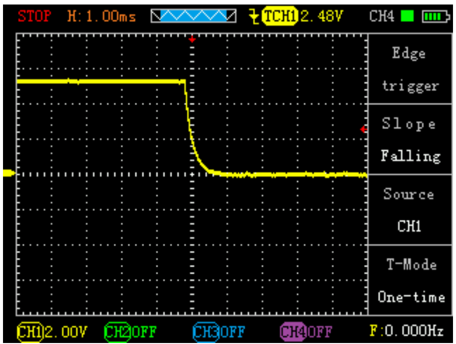

STOP H:1.00ms
TCH1 2.48V
CH4
Edge trigger
Slope Falling
Source CH1
T-Mode One-time
CH1 2.00V
CH2 OFF
CH3 OFF
CH4 OFF
F:0.000Hz

Figure 3-4

you can easily capture the event accidental, such as a suddenly low voltage:press”RUN” key to start the wait when there is a low level occurs, the devices will automatically trigger and the trigger waveform record before and after a period of time off.”HORI” key can change the horizontal position of the trigger position, and then you can get different lengths, which can easily observe the waveform. See Figure 3-4

3.4 Use Multimeter to Measure DC Voltage

- Use “AUTO” measure DC Voltage.
  ①Press “AVΩ”key, enter Multimeter mode,
  Auto range default.
  ②Press “ ◀’ or “ ▶” to select “DC Voltage”
  ③ Put the pen on the test point, and it will read The value.
  See Figure 3-5.
- Set the Voltage Range manually.
  ①Press “ ◀’ or “ ▶” to select “DC”
  ②Press “▲ ” or “ ▼ to adjust the range.
  See **figure** 3-6.

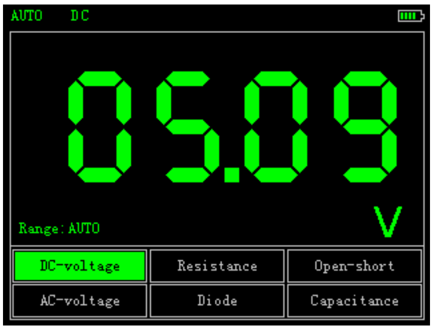

AUTO
DC
05.09
Range: AUTO
V
DC-voltage
Resistance
Open-short
AC-voltage
Diode
Capacitance

Figure 3-5

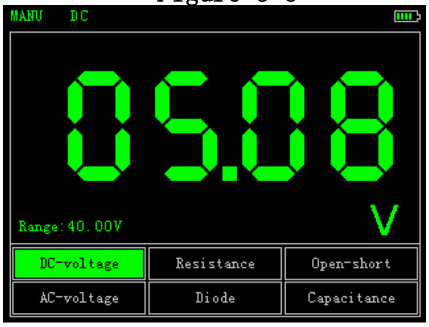

MANU
DC
05.08
Range: 40.00V
V
DC-voltage
Resistance
Open-short
AC-voltage
Diode
Capacitance

Figure 3-6

Chapter 4 System Tips and Troubleshooting

4.1 Prompting Message

Trigger level limit:
Horizontal position limit:
Voltage range limit:
USB storage device is connected successfully:

4.2 Troubleshooting

1. If you press the "⏻" button oscilloscope screen remains dark, no display, follow these steps:

(1) Open the instrument battery cover, check whether the power supply or battery power leakage, flatulence, etc.

(2) After the inspection is completed, restart the instrument.

(3) If you still can not properly use the product, please contact us.

2. After signal acquisition, signal waveform screen does not appear, please

follow these steps:

(1) Check whether the probes are correctly connected to the signal line connection.

(2) Check whether the signal cable is properly connected to the BNC.

(3) Check whether the probe is properly connected with the analytes.

(4) Check whether the analyte signal is generated.

(5) Re-acquire the signal again.

3. Measured voltage amplitude value is 10 times greater than the actual value, or 10 times smaller:

Check whether the channel attenuation factor of the probe matches the actual attenuation ratio.

4. There waveform display, but not stable:

Check the trigger source trigger menu settings are consistent with the actual signal input channels.

5. Press "RUN" button without any display:

Trigger checks whether the trigger menu in the "normal" or "Single" and the trigger level has been exceeded if the signal range. If it is, the trigger level is centered, or set the trigger mode to "AUTO" file.

6.Stepped waveform display:

This phenomenon is normal. When the base level is too low may stall, increasing the level of the base when the horizontal resolution can be increased to improve the display.

Chapter 5 service and support

5.1 Warranty Description

We guarantee the production and sale of its products, the date of shipment from authorized dealers within a year, does not appear in material and workmanship defects. As specified in the detailed product warranty proved defective, we will provide repair or replacement service.

In addition to this summary, or use the warranty provision of the warranty, we do not make any other warranties, express or implied. The Company's indirect, special or damage arising there from shall not be liable.

Appendix A: Technical Specifications

Unless otherwise noted, all technical specifications are used for attenuation switch setting 10X probes and these series oscilloscopes.

To verify that the oscilloscope meets specifications, the oscilloscope must meet the following conditions:

●The oscilloscope must be more than thirty minutes of continuous operation within the specified operating temperature.

●If the operating temperature changes by more than 5 degrees, will have to be corrected, unless labeled "typical" outside the specifications, all specifications are guaranteed.

●Oscilloscope must be within the factory calibration interval.

Technical Specifications

import	
Input coupling	**AC、DC**
Input impedance	**1MΩ 25pF**
The maximum input voltage	**40V (probe X1); 400V (probe X10) can be measured 220V voltage; (probe X100) 2000V voltage can be measured**
Probe attenuation	**1X、10X**
Set the probe attenuation factor	**1X、10X、100X**
Signal acquisition system	
Sampling Method	**Real-time sampling, random sampling**
Memory depth	**4K**
Acquisition Mode	**Sample, Peak Detect**
Vertical System	
Vertical Sensitivity	**10mV-5V (Probe 1X) 100mV-50V (probe 10X) (1,2.5,5 step)**
Vertical accuracy	**+/-3%**
Vertical resolution	**8bit**
Bandwidth	**10MHz**
Horizontal Systems	
Real-time sampling rate	**100 MSa/s**
Horizontal scan range	**25nS/div-5S/div**
Trigger System	
Mode	**Auto, Normal and Single**
Type	**Rising edge trigger, falling edge trigger**
Automatic detection	**Support (20Hz-10MHz)**
Measurement System	

Cursor measurements	**Support time and voltage cursors**
Measurements	**Manual**
Measure	**Peak and frequency**
Equipment	
Screen	**3.2-inch, 16-bit true color, TFT, 320 * 240**
Battery	**3000 + mA lithium battery (single cell about four hours of continuous work)**
Size	**115 * 180 * 35 (mm)**

Appendix B: ADO 102/ADO 104 oscilloscope accessories

ADO 102 oscilloscope:	ADO 104 oscilloscope:
- User manual (CD)	- User manual (CD)
- Certificate	- Certificate
- A dedicated high-voltage ignition probe (Found 1: 3000)	- Two dedicated high-voltage ignition probe (1: 3000)
- 1: 1/10: 1 probe two	- 1: 1/10: 1 probe four
- Multimeter table pen one pair	- Multimeter table pen one pair
- Four broken wire needle	- Six broken wire needle
- Lithium battery × 2	- lithium batteries × 2
- Battery Charger	- Battery Charger
- Portable Kit	- Portable Kit
- USB cable one	- USB cable one

Appendix C: routine maintenance and cleaning

Routine maintenance

Do not store or leave the instrument in where the LCD display will be exposed to direct sunlight for a long time.

Do not allow sprays, liquids and solvents touches on the instrument or probe, to avoid damage to the instrument and probe.

Please charge the battery in the battery is finished using the situation.

Clean

Regularly inspect the instrument and probe according to operating conditions.

Please follow the steps below to clean the outer surface of the instrument:

1.Use external dust soft cloth to wipe the instrument and probe. When cleaning the LCD screen, be careful not to scratch the clear plastic protective screen.

2.Use a damp but not dripping, soft cloth to wipe the instrument, please remove the battery before wiping. Use a mild detergent and water to scrub. Do not use any corrosive chemicals, to avoid damage to the instrument and probe.

WARNING: Before reinstalling the battery, make sure the instrument is completely dry to avoid water damage to equipment caused by electrical short circuit.