**Brief introduce —ADO series**

The automotive oscilloscope of ADO series is produced by Jinhan Electronic CO.,Ltd with the feature of compact ,portable and flexible operation. We use TFT LCD to make it ease using and improving the efficiency for user.

In addition ,this products has been proved with the characteristic of Stable performance, easy operation and powerful by several test of all kinds of cars, so it be provided with good performance and competitive price. The real-time sampling rate can get to100MSa/S, so it can meeting the demand of automotive market of capture quick and complex signals.it can also provide other features : Support USB device storage, the user can upgrade through USB. Dedicated test items and general oscilloscope to meet the requirements of different levels of customers

**Characteristic:**

|  |  |  |
| --- | --- | --- |
| **Model** | **ADO102** | **ADO104** |
| **Channel** | 2 | 4 |
| **Bandwidth** | 10MHZ | |
| **Sampling rate** | 100MSa/S | |
| **Storage depth** | 4K | |
| **Multimeter** | contain | |
| **Features** | —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 | |

1. **Safety warning:**

In order to avoid personal injury and prevent any damage to the product or any other product connected with it, It is inevitable to have a deep realize about the safety precautions of our products before operate.



NOTE：**It is forbidden to use USB connection and oscilloscope (or multimeter) for measurement in the same time ,it may damage the instrument！**

**Only the trained personnel can run maintenance procedures.**

**1. Avoid fire and personal injury**

* **Correct plug**

Do not insert or remove the probe or test lead when it is connected to a voltage source.

* **Connect the probe correctly**

The probe ground wire is the same as ground potential. Do not connect the ground wire to high voltage. And do not touch exposed contacts and parts during testing.

* **Check all terminal ratings**

In order to avoid the impact of fire and excessive current，please have a read of product manual contain all ratings and markup information， before you Connect the product to learn more about ratings

* **Do not open the lid**

Do not operate the product with the cover or panel is removed

* **Avoid circuit exposure**

Do not touch exposed connectors and components after starting up.

* **Do not operate when you suspect that the product has failed**

If you suspect that the product has failed, please check with qualified service personnel.

* **To maintain proper ventilation, do not operate in humid conditions**
* **In order to get pure signal and protect products ,please far away heat source , fan blades and drive shaft when measure the car signal.**
* **Do not operate in flammable, explosive atmospheres**
* **Keep the surface clean and dry**

**2、Safety terms and markings**

|  |  |
| --- | --- |
| **WARNING :** | A warning statement states the conditions and actions which may endanger the safety of life |
| **The terms in this manual. The following terms may be appear in this manual:** | |
| **NOTE :** | CAUTION Indicates conditions and actions that may cause damage to this product and other property. |
| **Terms on the product:** | |
| The following terms may appear on the product | |
| **DANGER :** | There is a direct injury hazard near the mark. |
| **WARNING :** | Indicates a potential hazard near the mark. |
| **CAUTION :** | Indicates a potential hazard to this product and any other property. |
| **Symbols on the product: The following symbols may appear on this product** | |

|  |  |  |
| --- | --- | --- |
| 截图07 | 截图04 | 截图08 |
| **Warning high pressure** | **Protective earthing** | **Measure the ground section** |

目录

[Content summary 2](#_Toc490576821)

[Chapter 1 Getting Started Guide 2](#_Toc490576822)

[1.1 To have a first realize about the front panel and user interface of ADO 2](#_Toc490576823)

[1.2 Probe 4](#_Toc490576824)

[1. The safety of the probe 4](#_Toc490576825)

[2. Probe compensation（ See detail in the probe manual, The factory has been calibrated ） 4](#_Toc490576826)

[Chapter 2 Introduction and operation of functions 5](#_Toc490576827)

[The main functional framework of the oscilloscope 5](#_Toc490576828)

[2.1 Automotive oscilloscope 5](#_Toc490576829)

[2.1.1 . Quick Operation Guide 6](#_Toc490576830)

[2.1.2 Ignition function 7](#_Toc490576831)

[2.1.3 Sensor function 17](#_Toc490576832)

[2.1.4 Actuator function 26](#_Toc490576833)

[2.1.5 Bus test 29](#_Toc490576834)

[2.2 Universal oscilloscope 31](#_Toc490576835)

[2.2.1 Menus and Control buttons 31](#_Toc490576836)

[2.2.2 Connector 32](#_Toc490576837)

[2.2.3 Automatic setting 32](#_Toc490576838)

[2.2.4 Default setting 33](#_Toc490576839)

[2.2.5 Vertical Systems 33](#_Toc490576840)

[2.2.6 Horizontal system 34](#_Toc490576841)

[2.2.7 Trigger system 36](#_Toc490576842)

[2.2.8 Math System 37](#_Toc490576843)

[2.2.9 System Setup 37](#_Toc490576844)

[2.2.10 The storage system 38](#_Toc490576845)

[Note: Do not use this oscilloscope (or multimeter) to measure when connecting to USB, as this may damage the instrument! 39](#_Toc490576846)

[2.3 Introduction and Operation of Oscilloscope Multimeter Function 40](#_Toc490576847)

[Chapter3 Application Examples 43](#_Toc490576848)

[3.1 Singal measure 43](#_Toc490576849)

[3.4 Use Multimeter to Measure DC Voltage: 45](#_Toc490576850)

[Chapter 4 System Tips and Troubleshooting 46](#_Toc490576851)

[4.1 Prompting Message 46](#_Toc490576852)

[4.2 Troubleshooting 46](#_Toc490576853)

[Chapter 5 service and support 47](#_Toc490576854)

[5.1 Warranty Description 47](#_Toc490576855)

[Appendix A: Technical Specifications 48](#_Toc490576856)

[Appendix B: ADO 102/ADO 104 oscilloscope accessories 49](#_Toc490576857)

[Appendix C: routine maintenance and cleaning 49](#_Toc490576858)

# Content summary

This manual major in making a introduce about the operation message of handheld automotive oscilloscope of ADO series, including the following sections：

* **Getting Started Guide：**

making a brief introduce about Digital handheld oscilloscope and multimeter front panel, user interface, function check and probe compensation.

* **Function introduction and operation：**

There is a brief introduce about function and operation of universal oscilloscope, car oscilloscope and multimeter

* **Application example:**

Provide some measurement examples for your reference.

* **System prompts and troubleshooting：**
* **Service and support：**
* **Appendix：**

# Chapter 1 Getting Started Guide

ADO series digital handheld storage oscilloscope is a small, lightweight portable instrument. It through a color display provide user with a portable operation and basic test .

This chapter focuses on how to perform the following tasks：

▲Getting to know the front panel and user interface of ADO

▲Implement probe compensation

▲ Match the probe attenuation factor

## 1.1 To have a first realize about the front panel and user interface of ADO

The first step to have a deep realize about the front panel of the oscilloscope, before using the ADO. The following is a simple description and introduction about the operation and function of ADO front panel , we hope it can help you to control our products in a short time.

To convenient operation , ADO’s front panel is marked with a Chinese menu. The left and right sides of the display on the panel are marked with various function keys. Use the up, down, left and right keys to set different options for the current menu and the red power button is used to control the machine on/off. Other buttons is the function keys, through them, you can enter a different function menu or directly get a specific function application. **As shown in Figure 1-1 and Figure 1-2.**

RUN/STOP

Channel 1-2

RUN/STOP

Multimeter

Zoom button

Move button

Back

F1-F4 multi-selector button



Figure 1-1 ADO102

RUN/STOP



Figure1-2ADO104

Channel1-4

Move the button

Trigger status display

Channel 1 mark

Show vertical volts / division

Display power

Horizontal displacement

Show the amount of the trigger position

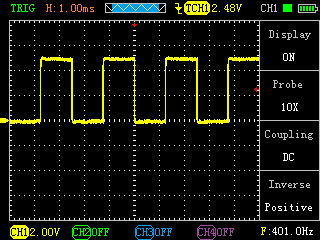
Channel operation status

Show horizontal time / div

Display

level  
Trigger position

Corresponds to a different function keys, menus will vary



Frequency waveform display

**Figure 1-3 Interface is shown in Figure**

## 1.2 Probe

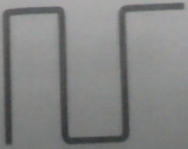
## The safety of the probe

The protection settings around the probe body can protect the finger from electrical shock. Before making any measurements, connect the probe to the oscilloscope and negative grounded (Note: must to keep the consistent on the attenuation of the probe and the oscilloscope )

## Probe compensation（ See detail in the probe manual, The factory has been calibrated ）

This adjustment is required in the first connection between probe and one of the Input channel ,it is a matching of Probe and input channel .The probe Without compensation correction may cause a test result of imprecise or wrong. In that case you need to adjust the probe compensation ,just as following step ：

1. First step to set probe option attenuation and switch meanwhile to 10x,,within the channel menu, and connect the probe with channel . If you use probe hook head, ensure reliable contact with the probe.
2. Connect the probe end to the output connector, connect the ground clip to the ground connector of the signal generator, display the channel, and press the "Auto" button.
3. Check the shape of the displayed waveform. See Figure 1-4.
4. If necessary, adjust the probe and repeat it if necessary.



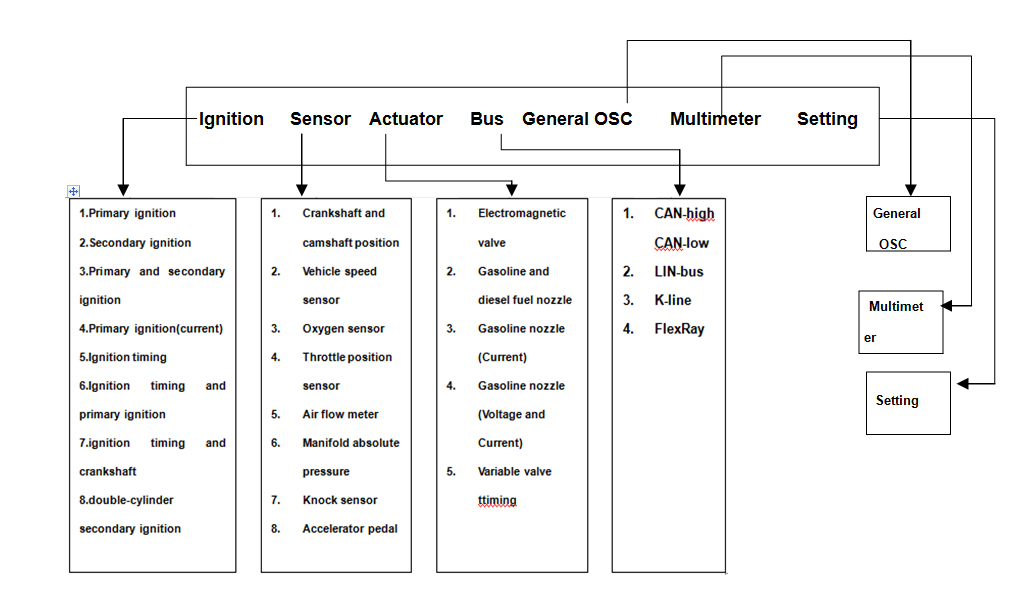
Over compensation

Compensation is appropriate

Less compensation

# Chapter 2 Introduction and operation of functions

## The main functional framework of the oscilloscope



**According to the functional framework, now we will to realize the AOD from three modules: car oscilloscope ,,general purpose oscilloscope, multimeter.**

## 2.1 Automotive oscilloscope

**Features introduce**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Ignition** |  | **Sensor** |  | **Actuator** |  | **Bus** |
|  |  |  |  |  |  |  |
| **1.****Primary ignition**  **2.Secondary ignition**  **3.Primary and secondary ignition**  **4.Primary ignition(current)**  **5.Ignition timing**  **6.Ignition timing and primary ignition**  **7.ignition timing and crankshaft**  **8.double-cylinder secondary ignition** |  | 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**   **Accelerator pedal** |  | 1. **Electromagnetic valve** 2. **Gasoline and diesel fuel nozzle** 3. **Gasoline nozzle (Current)** 4. **Gasoline nozzle (Voltage and Current)**   **Variable valve ttiming** |  | 1. **CAN-highCAN-low** 2. **LIN-bus** 3. **K-line**   **FlexRay** |

When the voltage signal voltage of measured signal is not clear , you could use multimeter function which contained in this series of oscilloscopes to test out it and then to set the oscilloscope and probe attenuation ratio. The text of the functional test with the measured model is Dodge Cool Granville 2.4L version. As the different car models measured waveforms are different, so there some differences may be exist. While measuring two kinds of signals, low frequency signal can be used as a trigger source to ensure the stability of the waveform. (Change the trigger source, press the trigger button to change)

* + 1. **. Quick Operation Guide**

Setting essentials：

|  |  |  |  |
| --- | --- | --- | --- |
|  | step1 |  | Step2 |
| (1)Setting waveform amplitude: | To select the corresponding channel |  | through the up and down keys to adjust |
| (2)The movement of the waveform: | |  |
| Up and down: | Select the corresponding channel | adjust through the left and right keys |
| left and right: | Press Time base key | adjust through the left and right keys |
| (3)Adjust the waveform density (time base): | press the time key | through the up and down keys to adjust |
| (4)Waveform freeze playback View: | press the start / stop key, then press the time base button, | moving the left and right keys to see whether have phenomenon of missing crankshaft |
|  |  |  |
| (5)Wave is difficult to capture: first press the trigger key, then by moving the "L"and"R" keys to control the right side of the screen red trigger arrow, the red trigger arrows move to the appropriate position of the waveform until the waveform stabilized, usually with the left zero potential or above A little bit of position. And the source of the trigger must be the corresponding channel, the position of the triggered arrow is marked on the right side of page 3. (Trigger function in the car circuit detection process is very frequent must be proficient); | | | |
| |  |  |  | | --- | --- | --- | | **Supplementary content** | | | | **Class 5 signals on the car circuit：** | | | | 1) DC signal (DC): | | such as the battery voltage control module (PCM) output sensor reference voltage; | | 2) AC signal (AC): | | abs speed sensor magnetic crankshaft and camshaft position sensor deflagration sensor; | | 3)frequency modulation signal: | | digital air flow sensor Hall-type speed sensor Hall crankshaft and camshaft position sensor; | | 4) pulse width modulation signal: | | primary ignition coil electronic ignition timing nozzle all kinds of solenoid valve; | | 5) Serial multiplex signal: | | CAN / LIN bus; | | **Automotive electronic signal of the five judgments based on** | | | | Amplitude： | the electronic signal at a certain instantaneous voltage; | | | Frequency： | the time between two events or cycles, usually the number of cycles per second (Hz) | | | Pulse width： | the time or duty cycle of the electronic signal | | | Shape： | the shape of the electronic signal characteristics; its curve and the rising edge of the rising edge. | | | Array: | the repetition of the composition of the specialized information signal | |   (6)If the difference among two frequency test signal is large,There may be a channel of the waveform shaking , this time you need to trigger the channel to a slower frequency of the signal source; If measuring the crankshaft and camshaft signal in the same time ; ch1 connect the crankshaft, ch2 connect the camshaft. Press the trigger button, then press F3, will trigger the source to ch2; moving left and right keys can control screen to the right of the red trigger arrow to fine-tune; | | | |
| (7) Remember the notes on the oscilloscope screen on page 3; | | | |

* + 1. **Ignition function**

**（1）Ignition Introduction**

**1）Ignition system type**

There is a long history of the use of traditional ignition systems with boards，Has now been gradually replaced by a direct ignition system (DIS).

Direct ignition system is divided into three types:

▲Double-ignition system (DEC) with double-ended output ignition coil.

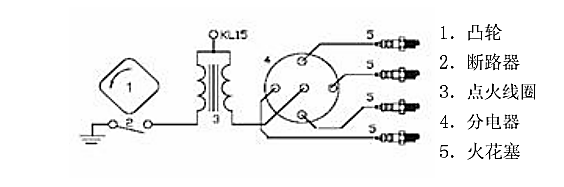
▲ single-ended output ignition coil using a single ignition system (CPC).

▲ Integrated Ignition System (COP) with integrated spark plugs.

The common feature of the three ignition systems is that the output of the ignition coil is delivered directly to the spark plug without passing the distributor.

**2）Traditional ignition system.**

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

 Traditional ignition system main consists by a battery, cam, breaker, ignition coil, distributor and spark plugs;

The role of the battery is the power required to supply the ignition system, cams and circuit breakers be used to control the ignition system power;

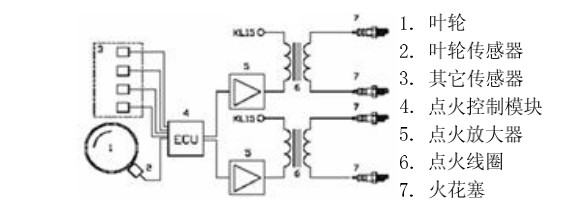
The ignition coil stores the ignition energy and converts the battery voltage to the ignition high voltage;

The role of the circuit breaker is to turn on or off the point coil primary circuit;

The role of the distributor is to transform the Ignition high pressure produced by fire coil to cylinder spark plugs according to the working order of the engine

The spark plug put ignition high pressure into the cylinder combustion chamber，and produce spark between the electrodes, then Ignite combustible mixture. The advantage of this ignition system is easy to maintenance and testing, but one of the shortcomings is mechanical parts and electrical contacts easy to wear, life is short, high-voltage connection is also easy to damage.

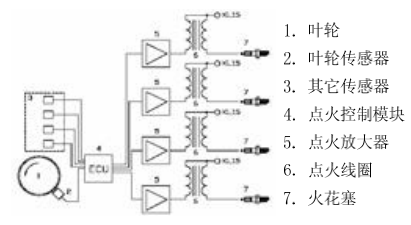
**3）DEC:**



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

The dual ignition system be consisted of electronic devices, without mechanical parts. Each two cylinders share an ignition coil，coil secondary two electrodes connect a spark plug separately. That’s mean there are two spark plugs at the same time ignition, one of the tanks in the normal ignition, the other cylinder is in the exhaust process(Spark spark "waste" in the exhaust)，The pressure in the exhaust of the cylinder close to the air pressure, so it just need a low Ignition voltage.

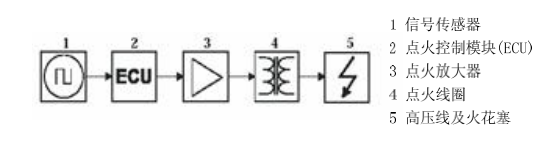
One of the advantages of a dual ignition system is the lack of failure , so seldom need to maintain, In addition it have a good adjust performance in Ignition system, like radio waves less, low fuel Consumption. The disadvantage is still need high voltage lines and spark plug connectors.

**4）CPC and 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 which is the most advanced ignition system today. This ignition system is divided into two types: CPC and COP. The integrated ignition system integrates the ignition coil on the spark plug , single ignition is followed by a high voltage line from the ignition coil to the spark plug.

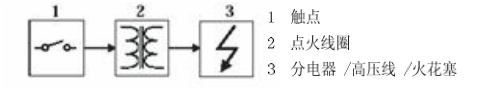
**5）Ignition principle**

**▲The electronic ignition**

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

Electronically controlled ignition through a set of sensors to collect information related to the engine，contain Speed, cooling temperature and engine load. Position sensors and speed sensors are the most important information for ignition systems, which come from Impeller sensor or camshaft sensor. According to this message , ignition control module can calculate the ignition time and charging time. If there is some sensor is not working may put out a wrong signal, so we need the modern control module to check the authenticity of signal put out by sensor. It is invalid to the ignition control module outputs the signal directly to drive the ignition coil，we need to enlarge the signal by ignition amplifier. In fact, the ignition amplifier is generally installed in the ignition coil, in this case the primary ignition signal is undetectable; Or installed in the ignition control moduleIn this case the output signal of the ignition control module is undetectable. Thus, it is particularly important to detect engine failures and performance through secondary ignition signals.

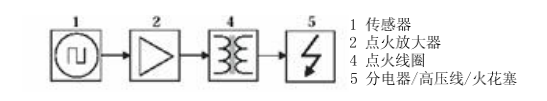
**▲Mechanical ignition system**



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

Contact-driven

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



Sensor-driven

In a mechanical ignition system, the charging time and ignition time are controlled by the distributor camshaft. The electrical sensor (Hall or magnetoelectric) or contact acts as a sensor.。The contacts can drive the ignition coil directly，And the electric transmitter to go through the ignition to drive the ignition coil.

**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) the correct broken line pin broken line as shown in the figure((except the secondary ignition,all of the other ignition need to broken line, the line to measure the secondary ignition directly to the ignition probe caught in the sub-line can be)**

****

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

**1）Primary ignition：**

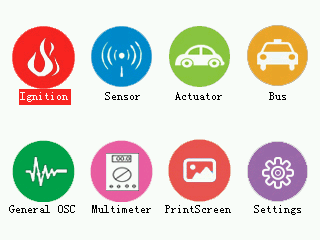
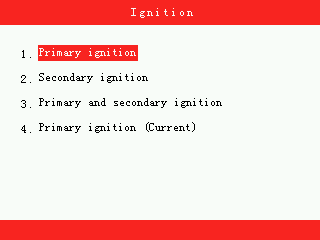
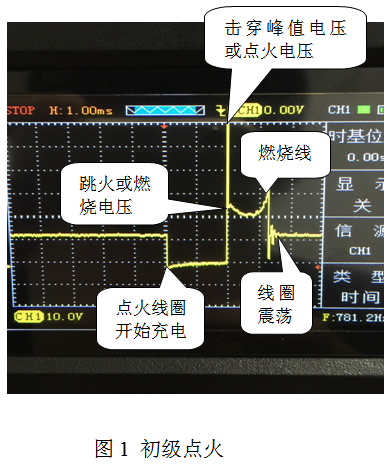


Figure 1 Figure 2



The figure is the Chrysler Dodge measured at idle time of the primary ignition voltage waveform. The starting voltage is 14V, the coupling mode is DC coupling, the starting voltage is the battery voltage. The coil began to charge, then the horizontal axis of the time base is 1ms, accounting for two cells, so the charging time is 2 milliseconds, an electromotive force is generated after power failure, the burning time is 1.1 ms. There are more than oscillating waveforms , Sasser is a Damped Sasser which produced by the mutual inductance among ignition primary coil and secondary coil , This waveform is a direct reflection of the working state of the two coils.

Breakdown voltage or ignition voltage peak

Burn line

Arcing or burning voltage

Oscillation coil

Ignition coil begins charging

Pic-1 Primary ignition

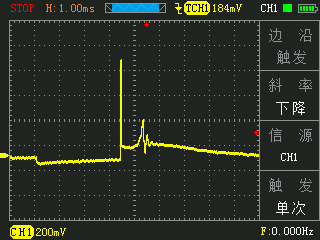
Note: Time base, vertical volt / grid adjustment, storage reference waveform and screenshots are separate located in the general oscilloscope function's horizontal system, vertical systems and storage systems , other operations copy the general operation of the oscilloscope.

When ignition , the coil secondary produces a high voltage. When the voltage gradually increased to a certain level, Spark plug put out spark, this voltage is the ignition voltage. The voltage then drops rapidly to another voltage and remains for a while，this is the combustion voltage，The burning time is the maintained voltage time at the combustion voltage. At the end of the burning, The energy in the ignition coil is substantially exhausted , the residual energy forms damping oscillations on the coil.

From the graph , you can analyze the vehicle's operating situation in detail. Ideally, the pattern is very stable which mean the voltage of each ignition process is the same. The graphics of each cylinder should be roughly similar. But in the real operation it is not so perfect , the shaking is always exist ,small or large ,in the graph. For example, Ignition or breakdown voltage is unstable, and the burning time may also be different, but that is not mean the engine is faulty. This situation may need me integrate the experience gained in past time ,and other graphics to make a comprehensive analysis. So it is a low probability event to catch a very ideal graphics in every test .

**Ignition or breakdown voltage:**

If the ignition voltage is too high, even beyond the screen range，which Indicate that the resistance value in the secondary ignition circuit is too high. There are many reason can produce the phenomenon of high breakdown voltage like: there is an open circuit in line , spark plug damage, high pressure line or spark plug gap is too large and so on . In contrast，If the breakdown voltage is too low, indicating that the resistance in the secondary circuit circuit resistance is lower than normal, this may caused by the follows reason : the spark may be too dirty or broken, high voltage leakage and others .

**Burning line and time:**

If there is too much clutter on the burning line, you need to check whether the cylinder bad ignition, ignition too early, the injector is damaged or the spark plug is dirty. The length of the duration of the combustion line is related to the concentration of the gas in the cylinder, normally, when the burning time more than 2ms means that the mixed gas is too thick. Conversely, if the burning time is less than 0.75 ms means mixture is too thin。

Currently, We use the sensor capacitive probe as Ignition probe. One end of the capacitor module is clamped on the cylinder line or on the ignition extension line, and the other end is grounded .The probe is marked as 10000:1, but in the actual measurement process found that the attenuation voltage has a certain difference, Usually at the position of the oscilloscope X1，factory default vertical Vog is 200mv / lattice, vertical volts about 200mv ~ 1v to fine-tuning（Press the corresponding channel ,and then up and down keys to adjust the value of the bottom left corner of the screen）Ensure that the breakdown voltage does not exceed the screen. The density of the waveform can be adjusted by time base, The factory default is 1ms, the coil charging time in milliseconds to calculate, EFI motorcycle time base units may be smaller.

**2）Secondary ignition**

**NOTE:**

* Independent ignition and high pressure ignition probe need to part with special ignition extension cable and ignition sensor probe respectively，connect the ignition probe to oscilloscope CH1.
* As the oscilloscope secondary ignition has been default set with Ignition system with sub - cylinder line (probe file 1X, time base file 1ms), Ignition probe with a capacitor (black small box) one folder in the sub-line line, the other end of the ground or access the battery negative. If the car is an independent ignition system, you will need to purchase an "independent ignition extension cord" (one end of the ignition coil package is a spark plug effect instead of the sub-cylinder line) when the ignition probe is caught on the independent ignition extension line.

**We all know that the engine ignition system is divided into three categories：**

First one :All cylinders share an ignition coil, the high voltage generated by the ignition coil is distributed to the spark plugs of the cylinders through the distributor. Early carburetor period and electronic control engine are used in this way.

Next one : The two cylinders share one ignition coil, like Elan , Teke Excelle. In four-cylinder engine, first and fourth cylinder share one ignition coil, second and third cylinder share one ignition coil.

Last one: Independent ignition which a spark ignition plug on each cylinder，This ignition system has three major advantages: 1. Strong energy of ignition 2. Good sealing and good anti-interference ability 3. Long life, now the car is basically this ignition system.

We know that the primary ignition waveform is generated by the primary coil, the secondary ignition waveform is generated by the secondary coil. Relatively, the primary ignition produces a low voltage, and the secondary ignition produces a high voltage of tens of thousands of volts. Note that the high pressure here is just a pulse signal which can break the spark plug electrode ignition cylinder mixed gas in a moment, just like the lighter is ignited，The high voltage million pressure will not cause harm to the person. No matter the voltage is primary ignition or the secondary ignition，its energy is from the 12V or 24V battery voltage through the primary coil generated by the primary voltage，through the secondary coil to produce secondary high voltage pressure.

**Note:**

The ignition extension cable connection and steps shown as below (ignition extension line to be purchased separately)



1、







**3) primary ignition, secondary ignition**

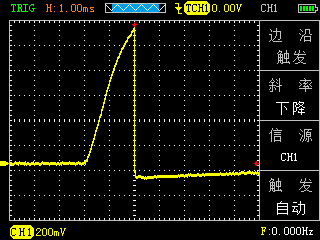
This function can achieve primary ignition, secondary ignition, through CH1 and CH2，to more intuitive observation and contrast two waveforms. Before you select the "primary ignition, secondary ignition" to get the user interface ,there will be prompted "CH1: primary use standard probe, CH2: secondary use of special ignition probe" , then waiting a seconds min you can enter the oscilloscope interface，For other specific operations please refer to the above primary, secondary ignition function.

Note: This function CH1 for the primary ignition, CH2 for the secondary ignition, pay attention to the probe connected to the channel.

The figure shows the current waveform of the primary ignition. When the current begins to flow into the ignition coil, the resulting waveform will rise at a certain slope due to the characteristics of the coil-specific resistance and inductance. The rising slope is a very important criterion. Usually the primary ignition waveform will rise at an angle about 60 °. At the same time in the same time base unit (1ms),the time of primary ignition current waveform coil power is same as the primary ignition voltage waveform coil charging time (about two cells) ,and the maximum current through about 5A ~ 6A. When the current of ignition module is turned off , the current waveform is almost vertical. It should be noted that when the current begins to flow into the ignition coil, observe the current waveform of the ignition coil, if the left is almost vertical rise, it shows the ignition coil resistance is too small (short circuit), this will cause driving performance failure, and will Damage the switching transistor in the ignition mode.

In addition, the time that the current waveform from the beginning to reach the peak is usually the same,, Which is due to the filling of a good ignition coil current, the time used is kept constant. The ECU can increase or decrease the turn-on time of the ignition coil through the ignition module to control the magnitude of the current flowing into the ignition coil Measuring current waveforms need to use the current clamp, current clamp straight clip signal line , oscilloscope set to X1 vertical stripe 200mv time base 1ms current clamp do not take anti or the waveform will be reversed. If you want to measure the current, we can recommend one or two relatively high cost of current clamp.

**4）Primary Ignition (Current)**

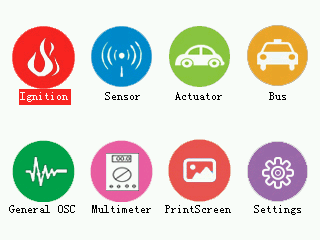
****

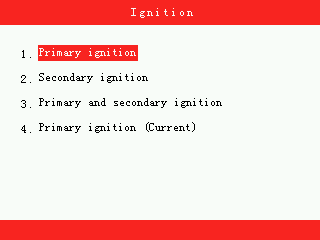
**Figure 3 how to use the current clamp**

**Figure 2**

* + 1. **Sensor function**

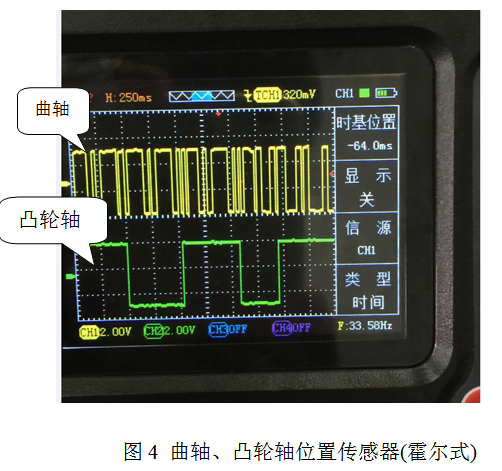
**1）Crankshaft, camshaft position sensor (magnetic type, Hall type)**





**Figure 2**

**Figure 1**



Crankshaft

Camshaft

pic-4 Crankshaft, camshaft position sensor（Hall）

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

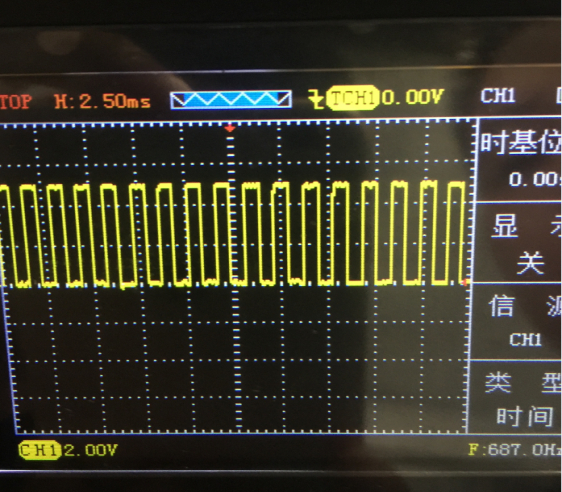
****

Figure 5 Hall-type vehicle speed sensor

**3）Oxygen sensor (zirconium, zircon oxygen before and after oxygen, titanium)**

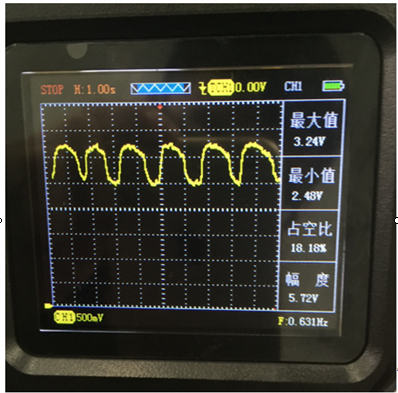
****

Figure 6 Titanium type oxygen sensor (idling conditions)

The range of the titanium oxygen sensor in the case is quite special；about 2.5V to 3.2V between the changes；This type of titanium oxygen sensor is the most common only in Chrysler's car. If there is question in the field , you can consulted professional professional Chrysler cars technical.

**NOTE：**

Oxygen sensors are also known as exhaust gas sensors，It plays a very important role in the exhaust emission control of vehicles equipped with catalytic converters. The oxygen sensor is mounted on the exhaust pipe before the catalyst. The voltage variation of the zirconium oxygen varies in the range of 0 to 5 V from 0 to 1 V, because the titanium oxide sensor requires a power supply voltage. A vehicle equipped with an oxygen sensor is called a "closed loop", meaning that after the fuel is burned, the sensor will analyze the exhaust emissions and re-adjust the engine oil according to the results..

Regardless of the number of wires between the oxygen sensor and the engine control module, the sensor output is always on the black line.

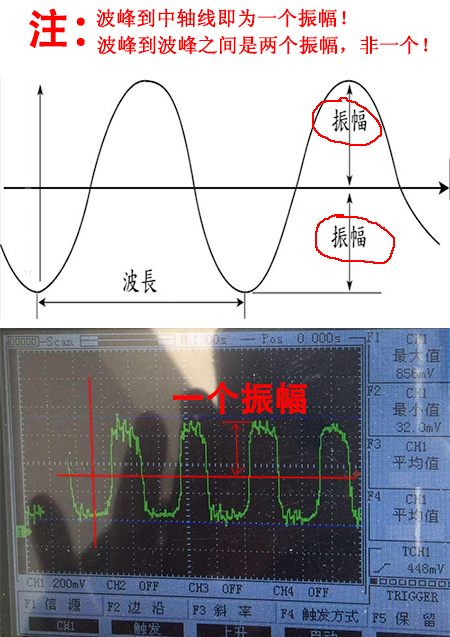
**Single line:** This line is used to output the sensor itself to generate voltage, usually black.

**Two lines:** one output line and one output ground wire.

**Three lines:** one output line and two heating lines (power and ground). The internal heating device increases the temperature during cold start to allow the car to be quickly controlled.

**Four lines:** a signal line and a signal ground wire. The other two are heating lines.

Zirconium oxygen sensor needs to reach more than 300 ℃ temperature to work properly, the oxygen sensor normal output feedback voltage between 0 ~ 1V change

0.5V above the output means the mixture air is too thick; 0.5V is a appropriate balance among thin and thick , 0.5V below the output that the mixture is too thin. The output voltage change indicates that the engine control module is changing the air-fuel ratio (air to fuel ratio, mixed gas concentration).  
 Normal zircon oxygen sensor output voltage waveform should meet the 3 elements: the highest voltage value, the minimum voltage value, the response time (voltage from high to low time). Normally, the permissible range is the maximum voltage value> 850mV, the minimum voltage value is 75 ~ 175mV, the response time is <100ms. . The requirement for waveform amplitude variation is not less than 8 times the amplitude of the waveform in 10 seconds, That is, in the case of time base 1S, the waveform reflects the change in the dilute concentration of the oxygen content in the exhaust gas 8 times ----- the change of the high and low voltage 8 times. The frequency of the oxygen sensor will be accelerated when accelerating. As shown in Figure 7 below.

One amplitude

Amplitude

Wavelength

Note: 1、The axis is a peak-to-amplitude

2、Peak to trough for the two amplitudes，not one

Start the engine, keep the engine speed 1500-2000rpm, after 3 minutes，Until the engine reaches the normal operating temperature，Because the engine must reach the normal operating temperature and enter the closed loop, the instrument read out the oxygen sensor signal is correct. When test oxygen sensor , oxygen sensor has power, but not see the waveform changes,, the cause of the failure may be as follows:

Pic-7 Zirconia oxygen sensor

● Poor connection

● Oxygen sensor failure

Amplitude

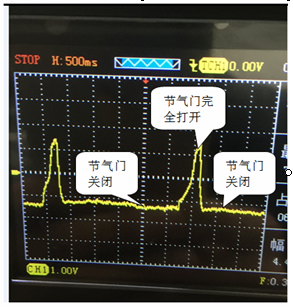
● Engine vacuum leak

● Poor fuel mix ratio control

Note: 1、The axis is a peak-to-amplitude

2、Peak to trough for the two amplitudes，not one

**4）Throttle position sensor (sliding resistance, Hall type, eddy current type)**

****

The throttle fully open

Throttle Close

Throttle Close

**NOTE：Turn on the ignition switch and do not start the engine**，Detect the throttle position sensor signal, slowly open and close the throttle, observe there is or without sudden wave or irregular change in waveform.When analyzing the throttle position sensor waveform, you should find out any abnormal waveforms in any signal waveform, For example, an instantaneous voltage drop may indicate that the sensor itself is wrong, damaged, or dirty.。And this is not normal signal waveform, but also easily lead to misjudgment of the oscilloscope, the vehicle failure. Most of the throttle position sensor, in the idle time, the voltage value should be below 1.25V, and the throttle fully open, the voltage should be 3.4V or more, and its voltage should be smooth changes without any surge or voltage drop and so on. When the ignition switch is turned on and the engine don't work , If the waveform does not change with the throttle opening,the cause may be as follows:

**● Poor connection**

**● The sensor itself is not good**

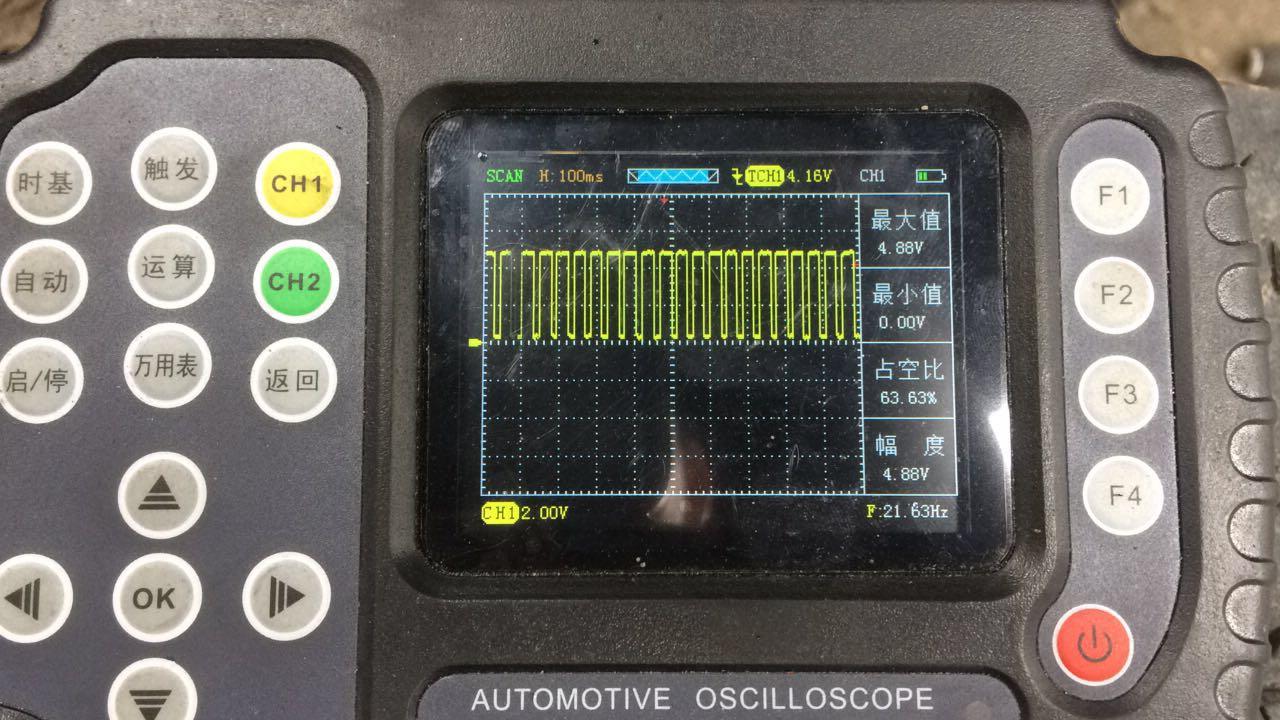
As shown in the following figure throttle position sensor of the anatomical map, the red key refers to the carbon film, in the throttle at different openings in the metal contacts on the carbon film trajectory will correspond to the corresponding changes in the output voltage. Usually the throttle position sensor voltage should be less than 1v from idle when the throttle is fully open when less than 5v. The waveform should not be broken up and down, the ground to the peak or large fall. the waveform of one of four in the throttle opening need to special attention which is a component that universally used in sensor carbon film in driving. The first one of eight to third of the Carbon film in front throttle is usually first worn out or carbon film off, causing the waveform to fall directly. Usually the throttle position sensor failure, will cause the engine idle operation is not normal(Such as idling too high or too low, idle instability, idle easy to turn off) or engine acceleration is not normal (such as acceleration when the engine shaking, speed up the reaction hysteresis, etc.)，And sometimes lead to the engine in the operation of intermittent jitter and so on.

**5）Air flow meter sensor**

**Note: The air flow meter is generally divided into analog air flow meter and digital air flow meter:**

**●Hot wire air film air flow meter**

The function of the air flow meter is to measure the air flow into the throttle body. The air flow into the throttle body varies with the engine speed. The analog air flow meter will convert the detected air flow to a voltage signal among 0-5V then sent to the oscilloscope. Start the engine, depress the accelerator pedal, then the air flow signal value be enlarged with the throttle opening increased.

In the idle should remain stable, when full throttle, the signal will rise to the maximum. Observe the abnormal phenomenon in the waveform signal, such as：Whether the waveform is smooth, with or without a sudden wave, the waveform shape suddenly deformed, usually between the oscilloscope and the sensor line, there is a bad contact situation, or the sensor itself bad line.

The sensor voltage output signal, which is usually the lowest at idle and increases as the engine load increases, typically about 800mv at idle and about 4.5V when the throttle is fully open.

●**Digital air flow meter**

The function of the digital air flow meter is to measure the air flow into the throttle body. The air flow into the throttle body varies with the engine speed. The digital air flow meter converts the detected air flow into a frequency signal. The higher the frequency signal, the greater the amount of air. Start the engine, this time will be displayed on the screen square wave graphics, if no waveform display, you may enter the analog air flow meter.

Observe the abnormal phenomena in the signal waveform, for example, whether the square wave waveform changes at right angles, or whether there is a sudden wave. Sensor frequency signal waveform suddenly changes, usually that the oscilloscope and the sensor line between the poor contact situation, or the sensor itself bad line.

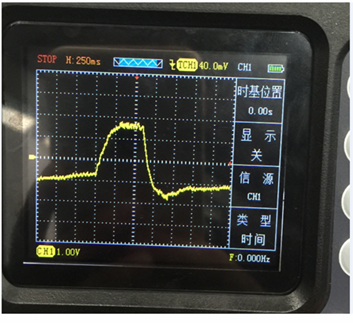
Digital air flow meter produces a neat square wave signal, different air flow will correspond to different waveforms of the duty cycle. We refer to these signals as frequency modulation signals. To tap the sensor while ignition key is turned on and the engine does not start. If the waveform change that mean the air flow meter sensor itself is bad, or the line has short circuit or open circuit.

Air flow meter sensor signal generated by the frequency signal, the frequency is how many square wave per second signal. In normally, the frequency signal value independent generated by air flow meter sensor and engine fixed speed does not change much, If the fluctuation range is too large, it means that the air flow meter sensor is not good. If the air flow meter is detected, the air flow meter has a power supply but does not change the waveform. The cause of the malfunction may be as follows.

●**The oscilloscope does not receive the signal from the air flow meter**

**●The sensor itself is unstable**

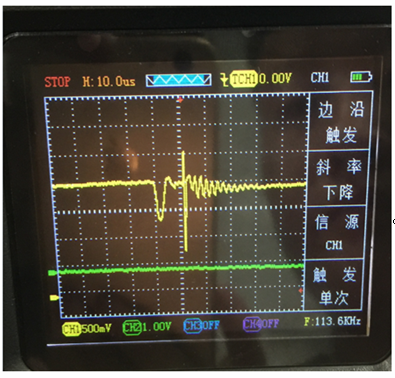
**6）Intake manifold absolute pressure sensor**

****

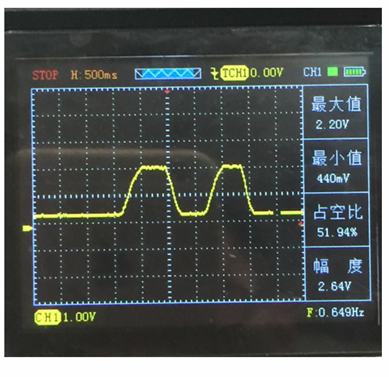
* Figure 9

**Idle speed**

**7）Detonation sensor**

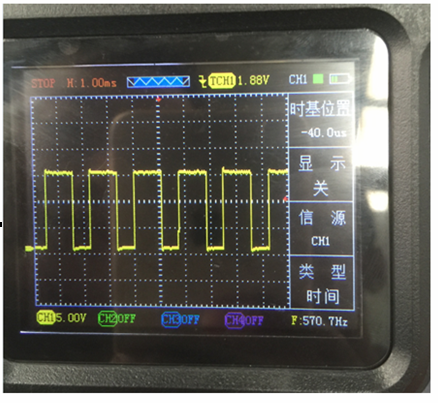
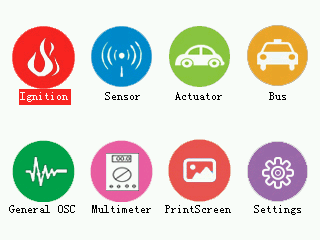
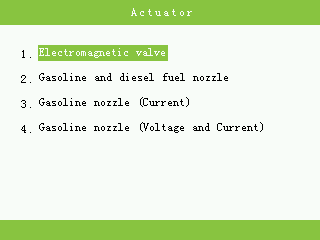


**8）Accelerator**



* + 1. **Actuator function**

**1）The electromagnetic valve**

****

**2）Gasoline, diesel fuel injectors**

**3）Gasoline injector (current)**

**4）Gasoline injector (voltage, current)**

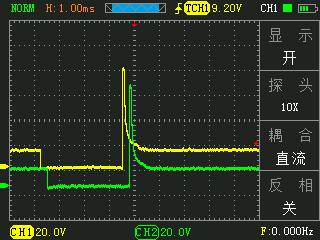
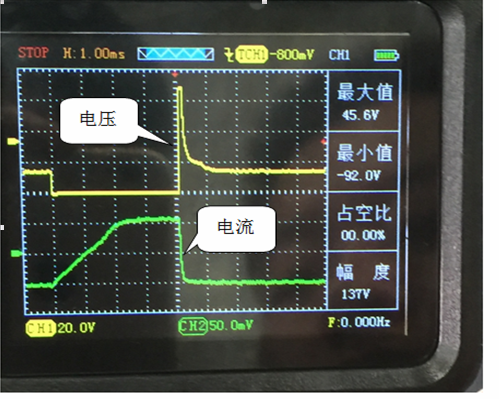
![7%J{LLM0}M@](B6CTS$RXU2](data:image/jpeg;base64,)

Figure 13 Saturated switch type gasoline injector (voltage, current)

****

Voltage

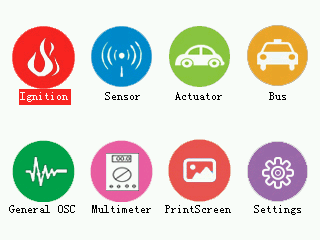
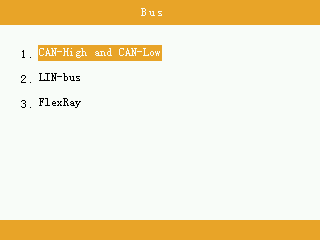
Zero potential

Current

Note: The waveform has a rectangular concave which is the fuel injection time (fuel injection pulse width). The injection time of the voltage waveform in the figure is consistent with the rise time of the current waveform. Solenoid valve will produce an induced electromotive force after cut its power, which is the normal performance of the coil work. the current waveform has a rise shown about a 45 °angle, a sharp rise indicates a short circuit of the solenoid valve coil.

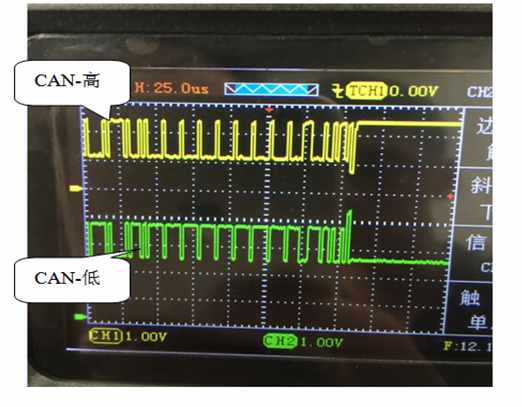
* + 1. **Bus test**

**1）CAN-high, CAN-low**



**Picture-1**

**Picture-2**



CAN- low

**Pic-14 CAN-high, CAN-low**

CAN- high

**Pic-14 CAN-high, CAN-low**

**Pic-14 CAN-high, CAN-low**

**Pic-14 CAN-high, CAN-low**

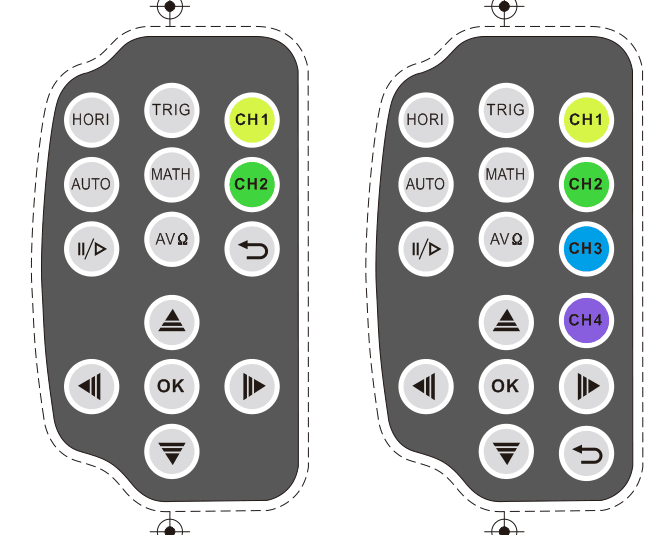
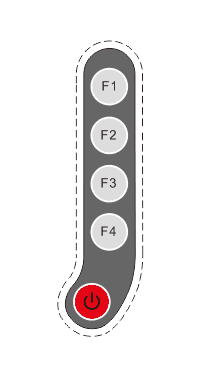
**2) LIN-bus**

**3) FlexRay**

## Universal oscilloscope

* + 1. **Menus and Control buttons**

As shown in the following figure:

**ADO102 control button**   **ADO104 control button ADO General Button**

**All models**

|  |  |
| --- | --- |
| Time base | The "Horizontal" control menu is displayed |
| trigger | Show the “trigger” control menu |
| CH1、CH2  CH3、CH4 | Display the setting menu “CH1、CH2CH3、CH4” |
| automatic | Automatic setting the oscilloscope control state，press the Channel 1 to 4 to achieve the One-touch trigger function of 20 HZ-10 MHZ |
| Start / stop | Continuous acquisition of waveforms or stop acquisition.  Note: In the stop state, for the waveform vertical and horizontal time base can be adjusted within a certain range, equivalent to the signal in the horizontal or vertical direction of the expansion |
| multimeter | Press "multimeter" to enter multimeter mode |
| return | Press "Back" to return to the previous menu |
| 截图11截图11 | Oscilloscope for zooming in, zooming out, or moving the display cursor; used in the multimeter function to adjust the range |
| 截图11截图11 | The oscilloscope can be used to move the waveform or move the display cursor; used as a selection test type in the multimeter function |
| OK | Function confirmation key |
| F1、F2、F3、  F4 | Respectively, select the settings in the first 1,2,3,4 option menu |
|  | Oscilloscope on / off key |

* + 1. **Connector**

CH4 CH3 CH2 CH1

COM

V**Ω**

CH2 CH1

COM

V**Ω**

**** 

**ADO102 ADO104**

**Figure 2-1**   **Figure 2-1**

* CH1-CH4: Input connection for displaying waveforms.
* "COM port" and "VΩ port" are used to connect black and red test leads
  + 1. **Automatic setting**

ADO series digital storage oscilloscope with automatic setting function. so it can automatically adjust the voltage range, time base, and the trigger mode to the best form display according to the input signal, . The "Auto" button is the function button that is set automatically.

●If multiple channels have a signal, the channel with the lowest frequency signal is used as the trigger source.

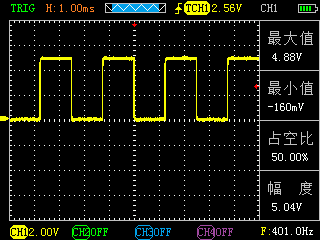
●If no signal is found, connect channel 1 to a signal and press the "Auto" button. As shown in Figure 2-3:

Figure 2-3:

* + 1. **Default setting**

Before the oscilloscope be sent to the market ,it has been setting to routine operation (default setting),there is a "Factory mode recovery" operation in the main menu of system setting ,select "Restore Factory" then press "ok" (by Up and down keys) ,the instrument can saved and returned to the factory settings, restart the instrument can be used.

* + 1. **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 |

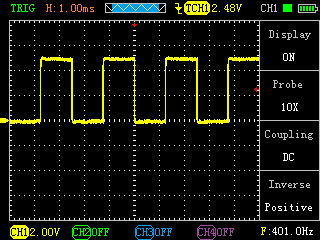
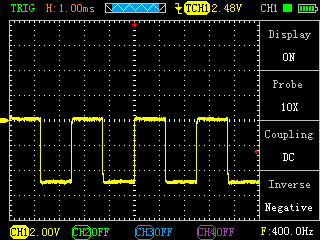
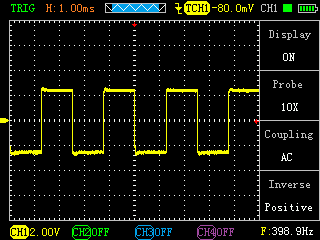
**1). Set the channel coupling and reverse**

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

●Main menu, select "Universal oscilloscope" press "OK" to enter the oscilloscope interface. 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

****

**Figure 2-4**  **Figure 2-5 Figure 2-6**

**2).Probe scale setting**

To cope with the attenuation factor setting of the probe, 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:

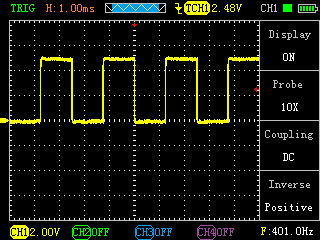
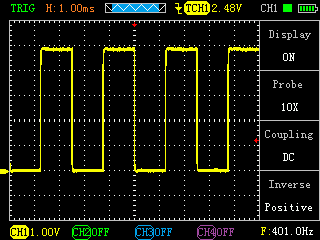
● Press "CH1" → "F2" to set the probe ratio for 10X.

**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:

截图11截图11截图11截图11● 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

**Figure 2-7 Figure 2-8**

* + 1. **Horizontal system**

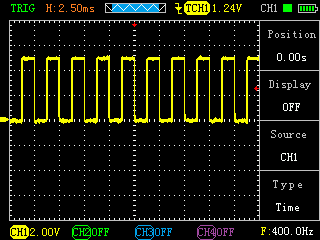
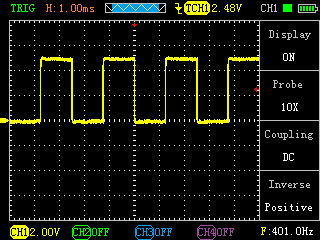
Using the control buttons to change the level of the horizontal scale (time base), trigger horizontal position (trigger position) in storage . Changing the horizontal scale will causes the waveform expansion or contraction relative to the screen center, Change the horizontal position relative to the 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:**

截图11截图11 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



**Figure 2-9 Figure 2-10**

**● Horizontal Position:**

截图11截图11Adjust 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 resolution of the button is changed with time base. Press "AUTO" key can make the horizontal position return to zero.

●Cursor measurement:

截图11截图11截图11截图11 Adjust the measurement, press the " HORI " keys, press "F2-F4" respectively to select the corresponding function (display, source, type), and then press the " HORI " on the to enter the cursor display interface, and then " " " " or " ", " " key to adjust the cursor position.

* + 1. **Trigger system**

The trigger determines the time that 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 | Select the trigger signal to trigger on the rising edge |
| DOWN | 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 |

Operating instructions (example channel 1):

* Set the trigger level:

截图11截图11截图11截图11截图11截图11.Main menu, select "Universal oscilloscope" press "OK" to enter the oscilloscope interface .Press "CH1", then press" "or" "adjusts channel 1 mark. Press the "TRIG", then press" "" "or" "" "adjust the trigger flag arrow, The trigger level is set according to the trigger flag relative to the channel 1 flag position and the voltage value represented by each cell in the current vertical direction.

* Set source:

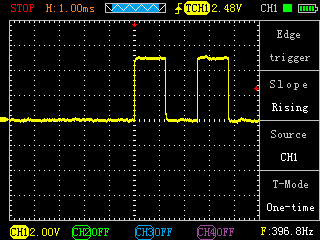
Press the "F3" key to select the source (CH1-CH4)

* Set slope:

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

* Set the trigger mode

Press "F4" to select "Auto", "Normal" or "Single".

* Auto: The waveform is refreshed regardless of whether or not the trigger conditions are met.
* Normal: The waveform is refreshed when the condition is satisfied and the trigger condition is not satisfied.( Do not refresh the wait for the next trigger event.)
* Single: Collect the waveform once it meets the trigger condition and then stop it. As shown in Figure 2-11

**Figure 2-11**

* + 1. **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.

* + 1. **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" 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.

1. 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.

1. 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.

1. 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.

1. 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.

* + 1. **The storage system**

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

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 and parameters are stored and can be called out by "reference waveform" respectively, displayed on the screen.

**To save a reference waveform:**

**To save a picture:**

**Note: screenshot function can save about 20 pictures,the actual amount depend on the size of the memory decision, if prompted to screenshot failure, re-screenshots look, if it doesn't worke then look at the memory can delete a few pictures.**

**View storage oscilloscope image method:**

1. **view on computer**
2. **view on oscilloscope:**

enter the main menu to select screenshot function to enter Screenshot preview function ,you can view storage oscilloscope image. Press the "OK" key to select the screenshot, press any key to return to the screenshot list, "F3" key to delete the currently selected screenshot, "F4" key to delete all screenshots.

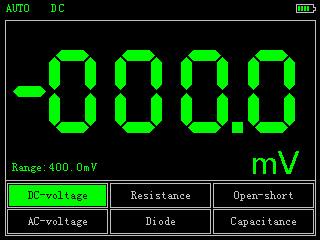
## Note: Do not use this oscilloscope (or multimeter) to measure when connecting to USB, as this may damage the instrument!

## 2.3 Introduction and Operation of Oscilloscope Multimeter Function

This series of oscilloscopes not only can be used as oscilloscope but also to mutimeter . The function of digital multimetercan be used to test the DC and AC voltage, resistance, capacitance, diodes, buzzer on-off . This instrument uses TFT full color display, and has a range display, polarity display, overload display, battery power display.

**Table 2-6 multimeter range**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | | |



DC or AC

Electricity

Running state

Display manually or automatically

DC or AC

Electricity

Running state

Display manually or automatically

DC or AC

Electricity

Running state

Display manually or automatically

**Meter Interface**

**Meter Interface**

**Meter Interface**

**Measure Method:**

**Table2-7 Multimeter** Operation Key Function

|  |  |
| --- | --- |
| **Key** | **Description** |
| **Multimeter** | Press this key to enter Multimeter Mode. |
| 截图11截图11 | 截图11截图11Press “ ” or “ ” to select Mesure Type |
| 截图11截图11 | 截图11截图11Press “ ” or “ ” to tune the Range |
|  | Multimeter’s RUN/HOLD key. |

**Note 1:** Multimeter default range is "automatic" file, if you want to manually set the range, please predict the size of the voltage to be measured.

**Note 2:** "RS232" in the display interface is flashing to indicate that the multimeter is running; "AUTO" means setting the range automatically

**（1）DC and AC voltage measurement**

**（2）Resistance measurement**

**（3）Capacitance measurement**

**Note: The scale can not be set manually**

**（4）Diode and continuity test**

**Attention:**

1. The device has forward and reverse voltae, when the diode connected reversed, the value is negative.
2. Diode and Buzzer-off mearusing only have “Auto” Range.
3. When measuring,must keep “Sound” On, or the Buzzer can’t alarm.

**Ways to setup:**

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

1. **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.

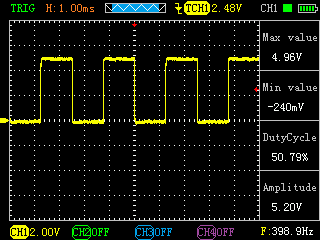
**Waring 2:** Please select the appropriate Range before measure object.

**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

Measuring an unknown signalman and show it’s value immediately. Quickly display and measure the frequency and peak-to-peak values of the signal

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

**Figure 3-1**

The OSC will automatically set the optimum waveform display to get the super performance. On the base , you can adjust the Vertical or Horizontal scale, until the waveform meets your requirements.

**● running the auto measure of signal voltage and time parameters：**

The digital storage oscilloscope allows automatic measurement of most display signals.

Parameter values (maximum, minimum, duty, amplitude, period), follow these steps:

**3.2 Cursor measure**

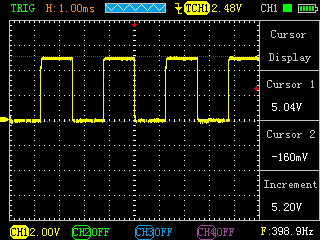
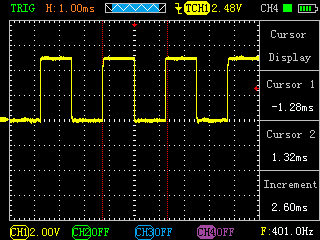
This OSC can automatic measure a variety of waveformparameters. All measurement parameters can be measured by the cursor.Use the cursor and measure the waveform parameters quickly

● 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:

截图11截图11截图11截图11

Note: If you use the cursor to measure the time, only in the second step above, set the cursor type to time

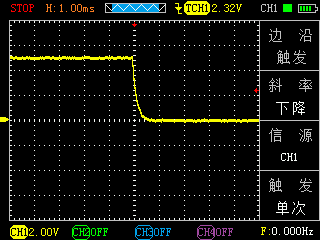


**Figure 3-2 Figure3-3**

**3.3 Capture the Single Signal**

The advantage and feature of digital storage oscilloscope is capture the Aperiodic signal like pulse, burr in Conveniently. If we need to capture a unit signal , first of all need to have a certain prior knowledge of this signal in order to set the trigger level and trigger edge. If the signal is not sure the situation, you can automatically or normal trigger mode to observe the first to determine the trigger level and trigger edge.

**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”.

Figure 3-4

1. Press “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 ，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:

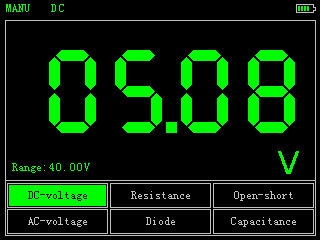
* Use “AUTO” measure DC Voltage.

1. Press “AVΩ”key, enter Multimeter mode, Auto range default.
2. 截图11截图11Press “ ” or “ ” to select “DC Voltage”
3. Put the pen on the test point, and it will read The value see Figure 3-5.

**Figure 3-5**

* Set the Voltage Range manually.

1. 截图11截图11Press “ ” or “ ” to select “DC”
2. 截图11截图11Press “ ” or “ ” to adjust the range.See figure 3-6.



**Figure 3-6**

**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.

1. **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 - Two dedicated

ignition probe (Found 1: 3000) 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.**