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## Precaution on Operation

- The appliance is a sophisticated electronic device, never have it clashed when in use.
- Main unit screen may flash at the moment of engine ignition, which is normal.
- You may unplug the main unit if the program can not be actuated or confused screen occurs. Plug again to continue the operation.
- Make sure the appliance is properly connected to the DLC to avoid communication interruptions.
- During operation, keep the screen upward and leveled.
- Be careful when plugging and unplugging the main cable and diagnostic connector. Tighten the screw before operation to avoid unexpected disconnecting and/or damage to the port.
- Handle with care. Avoid collision. Unplug the power after operation.
- Do not insert or pull the GDS card when the main unit is powered on.
- After the operation, the stylus shall be inserted into the hole on the back of the main unit, and put away the cable and connector, etc accessories to the box to avoid the lost.
- Unplug the power cable by holding the connector, not the cable itself.

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# 1 Foreword

## 1.1 Introductions

X-431 GDS is a new generation of sophisticated and integrated automotive diagnostic product with colorful screen and powerful functions developed by LAUNCH, and Scopebox is an optional function box for GDS, including automotive oscilloscope and automotive ignition waveform.

Automotive oscilloscope can make the auto repair technician quickly judged the faults on automotive electronic equipment and wiring, and the oscilloscope sweep speed is far greater than the signal frequency of such vehicles, usually 5-10 times of the measured signal. The automotive oscilloscope not only can quickly capture the circuit signal, but also can slowly display the waveform to observe and analyze. It can also record and store the tested signal waveform which can be played back to observe for the fast signal, having great convenience to failure analysis. Either high-speed signal (e.g.: injection nozzle, intermittent fault signal) or the slow-speed signal (e.g. the throttle position change and the oxygen sensor signal) can be observed through automotive oscilloscope in an appropriate waveform.

The electronic signal can be compared and judged via measuring five parameters indexes. The five parameters indexes are the amplitude (the maximum voltage of signal), the frequency (the cycle

time of signal), the shape (the appearance of signal), the pulse width (the duty cycle or the time range of signal), and the array (the repetition characteristic of signal), which can be tested, displayed, saved by the automotive oscilloscope. Via the waveform analysis can further detect the circuit fault on sensors, actuators, circuits, and electronic control units, etc.

## **1.2 Product features**

- Rapidly capture the circuit signal.
- Display waveform slowly for observation and analysis.
- Record and store the tested signal waveform for playback and failure analysis.
- Detect, display and store all the electrical signal of five parameters, namely amplitude, frequency, shape, pulse width, and array.

## **1.3 Product function**

Provides specialized automotive oscilloscope function and supports ignition waveform analysis.

## **1.4 Technical parameters**

Scopebox: 4 channels, highest sampling frequency 150MHZ, max storage depth 64MSa, 8-bit resolution



## 2 Structure and Accessories

### 2.1 Scopebox structure



Fig 2-1 Scopebox Structure Diagram

Table 2-1 shows the ports and indicators for X-431 GDS Scopebox

No.	Name	Description
1	CH1	Channel 1
2	CH2	Channel 2
3	CH3	Channel 3
4	CH4	Channel 4
5	External trigger	External trigger signal



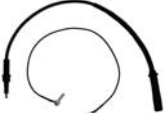



6	Fixed signal generator	Generate a square signal with fixed 1K frequency
7	Power indicator	Oscilloscope power indicator, which will be steady red after the oscilloscope is powered on
8	Operating indicator	The indicator will be steady green after the oscilloscope operated.
9	Communication indicator	After the data communication, the indicator will blink (Green).
10	Power interface	Connect to power supply via the power adapter.
11	B-shaped USB interface	Connect main unit via USB connect line as separated individual USB devices

## 2.2 Scopebox accessories

Scopebox includes the secondary pickup cable for 4-channel oscilloscope, crocodile clips for 4-channel oscilloscope, etc. See Table 2-2.

As the product configuration can be different, the accessories included with the product may differ from the accessories listed on this manual. Please see the packing list attached to the product for the detailed accessories.

Table 2-2 Accessory checklist

No.	Name	Picture
1	Secondary ignition pickup for 4-channel oscilloscope	 A black cable with a BNC connector on one end and a metal pickup probe on the other.
2	Crocodile clips for 4-channel Oscilloscope	 Two alligator clips, one red and one black.
3	Direct ignition extension cord	 A black cable with a BNC connector on one end and a metal pickup probe on the other.
4	6-way universal guide line for 4-channel oscilloscope	 A black cable with six colored wires (red, yellow, blue, green, black, white) protruding from one end.
5	BNC to 4mm connector test cable	 A black cable with a BNC connector on one end and a 4mm connector on the other.
6	Pin connector for 4-channel oscilloscope	 Five different colored pin connectors (black, yellow, blue, red, green) with metal pins.

## 3 Automotive Oscilloscope

### 3.1 Connection

X-431 GDS Scopebox should work with the X431 GDS main unit.

1. Firstly, power on the main unit (Connect one end of the power adaptor into the power interface of main unit, and the other end to the DC 12V power supply. Alternatively it can be also powered by cigarette lighter cable and double clip power cord).
2. Then plug one end of ground cable of oscilloscope into external trigger channel (GND), the other end should be grounded.
3. Connect one end of probe cable of oscilloscope to the CH1, CH2, CH3, or CH4 on oscilloscope module, and then connect the other end to related signal terminal.

**Warning:** please use the specific capacitance probe when diagnosing the ignition high voltage line. Never connect the oscilloscope to the ignition secondary circuit directly.

### 3.2 Initial interface introduction

Fig. 3-1 displays the initial interface of oscilloscope.

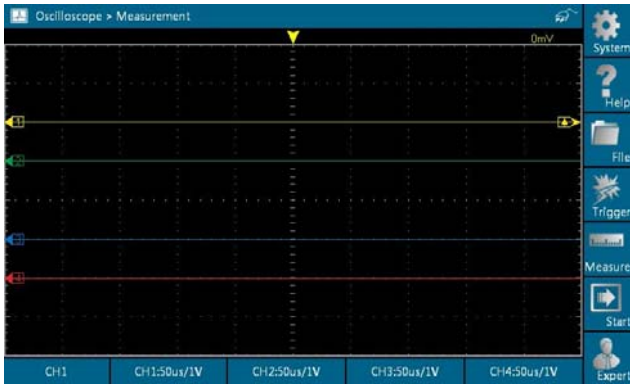


Fig.3-1

**Button descriptions:**

**[System]:** includes show desktop, Wi-Fi setting, current version and exit the program.

**[Help]:** displays help files.

**[File]:** supports import waveform, store waveform, store graphics, record waveform, print waveform, show/hide the grid, display cached interface, turn pages, and clear.

**[Trigger]:** The following options are available: one-channel trigger / alternation trigger, trigger channel source, trigger types, trigger modes, horizontal trigger hold-off setting and auto calibration.

**[Measure]:** measures the time and the voltage for the waveforms.

**[Start/stop]:** starts/stops collecting oscilloscope waveforms.

**[Expert]:** provides automatic pre-setting function of specialized sensors.

## 3.3 Operations

### 3.3.1 Channel selection and attributes setting

#### <1> Channel selection

There are two ways available for channel selection.

- A. Select from the channel menu;
- B. Select via each channel attribute button.

See Fig. 3-2.

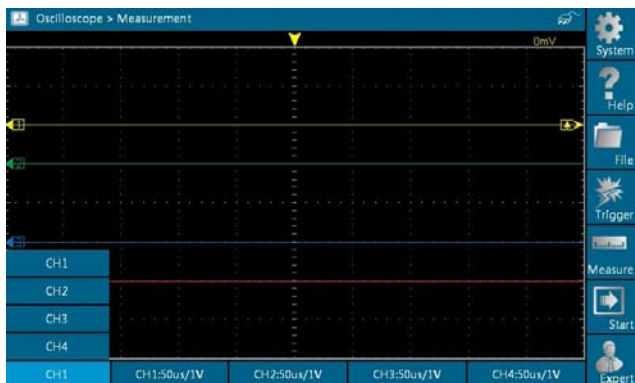


Fig.3-2

#### <2> Channel attributes setting

Each channel features five attributes.

- A. Channel switch selection.
- B. Channel voltage adjustment: + indicates increase voltage by one level, while - indicates decrease voltage by one level.
- C. Channel time-base adjustment: + means to increase time-base

by one level and – means to decrease time-base by one level.

D. Channel phase selection: normal phase or reverse phase.

E. Channel coupling modes selection: DC, AC, or Ground.

See Fig. 3-3 and Fig. 3-4 for channel 1 & channel 4 attributes setting interfaces respectively.

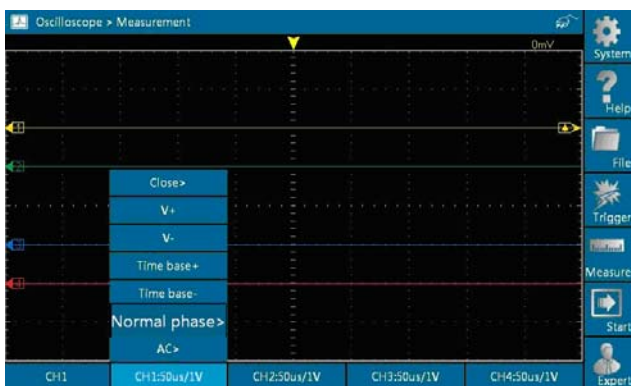


Fig.3-3 Channel 1 attributes setting

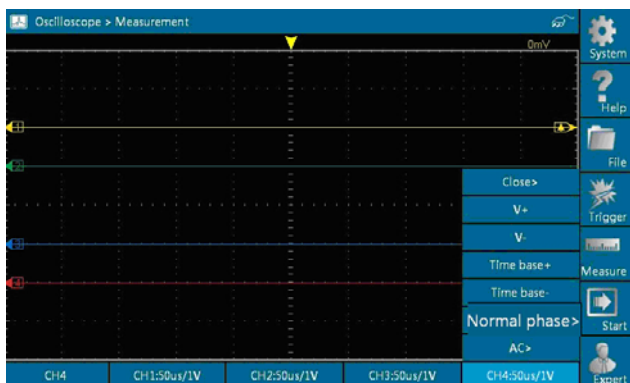


Fig.3-4 Channel 4 attributes setting

### 3.3.2 Trigger setting

#### <1> Trigger source

Single channel trigger and alternation trigger are included.

[Single channel trigger]: collects all channels data by triggering one channel;

[Alternation trigger]: Each channel collects data separately based on its own channel triggering, only for AUTO mode.

Fig. 3-5 and Fig. 3-6 show single channel trigger & alternation trigger setting interfaces.



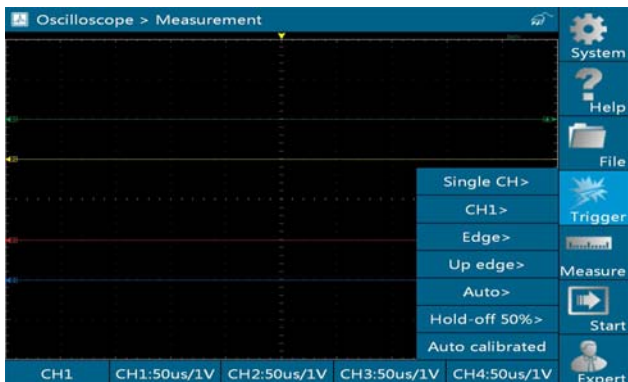


Fig.3-5 Single channel trigger

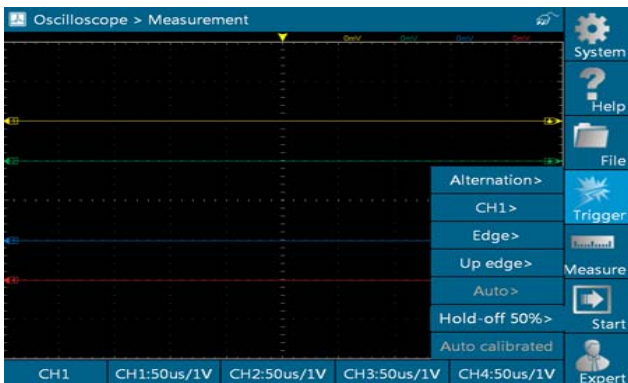


Fig.3-6 Alternation trigger

## <2> Trigger channel

To set trigger mode and voltage for one channel, please select this channel first. See button [Trigger].

### <3> Trigger type

Includes edge trigger and pulse trigger, see button [Time base].

[Edge trigger]: Touch [edge] to select rising edge or falling edge;

[Pulse trigger]: Touch button [pulse] to select. There are 6 modes available.

### <4> Trigger mode

It falls into: Auto, Normal and Single trigger. See button [Auto].

[Auto]: continuous trigger. Automatically trigger when it meets the trigger conditions; otherwise, the trigger will be forced by system;

[Normal]: continuous trigger. Trigger only when the trigger conditions are met, or else trigger does not happen.

[Single]: single trigger. Only trigger once when the trigger conditions are met.

### <5> Horizontal trigger hold-off setting

This option allows you to set the horizontal trigger position of the oscilloscope. It can be set by clicking the trigger icon directly or through the menu. See Fig. 3-7.

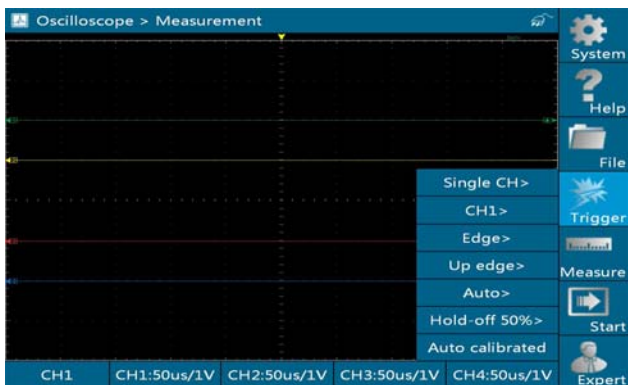


Fig.3-7

In Fig. 3-7, the yellow inverted triangle is the horizontal hold-off pointer. Button [Hold-off 50%] can coarsely tune the horizontal trigger, and make fine adjustment in the horizontal trigger hold-off zone.

#### <6> Auto calibration

Click [Auto calibrated] button, the oscilloscope will perform automatic calibration. [Auto calibrated] button will be temporarily invalid during calibrating. Once it becomes active, it indicates calibration has completed. See Fig. 3-8.

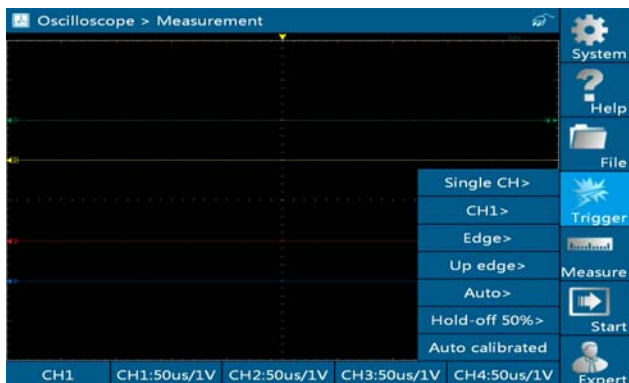


Fig .3-8

### 3.3.3 Channel measurement

#### <1> Timebase measurement

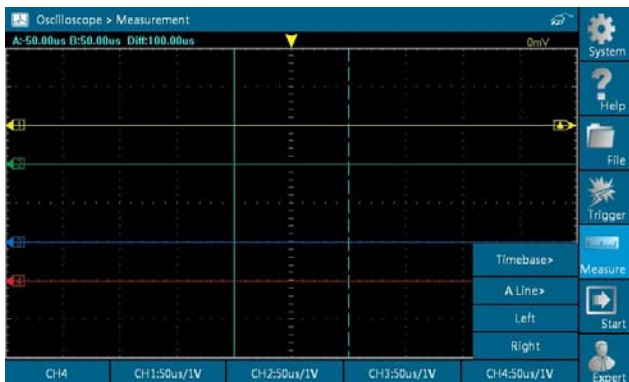


Fig.3-9

**Button descriptions:**

**[Timebase]:** used to select mode. When it is displayed as timebase, it is in time measurement mode;

**[A line]:** enables you to select A\B measurement line. The currently selected line is a solid line;

Left\Right move: fine adjustment button for timebase;

A\B line: time measurement line;

Measurement value display area: an area for displaying time measurement result.

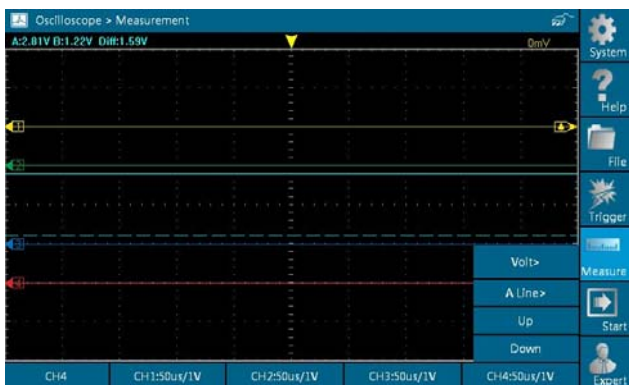
**<2> Voltage measurement**

Fig.3-10

**Button descriptions:**

**[Voltage]:** used to select mode. When it is displayed as Volt, it is in voltage measurement mode;

[A line]: enables you to select A/B measurement line. The currently selected line is a solid line;

[Up/Down]: fine adjustment button for voltage.

### 3.3.4 Expert settings

This option is specially designed to measure related vehicle sensors. After selecting one sensor, the oscilloscope will be preset based on preset value of this sensor.

Click [Expert] to enter the expert setting interface. See Fig.3-11.

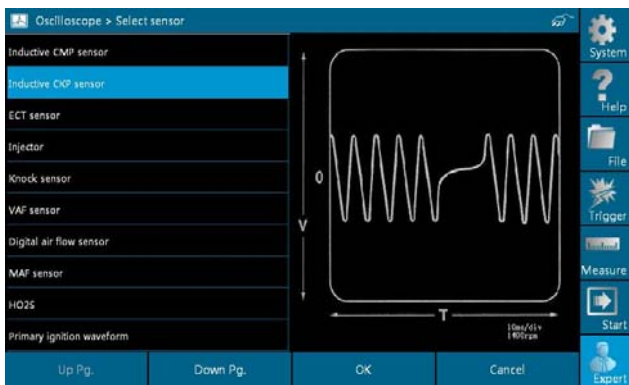


Fig.3-11

In Fig.3-11, left side lists sensor list and right side displays current sample waveform of selected sensor.

### 3.3.4 File management

#### <1> Store picture

This option is designed to save the currently displayed waveforms as graphic file. It can be performed when the oscilloscope stops collecting data.

Touch [File], then select [Store picture] from the pull-down list. See Fig. 3-12.



Fig.3-12

#### <2> Store waveform

This item is to save the currently displayed waveforms as data file which can be played back by oscilloscope. It can be performed when the oscilloscope stops collecting data.

Touch [File], then select [Store waveform] from the pull-down list. See Fig. 3-13.



Fig.3-13

### <3> Record waveform

This function is used to record waveforms that are collected by oscilloscope at a period, and save it as data file which can be played back in future.

It can be performed when the oscilloscope stops collecting data.

Touch [File], then select [Record] from the pull-down list to start recording. See Fig. 3-14.





Fig.3-14

[Record/Stop]: starts / stops recording. While recording, the recorded pages will be shown on the screen.

#### <4> Import waveform for playback

The Import function enables you to import the stored waveform file for playback and review. It only works when the oscilloscope stops collecting data.

Click [File], then select [Import] from the pull-down list. See Fig. 3-15.

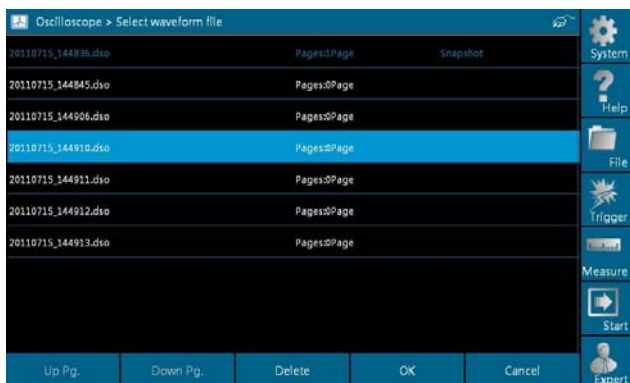


Fig.3-15

To delete a waveform file, please select it first, then touch [Delete] button.

Click [OK] button to open the waveform file, then use channel attributes setting to adjust the waveform display, or touch [File] ->[Pre Pg.] [Next Pg.] to turn pages. See Fig. 3-16.

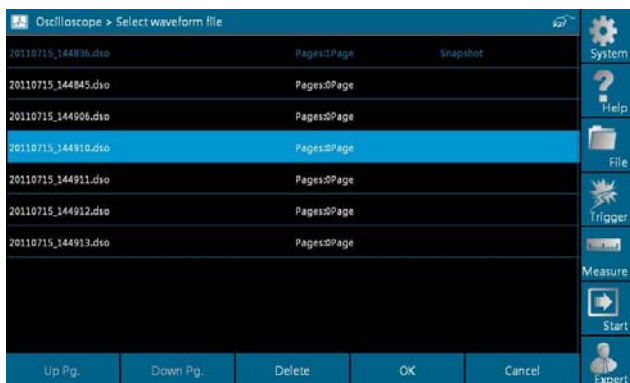


Fig.3-16

### <5> Print waveform

This option allows you to print the currently displayed waveform out through a specific printer. Before printing, make sure that the oscilloscope stops collecting data and the printer is properly connected.

Click [File], then select [Print] from the pull-down list. See Fig. 3-17.



Fig.3-17

<6> Show / hide the Grid

Click [File]>[Grid] button to show/hide grid. See Fig. 3-18.



Fig.3-18

### <7> Display and Clear cached waveforms

This oscilloscope stores 10 pages of cached waveform data. While in data collection stop mode, click [File], and then choose [Pre Pg.]/[Next Pg.]/[Empty] from the pull-down menu to operate the cached data. See Fig. 3-19.



Fig.3-19

### 3.3.5 System settings

Click [System] to enter system settings interface, similar to Fig. 3-20:

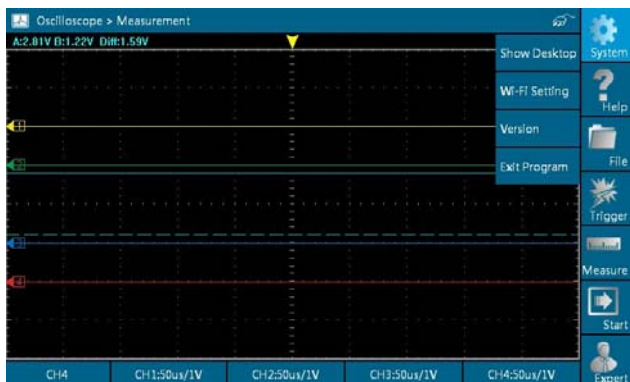


Fig.3-20

**Button description:**

[Show Desktop]: to return to main menu screen

[Wi-Fi setting]: to configure Wi-Fi connection

[Version]: display the version information

[Exit program]: to exit this program

**View version information**

In main menu, click [System], and then select [Version] to view the current version of the oscilloscope. See Fig. 3-21.



Fig.3-21

### 3.3.6 View help file

In main menu, click [Help] to enter a screen similar to Fig. 3-22.



Fig.3-22

## 4 Automotive Ignition waveform

The ignition system is the system which has greatest impact on the performances of gasoline engine, as the statistical data shows that nearly half of the failures are caused by poor work of electrical system. And the performance tests of engine often start from the ignition system. Nowadays ignition system includes distributor and distributorless. Distributorless includes independent ignition and simultaneous ignition.

1. Distributor ignition system i.e. contact breaker with contact-controlled ignition system (commonly known as the platinum) and contact breaker with noncontact-controlled ignition system combined with magnet, hall components or infrared.
2. Independent ignition system: crankshaft sensor send out the ignition timing signal and cylinder identification signal so that the ignition system can send out ignition signal to specified cylinder in specified time, each cylinder has its independent ignition coil.
3. Simultaneous ignition system: two cylinders share one ignition coil, when two cylinder pistons reach top dead center at the same time (one is compression, another is the exhaust), two spark plugs will be ignited at the same time, at this time, the ignition for the former cylinder is in high-pressure low temperature gas mixture, the ignition is valid, while for the latter one is in low-pressure high temperature exhaust gas, the



ignition is invalid.

X-431 GDS can test and analyze the primary/secondary signal for various engine ignition systems.

In main menu, click "Engine ignition waveform" - "Configuration" to enter the interface shown as Fig. 4-1:

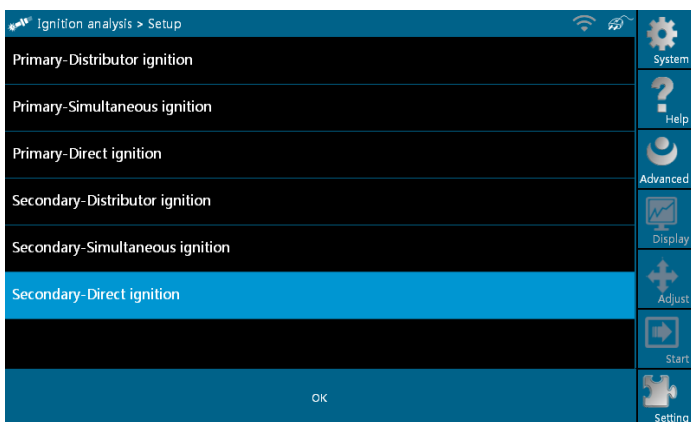


Fig.4-1

This interface includes six engine ignition analyses: Primary-Distributor ignition, Primary-Simultaneous ignition, Primary-Direct ignition, Secondary-Distributor ignition, Secondary-Simultaneous ignition, and Secondary-Direct ignition.

## 4.1 Primary-distributor ignition analysis

Tips:

Generally, the sequence of ignition is (The specific sequence is

subject to the actual engine ignition sequence)

Four-stroke in-line four-cylinder: 1—2—4—3, or 1—3—4—2

Four-stroke in-line six-cylinder: 1—5—3—6—2—4, or

1—4—2—6—3—5

Four-stroke in-line eight-cylinder: 1—8—4—3—6—5—7—2

Five-cylinder: 1-2-4-5-3

V 6 engine: generally speaking, based on the person sitting on the driver cab, if the right side cylinder numbers on the right side, from the front to the back are as follows: 1, 3, 5; and the cylinder numbers on the left side, from the front to the back are as follows: 2, 4, 6; then the ignition sequence is: 1 - 4 - 5 - 2 - 3 - 6. If the cylinder numbers on the right side, from the front to the back are as follows: 2, 4, 6; and cylinder numbers on the left side, from the front to the back are as follows: 1, 3, 5; then the ignition sequence is: 1 - 6 - 5 - 4 - 3 - 2.

The Figure 4-2 shows the normal ignition waveform of distributor ignition system, the upper one is the secondary waveform, the lower one is the primary waveform.

The section A is the opening of contact point; section B is the closing of contact point, during which the ignition coil is charging.

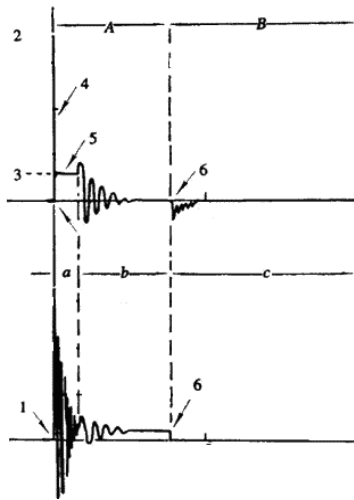


Fig.4-2

- 1) Contact break point: the primary circuit of ignition coil cut off, the secondary voltage was sensed and increased sharply
- 2) Ignition voltage: secondary coil voltage overcome the damper of high voltage line, the contact breaker gap and the spark plug gap to release magnetizing energy, 1-2 section is the breakdown voltage;
- 3) Spark voltage: For the capacitor discharge voltage;
- 4) Ignition voltage pulse: For the charge and discharge sections;
- 5) Spark line: The inductance discharge process, i.e. the mutual inductance voltage of ignition coil maintains the conduction of secondary circuit;

- 6) Contact point close: The current flow into primary coil, the primary coil oscillates due to the mutual inductance.

### **Primary ignition waveform**

Section **a** shows the voltage oscillation on the primary circuit due to the magnetic induction of spark in the duration;

Section **b** shows the damped oscillation generated by remaining magnetic field energy after the spark;

Section **c** shows the period of primary coil charging.

Seen from the waveform, the amplitudes of breaker contact closed angle, break angle and breakdown voltage and spark voltage are very clear, besides, the spark delay period and two oscillations can also be tested. For the ignition system without faults, compared with the whole cycle, the contact closed angle just 45%-50% (four-cylinder), 63%-70% (six-cylinder), or 64%-71% (eight-cylinder); the breakdown voltage is over 15kv; the spark voltage is about 9kV, the spark period is greater than 0.8ms. If these values or waveform are abnormal, it means there is fault or the system needs to be adjusted.

## **4.2 Primary-simultaneous ignition analysis**

The Figure 4-3 below shows the valid and invalid ignition waveforms. Under the working status of valid ignition, the breakdown voltage and spark voltage are higher due to the cylinder was filled fresh combustible mixture gas, which has a lower ionization level; vice versa; the above-mentioned shall be distinguished during testing.

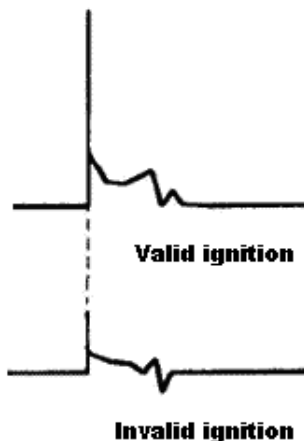


Fig.4-3

### 4.3 Primary-direct ignition analysis

The Figure 4-4 shows the normal secondary (the upper one) and (the lower one) primary ignition waveform of direct ignition system. Because the on/off of primary circuit is not opening/closing of mechanical contact, but the conduction of transistor. The primary voltage has no obvious oscillations within the duration, but the voltage increases during the magnetization process due to current limiting, and this change can cause corresponding fluctuations of secondary voltage line as a result of induction of ignition coil.



Fig.4-4

#### 4.4 Secondary-distributor ignition analysis

Connections: Plug the BNC end of secondary ignition pickup into CH1/CH2/CH3/CH4 channel of Scopebox, then connect the high-voltage clip to high-voltage line, and crocodile clips to ground.

After properly connected, power on and confirm the cylinder number and ignition sequence, the interface will be shown as Figure 4-5:

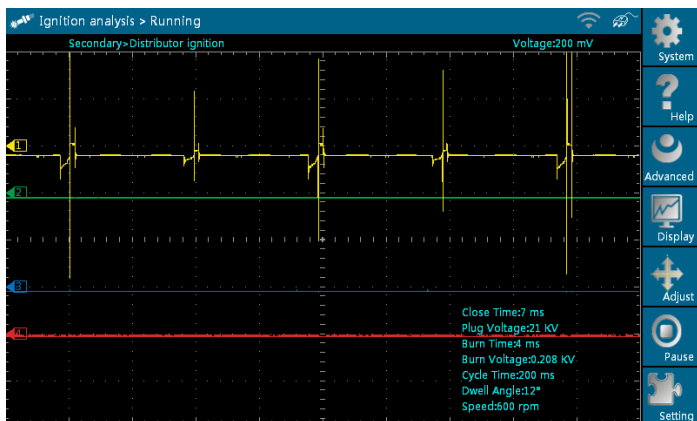


Fig.4-5

**Tips:**

Common ignition sequence (the specific sequence is subject to the actual engine ignition sequence)

Four-stroke in-line four-cylinder: 1—2—4—3, or 1—3—4—2

Four-stroke in-line six-cylinder: 1—5—3—6—2—4, or

1—4—2—6—3—5

Four-stroke in-line eight-cylinder: 1—8—4—3—6—5—7—2

Five-cylinder: 1-2-4-5-3

V 6 engine: generally speaking, based on the person sitting on the driver cab, if the right side cylinder numbers on the right side, from the front to the back are as follows: 1, 3, 5; and the cylinder numbers on the left side, from the front to the back are as follows: 2, 4, 6; then the ignition sequence is: 1 - 4 - 5 - 2 - 3 - 6. If the cylinder numbers on the right side, from the front to the back are as follows: 2,

4, 6; and cylinder numbers on the left side, from the front to the back are as follows: 1, 3, 5; then the ignition sequence is: 1 - 6 - 5 - 4 - 3 - 2.

The Figure 4-6 below shows the normal ignition waveform of distributor ignition system, the upper one is the secondary waveform, and the lower one is the primary waveform.

The secondary waveform:

A section is contact open period; B section is make contact period, which is the magnetizing field of ignition coil.

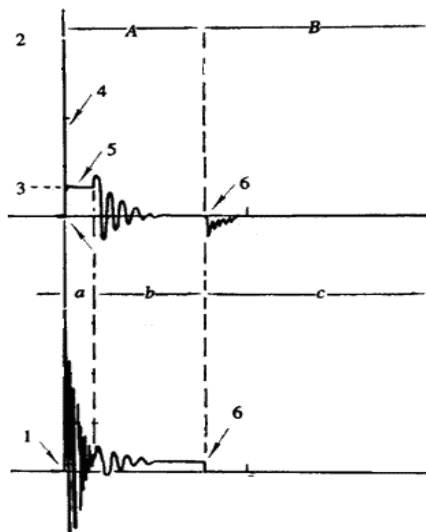


Fig.4-6



- 1) Contact break point: the primary circuit of ignition coil cut off, the secondary voltage was sensed and increased sharply
- 2) Ignition voltage: secondary coil voltage overcome the damper of high voltage line, the contact breaker gap and the spark plug gap to release magnetizing energy, 1-2 section is the breakdown voltage
- 3) Spark voltage: For the capacitor discharge voltage
- 4) Ignition voltage pulse: For the charge and discharge sections
- 5) Spark line: The inductance discharge process, i.e. the mutual inductance voltage of ignition coil maintains the conduction of secondary circuit
- 6) Contact point close the current flow into primary coil, the primary coil oscillates due to the mutual inductance.

### **Primary ignition waveform**

Section **a** shows the voltage oscillation on the primary circuit due to the magnetic induction of spark in the duration;

Section **b** shows the damped oscillation generated by remaining magnetic field energy after the spark;

Section **c** shows the make contact magnetizing period of primary coil.

Seen from the waveform, the amplitudes of breaker contact closed angle, break angle and breakdown voltage and spark voltage are very clear, besides, the spark delay period and two oscillations can also be tested. For the ignition system without faults, compared with the whole cycle, the contact closed angle just 45%-50% (four-cylinder), 63%-70% (six-cylinder), or 64%-71% (eight-cylinder);

the breakdown voltage is over 15kv; the spark voltage is about 9kV, the spark period is greater than 0.8ms. If these values or waveform are abnormal, it means there is fault or the system needs to be adjusted.

#### **4.5 Secondary-simultaneous ignition analysis**

Connections: Plug the BNC end of secondary ignition pickup into CH1/CH2/CH3/CH4 channel of Scopebox, then connect the high-voltage clip to high-voltage line, and crocodile clips to ground. Connection as shown in figure 4-7:



Fig.4-7

After properly connected, power on, the interface of

secondary-simultaneous ignition will be shown as Figure 4-8.

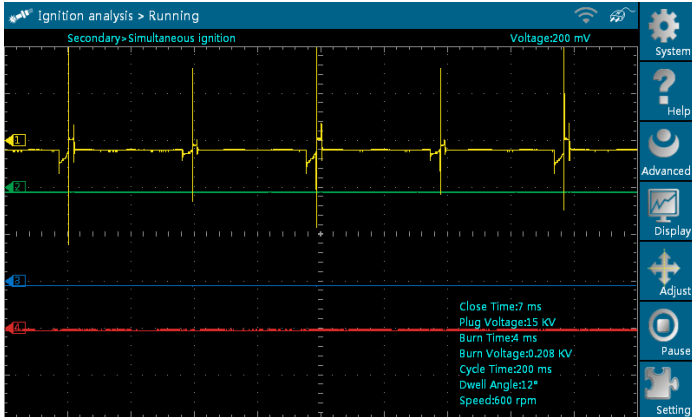


Fig.4-8

Fig. 4-9 below shows the valid and invalid ignition waveforms. Under the working status of valid ignition, the breakdown voltage and spark voltage are higher because the cylinder is filled with fresh combustible mixture gas, which has a lower ionization level and vice versa.

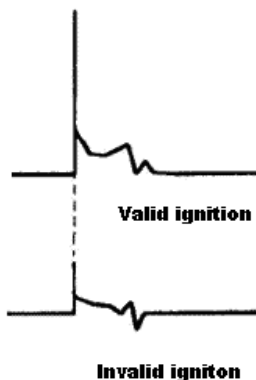


Fig.4-9

## 4.6 Secondary-direct ignition analysis

Connection:

- 1) When the high-voltage wire is exposed, plug the BNC end of secondary ignition pickup into CH1/CH2/CH3/CH4 channel of Scopebox, then connect the high-voltage clip to high-voltage line, and crocodile clips to ground.
- 2) If no high-voltage wire exposes, dismantle ignition coil of tested cylinder and use direct ignition extension cord. Connect one end to ignition coil which should be grounded via direct ignition grounding wire, and insert the other end into cylinder to joint with spark plug. Then plug the BNC end of secondary ignition pickup into CH1/CH2/CH3/CH4 channel of Scopebox, then connect the high-voltage clip to high-voltage line, and crocodile clips to

ground.

Connections are shown in Fig. 4-10:



Fig.4-10

The secondary direct ignition interface is shown as the following Fig. 4-11.



Fig.4-11

Fig. 4-12 shows the normal secondary (the upper one) and (the lower one) primary ignition waveform of direct ignition system. Because the on/off of primary circuit is not opening/closing of mechanical contact, but the conduction of transistor. The primary voltage has no obvious oscillations within the duration, but the voltage increases during the magnetization process due to current limiting, and this change can cause corresponding fluctuations of secondary voltage line as a result of induction of ignition coil.

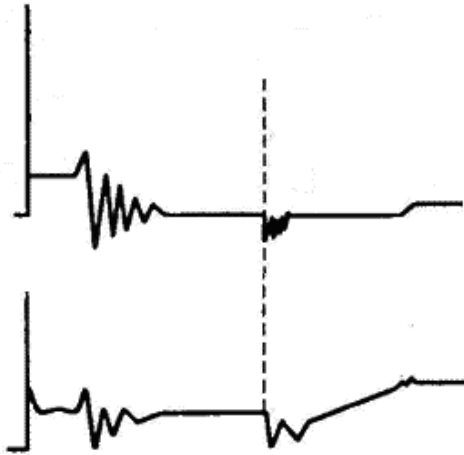


Fig.4-12

## 4.7 Waveform analysis mode

The ignition secondary single-cylinder waveform test is mainly used to:

- a. Analyze the ignition dwell angle of single cylinder.(ignition coil charging time)
- b. Analyze the capability of ignition coil and secondary high tension circuit (from ignition line to ignition voltage line).
- c. Find the improper mixture A/F ratio of single cylinder (from combustion line).
- d. Analyze the capability of capacitance (platinum or ignition

system).

- e. Find the spark plug that causes misfire of the cylinder (from combustion line).

This test can provide very meaningful information about the combustion quality for each cylinder. If necessary, this test can also be performed during driving. Since the secondary ignition waveform is significantly affected by different engines, fuel systems and ignition conditions, it is useful for detecting the faults of engine mechanical parts, fuel system components, and ignition system components. Different parts of the waveform can specify that some components and systems on the specific cylinder have faults. Refer to the instructions for various parts of waveform for the related component working status of specific waveform section.

#### **Test methods and conditions:**

Start the engine or drive the vehicle according to the driving performance fault or poor ignition, etc. Confirm the consistence of judgement standard (the amplitude, frequency, shape and pulse width, etc., for each cylinder), check the fault of the waveform for corresponding components.

Waveform results: observe the ignition coil at the beginning of charging, the relative consistent falling edge represents the dwell angle and ignition timing of each cylinder are precise.



**Ignition line:**

Observe the height consistence of flashover voltage. Too high flashover voltage (even out of the oscilloscope screen) represents a high resistance existed in the ignition secondary circuit (for example, open circuit, or damaged spark plug or high voltage line, or too large time gap on spark plug), while the too short sparking voltage represents the resistance of ignition secondary circuit is lower than normal value (due to pollutant and broken spark plug or the high voltage line of spark plug has electrical leakage, etc.).

**Spark or combustion voltage:**

Observe the consistence of spark or combustion voltage, as it represents the consistence of spark plug and the air-fuel ratio of each cylinder. In case that the mixing ratio is too lean, the combustion voltage will be lower than normal value.

**Combustion line:**

Observe the spark or the combustion line which shall be clean with few clutter, as lots of clutter indicates the cylinder has poor ignition due to ignite too early, damaged nozzle, pollutant spark plug, or other reasons. The duration of combustion line indicates the mixing ratio of the cylinder is abnormal lean or rich. Too long combustion line (usually greater than 2ms) represents the mixing ratio is rich, whereas too short of combustion line (usually less than 0.75ms) represents the mixing ratio is lean.

**Ignition coil oscillation:**

Observe at least two oscillation waveforms after the combustion line, which will be better if more than three oscillation waveforms, as it represents the ignition coil and capacitor (on Platinum or ignition system) are normal.

**Primary voltage analysis**

According to the faulty primary voltage waveform collected by the ignition analysis, the related components and mechanical equipment status of ignition system electrical circuit can be analyzed, which provides a reliable basis for the adjustment and maintenance of power circuit to avoid the blind demolition.

The waveform shown on Fig. 4-13, appears a lot of clutter on the contact break point, which is obviously caused by the serious erosion on contact break point. It can be verified via burnishing the contact or changing the circuit breaker.

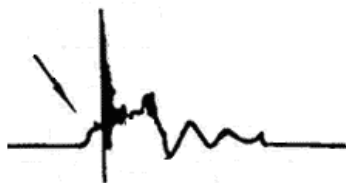


Fig 4-13

For the primary voltage waveform shown on Fig. 4-14, the damped attenuation cycles obviously reduced on the spark period, the

amplitude became lower, which is evidently caused by capacitor leakage.

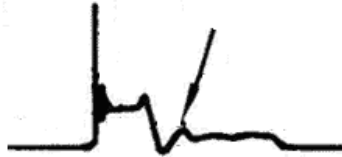


Fig 4-14

The waveform on Fig. 4-15, shows the accidental pumping during contact closing period. The irregular beating is caused by insufficient spring force.



Fig.4-15

The curve on Fig. 4-16 shows the contact angle is too small during the magnetizing period, which is caused by too large contact gap.



Fig.4-16

A lot of clutter will be displayed on the horizontal section of primary waveform if contact has poor grounding, as shown below figure 4-17.

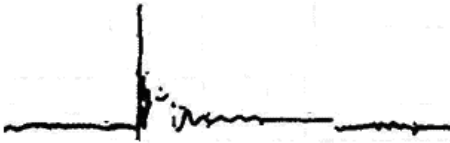


Fig.4-17

Fig. 4-18 shows the fault of low-voltage waveform in electronic ignition system. The voltage does not rise during magnetizing, which indicates that the effect of limitation of the circuit failed and no components on distributorless ignition system can be adjusted. When this waveform is abnormal, you can only replace the ignition coils, igniter, ignition signal generator and cam position sensor, etc., one by one, to find out the faulty component or module.



Fig.4-18

The secondary waveform is also affected by the spark plug, the combustion process, mixture gas composition, the engine thermal state of the ignition coil, etc., which is more complicated. The following lists a large number of measured secondary faulty waveform for reference. Since various factors lead to the failures, Fig. 4-19 just shows the major possible factors for the failures.



**Secondary circuit resistance is too large**



**Oil or coke was attached in spark plug**



**Spark plug gap is too large or mixture gas is too lean**



**Injector of electronic fuel injection poor work**



**Spark plug overheated or valve guide leakage**



**Mixture ratio is too rich or spark plug leak electricity**



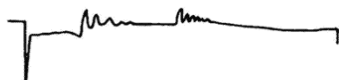
**Mixture ration is too lean or cylinder pressure is too low**



**Distributor cover or distributor lead is matched un-tightly**



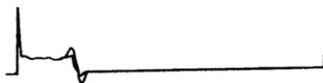
**Spark plug was attached carbon or gap is too small**



**The primary circuit is reverse**



**Ignition coil or capacitor leak voltage**



**Primary lead of Igniton coil is open**

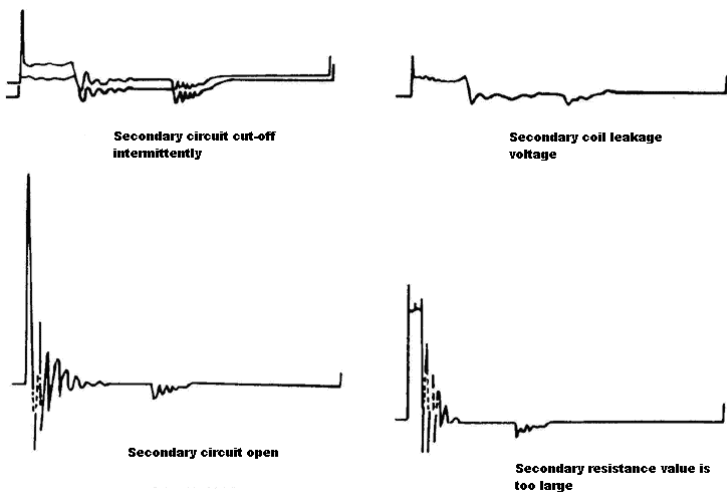


Fig.4-19

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**Order Information**

Replaceable and optional parts can be ordered directly from your LAUNCH authorized tool supplier. Your order should include the following information:

1. Quantity
2. Part number
3. Item description

**Customer Service Department**

If you have any questions on the operation of the unit, please call:

+86-755-84528767

If your unit requires repair service, return it to the manufacturer with a copy of the sales receipt and a note describing the problem. If the unit is determined to be in warranty, it will be repaired or replaced at no charge. If the unit is determined to be out of warranty, it will be repaired for a nominal service charge plus return freight. Send the unit prepaid to:

Attn: Customer Service Department  
LAUNCH TECH. CO., LTD.  
Launch Industrial Park,  
North of Wuhe Avenue,  
Banxuegang, Bantian,  
Longgang, Shenzhen, Guangdong  
P.R.China, 518129

Launch website: <http://www.cnlaunch.com>

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