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To avoid personal injury, property damage, or accidental damage to the product, please read all the information in this chapter before using the product.

Safety Warning

Please read the following safety precautions carefully to avoid personal injury and damage to this product or other connected products. To avoid possible injury and danger, this product shall only be used within the specified range.

Be careful when handling equipment.

Do not drop, bend, puncture, insert foreign objects or place heavy objects on the device, which may damage the internal wearable components.

Avoid fire or personal injury.

Only authorized professional personnel shall perform maintenance.

Connect and disconnect properly.

- Do not unplug when the probe or test end is connected to the voltage source.
- Before connecting the probe to the circuit under test, please connect it to the Oscillograph Multimeter. Disconnect the probe from the circuit under test before disconnecting the probe from the test instrument.

Use the correct probe. To avoid excessive current impact, use the correct rated probe for the measurement.

Avoid circuit exposure. Do not touch any exposed connectors and components when the power is on.

Do not operate the product when you suspect a malfunction. If you suspect

a product malfunction, have it checked by qualified maintenance personnel.

Keep ventilation.

Keep your product properly ventilated.

Do not operate in a humid environment.

Do not operate in a flammable or explosive environment.

Keep the surface of the product clean and dry.

Do not disassemble or modify the equipment.

The equipment is a sealed unit with no end-user serviceable parts inside. Only authorized maintenance agency or authorized technicians shall perform internal repairs. Attempting to disassemble or modify the unit will void the warranty.

Do not attempt to replace the internal battery.

Only authorized maintenance agency or authorized technicians shall replace the internal rechargeable batteries.

Precautions for operation of automotive ECU.

- After the ignition switch is on, do not disconnect the vehicle's internal electrical device at will to avoid damage to the ECU or equipment.
- Do not place magnetic objects close to the computer to avoid circuits and components failure in the ECU.
- Before performing welding work on the vehicle, disconnect the ECU system power first.
- When performing repair work close to computers or sensors, special care shall be taken to avoid damaging the ECU and sensors.
- When disassembling and installing programmable read-only memory, the operator shall wear a grounding metal band with one end wrapped around wrist and the other end clipped to the vehicle body, so as to avoid ECU circuit failure caused by static electricity.
- Ground the ECU harness connector reliably to avoid damage to the electronic components such as integrated circuits inside the ECU.

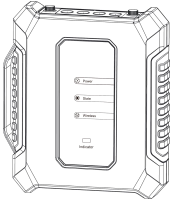
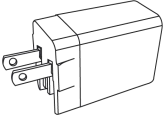


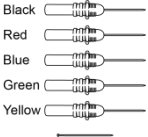

Contents


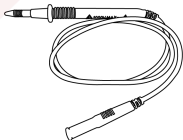
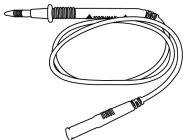
1. Packing List	1
2. Product Introduction	2
2.1 Overview	2
2.2 Composition	3
2.3 Technical Parameters	4
3. Oscilloscope Operation	6
3.1 Preparation before measurement	6
3.1.1 Start device and APP	6
3.1.2 Communication Setting	10
3.1.3 Automatic Calibration	10
3.1.4 Connection	11
3.2 How to operate	12
3.2.1 Select channel	12
3.2.2 Channel attributes and trigger setting	12
3.2.3 Automatic Setting	16
3.2.4 Menu Operation	16
3.2.5 Car Test	19
3.2.6 Cursor Measurement	20
3.2.7 Quick save	21
3.2.8 REF (Reference) Waveform	21
4. Multimeter Operation	23
4.1 Preparation before measurement	23
4.1.1 Start device and APP	23
4.1.2 Communication Setting	23
4.2 How to operate	24

4.2.1 Voltage Measurement	24
4.2.2 Current Measurement	26
4.2.3 Resistance Measurement	27
4.2.4 Diode Measurement	28
4.2.5 On-off Measurement	28
4.3 Detection Examples	29
4.4 Precautions	30
5. Maintenance	32
Warranty.....	33

1. Packing List

The following accessories are for reference only. Please consult from the local agency or check the package list supplied with this tool together.

No.	Name	Q'TY	Reference Picture
1	iSmartEV OM210	1	
2	Power Adaptor	1	
3	USB Cable (Type-B)	1	
4	Oscilloscope Test Clip	2	
5	Pin Kit	1	
6	Crocodile Chuck Black	2	

	Crocodile Chuck Red	2	
7	Multimeter Test Lead Black	1	
	Multimeter Test Lead Red	1	
8	User Manual	1	-
9	Packing List	1	-

2. Product Introduction

2.1 Overview

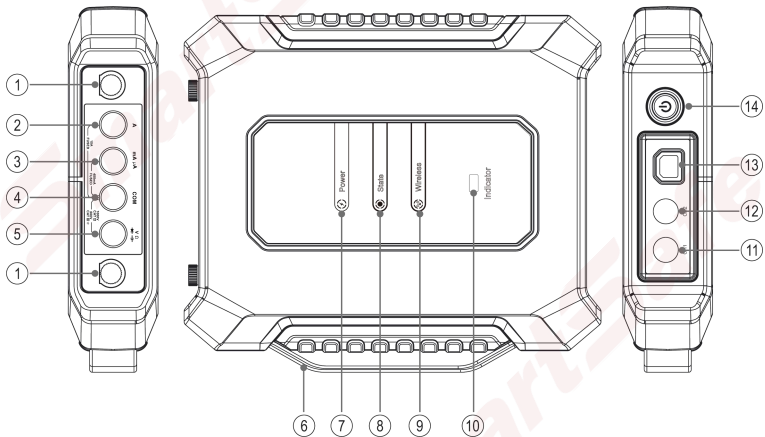
iSmartEV OM210 is a new energy test equipment developed by SmartSafe, which integrates oscilloscope and multimeter functions. The tool needs to be used together with detection tool (such as iSmartEV P01).

The oscilloscope is mainly used to measure voltage signals and analyze the form of electronic signals. Automobile repair technicians can quickly judge automobile electronic equipment and circuit failure by observing the waveform of the whole signal. Oscilloscope scanning speed is far greater than the frequency of the such automobile signals, usually 5~10 times of the measured

signal. The automobile oscilloscope can not only capture circuit signals quickly, but also display these waveforms at a slower speed, so as to observe and analyze at the same time. It can also store and record the tested signal waveform, and observe the fast signal that has occurred through playback, which greatly facilitates fault analysis.


The multimeter mainly measures voltage, current and resistance. It can judge whether the part is good or not and whether the circuit is complete by simple measurement.

2.2 Composition



No.	Name	Description
1	Fuse	
*2	A	10A current input terminal
*3	mAμA	Milliampere/Microampere (Less than 400ma) current input terminal
*4	COM	Negative common terminal
*5	V/Ω	Voltage/Resistance and other input terminals

E* Note: The above are related interfaces of multimeter function.

6	Handle	
7	Power Indicator	Red flashing indicates insufficient power; If the red light is normally on, it indicates that charging is in progress; A constant green light indicates that the battery is normal or fully charged.
8	State Indicator	Green light indicates normal operation.
9	Wireless Indicator	The red flashing indicates that the wireless connection is in progress; The green light indicates that the wireless connection is normal.
10	Indicator	Green light indicates normal operation.
11	CH1	Oscilloscope Channel 1
12	CH2	Oscilloscope Channel 2
13	Communication/Charging Jack	<p>1. When charging, use the power adaptor and USB cable to charge the Oscillograph Multimeter.</p> <p>2. When transmitting data, use USB cable to connect the Oscillograph Multimeter and detection equipment.</p> <p> <i>Note: The detection equipment cannot supply power to the Oscillograph Multimeter. Please charge the Oscillograph Multimeter before use.</i></p>
14	Power Button	Press and hold this key to turn on/off.

2.3 Technical Parameters

When used as oscilloscope:

Item	Specification Parameters
Number of Channels	2
Bandwidth	10MHz
Maximum Real-time	100Mbps

Sampling Rate	
Time Base Range	1us/div~10s/div, step by 1 ~ 2 ~ 5 times
Sampling Mode	Common sampling, peak detection, average value
Storage Depth	1M
Input Coupling	DC, AC and Grounding
Input Impedance	1MΩ±2%
Input Capacitance	20pF (maximum)
Vertical Sensitivity	2mV/div~5V/div
Vertical Resolution	8bits
Maximum Input Voltage	40V peak (DC + AC peak)
Probe Attenuation Coefficient	1X, 10X (probe support required)
Trigger Type	Edge trigger, pulse width trigger
Trigger Mode	Automatic, normal, single time
Automatic Measurement	Peak, AVG Value, Max Value, Min Value, Frequency, Cycle

When used as multimeter:

Item	Specification Parameters
DC Voltage	Automatic range, test range: ±600V
AC Voltage	Automatic range, test range: ±600V
DC Current	Automatic range, test range: ±10A (external sensors are required for large range currents)
AC Current	Automatic range, test range: ±10A. Average value measurement (external sensors are required for large range currents)

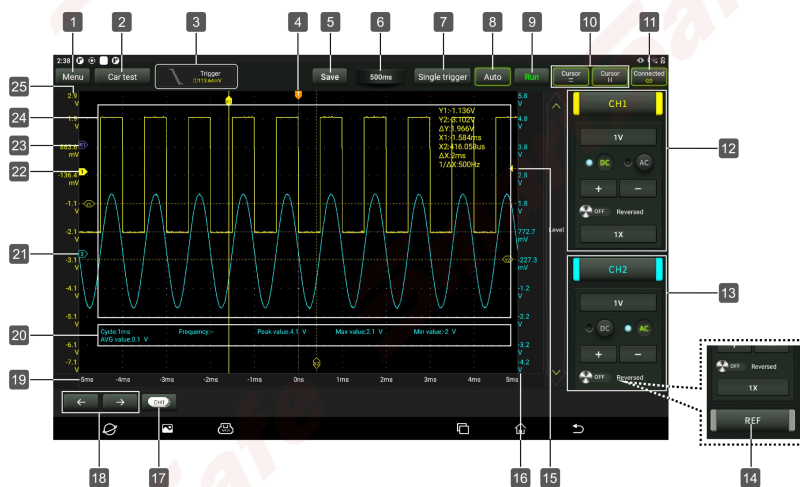
Resistor	Automatic range, test range: 0Ω~6MΩ
Diode	0~2.0V
On-off Detection	Sound when it is lower than 50Ω


3. Oscilloscope Operation





3.1 Preparation before measurement







3.1.1 Start device and APP

1. Long press the **Power** button on the oscillograph multimeter to turn on the device.
2. Tap **Oscilloscope** in the main interface of “Toolbox” function of the detection tool (such as iSmartEV P01) to start the App.



No.	Description	Operation Prompt
1	<p>Menu</p> <p>Include the following options:</p> <ul style="list-style-type: none"> • Measure: provide 6 parameter measurement items. • Save: Set the save format and save path of channel waveform. • Show: Set the waveform display style. • User Settings: Provide functions such as data clearing, oscilloscope setting and automatic calibration. • About: Display the specific information of the program. 	Click once to expand the submenu. Click again to retract the submenu.
2	<p>Car Test</p> <p>It provides various vehicle related test content (such as circuit, sensor, actuator, communication test, combined test) and corresponding test connection methods.</p>	Click once to expand the submenu. Click again to retract the submenu.
3	<p>Trigger</p> <p>Used to set trigger channel and trigger type.</p>	Click once to expand the submenu to set channels and conditions. Click again to retract the submenu.
4	<p>Horizontal Trigger Position Mark</p>	Press and hold  and drag left and right to adjust the horizontal trigger position.
5	<p>Save</p> <p>It can quickly save the measurement waveform of the currently opened channel.</p>	To change the save path and file type, tap Menu -> Save to set.
6	<p>Horizontal Setting</p> <p>Control the horizontal time base.</p>	Click once to expand the horizontal time base option and select the appropriate time base value.
7	<p>Single Trigger</p> <p>Capture a trigger, complete the acquisition, and then stop.</p>	
8	<p>Auto</p>	

	<p>Click to enable the automatic range function. When the automatic range function is enabled, the oscilloscope will automatically set various parameters, including vertical scale, horizontal time base and trigger level. When the signal is connected, these parameters will change automatically, and there is no need to operate again after the signal changes. The oscilloscope will automatically recognize and make corresponding changes.</p>	
9	<p>Wait/Run/Stop</p> <p>Wait: All pre-triggered data has been obtained, and the oscilloscope is ready to receive the trigger.</p> <p>Run: Indicates that the oscilloscope is running.</p> <p>Stop: Stop collecting data.</p>	
10	<p>Cursor Settings</p> <p>Click  to turn on/off the horizontal measurement cursor switch. When it is turned on, two reference lines named Y1 & Y2 will appear in the waveform display area of the screen.</p> <p>Click  to turn on/off the vertical measurement cursor switch. When it is turned on, two reference lines named X1 & x2 will appear in the waveform display area of the screen.</p>	<p>Click once to enable the cursor measurement function. Click again to disable the function.</p>
11	<p>Connection Status Button</p>	<p>Click to search and connect devices, and "Connected" will be displayed after successful connection.</p>
12	<p>Channel 1 Setup Panel</p> <p>Control the amplitude of the displayed signal. You can set the inversion, coupling mode and probe attenuation coefficient.</p>	<p>When the channel is enabled, click  /  once to disable the channel and hide the channel setting menu.</p>
13	<p>Channel 2 Setup Panel</p> <p>Control the amplitude of the displayed signal. You can set the inversion, coupling mode and probe attenuation coefficient.</p>	<p>Click it again to enable the channel and expand the channel setting menu.</p>

14	REF (Reference) Channel Setting Set the reference channel.	In the channel setting panel area, press and slide the screen up to call up the REF reference channel button, and click this button to call up the reference channel setting menu.
15	Edge Trigger Level Identification	Press and hold the icon to drag up and down to set the trigger level.
16	Channel 2 Voltage Scale	Click +/- to adjust the interval value of channel 2 voltage scale.
17	 Channel selection button Click to select the target channel.	Click once to call up the channel (only the opened channels are displayed) selection pop-up window. Click again to close the window.
18	 Fine-tuning button	When the horizontal cursor is turned on, the fine-tuning buttons are displayed as  and  . If the vertical cursor is turned on, the fine-tuning buttons are displayed as  and  .
19	Horizontal Time Base	
20	Measured Value Display Area	It can be called up through Menu -> Measure .
21	Channel 2 Mark Indicate the reference point of the displayed waveform. If there is no mark, the channel is disabled and will not be displayed.	
22	Channel 1 Mark Indicate the reference point of the displayed waveform. If there is no mark, the channel is disabled and will not be displayed.	
23	REF(Reference) Channel Mark Indicate the reference point of the displayed waveform. If there is no mark, the channel is disabled and will not be displayed.	

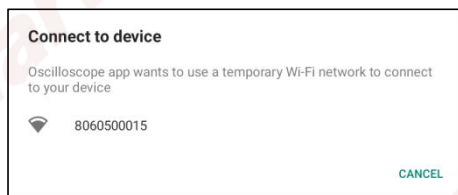
24	Waveform Display Area	
25	Channel 1 Voltage Scale	Click +/- to adjust the interval value of channel 1 voltage scale.

3.1.2 Communication Setting

The main connection methods between the Oscillograph Multimeter and the detection tool are Wi-Fi communication and USB wired communication.

Wi-Fi communication

Click “Connect” to search for and connect the oscilloscope device. After successful connection, the detection device screen will show the connection status and the Wireless indicator on the Oscillograph Multimeter will light up in green.




USB communication

When connecting the oscilloscope to the detection equipment via USB cable, the system will automatically switch to USB communication mode. At this time, the Wireless indicator on the Oscillograph Multimeter will be off.

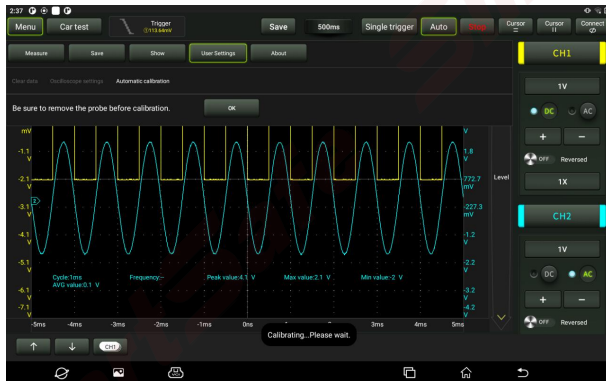
3.1.3 Automatic Calibration

The auto-calibration program optimizes the oscilloscope signal path with maximum measurement accuracy. The user can run this program at any time, but shall run it if the ambient temperature changes by 10°C or more. In order to calibrate more accurately, the oscilloscope must be powered on and warmed up for 20 minutes before auto-calibration. The calibration mainly includes the calibration of the analog channel, the trigger voltage in the trigger circuit and the horizontal baseline shift nonlinearity.

 *Note: During automatic calibration, please ensure that no signal is input to the input*

terminal of CH1/CH2, otherwise the instrument may be damaged.

Tap Menu -> User Settings -> Automatic calibration.

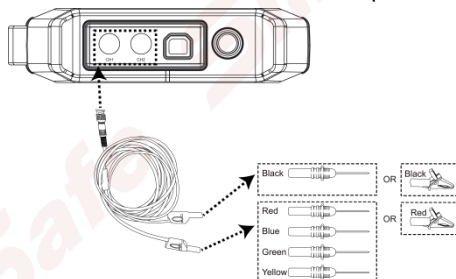


Click **OK** on the window below to start calibration, and the message “Calibration...Please wait.” will appear on the screen. When the automatic calibration is finished, the “Calibration Successful” pop-up box will appear on the screen.

3.1.4 Connection

When testing sensor:

1. Connect the BNC connector end of the oscilloscope test clip to channel CH1/CH2 (select the channel number and quantity of channels as needed), connect the black connector of the other end to the black pin or black alligator clip, and connect the red connector to the other color pin or red alligator clip.



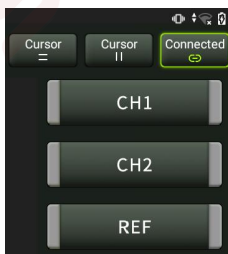
2. Connect the black pin or black alligator clip to the ground wire port of the vehicle sensor, and connect the other color pin or red alligator clip connected with the red connector to the signal terminal of the vehicle sensor.


3.2 How to operate

3.2.1 Select channel


The system channels are CH1 (channel 1), CH2 (channel 2) and REF (reference channel), please select channels as follows:

A. Select channels with the channel button on the right side of the screen.



B. Click  to select target channel. This method is only applicable to opened channels.

 *Note: Each channel and waveform is marked with a different color for better comparison and distinction by users.*

The oscilloscope can display multiple waveforms at the same time, but only one waveform is allowed to be displayed on the top layer. The channel that is displayed on the top layer is called the current channel, and it will be marked with . The channel without this mark is not the current channel.

3.2.2 Channel attributes and trigger setting

1. Horizontal time base setting

The horizontal time base setting allows you to set the horizontal axis unit scale time size (time base value). Click **“6-horizontal setting”** button to expand the time base options and select the appropriate time base value.

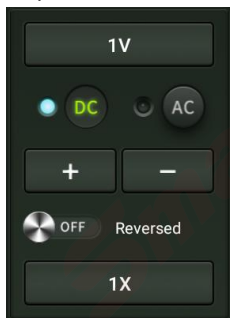


If waveform capture has been stopped, the waveform can be horizontally enlarged or reduced by horizontal time base adjustment.

2. Channel setting panel

The channel setting panel can be used to adjust the vertical scale and make other settings for the channel. Each channel has a separate settings panel, and each channel can be set up individually.

Click the target channel to call up the channel setting panel.



Description of setting options:

Menu Option	Description/Settings
DC/AC Coupling Mode	Trigger coupling is used to define which part of the signal passes through the trigger circuit. Channel coupling includes DC coupling and AC coupling. DC: DC coupling. The DC component and AC component

	contained in the measured signal can pass through, and can be used to view waveforms as low as 0Hz without large DC offset. AC: AC coupling. The DC signal of the measured signal is blocked and only the AC component is allowed to pass through, which can be used to view the waveform with large DC offset.
Inversion	After the inversion switch is turned on, the voltage value of the displayed waveform is inverted. The inversion will affect the display of the channel. When the basic trigger is used, the trigger level needs to be adjusted to keep the waveform stable.
Probe Type	Select the attenuation coefficient of the probe. The attenuation coefficient changes the vertical scale of the oscilloscope so that the measurement result reflects the true voltage value at the probe.
Vertical Scale Value	Click +/- to adjust the vertical scale value (voltage value).

3. Trigger setting

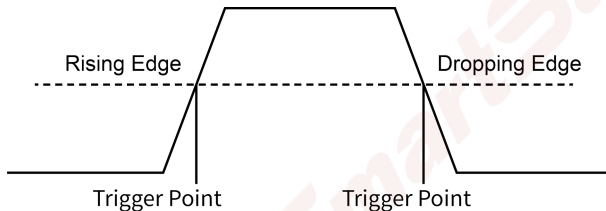
The trigger determines when the oscilloscope starts to acquire data and display waveforms. If the trigger setting is reasonable, it can convert unstable display or white screen into a meaningful waveform. When the oscilloscope starts to acquire the waveforms, it acquires enough data to draw the waveform to the left of the trigger point. While waiting for the trigger condition to occur, the oscilloscope continues to acquire data. After the trigger is detected, the oscilloscope continues to acquire enough data to draw the waveform to the right of the trigger point.

Trigger means: set certain trigger conditions according to requirements, and when a certain waveform in the waveform stream meets this condition, the oscilloscope captures the waveform and its adjacent parts in real time and displays them on the screen.

Click “**3-Trigger**” to access the following interface:



This oscilloscope uses edge trigger, which is the most common and effective trigger method, and the majority of Apps use this trigger method to trigger the waveform. Edge trigger means that the trigger is identified by finding the specified edge (rising edge, falling edge) and voltage level on the waveform. When the voltage of the signal under test changes in the same direction as the setting and its value changes to the same as the trigger voltage, the oscilloscope is triggered and captures the waveform.



Menu Option	Description/Settings
Source	Select the channel source of the trigger signal.
Trigger	Level: Set the amplitude level that the signal must cross during waveform acquisition. Rise: Triggered at the rising edge. Drop: Triggered at the dropping edge. Close: Turn off the trigger mode.

In this trigger mode, the user can directly drag the edge trigger level icon ◀ to set the trigger level.

3.2.3 Automatic Setting

The oscilloscope has automatic setting function, which can set the oscilloscope to display waveforms in the best way automatically.

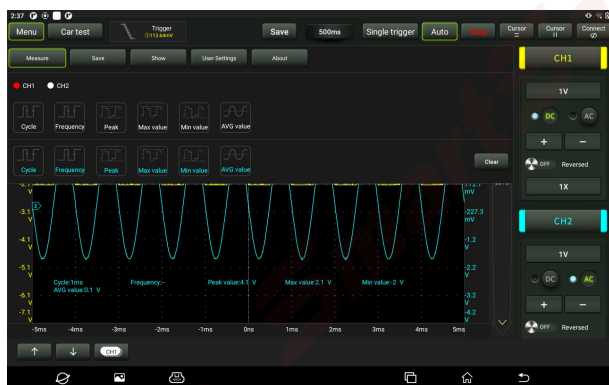
Click **Auto**, the system automatically adjusts the horizontal and vertical calibration of the oscilloscope, the coupling, type and position of the trigger, and other settings, so as to obtain a stable waveform display.

3.2.4 Menu Operation

1. Measure

The oscilloscope provides 6 types of parameter automatic measurement functions.

Click to select measurement function. All selected measurement functions are displayed to the left of the **Clear** button. The corresponding values are displayed at the bottom of the screen.

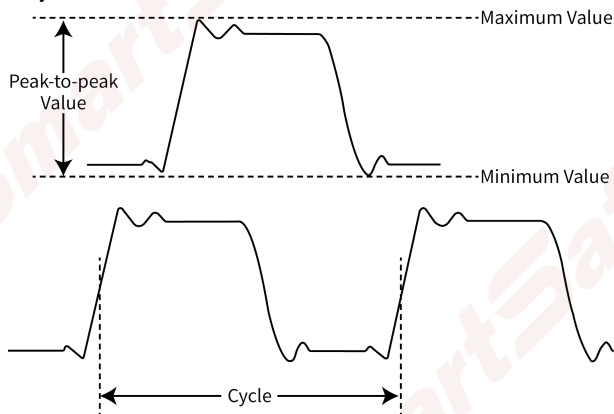


To remove the measurement function, click again.

Menu Option	Description/Settings
Cycle	The time between the threshold intermediate values of two consecutive, homogeneous edges.

Frequency	The reciprocal of the period.
Peak	The voltage value from the peak to the lowest point of the waveform.
Max value	The voltage value from the highest point of the waveform to GND (ground).
Min value	The voltage value from the lowest point of the waveform to GND (ground).
AVG value	The arithmetic average over the entire waveform or selected area.

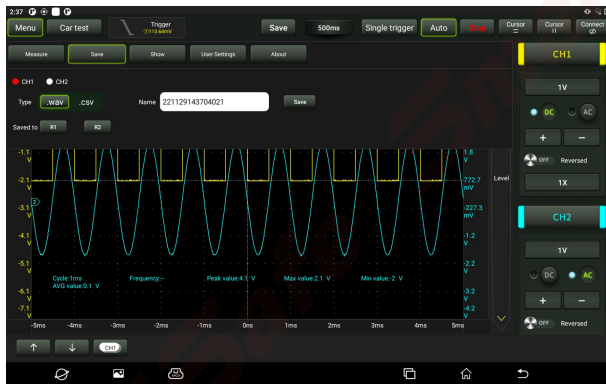
The following figure explains the meaning of some measurement items, for reference only.



Click **Clear** to close all measurement items.

2. Save

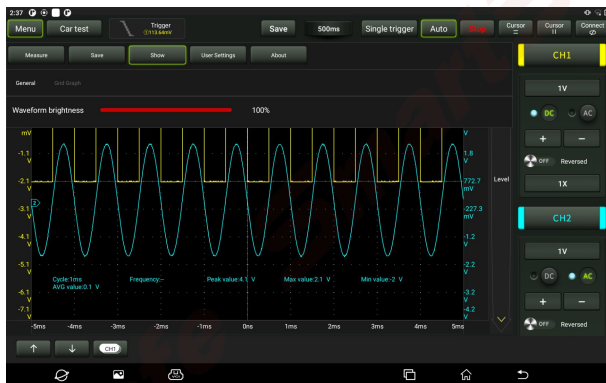
The save option is used to save the waveform of the channel. Click **Save** and the screen will display as below:



First select the measurement channel, then select the measurement type WAV or CSV, then modify the name and save, and finally select to save to R1/R2. The saved files can be called by REF (reference) channel for reference and playback.

3. Show

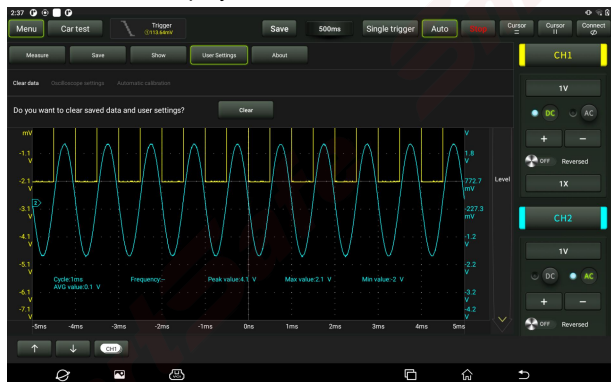
The show option is used to set the brightness of the waveform, coordinate axis display intensity, etc. The coordinate types include **Full**, **Grid**, **Cross-hair** and **Frame**.



4. User setting

The user setting options can set clear data, waveform display automatic

calibration and oscilloscope parameter save and restore, etc. Click **User Settings**, the screen will display as follows:



Option Description:

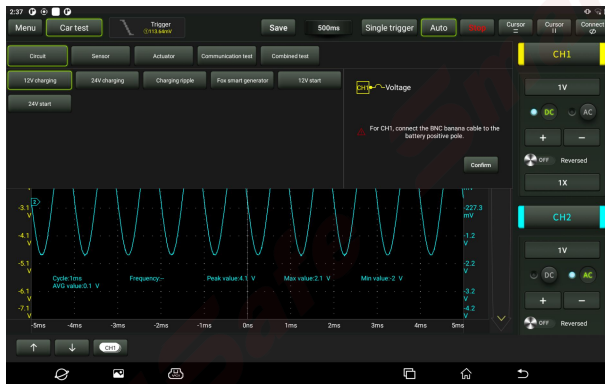
Menu Option	Description/Settings
Clear Data	Clear the saved data and user settings.
Oscilloscope Settings	Users can use the "Save" function to save the system setting parameters. The "Restore" function allows users to call the previously saved system settings to avoid duplicate settings.
Automatic Calibration	Automatic calibration can optimize the oscilloscope signal path with maximum measurement accuracy.

5. About




Information about display App and firmware version.

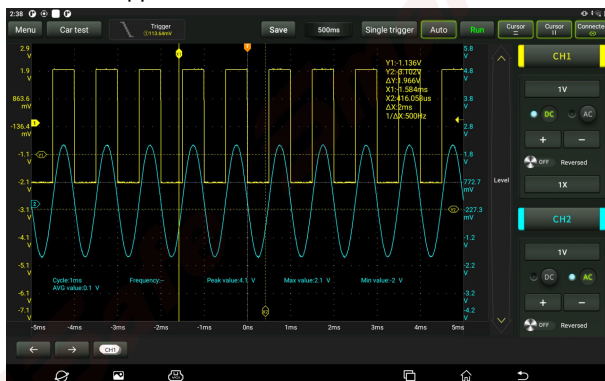
3.2.5 Car Test

There are buttons for various vehicle related test content (including Circuit, Sensor, Actuator, Communication test and Combined test) in the "Car test" option. After the user selects the test content as required, the oscilloscope will automatically set the corresponding parameters to achieve the purpose of rapid setting. After selecting the function, please perform the wiring test according to the prompt in the small box on the right.



3.2.6 Cursor Measurement

The “Cursor” option can be used to assist with measurements. Turn on the cursor and place the cursor on the measurement point to read out the waveform measurement value. There are horizontal cursors  display horizontal lines to measure vertical parameters and vertical cursors  display vertical lines to measure horizontal parameters. Click cursor option , two horizontal Y1&Y2/ vertical cursor X1&X2 measurement lines will appear in the interface, click on the relevant line and drag to move the line position. Click the “Cursor” option again, the function will be closed and the auxiliary lines will disappear.



 Note:

\triangle Reading: Indicates the difference between two cursor positions.

Voltage reading after Y1, Y2: Indicates the position of the activated cursor in the horizontal cursor relative to the current channel identification point.

Time reading after X1, X2: Indicates the position of the activated cursor in the vertical cursor with respect to the trigger point.

$1/\triangle X$: Frequency.

3.2.7 Quick save

The “Quick Save” option can quickly save the measurement waveform of the currently opened channel. The oscilloscope can save the waveform of analog channel or mathematical channel to the local, the file type can be WAV or CSV. The oscilloscope provides two reference channels, which can be called to load WAV type files to the reference channel and open the reference channel to display the reference waveform. The relevant settings can be found in “Menu”.

3.2.8 REF (Reference) Waveform

The oscilloscope provides REF channel for displaying reference waveform. Users can load the previously saved waveform file into the reference channel by calling, and compare it with the actual waveform to find out the difference.

1. If the previous waveform file is saved in R1, click the button under “R1 Reference Waveform” as shown in the figure below to call up the list of saved waveform (R2 reference waveform operation is the same as R1 reference waveform).



2. Click the reference waveform to be viewed to display the waveform on the screen, and click the blank area of the screen to hide the reference waveform list.



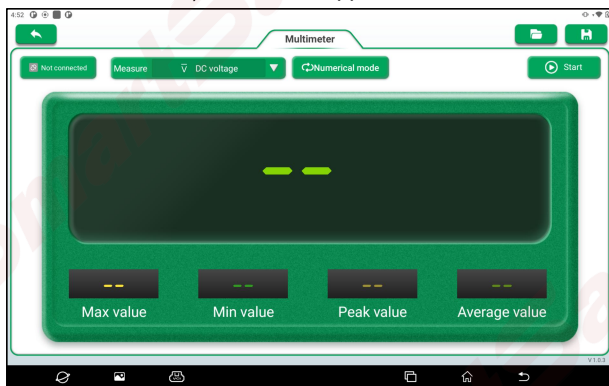
Click **ON/OFF** button to display/hide reference waveform.

4. Multimeter Operation

4.1 Preparation before measurement

4.1.1 Start device and APP

1. Long press the **Power** button on the Oscilloscope Multimeter to turn on the device.
2. Tap **Multimeter** in the main interface of “Toolbox” function of the detection tool (such as iSmartEV P01) to start the App.

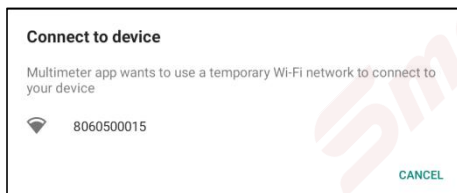


4.1.2 Communication Setting

The main connection methods between the Oscilloscope Multimeter and the detection tool are Wi-Fi communication and USB wired communication.

Wi-Fi communication

Click **Not connected** to search for and connect the multimeter device. After successful connection, the detection device screen will show the connection status and the Wireless indicator on the Multimeter will light up in green.

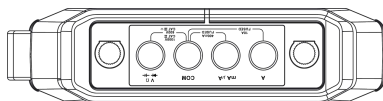


USB communication

When connecting the multimeter to the detection equipment via USB cable, the system will automatically switch to USB communication mode. At this time, the Wireless indicator on the Oscilloscope Multimeter will be off.

4.2 How to operate

Prepare the required red and black multimeter test leads, and find the multimeter measurement ports on the top of the tool.

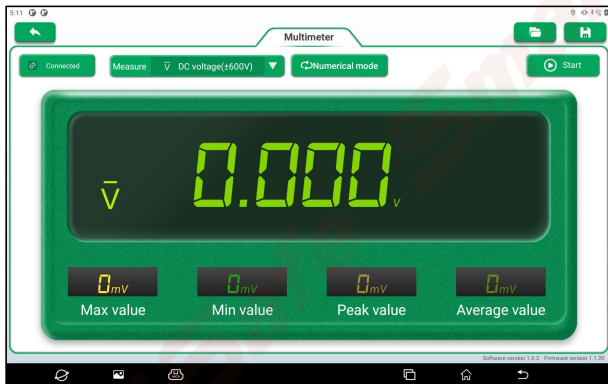


The multimeter can measure voltage, current, resistor, diode and on-off. Different measuring objects have different connection methods.

4.2.1 Voltage Measurement

The connection method for measuring DC voltage is the same as that for measuring AC voltage.

1. Select "DC Voltage" or "AC Voltage" and the corresponding range.



2. Insert one end of the black multimeter test lead into the "COM" end and one end of the red multimeter test lead into the "V/ Ω " end.
3. Connect the black and red test leads to the power supply or load under test. Keep contact stable.
4. Tap **Start**, the value will be displayed on the screen.

⚠ Warning: The head of the multimeter test lead is metal. During the measurement, do not touch it with hands, otherwise it will not only affect the measurement results, but also may cause electric shock.

Option Description:


Numerical waveform mode: Display the measurement results in the form of numerical value and waveform.




Numerical mode: Display the measurement results in numerical mode.

Waveform mode: Display the measurement results in waveform mode.



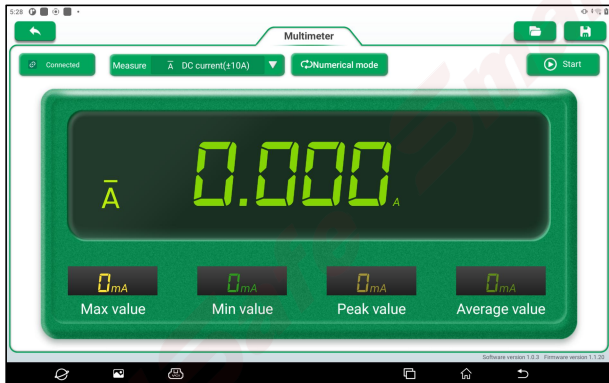
: Open the saved waveform file.

: Save the measurement results of the current screen as a waveform file.

4.2.2 Current Measurement

The connection methods for measuring DC current and AC current are the same.

1. Select "DC current" or "AC current" and the corresponding range.



2. Insert one end of the black multimeter test lead into the "COM" end. If the current is greater than 400mA, insert one end of the red multimeter test lead into the "A" end. If the current is less than 400mA, insert one end of the red multimeter test lead into "mA μ A" end.
3. Connect the black and red test leads to the circuit under test. Keep contact stable.
4. Tap **Start**, and the value will be displayed on the screen.

4.2.3 Resistance Measurement


1. Select "Resistor".



2. Insert one end of the black multimeter test lead into the "COM" end and one

end of the red multimeter test lead into the "V/ Ω " end.

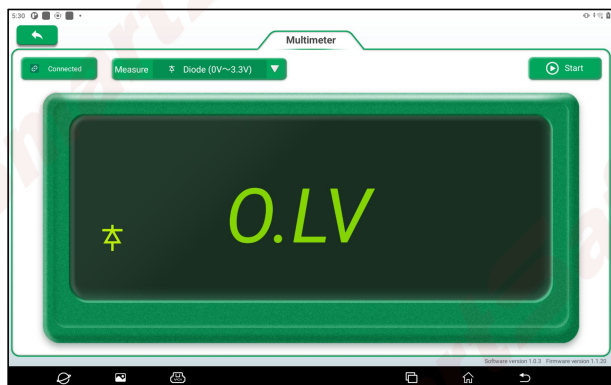
3. Connect the black and red test leads to the metal parts at both ends of the resistance. Keep the contact between the test lead and the resistance stable.
4. Tap **Start**, and the value will be displayed on the screen.

 *Note: During the measurement, you can touch the resistance by hand, but do not touch both ends of the resistance at the same time, which will affect the measurement accuracy.*

4.2.4 Diode Measurement

The multimeter can also measure light emitting diodes and rectifying diodes. The multimeter test lead position is the same as the voltage measurement.

1. Select "Diode".



2. Insert one end of the black multimeter test lead into the "COM" end and one end of the red multimeter test lead into the "V/ Ω " end.
3. Connect the red test lead to the positive electrode of the diode and the black test lead to the negative electrode. Keep the contact between the test lead and the diode stable.
4. Tap **Start**, and the forward conduction voltage reading of the diode will be displayed on the screen.

4.2.5 On-off Measurement

1. Select "ON/OFF".



2. Insert one end of the black multimeter test lead into the "COM" end and one end of the red multimeter test lead into the "V/ Ω " end.
3. Connect the red and black test leads to the circuit under test.
4. Tap **Start**, the measurement results will be displayed on the screen. If the resistance of the circuit under test is $\leq 50\Omega$, the buzzer will sound; If the resistance of the circuit under test is $\geq 610\Omega$, 0.L will be displayed on the screen.

4.3 Detection Examples

Detection of knock sensor

(1) Detection of knock sensor resistance

Turn the ignition switch to the "OFF" position, disconnect the lead connector of the knock sensor, and detect the resistance between the knock sensor connecting terminal and the housing via resistance measurement, which should be ∞ (non-conductive). If it is 0Ω (conductive), the knock sensor must be replaced. For magnetostrictive knock sensor, the resistance measurement can also be used to detect the coil resistance. The resistance value shall meet the specified value (Refer to the maintenance manual of the corresponding model for specific data). Otherwise, the knock sensor must be replaced.

(2) Inspection of knock sensor output signal

Unplug the connecting plug of the knock sensor and check the voltage between

the knock sensor connecting terminal and the grounding with the "AC voltage" measuring gear when the engine is idling. There should be pulse voltage output. If not, the knock sensor must be replaced.

Detection of cooling water temperature sensor

(1) Resistance detection of cooling water temperature sensor

On-vehicle inspection: Turn the ignition switch to OFF position, remove the cooling water temperature sensor wire connector, and test the resistance value between the two terminals of the sensor via resistance measurement. The resistance value is inversely proportional to the temperature (negative temperature coefficient), and shall be less than 1K Ω when the engine is hot.

Single piece inspection: Unplug the cooling water temperature sensor wire connector, and then remove the sensor from the engine. Place the sensor in the water in the beaker, heat the water in the beaker, and measure the resistance value between the two terminals of the water temperature sensor under different water temperature conditions via resistance measurement. Compare the measured value with the standard value. If it does not meet the standard, the water temperature sensor should be replaced.

(2) Output signal voltage detection of cooling water temperature sensor

Install the cooling water temperature sensor and plug the wire connector of the sensor. When the ignition switch is turned to the ON position, test the sensor output voltage signal from the two terminals of the water temperature sensor wire connector. The measured voltage value shall change inversely with the cooling water temperature. When the cooling water temperature sensor harness is disconnected and the ignition switch is turned on, the voltage should be about 5V.

4.4 Precautions

1. The head of the multimeter test lead is metal. Do not touch it with hands during measurement, otherwise it will not only affect the measurement results, but also cause electric shock.

2. Before the measurement, calibrate the measuring range and the jack inserted by the test lead, and then carry out the measurement after there is no error.
3. If the measured value cannot be estimated before measurement, the highest range shall be used for measurement first, and then the appropriate range shall be selected according to the measurement results.
4. It is strictly prohibited to switch the range when measuring high voltage or large current to prevent arcing and burning the switch contacts. To shift gears, the metal contacts must be disconnected first.
5. It is strictly prohibited to measure the resistance when the circuit under test is live to avoid damaging the instrument.
6. When measuring DC power, select appropriate gear. For different components, the current is different. You can refer to the marked parameters of components to switch gears. During measurement, it is connected to the circuit in series, and then measured one by one. The voltage of the branch can be disconnected first. In particular, it is forbidden to connect the multimeter in parallel in the circuit, which will not only damage the multimeter but also cause casualties.

5. Maintenance

Note: To avoid damage to the oscilloscope or probe, do not expose it to mist, liquids or solvents.

Cleaning

Check the Oscillograph Multimeter and probe frequently in accordance with the requirements of operating conditions, clean the external surfaces of the instrument as follows.

1. Use a lint-free cloth to clean the outside of the Oscillograph Multimeter and probe from floating dust.
2. Use a soft cloth moistened with water to clean the oscilloscope.

Note: To avoid damaging the surface of the Oscillograph Multimeter or probe, do not use any corrosive reagents or chemical cleaning reagents.

Warranty

This WARRANTY applies only to customers and dealers who have purchased SmartSafe products through normal procedures.

Within one year from the date of delivery, SmartSafe Company shall guarantee the defects of its electronic products caused by materials or processes. Damage of the equipment or components caused by abuse, unauthorized modification, use for purposes other than the design of the product, or failure to operate in the way specified in the instruction shall not be covered by this warranty.

Disclaimer

The warranty mentioned above may supersede any other warranty.

Order notification

The replaceable parts and optional parts can be ordered directly from the suppliers authorized by SmartSafe. Please specify when ordering:

- Quantity ordered
- Part number
- Part name

Customer Service Center

If the equipment needs to be repaired, please send the equipment to SmartSafe, together with the purchase invoice and problem description. If the equipment is within the scope of the warranty, SmartSafe offer free maintenance; If the equipment is outside the scope of the warranty, SmartSafe will charge for maintenance and return freight.

Address of SmartSafe Company:

3310, Building 11, Tian 'an Yungu Industrial Park, Bantian Street, Longgang District, Shenzhen, Guangdong, China. Postcode: 518110

Statement: The Company reserves the right to change the product design and specifications without prior notice. The appearance and color of the object may be different from that shown in the instruction manual. The object shall prevail. We have tried our best to make all the descriptions in the book accurate, but there are still some inaccuracies. If you have any doubt, please contact the distributor or after-sales service center. The company will not assume any consequences caused by misunderstanding.