# OWON®

# HDS200 Single Channel Series

# Handle Oscilloscope User Manual

■ **HDS241**

■ **HDS271**

※：The illustrations, interface, icons and characters in the user manual may be slightly different from the actual product. Please refer to the actual product.

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# General Warranty

We warrant that the product will be free from defects in materials and workmanship for a period of 3 years from the date of purchase of the product by the original purchaser from the our Company. The warranty period for accessories such as probes, adapter is 12 months. This warranty only applies to the original purchaser and is not transferable to a third party.

If the product proves defective during the warranty period, we will either repair the defective product without charge for parts and labour, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by our company for warranty work may be new or reconditioned like new. All replaced parts, modules and products become the property of our company.

In order to obtain service under this warranty, the customer must notify our company of the defect before the expiration of the warranty period. Customer shall be responsible for packaging and shipping the defective product to the designated service centre, a copy of the customers proof of purchase is also required.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. We shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than our company representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of not our supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

Please contact the nearest Sales and Service Offices for services.

**Excepting the after-sales services provided in this summary or the applicable warranty statements, we will not offer any guarantee for maintenance definitely declared or hinted, including but not limited to the implied guarantee for marketability and special-purpose acceptability. We should not take any responsibilities for any indirect, special or consequent damages.**

# Table of Contents

# 1. Safety Information

(Before using this product, please read the safety information in advance)

## Safety Requirements

Please read the following safety precautions to avoid personal injury and prevent damage to this product or any other products connected to it. In order to avoid possible hazards, this product can only be used within the specified range.

- **Only a qualified person should perform internal maintenance.**
- **Check all Terminal Ratings.** To avoid fire or shock hazard, check all ratings and markings on this product. Refer to the user manual for more information about ratings before connecting to the instrument.
- **Do not operate without covers**. Do not operate the instrument with covers or panels removed.
- **Avoid exposed circuit**. Be careful when working on exposed circuitry to avoid risk of electric shock or other injury.
- **Do not operate if any damage.** If you suspect damage to the instrument, have it inspected by qualified service personnel before further use.
- **Do not operate in damp conditions.**
- **Do not operate in an explosive atmosphere.**
- **Keep product surfaces clean and dry.**
- **Using the equipment not in accordance with the method specified by the manufacturer may damage the protection provided by the equipment.**

## Safety Terms and Symbols

### Terms in this manual

The following terms may appear in this manual:

⚠ **Warning:** Warning indicates conditions or practices that could result in injury or loss of life.

⚠ **Caution:** Caution indicates the conditions or practices that could result in damage to this product or other property.

**Terms on the product.** The following terms may appear on this product:

**Danger:** Indicates an immediate hazard or injury possibility.

**Warning:** Indicates a possible hazard or injury.

**Caution:** Indicates potential damage to the instrument or other property.

## Symbols on the product

The following symbol may appear on the product:

⚡ Hazardous Voltage　　　　⚠ Refer to Manual

⏚ Protective Earth Terminal　　⏛ Chassis Ground

⏚ Test Ground

⚠**Warning:**

To prevent electric shock or fire, use a suitable power adapter. Only power adapters that are dedicated to this product and approved for use in the country of use may be used.

⚠**Warning:**

The channel of the oscilloscope is non-isolated channel. Note that the channel should use a common reference when measuring, and the ground wires of the probes cannot be connected to non-isolated place with different DC electrical levels, otherwise it may cause a short circuit due to the ground wire connection of the oscilloscope probe.

⚠️**Warning:**

Note that the channel should use a common reference when measuring, otherwise it may cause a short circuit due to the ground wire connection of the oscilloscope probe.

Schematic diagram of the internal ground wire connection of the oscilloscope:
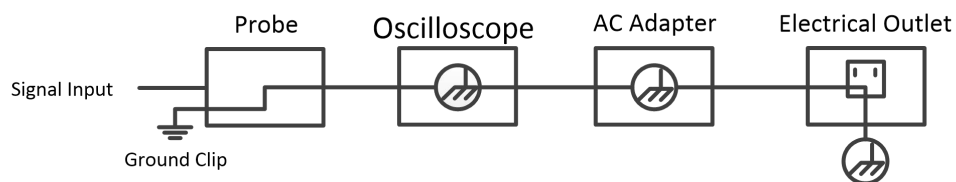


Schematic diagram of internal ground connection when oscilloscope is connected with computer through the port:
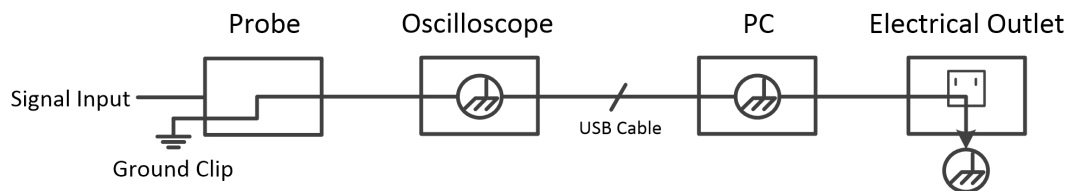


⚠️**Warning:**

If the input port of the oscilloscope is connected to a voltage with a peak value higher than 42V (30vrms) or a circuit with a peak value of more than 4800 VA, the following measures shall be taken to avoid electric shock or fire:

● Only voltage probes, test wires and adapters with proper insulation attached to the oscilloscope or accessories suitable for oscilloscope instrument series products specified by our company shall be used.

● Before use, check the multimeter test probe, oscilloscope probe and accessories for mechanical damage. If damage available, replace it.

● Remove all unused multimeter test probes, oscilloscope probes and accessories ( USB etc.).

● Firstly, plug the power adapter into the AC socket, and then connect it to the oscilloscope.

● When testing in a CAT II environment, do not connect a voltage higher than 400 V to any input port.

- When testing in a CAT II environment, do not connect a voltage with a voltage difference of more than 400 V to the isolated input port.

- Do not use an input voltage higher than the rated value of the instrument. Pay special attention when using 1:1 test wires, because the probe voltage will be directly transmitted to the oscilloscope.

- Do not touch the bare metal BNC or banana plug.

- Do not insert metal objects into the connector.

- Use the oscilloscope only in the specified way.

- The voltage rating mentioned in the "warning" information is the limited value of "working voltage". They represent V ac rms (50-60 Hz) in AC sine wave applications; and V dc in DC applications. CAT is the prefix, and II refers to the level. Level II is the low voltage and high energy level, which refers to the local electrical level applicable to electrical appliances and portable equipment.

# 2. How to Implement the General Inspection

After you get a new oscilloscope, it is recommended that you should make a check on the instrument according to the following steps:

## Check whether there is any damage caused by transportation

If it is found that the packaging carton or the foamed plastic protection cushion has suffered serious damage, do not throw it away first till the complete device and its accessories succeed in the electrical and mechanical property tests.

## Check the Accessories

The supplied accessories have been already described in the "Appendix A: List of Accessories" of this Manual. You can check whether there is any loss of accessories with reference to this description. If it is found that there is any accessory lost or damaged, please get in touch with our distributor responsible for this service or our local offices.

## Check the Complete Instrument

If it is found that there is damage to the appearance of the instrument, or the instrument can not work normally, or fails in the performance test, please get in touch with our distributor responsible for this business or our local offices. If there is damage to the instrument caused by the transportation, please keep the package. With the transportation department or our distributor responsible for this business informed about it, a repairing or replacement of the instrument will be arranged by us.

# 3. How to Use the Oscilloscope

## The Structure of the Oscilloscope

### Front Panel and Keys

The front panel and keys of the oscilloscope are shown in the below:
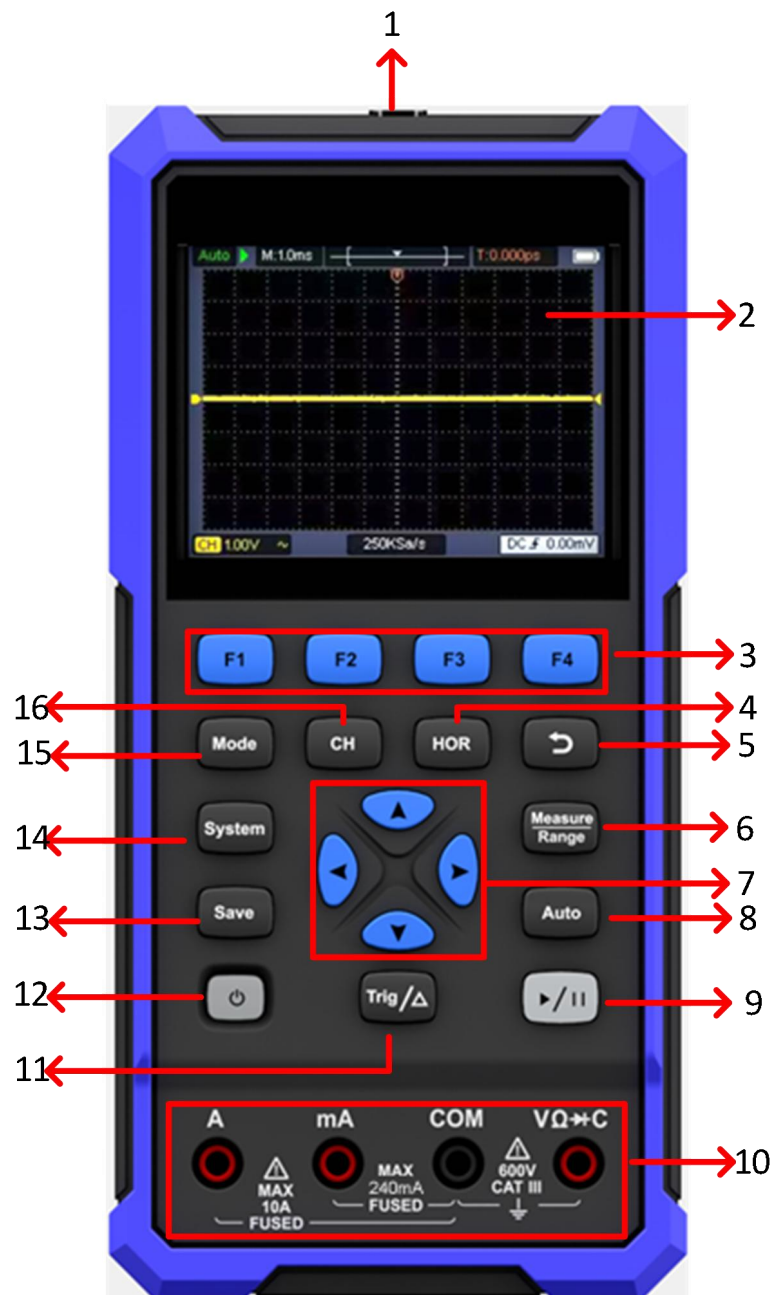


Figure 3- 1: Front Panel of the Oscilloscope

Description:

| Num | Illustration in multimeter mode | Illustration in oscilloscope mode |
|---|---|---|
| 1 | The measured signal input connector. | |
| 2 | Display area. | |
| 3 | The **F1 - F4** keys are multi-function keys. In each menu mode, press the corresponding key to select the corresponding menu item. | |
| 4 | | Press **HOR** key,through ▲ ▼ key to change the horizontal time base setting, and observe the change of the state information caused by it;it can also be found that the **horizontal time base** display corresponding to the status bar has changed correspondingly; the horizontal position of the signal in the waveform window can be adjusted by pressing ◄ ► . |
| 5 | | Return key,Press this key to return to the previous menu; when the menu is the first level, press the return key to close the menu (Note: Valid when the return icon is displayed). |
| 6 | Range switch key. | Measurement menu key. |
| 7 | | Function of direction keys▲ ▼: used for the up and down movements of waveform, the time base changing, the voltage cursor movements and the trigger of electrical level change in the oscilloscope; Function of direction keys◄ ►: used for the left and right movements of waveform, the voltage position changing and the movements of time cursor in the oscilloscope. |
| 8 | Auto range key. | Automatic setting key. |

| 9 | Value hold key. | Stop/Run key. |
|---|---|---|
| 10 | Multimeter input port. | |
| 11 | Relative value key. | Trigger menu key. |
| 12 | Long press to turn off, short press to turn on. | |
| 13 | Save setting key. | |
| 14 | System setting key. | |
| 15 | Switch key for working state of oscilloscope, multimeter or signal source. | |
| 16 | | Channel key. |

## Side Panel



Figure 3- 2: Side Panel of the Oscilloscope

Description：

1. Probe compensation: 2.5V/1kHz square wave signal output or signal generator output connector.
2. Charging or USB communication interface.
3. Bracket.

# Introduction to the User Interface of the Oscilloscope
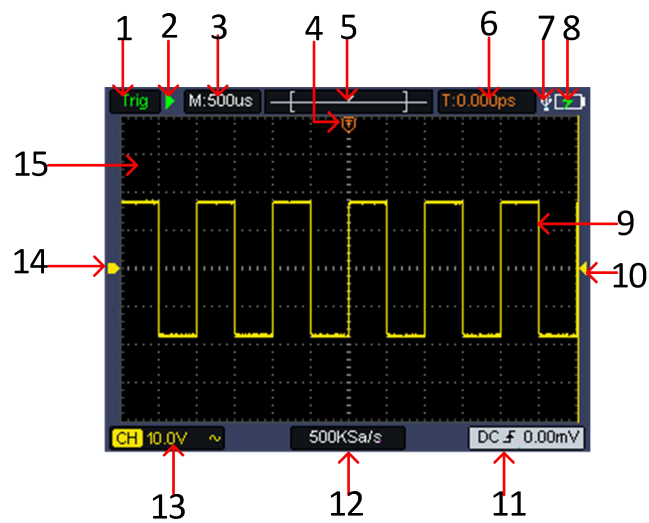


Figure 3- 3: Oscilloscope Interface

Description:

1.  The trigger status indicates the following information:

    ● Auto: Automatic mode. The waveform is being collected without triggering.

    ● Trig: A trigger has been detected and post trigger information is being collected.

    ● Ready: All pre trigger data have been obtained and the oscilloscope is ready.

    ● Scan: Scan mode. Continuously collect and display waveform data.

    ● Stop: Stop collecting waveform data.

2.  Run/stop.

3.  Time base display.

4.  The pointer indicates the trigger horizontal position.

5.  The pointer indicates the trigger position within the current storage depth.

6.  Indicating the value of the current trigger horizontal position, and displaying the position of the current waveform window in the memory.

7.  It indicates that there is a USB disk connecting.

8.  Battery power and external power supply indication.

9.  Channel waveform.

10. The pointer indicates the trigger level position of the channel.

11. The icon indicates trigger relative information, including   coupling mode, trigger type and trigger level. For details, please refer to "Trigger System" on page 18.

12. The current sampling rate.

13. The channel information reading indicates the voltage scale of the channel.

    The icon indicates the coupling mode of the channel:

    "—" means DC coupling;

    "∼" means AC coupling;

    "⊥" means Ground coupling.

14. The pointer indicates the grounding reference point (zero position) of the channel waveform.

15. Waveform display area.

## How to Conduct Functional Check

Making a quick functional check to verify that the instrument is working properly. Please proceed as follows:

1.  **Press the switch at the bottom left of the main unit ⏻.**

    The internal relay will make a slight click. The instrument executes all self-check items, and enter the interface. The default probe menu attenuation coefficient setting value is **10X**.

2.  **The switch on the oscilloscope probe is set to 10X and connected with the channel.**

    Align the slot on the probe with the plug on the bayonet nut connector (**BNC**) of the connector and insert it, then turn the probe to the right and tighten it.

    Connect the probe tip and ground clamp to the connector of the probe

compensator. Please pay attention to the terminal polarity. The square terminal represents the signal output, and the round terminal represents the reference ground.

3. **Press the "Auto" key on the front panel.**

Within a few seconds, a square wave display (1kHz/2.5Vpp) can be seen, as shown in Figure 3- 4.

**Note:** If the displayed waveform is not a square wave, press **System** first, then press **F3** (Factory), can see the square waveform display.
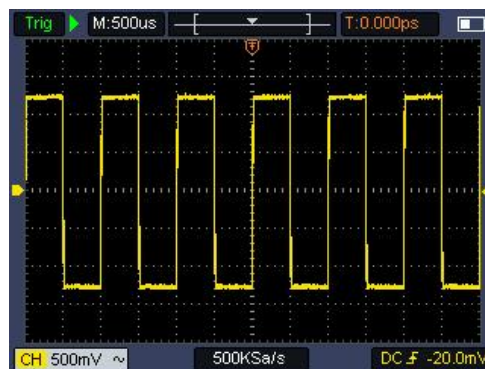


Figure 3- 4: Automatic Setting

## How to Conduct Probe Compensation

When connecting the probe to any input channel for the first time, make this adjustment to match the probe with the input channel. The probe without compensation or deviation compensation will lead to measurement error. To adjust the probe compensation, please follow the following steps:

1、 Set the probe menu attenuation coefficient to **10X**, and set the switch on the probe to **10X** (see "How to Conduct Probe Attenuation Coefficient Setting" in P13), and connect with the channel. If a hook probe is used, make sure it is in close contact with the probe. Connect the probe tip to the signal output connector of the probe compensator, and connect the reference wire clamp to the ground wire connector of the probe compensator, and then press the **Auto** key on the front panel.

2、 Check the displayed waveform and adjust the probe until the compensation is correct. See Figure 3- 5，Figure 3- 6.
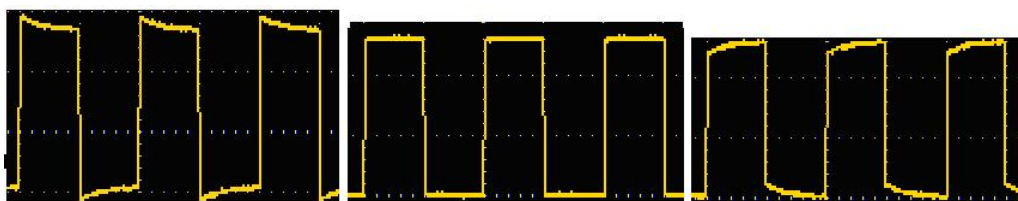
**Overcompensation    Correct compensation    Under-compensation**

Figure 3- 5: Display Waveform of Probe Compensation

3、 Repeat the steps if necessary.
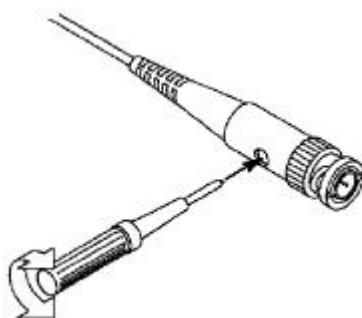


Figure 3- 6: Probe Adjustment

## How to Conduct Probe Attenuation Coefficient Setting

The probe has a variety of attenuation coefficients, which will affect the vertical position factor of the oscilloscope.

To change (check) the set value of probe attenuation coefficient in the oscilloscope menu, press **F2** key to select the desired attenuation coefficient, this setting is valid until it is changed again.

⚠ **Note:** The preset setting of the probe attenuation coefficient in the menu when the oscilloscope is delivered is 10X. Make sure that the attenuation switch setting value on the probe is the same as the probe attenuation coefficient option in the oscilloscope menu.

The setting value of the probe switch is **1X** and **10X**. See Figure 3- 7.
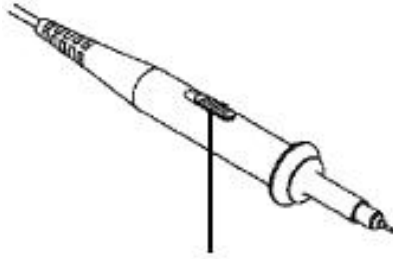
Figure 3- 7: Probe Attenuation Switch

⚠ **Note**: When the attenuation switch is set to **1X**, the probe limits the bandwidth of the oscilloscope to **5 MHz**. To use the full bandwidth of the oscilloscope, be sure to set the switch to **10X**.

## How to Safe Use of Probe

The safety ring surrounding the probe body provides a barrier to protect the fingers from electric shocks. See Figure 3- 8.



Figure 3- 8: Finger Safety Ring of the Probe

⚠ **Warning:** To prevent electric shock when using the probe, please keep your fingers behind the safety ring on the probe body.

To prevent electric shock when using the probe, do not touch the metal part of the probe head when the probe is connected to a voltage source.

Before making any measurements, connect the probe to the instrument and connect the ground terminal to the ground.

# Vertical System

The vertical system can be used to adjust the vertical scale, the position and other settings of the channel.

### Vertical position

Press **CH** key, and move the vertical position of the selected channel up or down by pressing the ▲ or ▼ direction keys. Press the ▲ and ▼ direction keys at the same time to center the vertical position.

### Vertical Volt/Div Setting

The volt/div range is 10mV/div-10V/div (probe 1X), stepping in the 1-2-5 way, or 100mV/div-100V/div (probe 10X), 1V/div-1000V/div (probe 100X), 10V/div-10000V/div (probe 1000X) , 100V/div-100000V/div (probe 10000X). Press **CH** key, through ◀ or ▶ direction key to change the volts/div setting of the channel.

The description of the vertical system setting menu is as follows:

| Menu | Settings | Descriptions |
|---|---|---|
| Coupling | AC | The normal sampling method uses the AC and DC components of the input signal. |
| | DC | Block the DC component of the input signal. |
| | GND | Disconnect the input signal. |
| Probe | 1X<br>10X<br>100X<br>1000X<br>10000X | Choose one of the values according to the probe attenuation factor to keep the vertical scale reading accurate. |

# Horizontal System

Press the **HOR** key to enter the horizontal system setting menu. Use the ◀ and ▶ direction keys to change the horizontal scale (time base) and horizontal trigger position. When changing the horizontal scale, the waveform is enlarged or reduced relative to the center of the screen. When the horizontal position changes, the position relative to the waveform trigger point

changes.

**Note**: Press the ◄ and ► direction keys at the same time to center the horizontal position.

The description of the horizontal system setting menu is as follows:

| Menu | Settings | Descriptions |
|---|---|---|
| Acqu Mode | Sample | Normal sampling method. |
| | Peak Detect | Used to detect interference glitches and reduce the possibility of confusion. |
| Length | 4K 8K | Select the length to be recorded. |
| Length | 4K 8K | Select the length to be recorded. |
| 1/2 | | Enter the next menu. |
| Refresh | High Low | Set the refresh rate to "High" or "Low". |
| Hor center | | Set the horizontal trigger position in the middle of the screen. |
| 2/2 | | Return to the previous menu. |

## Measuring System

## Automatic Measurement

Press $\frac{\text{Measure}}{\text{Range}}$ and **F1** key to realize automatic measurement. The measurement can be displayed at the bottom left of the screen.

Automatic range type including: Frequency, Period, Amplitude, Maximum, Minimum, Peak-to-Peak, Average and RMS.

The description of the automatic measurement **Function Menu** is as follows:

| Menu | | Descriptions |
|---|---|---|
| Meas ure | ON OFF | Turn automatic measurement on or off. |

| | Freq (F) □ | |
| | Period (T) □ | |
| | Amp (Va) □ | Add or delete the selected |
| Add | Min (Mi) □ | measurement type. |
| Del | Max (Ma) □ | Note: The unselected state is □; |
| | PK - PK (Vpp) □ | The selected state is ∎. |
| | Mean(V) □ | |
| | RMS (RMS) □ | |

## The automatic measurement of voltage parameters

The oscilloscopes provide automatic voltage measurements including Mean, PK-PK, RMS, Max, Min and Vamp. Figure 3-9 below shows a pulse with some of the voltage measurement points.
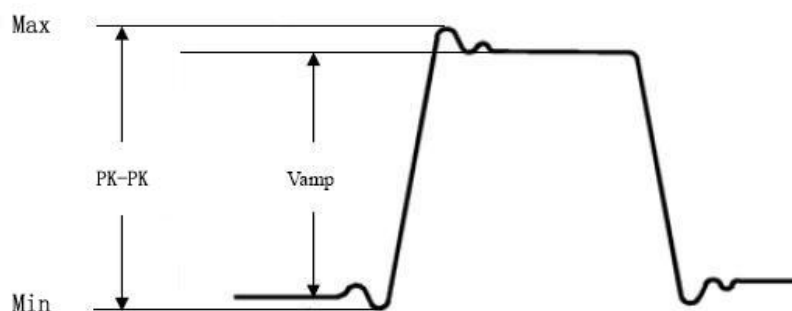


Figure 3- 9

**Mean:** The arithmetic mean over the entire waveform.
**PK-PK:** Peak-to-Peak Voltage.
**RMS:** The true Root Mean Square voltage over the entire waveform.
**Max:** The maximum amplitude. The most positive peak voltage measured over the entire waveform.
**Min:** The minimum amplitude. The most negative peak voltage measured over the entire waveform.

**Vamp:** Voltage between Vtop and Vbase of a waveform.

**Automatic measurement of time parameters**

The oscilloscope can automatically measure the period and frequency of the signal.

# Cursor Measurement

Press $\frac{\text{Measure}}{\text{Range}}$ and **F2** key to realize cursor measurement.

The description of **Cursor Measurement Menu** is as follows:

| Menu | Settings | Descriptions |
|---|---|---|
| Type | Voltage | Select to display the voltage measurement cursor and menu. |
| | Time | Select to display the time measurement cursor and menu. |
| | OFF | Turn off the cursor measurement. |
| A | | When the type is selected as **Voltage**，press the arrow keys ▲ ▼ to move the cursor line A; when the type is selected as **Time**, press the arrow keys ◀ ▶ to move the cursor line A. |
| B | | When the type is selected as **Voltage**，press the arrow keys ▲ ▼ to move the cursor line B; when the type is selected as **Time**, press the arrow keys ◀ ▶ to move the cursor line B. |
| AB | | Link A and B. By pressing the arrow keys ▲ ▼ two cursors can be moved at the same time; when the type is selected as **Time**, by pressing the arrow keys ◀ ▶ , two cursors can be moved at the same time. |

# Display unknown signals using automatic Settings

The automatic setting function enables the oscilloscope to automatically display and measure unknown signals. This function optimizes position, range, timebase, and trigger and ensures a stable display of any waveform. This feature is particularly useful for quickly checking several signals.

To enable auto-setup, perform the following steps:

1. Connect the oscilloscope probe to the measured signal.

2. Press the **Auto** key, the oscilloscope enters the automatic measurement state, and the measured signal will be displayed on the screen.

# Trigger System

The trigger determines when the oscilloscope starts to acquire data and display waveforms. Once the trigger is set correctly, it can convert an unstable display into a meaningful waveform.

When the oscilloscope starts to acquire data, it first acquires enough data to draw the waveform on the left side of the trigger point. The oscilloscope continuously acquires data while waiting for the trigger condition to occur. When a trigger is detected, the oscilloscope continuously acquires enough data to draw a waveform on the right of the trigger point.

The trigger mode of this series of oscilloscopes is edge trigger.

The edge trigger mode is to trigger on the trigger electrical level of the edge of the input signal, that is, trigger on the rising and falling edges of the input signal.

Entering the edge trigger, the trigger setting information is displayed at the bottom right corner of the screen, e.g. DC ⌁ 0.00mV. It indicates that the trigger type is rising edge, the trigger coupling is DC and the trigger level is 0.00mV.

The description of the trigger system setting menu is as follows:

| Menu | Settings | Descriptions |
|---|---|---|
| Coupling | AC<br>DC | Set to prevent DC component from passing through.<br>Set to allow all components to pass through. |
| Type | Auto | Waveforms can be acquired without detecting trigger conditions. |
| | Normal | The waveform is acquired only when the trigger conditions are met. |
| | Single | When a trigger is detected, a waveform is sampled and then stopped. |
| Slope | Rising edge<br>Falling edge | Trigger on the rising edge of the signal.<br>Trigger on the falling edge of the signal. |
| 1/2 | | Enter the next menu. |
| Trigger center | | The trigger position is set in the middle of the waveform. |
| Force | | Forced trigger key, which forcibly generates a trigger signal, mainly used in the "normal" and "single" modes of the trigger mode. |
| 2/2 | | Return to the previous menu. |

**Trigger level**: The amplitude level that the signal must cross when setting the waveform acquisition. Press the **Trig/△** key to enter the trigger menu, and

press the ▲ or ▼ key to move the trigger electrical level up and down.

## Save Settings

Press the **Save** key to enter the save function menu. By operating the save function menu, oscilloscope settings, reference waveforms, and files can be stored.

● **Configure**

Any setting can be saved inside the oscilloscope, and restore settings can also be called.

The description of **Configure** menu is as follows:

| Menu | Settings | Descriptions |
|---|---|---|
| Object | S1<br>S2<br>S3<br>S4 | Set waveform name. |
| Save | | Save the current parameter settings of the oscilloscope to the internal memory. |
| Recall | | Call the settings saved in the current storage location. |

● **Ref wave**

The actual waveform can be compared with the reference waveform to find out the difference. Press the **Save** key to enter the save function menu, and press **F2** to select the reference waveform to enter the reference waveform menu.

The description of the **Reference Waveform** menu is as follows:

| Menu | Settings | Descriptions |
|---|---|---|
| Object | R1<br>R2<br>R3<br>R4 | Set waveform name. |
| Display | ON<br>OFF | Call or close the waveform of the current target address in the internal memory. When it displays "On", if there is a stored waveform at the current address, the waveform will be displayed, and the address number and waveform related |

| | | information will be displayed in the upper left corner; if the current address is not stored, it will display "Address No.: No waveform saved". |
|---|---|---|
| Save | | Save the reference waveform of the source to the memory. |

● **File**

The file can be saved as waveform or image. The waveform and image can be read by plugging and unplugging the USB data cable or selecting MSC in the USB option on the next page of system settings.

The description of **File** menu is as follows:

| Menu | | | Settings | Descriptions |
|---|---|---|---|---|
| File | Wave | File name | wave1 wave2 wave3 wave4 | Select the file name of the stored waveform. |
| | | Save | | Store the waveform of the source in a csv file named by the specified file name. |
| | Image | File name | image1 image2 image3 image4 | Select the file name of the stored image. |
| | | Save | | Store the current screen image in the bmp file named by the specified file name. |

## System Settings

Press the **System** key to enter the system function menu.

● **Display**

The description of the menu is as follows:

| Menu | Settings | Descriptions |
|---|---|---|
| Brightness | 10% - 100% | Set the screen backlight to increase in a 10% cycle. |
| Backlight time | 30s 60s 120s Unlimited | Set the screen backlight luminance time. Unlimited means always on. |
| Menu time | 5s 10s 20s | Set the menu display time. |

| | 30s 60s | |
|---|---|---|
| Turned on | 00h：00m | Display how long it has been powered on. |

● **System**

The description of the menu is as follows:

| Menu | Settings | Descriptions |
|---|---|---|
| Language | | Set the menu language. |
| Shutdown time | 10 minutes 30 minutes 60 minutes Unlimited | Set the automatic shutdown time. Unlimited means no shutdown. Please pay attention to this setting if you use the battery only. |
| 1/2 | | Enter the next menu |
| About | | After pressing this key, the instrument model, serial number, version, and checksum can be displayed. |
| Upgrade | | To upgrade the system. The version of the upgrade package must be higher than the version of the instrument itself. |
| 2/2 | | Return to the previous menu |

● **Default setting**

Press the **System** key to enter the system setting menu. Select **F3** "Default Setting", the screen will prompt "Press < F3 > for default setting. Otherwise press the Return key". If you need to perform the default setting, press F3 again to complete the default setting, otherwise, press the return key.

● **USB Connection**

Press the **System** key to enter the system setting menu. Select **F4** to enter the next page. Press **F1** to select **HID** or **MSC**.

1) **MSC [Mass Storage Class]** is used to make USB read the files stored in the built-in memory.

2) **HID [Human interface Device]** is used to select the oscilloscope device as the host computer to control and communicate with the computer.

● **Factory Settings**

Press the **System** key to enter the system setting menu then press **F4** to

enter next page. Select **F2** "Default", the screen will prompt "Press < F2 > for factory setting. Otherwise press the Return key". If you need to perform the default setting, press F2 again to complete the default setting, otherwise, press the return key.

- **Automatic Calibration**

The automatic correction program can quickly make the oscilloscope reach the best condition to obtain the most accurate measurement value. You can execute this program at any time, but if the ambient temperature variation range reaches or exceeds 5℃, you must execute this program.

To perform automatic calibration, disconnect all probes or wires from the input connector. Then, press the **System** key. Press the menu selection key **F4** to enter the next page, and press the menu selection key **F3**. The screen will prompt "Disconnect all inputs Press < F3 > for factory setting. Otherwise press the Return key". If you need to perform the automatic calibration,press F3 again to complete it,otherwise press the return key.

# 4. How to Use the Multimeter

## About This Chapter

This chapter introduces the multimeter function of the oscilloscope step by step, and provides some basic examples of basic operations and how to use the menu.

## Instrument Interface

The multimeter uses four 4-mm safety banana plug input ends: **A, mA, COM,** and **VΩ→⊢C**.

Multimeter interface:



Multimeter Interface

Description:

1. Measurement type indication:

| | | |
|---|---|---|
| --- **DCV** | ------ | DC voltage measurement |
| ~ **ACV** | ------ | AC voltage measurement |
| --- **DCA** | ------ | DC current measurement |

| | | | |
|---|---|---|---|
| $\sim$ **ACA** | ------ | AC current measurement |
| $\Omega$ **Resist** | ------ | Resistance measurement |
| **Diode** | ------ | Diode measurement |
| **Cont** | ------ | On/Off measurement |
| **Cap** | ------ | Capacitance measurement |

2.Range indication: **Manual** means manual range; **Auto** means automatic range.

3. Current measurement range.

4. Indicating that there is a USB cable inserted.

5. Battery power indication.

6. "Hold" can keep the current reading on the display.

7. Measurement value and unit.

8. Display of switching resistance, buzzer, diode and capacitance measurement function.

9. The selected range V or mV in voltage measurement; the selected current range A or mA in current measurement.

10. To choose AC or DC current measurement.

11. To choose to AC or DC voltage measurement.

12. Display of relative value measurement function (only available when measuring DC current, DC voltage and resistance).

# 5. How to Use the Waveform Generator

The instrument can provide 4 basic waveforms, sine wave, square wave, ramp wave, pulse wave, and 8 arbitrary waveforms.

## Connect the output

Press the **Mode** button to switch the instrument interface to the waveform generator function interface.

Clamp the probe end and ground to the connector of the probe compensator, pay attention to the terminal polarity, the square terminal represents the signal output, and the circular terminal represents the reference ground.

To view the output of the signal generator, insert the slot end on the probe into the signal input channel of the oscilloscope.

**Note: BNC output ports not allowed to input any signal such as voltage, current and other electrical signal, otherwise, it will be burned.**
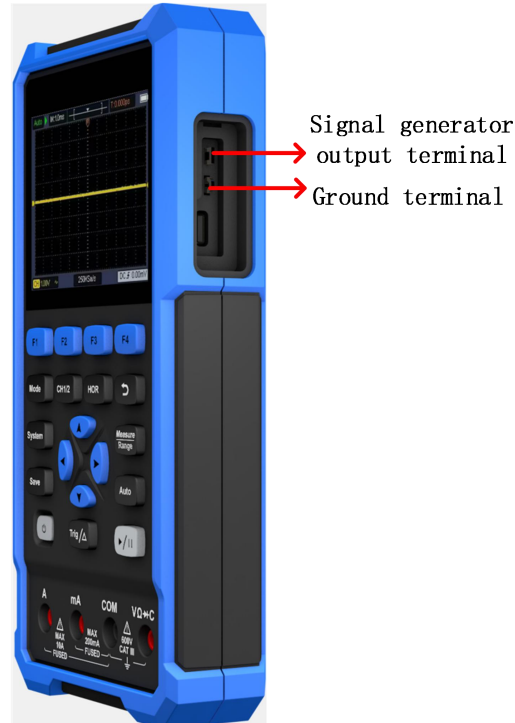


Figure 5- 1: Signal generator output terminal

## Set the waveform

(1)  Press the **Mode** button to switch the instrument interface to the waveform generator function interface.

(2) Press  `F1`  to select the desired waveform, and the screen will display the corresponding waveform setting menu.

(3) Set the parameters of the desired waveform through the operation panel **F3-F4** and the ▲ ▼ ◄ ► panel keys.

## Output the sine waveform

The sine waveform setting menu includes: Freq,  Amplitude .

### Set the Frequency

Press the  `F1`  key to enter the sine waveform setting interface.

Press the  `F3`  or  `F4`  key to switch to the Freq parameter, the selected parameter item will be displayed in green (the same below), and then use the ▲ ▼ ◄ ► direction keys to set the desired value.

### Use the direction keys to change the selected parameter value:

Press ▲ / ▼ to increase or decrease the value at the cursor. Press ◄ / ► to move the cursor left and right to different numerical digits.

### Set the Amplitude

Press the  `F3`  or  `F4`  key to switch to the Amplitude parameter, and then use the ▲ ▼ ◄ ► direction keys to set the desired value.

## Output the square waveform

Press the  `F1`  key to enter the square waveform setting interface.

The square waveform setting menu includes: Freq,  Amplitude .

For the setting Freq and Amplitude please refer to "Output the sine waveform" on page 27.

# Output the ramp waveform

Press the F1 key to enter the ramp waveform setting interface.

The ramp waveform setting menu includes: Freq, Amplitude , Symmetry.

For the setting Freq and Amplitude please refer to "Output the sine waveform" on page 27.

### Set the symmetry of the ramp waveform

Press the F3 or F4 key to switch to the Symmetry parameter, use the ▲ ▼ ◄ ► direction keys to set the desired value.

# Output the pulse waveform

Press the F1 key to enter the pulse waveform setting interface.

The pulse waveform setting menu includes: Freq, Amplitude , Duty.

For the setting Freq and Amplitude please refer to "Output the sine waveform" on page 27.

### Set the Duty Cycle of the pulse waveform

Press the F3 or F4 key to switch to the Duty parameter, use the ▲ ▼ ◄ ► direction keys to set the desired value.

# 6. Communication with PC

The oscilloscope supports communications with a PC through USB. You can use the Oscilloscope communication software to store, analyze, display the data and remote control.

To learn about how to operate the software. Please download the oscilloscope communication software on our official download website and view it.

Here is how to connect with PC. Please download the Oscilloscope software package from our official website onto your computer, double-click it, and follow the prompts until the installation is complete.

(1) **Connection:** Use a USB data cable to connect the **USB Device port** in the right panel of the Oscilloscope to the USB port of a PC.

(2) **USB Port Settings:** The USB protocol type of the oscilloscope needs to be switched to **HID** (Press **System → F4→ USB**, and switch to **HID**).

(3) Run the Oscilloscope software after, the connection information in the bottom right corner of the software will turn green.
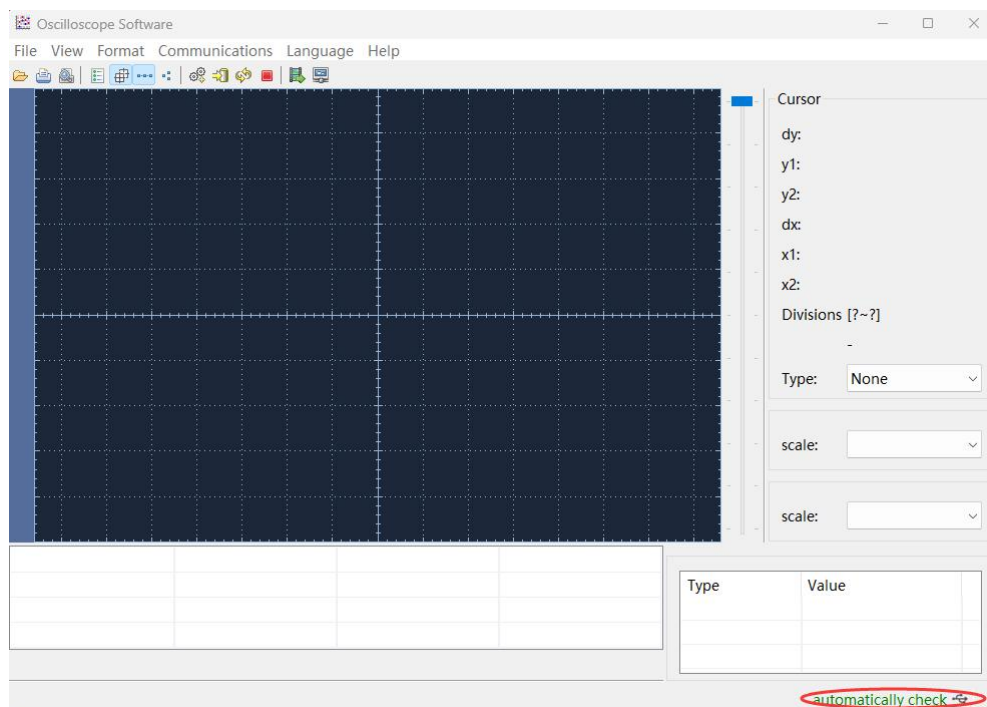


Figure 6- 1: Connect with PC through USB port

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# 7. Troubleshooting

**1. The oscilloscope cannot be turned on.**

It may be that the battery is completely exhausted. At this time, even if the oscilloscope is powered by the power adapter, the oscilloscope cannot be turned on. You need to charge the battery first, and do not turn on the oscilloscope. Wait for about 15 minutes, and then try to turn on the oscilloscope. If the oscilloscope still cannot be turned on, please contact us to serve you.

**2. The oscilloscope turns off after a few seconds of startup.**

It may be that the battery is exhausted. Check the battery symbol at the top left of the screen. ⚠ symbol indicates that the battery is exhausted and must be charged.

**3. After switching to the multimeter, the measurement type is displayed as E.**

It may be that the measurement type was not selected. At this time, press **F4**, the measurement type should display the corresponding measurement type. If E is still displayed, restart the oscilloscope.

**4. In the oscilloscope state, the measured voltage amplitude value is 10 times larger or smaller than the actual value.**

Check whether the channel attenuation coefficient is consistent with the actual probe error ratio.

**5. In the oscilloscope state, there is a waveform display, but it cannot be stabilized.**

● Check whether the source item in the trigger mode menu is consistent with the signal channel actually used.

● Check whether the trigger electrical level has exceeded the waveform range. Only by setting the parameters reasonably, the waveform can be displayed stably.

**6. In the oscilloscope state, nothing is displayed after pressing**

**RUN/STOP.**

Check whether the trigger mode of the trigger mode menu is normal or single, and the trigger electrical level is out of the waveform range. If so, center the trigger electrical level or set the trigger mode to automatic. In addition, you can press **Auto** to automatically complete the above settings.

**7. In the oscilloscope state, the display speed becomes slower when the average value sampling is set in the acquisition mode or the duration is set longer in the display settings.**

It is normal.

# 8. Technical Specifications

Unless otherwise stated, all technical specifications are applicable to the probe with the attenuation switch set to 10X and this series of oscilloscopes. The oscilloscope must first meet the following two conditions to meet these specifications and standards:

■ The instrument must be operated continuously for more than 30 minutes at the specified operating temperature.

■ If the operating temperature variation range reaches or exceeds 5℃, the system function menu must be opened to execute the "automatic correction" program (see automatic correction in "System Settings" on P21).

All specifications are guaranteed except those marked "typical".

## Oscilloscope

| Characteristics | | Descriptions | |
|---|---|---|---|
| Bandwidth | | HDS241 | 40 MHz |
| | | HDS271 | 70 MHz |
| Vertical resolution | | 8 bits | |
| Channel | | 1 | |
| Samp ling | Sampling method | Sampling, peak detection | |
| | Real-time sampling rate | 250 MSa/s | |
| | Waveform refresh rate | 10,000 wfms/s | |
| Input | Input coupling | DC, AC, GND | |
| | Input impedance (DC coupling) | 1 MΩ±2%, in parallel with 16 pF±10 pF | |
| | Probe attenuation | 1X, 10X, 100X, 1000X, 10000X | |
| | Maximum input voltage | 400 V (DC + AC , PK - PK) | |
| Horiz ontal | Sampling rate range | 0.25 Sa/s ～ 250 MSa/s | |
| | Waveform interpolation | Sinx/x | |
| | Sweep speed range (s/div) | 5ns/div - 1000s/div, step by the 1-2-5 way | |
| | Time base accuracy | ±100ppm | |
| | Record length | 8K or 4K optional | |

| | Sensitivity (Volt/div) range | 10 mV/div～10 V/div | |
|---|---|---|---|
| **Vertical** | Position range | ±2 V (10 mV/div – 200 mV/div)<br>±100 V (500 mV/div – 10V/div) | |
| | Analog bandwidth | HDS241 | 40 MHz |
| | | HDS271 | 70 MHz |
| | Low frequency response (AC coupling, -3dB) | ≥10 Hz | |
| | Rise time (typical on BNC) | HDS241 | ≤ 8 ns |
| | | HDS271 | ≤ 5 ns |
| | DC gain accuracy | ±3% | |
| **Measurement** | Cursor | ΔV, ΔT | |
| | Automatic | Period, Frequency, Mean, PK-PK, Max, Min, Amplitude, RMS | |
| **Triggering** | Trigger type | Edge | |
| | Coupling | DC, AC | |
| | Trigger mode | Auto, normal, single | |
| | Trigger level range | ±4 div from the center of the screen | |
| | Trigger level accuracy | ±0.3 div | |
| | Trigger position | According to Record length and time base | |
| | Edge triggering | Slope | Rising edge, falling edge |

## Multimeter

| Characteristics | Descriptions |
|---|---|
| Digital display | 24,000 counts |
| Measurement type | Voltage, Current, Resistance, Capacitance, Continuity, Diode |
| Maximum input voltage | AC : 750V DC : 1000V |
| Maximum input current | AC : 10A DC : 10A |

| Basic function | Range | Minimum resolution | Accuracy |
|---|---|---|---|
| **DC voltage** | 24.000mV | 0.001mV | ±(0.3%+20dig) |
| | 240.00mV | 0.01mV | ±(0.3%+6dig) |
| | 2.4000V | 0.1mV | ±(0.3%+5dig) |
| | 24.000V | 1mV | |

| | 240.00V | 0.01V | |
|---|---|---|---|
| | 1000.0V | 0.1V | ±(0.3%+10dig) |
| **AC voltage[1]** | 24.000mV | 0.001mV | ±(0.8%+10dig) |
| | 240.00mV | 0.01mV | |
| | 2.4000V | 0.1mV | |
| | 24.000V | 1mV | |
| | 240.00V | 0.01V | |
| | 750.0V | 0.1V | ±(1.0%+10dig) |
| | Frequency range: 40Hz-1000Hz | | |
| **DC current** | 24.000mA | 0.001mA | ±(0.8%+10dig) |
| | 240.00mA | 0.01mA | |
| | 2.400A | 0.1mA | ±(1.5%+10dig) |
| | 10.000A | 1mA | ±(2.5%+10dig) |
| | Overload protection<br>mA: self-healing fuse 400 mA/250 V<br>A: 10A/600 V, D5.2*20, fast-acting fuse | | |
| **AC current[1]** | 24.000mA | 0.001mA | ±(1.0%+10dig) |
| | 240.00mA | 0.01mA | |
| | 2.4000A | 0.1mA | ±(2.0%+10dig) |
| | 10.000A | 1mA | ±(2.8%+10dig) |
| | Frequency range: 40Hz-1000Hz<br>Overload protection<br>mA: self-healing fuse 400 mA/250 V<br>A: 10A/600 V, D5.2*20, fast-acting fuse | | |
| **Resistance** | 240.00Ω | 0.01Ω | ±(0.8%+10dig) |
| | 2.4000kΩ | 0.1Ω | ±(0.8%+5dig) |
| | 24.000kΩ | 1Ω | |
| | 240.00kΩ | 10Ω | |
| | 2.4000MΩ | 0.1kΩ | |
| | 24.000MΩ | 1kΩ | ±(1.0%+5dig) |
| | 100.00MΩ | 0.01MΩ | ±(5.0%+10dig) |
| **Capacitance[1]** | 2.000nF | 1pF | ±(5.0%+10dig) |
| | 20.00nF | 10pF | ±(3.0%+10dig) |
| | 200.0nF | 100pF | |
| | 2.000µF | 1nF | |
| | 20.00µF | 10nF | |
| | 200.0µF | 100nF | |
| | 2.000mF | 1uF | |
| | 20.00mF | 10uF | |
| **Others** | Continuity test | √ (<50Ω) | |

| | Diode test | √ (<0-2V) |
| --- | --- | --- |
| | Auto range | √ |
| | TRMS | √ |

**[1]** When measuring AC voltage/current or capacitance, accuracy guarantee range is 5% to 100% of the range.

## Arbitrary Waveform Generator

| Characteristics | Descriptions | |
| --- | --- | --- |
| **Waveform Frequency** | Sine | 10Hz～100KHz, step by the 1-2-5 way |
| | Square | 10Hz～100KHz, step by the 1-2-5 way |
| | Ramp | 10Hz～100KHz, step by the 1-2-5 way |
| | Pulse | 10Hz～10KHz, step by the 1-2-5 way |
| **Amplitude** | 1Vpp or 2.5Vpp | |

# General Technical Specifications

## Display

| Characteristics | Descriptions |
|---|---|
| Display type | 3.5-inch color LCD display |
| Display resolution | 320 horizontal × 240 vertical pixels |
| Display color | 65536 colors |

## Power supply

| Characteristics | Descriptions |
|---|---|
| Power supply | DC INPUT: 5VDC, 2A |
| Power consumption | ＜5 W |
| Battery | 2000mAh（3.7V，103450） |

## Surroundings

| Characteristics | Descriptions |
|---|---|
| Temperature | Working temperature: 0℃ ~ 40℃<br>Storage temperature: -20℃ ~ +60℃ |
| Relative humidity | ≤90% |
| Height | Operating: 3,000 meters<br>Non-operating: 15,000 meters |
| Cooling method | Natural cooling |

## Mechanical specifications

| Characteristics | Descriptions |
|---|---|
| Dimensions | 198 mm (length) × 96mm (height) × 38 mm (width) |
| Weight | Approx. 0.6 kg (without battery) |

**Calibration interval:** The recommended calibration interval is one year.

# 9. Appendix

## Appendix A: List of Accessories

- 1 USB cable
- 1 passive probes
- 1 set of multimeter probes (one red and one black)
- 1 user manual
- 1 probe correction adjustment knife

## Appendix B: Maintenance and Cleaning

## General maintenance

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

**Caution**: Do not let spray, liquid or solvent touch the instrument or probe to prevent damage to the instrument or probe.

**Cleaning**:

Check the instrument and probe frequently according to the operation. Clean the external surface of the instrument as follows:

1. Please wipe the floating dust outside the instrument and probe with a soft cloth. When cleaning the LCD, be careful not to scratch the transparent LCD protection screen.

2. Wipe the instrument with a damp but non dripping soft cloth. Please disconnect the power supply. It can be scrubbed with soft detergent or water. Do not use any abrasive chemical cleaning agent to avoid damaging the instrument or probe.

⚠️**Warning**: Please make sure the instrument is dry before re-energizing

to avoid electrical short circuit or personal injury caused by moisture.

## Charging and Replacement of Battery

During the long-term storage of the device, the battery may be too low due to the self-discharge of the lithium battery and the device cannot be turned on. This is a normal phenomenon.

Please use the attached adapter to pre-charge the device for 0.5 to 1 hour (depending on the storage time) before turning it on. In addition, if the device is not used for a long time, it is recommended to charge it at regular intervals to avoid over-discharge of the lithium battery.

### Battery Charging

The lithium battery may not be fully charged when delivered. To make the battery be charged, charge it yourself.

The power supply and battery indicator symbols in the upper right corner of the screen are explained as follows:

 symbol indicates the power-on charging status;

 symbol indicates battery power supply;

 symbol indicates that there is only about five minutes of use time left. Please charge as soon as possible according to the relevant tips to avoid damage to the battery.

### Charging Method

Charging the battery through the power adapter: Connect the oscilloscope to the power socket through the USB data cable and power adapter delivered with the machine for charging.

Charge the oscilloscope through the USB interface: Connect the oscilloscope to a computer or other equipment through a USB data cable for charging (pay attention to the load capacity of the power supply equipment to avoid

abnormal operation of the equipment).

**Note**

To avoid overheating of the battery during charging, the ambient temperature must not exceed the allowable value given in the technical specifications.

**Replacement of Lithium Battery**

Generally, the battery does not need to be replaced. However, when necessary, it can only be replaced by qualified personnel, and only **lithium batteries of the same specification** can be used.