

Handheld Digital Scopemeter

User Manual

Read this manual thoroughly before use

Abstract

This handheld scopemeter is a portable tool for waveform measurement. In contrast with analog oscilloscope, desktop digital oscilloscope or digital multimeter, it is one of the best test tools for use in teaching or field.

It uses a high speed AD sampler to convert the input analog signal into digital signal and displays the signal on a 128×64 LCD after processing the signal through a high-speed CPU.

It uses a high speed comparator to get a good edge trigger for a steady display, which is good for observation.

Its multimeter part uses a dedicated, 6000-count chip, which can provide a higher precision.

The scopemeter is equipped with a large capacity lithium battery, which can provide about 10 hours of use after it is fully charged.

NOTE:

- Understand all the instructions in this manual.
- Use only the supplied charger, whose output voltage is DC 5V, to charge the built-in lithium battery. To avoid damage or personal injury, do not use a charger with different ratings to charge the battery.
- When charging the built-in lithium battery, do not use the multimeter function.
- To prevent damage to the instrument, do not exceed the limits of the instrument's input voltage.
- Never place the instrument on an unstable stand or table to avoid dropping down and damage.
- Never place the instrument near any high-temperature object to avoid damage caused by overheating.
- Do not let any liquid flow into the case.
- Never place any heavy object on the instrument.
- To clean the instrument, use dry, soft cloth. Never use liquid or gas cleaner.
- Charge the built-in lithium battery before storing it for a long period of time. To speed up charging, turn off the instrument before charging.
- Before using the instrument, inspect the case. Do not use the instrument if it is damaged or if the case (or part of the case) is removed. Look for crack or missing plastic. Pay attention to the insulation around the connectors.
- Use caution when working with voltage above 30V ac, 42V peak, or 60V dc. Such voltages pose a shock hazard.
- To avoid electric shock or personal injury, do not touch any naked conductor with hand or skin.
- When using test lead or probe, keep your fingers behind the finger guard.
- Do not use the instrument where explosive gas, vapor or dust is present.
- Disconnect circuit power and discharge all capacitors thoroughly before testing resistance, continuity, or diode.
- To avoid damage to the instrument or any accident, do not tamper with the internal circuit of the instrument.

I. APPEARANCE

1.1 Appearance

This scopemeter with transverse-grip design is easy for operation even using one hand, and it is compact. See the following figure:

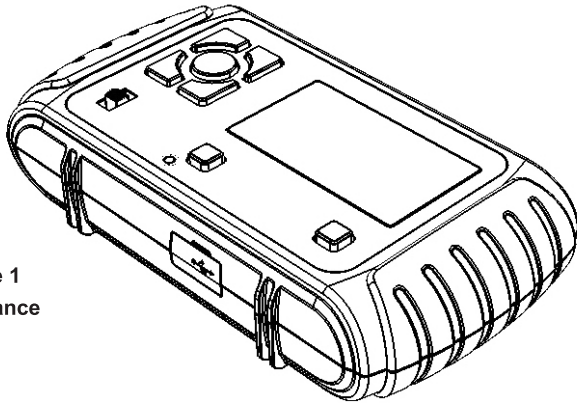


Figure 1
Appearance

1.2 Front Panel

The keyboard is on the left of the front panel, the LCD is on the right, and the power switch is on the bottom, as shown in Figure 2.

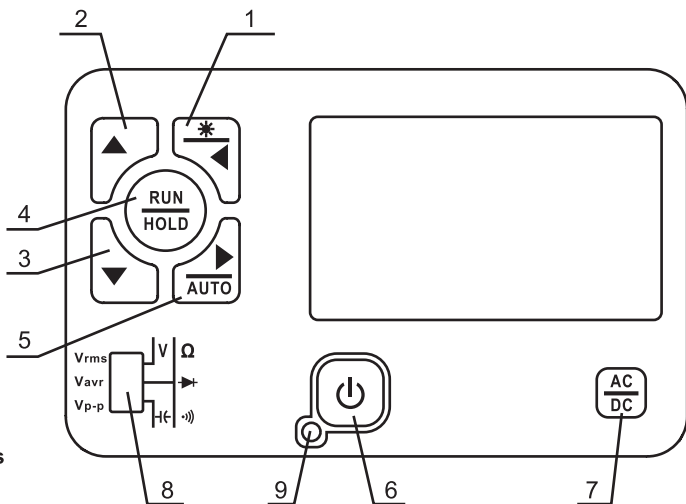


Figure 2
Layout of Controls

Controls:

1. Key

Press this  key to select desired item you want to set.

Press and hold this key for about 1 second to turn on or off the backlight.

(Only when you release the key will the key press take effect.)

2. Key

Used to change the setting of the selected item.


3. Key

Used to change the setting of the selected item.

4. **HOLD** Key


Used to stop or resume the instrument's operation (or measurement).

5. **AUTO** Key


Press this  key to select desired item you want to set.


Press and hold this key for about 1 second and then release, the scope will set the time base and amplitude range automatically according to the input signal.

6. Key


Press this  key to turn on/off the scopemeter.

7. **AC** **DC** Key

For scope, this " " key is used to select the desired input coupling mode, the corresponding coupling mode indicator will be shown on the lower-right corner of the display.

For multimeter, this " " key is used to select DC voltage or AC voltage measurement function, the corresponding indicator will be shown on the lower-right corner of the display.

8. Measurement Selector Switch

Multimeter: V ---- to measure voltage
center position ---- to measure resistance/diode/continuity
 ---- to measure capacitance

Scope: Vrms ---- to measure the RMS (Root-Mean-Square) value of voltage
Vavr ---- to measure the average value of voltage
Vp-p ---- to measure the peak to peak value of voltage

9. Charging Indicator

This charging indicator lights red when charging is ongoing. When the built-in lithium battery has been charged fully, this charging indicator turns off.

2. INTERFACE

2.1 The scope interface

The waveform area is shown on the left of the display, and the status is indicated on the right, as shown in Figure 3.

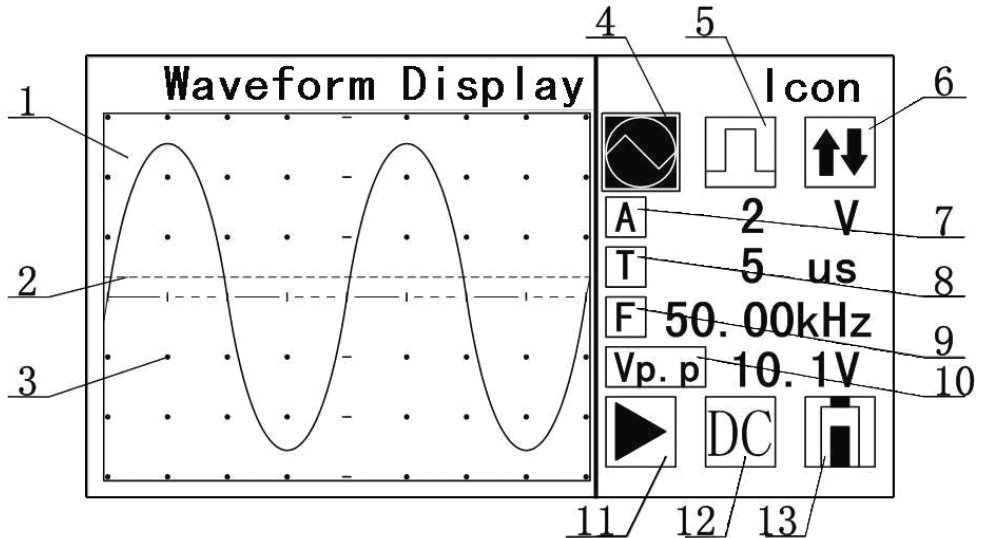


Figure 3 Scope Interface

Waveform Area:

1. **Waveform area:** Show the waveform
2. **Trigger level line:** The horizontal line of dashes indicates the position of trigger level.
3. **Grid:** Horizontal lines and vertical lines form a grid used to indicate the amplitude of voltage and time base.

Status Area

You can press the ◀ key or the ▶ key to select the desired item you want to set, the selected item will be highlighted. Then press the ▲ key or the ▼ key to change the setting of selected item. For more information about the items and icons, see **Appendix E**.

4. **Scope Icon:** Indicates that now the instrument is in scope mode. You can press the ▲ key or the ▼ key to switch between scope and multimeter modes.
5. **Trigger Type Icon:** Indicates the presently selected trigger type: rising edge, falling edge, or automatic trigger. You can press the ▲ key or the ▼ key to change the trigger type.

6. **Trigger Level Adjustment Icon:** When this trigger level adjustment icon is selected, you can press the ▲ key or the ▼ key to adjust the trigger level.
7. **Amplitude Range Adjustment Icon:** The present amplitude range (value for each grid in vertical) is shown to the right of this amplitude range adjustment icon. You can press the ▲ key or the ▼ key to adjust the amplitude range.
8. **Time Base Adjustment Icon:** The time base (value for each grid in horizontal) is shown to the right of this time base adjustment icon.
You can press the ▲ key or the ▼ key to adjust the time base.
9. **Frequency Icon:** The frequency of present waveform is shown to the right of this frequency icon.
10. **Voltage Amplitude Icon:** Indicate the value shown to the right of it is a rms value ("Vrms" appears), average ("Vavr" appears) or peak to peak ("Vp.p" appears) value. You can use the Measurement Selector Switch to select desired measurement.
11. **RUN (▶) or HOLD (■) Indicator:** Press the "^{RUN}/_{HOLD}" key to stop waveform acquisition, the last waveform is held on the display. Press this key again to resume waveform acquisition.
12. **Coupling Type Icon:** There are two coupling type icons: **DC** and **AC**.
Press the "^{AC}/_{DC}" key to switch between the coupling types.
13. **Battery Charge Level Indicator:** Indicates the present charge level of the lithium battery.
If the battery is low, you must charge it immediately.

2.2 The Multimeter Interface

The measurement result display area is on the left of the multimeter interface, and the status indication area is on the right of the multimeter interface, as shown in Figure 4.

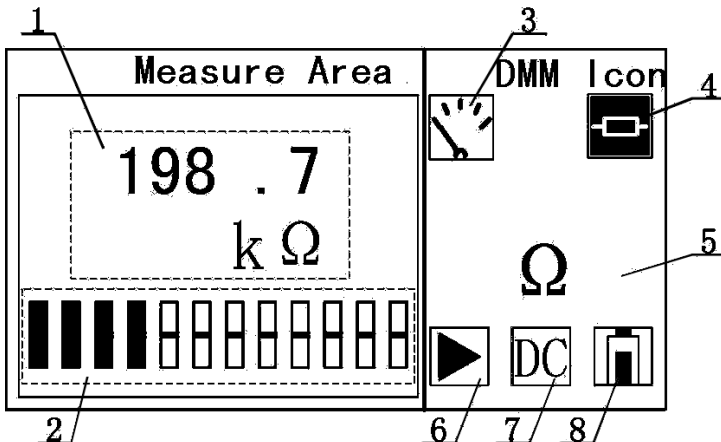











Figure 4
Multimeter Interface

Measurement Result Display Area

1. **Measurement Reading:** Includes value and unit.
2. **Bar Graph:** Functions like the pointer of an analog meter, indicating the measurement result visually.

Status Indication Area

3. **Multimeter Icon:** Indicates that the instrument is in multimeter mode. You can press the ▲ key or the ▼ key to change to scope mode.
4. **Resistance/Diode/Continuity Function Icon:** You can press the ◀ key or the ▶ key to select the , , or  icon, then press the ▲ key or the ▼ key to switch among the resistance, diode and continuity functions. The , , or  icon will disappear if you move the Measurement Selector Switch to the "V" or "⚡" position.
5. **Measurement Function Indicator:** Indicates the presently selected measurement function: voltage (DC V or AC V), resistance (Ω), diode (), continuity (), or capacitance (C).
6. **RUN (▶) or HOLD (■) Indicator:** Press the "  " key to stop measurement, the present reading will be held on the display. Press again exit HOLD mode and resume measurement.
7. **Voltage Function Icon:** Indicates that the multimeter is in DC or AC voltage measurement mode. Only in voltage function will the icon appear. " AC " represents AC voltage function is selected, while " DC " represents DC voltage function is selected.
8. **Battery Charge Level Indicator:** Indicates the present charge level of the lithium battery.
If the battery is low, you must charge it immediately.

3. OPERATION

3.1 Scope Operation

3.1.1 The setting of coupling

Press the " $\frac{AC}{DC}$ " key to select coupling type. When the " $\frac{AC}{DC}$ " key is in up position, the coupling is set to DC-coupling and both AC and DC components of the input signal will pass and be displayed; if the key is in down position, the coupling is set to AC-coupling and only the AC component of the input signal will pass and be displayed. See Figure 5.

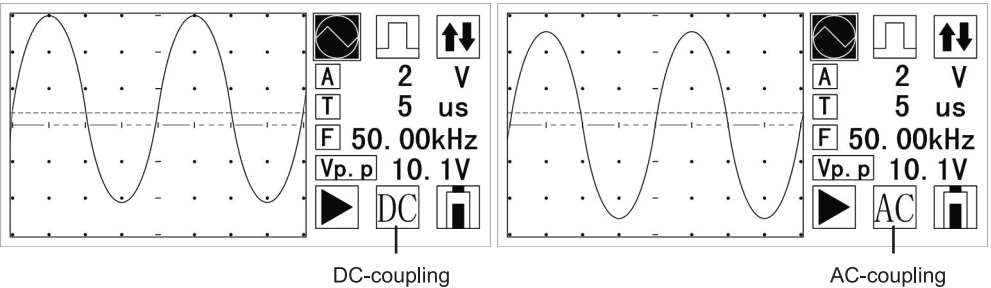


Figure 5 Setting of Coupling Type

3.1.2 Adjusting the amplitude range

Press the ◀ key or the ▶ key to select the amplitude range adjustment item (represented by the icon " **A** "), the present amplitude range setting will be highlighted (see Figure 6). Then press the ▲ key or the ▼ key to switch the amplitude range among 50mV/DIV, 100 mV/DIV, 200 mV/DIV, 500 mV/DIV, 1V/DIV, 2V/DIV, 5V/DIV, 10V/DIV and 20V/DIV. The ▲ key is used to increase the range, while the ▼ key is used to decrease the range.

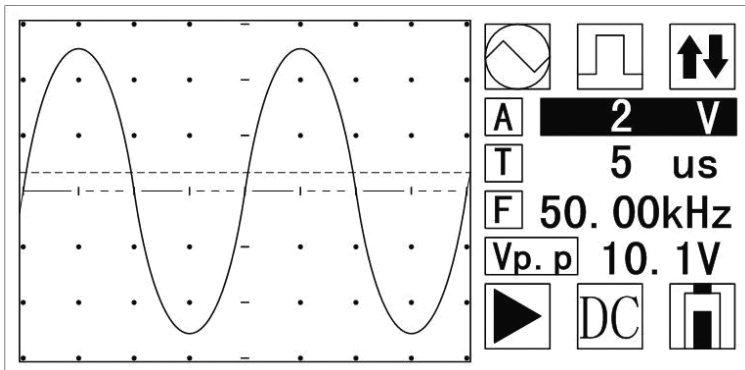


Figure 6 Adjust the Amplitude Range

3.1.3 Adjusting time base

Press the ◀ key or ▶ key to select the time base adjustment item (represented by the icon "T"), the present time base setting will be highlighted (see Figure 7). Then press the ▲ key or the ▼ key to switch the time base among 10ns, 20ns, 50ns, 100ns, 200ns, 500ns, 1μs, 2μs, 5μs, 10μs, 20μs, 50μs, 100μs, 200μs, 500μs, 1ms, 2ms, 5ms, 10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1s, 2s and 5s. The ▲ key is used to increase the range, while the ▼ key is used to decrease the range.

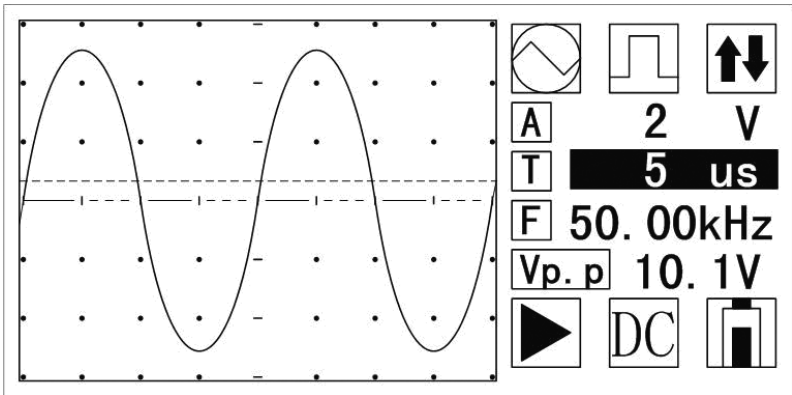


Figure 7 Adjust the Time Base

3.1.4 Settings the trigger

To select desired trigger type, first press the ◀ key or the ▶ key to select the trigger type icon, the icon will be highlighted. Then press the ▲ key or the ▼ key to select the trigger type among: Rising Edge, Falling Edge, and Auto.

To set trigger level, press the ◀ key or the ▶ key to select the trigger level icon, the icon will be highlighted. Then press the ▲ key or the ▼ key to change the trigger level, which is indicated by a line of dashes. (Refer to Figure 8)

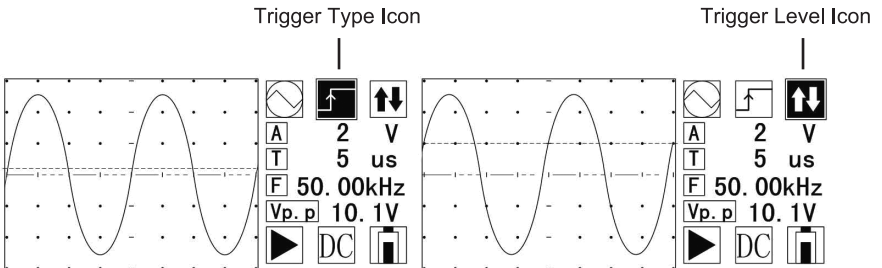


Figure 8 Setting of Trigger

3.1.5 Waveform Acquisition

Press the "**RUN**/**HOLD**" key to stop or resume waveform acquisition, the corresponding icon will appear as an indication (see Figure 9).

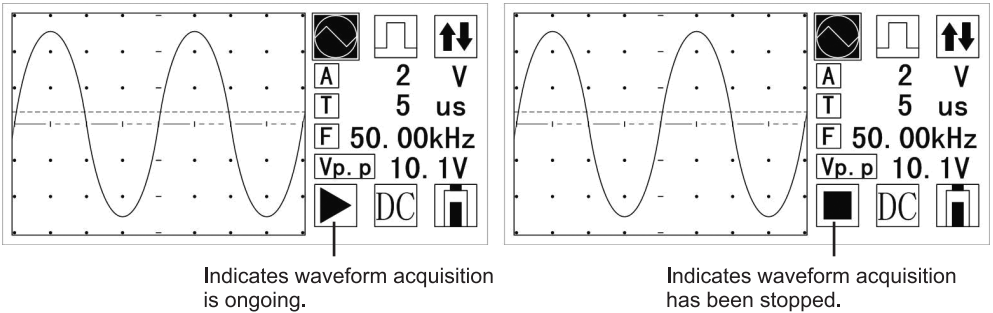



Figure 9

3.1.6 Auto




Press and hold down the **AUTO** key for about 1 second and then release, the scope will automatically set the amplitude range and time base to obtain a suitable view of waveform according to the amplitude and frequency of input signal.

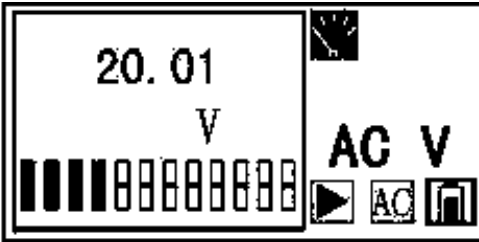
3.2 Operation of Multimeter

3.2.1 Switching to the Multimeter Interface

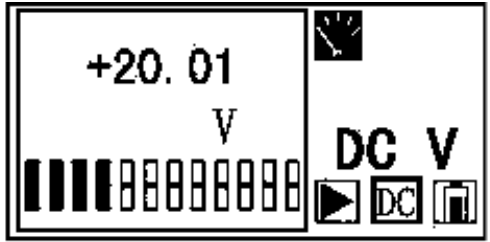
With scope interface being shown, press the ◀ key or the ▶ key to select the scope icon "  ". Then press the ▲ key or the ▼ key to switch to multimeter interface. The multimeter measurement function is partially determined by the position of the Measurement Selector Switch, and the corresponding icon and prompt are shown on the status area.

3.2.2 Selecting Desired Multimeter Function

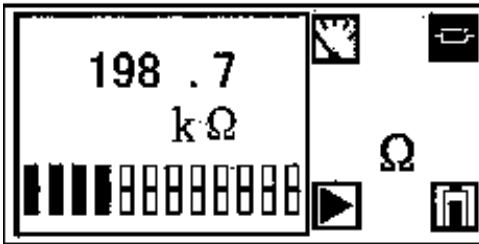
To select a desired measurement function, set the Measurement Selector Switch to desired position. For example, you can set this switch in the " **V** " position for voltage function, then press the **AC**/**DC** key to select DC or AC voltage measurement. Or you can set this switch in the " **∟** " position to select capacitance measurement function. Or you can set this switch in the center position to switch to the resistance, diode or continuity measurement interface, then press the ◀ key or the ▶ key to select the resistance (), diode () or continuity () function icon, whichever is available; and then press the ▲ key or the ▼ key to select resistance, diode or continuity measurement function, the corresponding interface will appear. The different measurement interfaces are indicated in Figure 10:



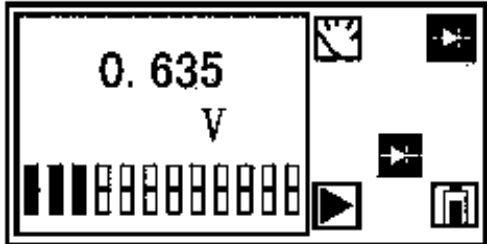
AC Voltage Measurement Interface



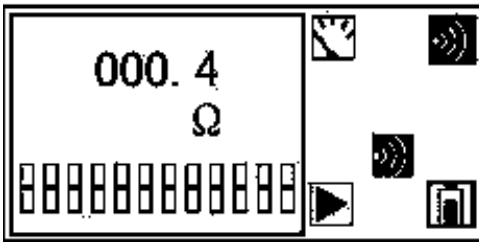
DC Voltage Measurement Interface



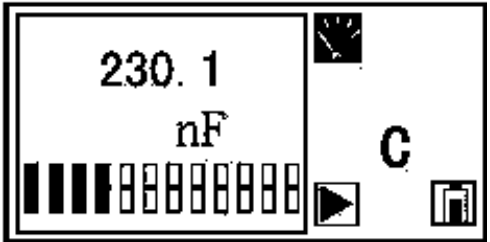
Resistance Measurement Interface



Diode Test Interface



Continuity Test Interface



Capacitance Measurement Interface

Figure 10 Sub-interfaces of Multimeter

3.2.3 RUN/HOLD

Press the " ^{RUN} HOLD " key to hold the reading on the display, the symbol " ■ " will appear as an indicator.

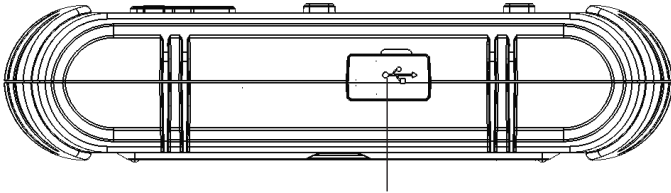
Press again to exit HOLD mode and resume measurement, the symbol " ► " will appear.

3.3 Charging the Battery and Battery Charge Level Indication

The built-in lithium battery is charged through the USB port (see Figure 11). During charging, the charging indicator (on the front panel of the scopemeter) will light up. When the charging is completed, the charging indicator will turn off. Charging a 1000mAh lithium battery takes about 5 hours.

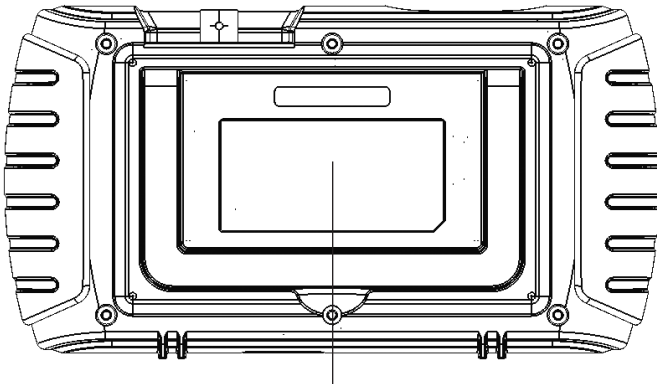
After you turn on the scopemeter, the battery charge level indicator on the status area indicates the battery's charge level.

The lithium battery is replaceable. To replace it, turn off the instrument and remove all test leads and probe. Pull the tilt stand to expose the screws of the battery cover. Remove the screws and the battery cover (see Figure 12). Replace the old battery with a new lithium battery of the same ratings. Reinstall the battery cover and the screws.



Under this small cover is the charging port

Figure 11 Charging Port



Battery Cover

Figure 12 Back View

4. Appendix

A. Technical Data

Performance

Performance of Scope	
Bandwidth(-3dB)	25MHz
Sampling Rate	Max 100M Sa/s
Channel	1
Coupling	AC, DC
Rise Time	< 17.5nS
Input Impedance	1M Ω , \leq 20pF
Max Input Voltage	CAT II 300V
Vertical Resolution	8 bit
Vertical Sensitivity	50mV/div - 20V/div Note 1
Horizontal Resolution	10nS/div
Horizontal Sensitivity	10nS/div - 5S/div Note 2
Record Length	0.1K/Channel
Trigger Mode	AUTO, Rising edge, falling edge
Basic Performance	
Screen	128 \times 64, with LED backlight
Battery	3.7V lithium battery, about 1000mAH
Charger	Input Voltage: 100 - 240Vac Output: DC5V \pm 10%, 1000mA
Size	174 \times 92 \times 40mm
Weight	about 330g

Note 1: Vertical sensitivity includes 9 ranges: 50mV/div, 100 mV/div, 200 mV/div, 500 mV/div, 1V/div, 2V/div, 5V/div, 10V/div, 20V/div.

Note 2. Horizontal sensitivity includes 27 ranges: 10ns/div, 20ns/div, 50ns/div, 100ns/div, 200ns/div, 500ns/div, 1 μ s/div, 2 μ s/div, 5 μ s/div, 10 μ s/div, 20 μ s/div, 50 μ s/div, 100 μ s/div, 200 μ s/div, 500 μ s/div, 1ms/div, 2ms/div, 5ms/div, 10ms/div, 20ms/div, 50ms/div, 100ms/div, 200ms/div, 500ms/div, 1s/div, 2s/div, 5s/div.

Performance of multimeter	
Display	6000 counts
Input	Max. Input Voltage: CAT II 600V
Continuity Test	In 600Ω range, beeps at < 25Ω
Diode Test	If voltage drop of the diode under test is more than 2V or if input terminals are open, the display will show " OL ". If voltage drop is less than 0.25V, the built-in buzzer will sound.
Capacitance Measurement	6.000nF - 6mF, 7 ranges
Resistance Measurement	600.0Ω - 60.00MΩ, 6 ranges
Voltage Measurement	6V - 600V, 3 ranges

Specification

Condition: at 23±5°C, and waiting 30 minutes after power-on before proceeding

Specification of Scope			
Vertical System: channel of scope			
Bandwidth (-3dB)	25MHz		
Accuracy	50 mV/div - 5 V/div: ± 3% of full scale		
Vertical Offset Accuracy (DC)	± 0.2div ± 2mV ± 0.5% of offset		
Trigger sensitivity	DC to 20MHz: 0.8 div		
Specification of probe			
Rise time	X1	23.3ns	
	X10	17.5ns	
Bandwidth	X1	DC to 15MHz	
	X10	DC to 25MHz	
Input Impedance	X1	1MΩ	
	X10	10MΩ (without scope's input resistance 1MΩ)	
Input Capacitance	X1	46pF (without scope's input capacitance)	
	X10	about 15pF	
Specification of Multimeter Accuracy Form: ± (% of reading + digits)			
Function	Range	Frequency, test current, or load voltage	Condition: at calibration temperature ± 5°C, for 1 year
DC Voltage	6.000V		± (0.5% + 8)
	60.00V		± (0.5% + 8)
	600.0V		± (0.5% + 8)

AC Voltage	6.000V - 600.0V	40Hz - 400Hz	$\pm (1.0\% + 10)$
		400Hz - 2kHz	$\pm (5.0\% + 10)$
Resistance	600.0 Ω		$\pm (1.0\% + 5)$
	6.000k Ω		$\pm (1.0\% + 5)$
	60.00k Ω		$\pm (1.0\% + 5)$
	600.0k Ω		$\pm (1.0\% + 5)$
	6.000M Ω		$\pm (1.0\% + 5)$
	60.00M Ω		$\pm (2.0\% + 5)$
Capacitance	6.000nF		$\pm (5.0\% + 8)$
	60.00nF		$\pm (3.0\% + 8)$
	600.0nF		$\pm (3.0\% + 8)$
	6000nF		$\pm (3.0\% + 8)$
	60.00 μ F		$\pm (3.0\% + 8)$
	600.0 μ F		$\pm (5.0\% + 8)$
	6.000mF		$\pm (8.0\% + 8)$
Diode	2.000V	Test Current: 2mA	Buzzer beeps if the voltage is less than 0.25V.
Continuity			Buzzer beeps if the resistance is less than 25 Ω .

B. Input Port and Definition

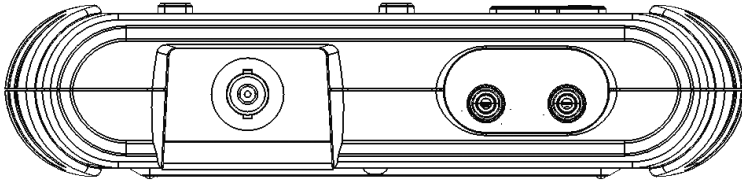


Figure 13 Input Ports for Measurements

1. Input Terminals of Multimeter

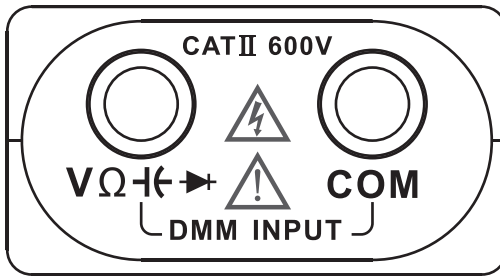


Figure 14 Input Terminals of Multimeter

See Figure 14, the black terminal on the left is a reference/ground terminal, and the red terminal on the right is a measurement terminal.

2. Input Port Of Scope

The input port of scope is a BNC socket. The outside of BNC is for ground, the center of BNC is for input signal.

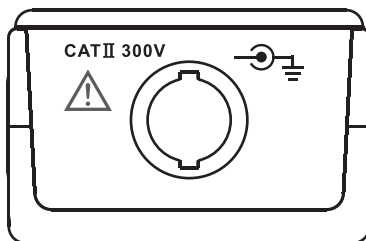


Figure 15
Input Port of Scope

3. Charging Socket

The charging socket is a standard mini USB port, it can be connected to USB port of PC or USB output port of a common mobile phone charger.

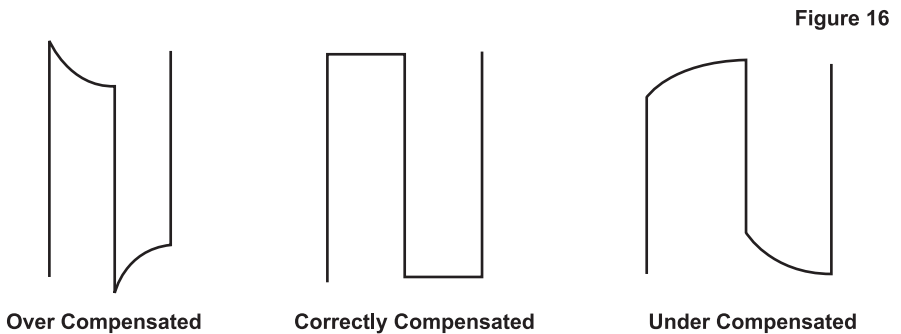
C. Compensating the Probe

The probe needs to be set according to the input signal. A signal of large amplitude should be attenuated and a signal with high frequency requires a setting of small input capacitance.

When you connect the probe to the scope for the first time, you must adjust the probe's compensation capacitance to match the input channel. If the probe is not properly adjusted, the measurement results may be inaccurate or incorrect.

Use the following procedure to adjust the probe's compensation capacitance:

1. Connect the probe to the scope input terminal. Then set the switch of the probe to the " 10X " position, and connect the probe to the squarewave signal of 1kHz.
2. Check the shape of the waveform on the display.



3. If the waveform shows that it has been over compensated or under compensated, use a non-metallic tool to adjust the trimmer on the probe for the flattest squarewave available.

D. Terminology

Trigger, Edge Trigger, Trigger Level

In order to make the scanning signal synchronize with the signal to be measured, we can set some conditions and then the signal to be measured is compared with these conditions. Only when the signal to be measured meet these conditions will the scanning be started, so the scanning frequency equals or is a multiple of the frequency of the signal to be measured, which is called synchronization. The technology is also called " trigger ", and these conditions is called the " trigger condition ".

There are many conditions that can be used and set as " trigger condition ". Among them, " edge trigger " is the most usual. In edge trigger, the change (the rising or falling edge) of the signal to be measured is compared with a certain level (trigger level). When the change reaches the level in the selected way, a trigger signal will be generated and a scanning will thus be caused.

Vertical Sensitivity

Vertical sensitivity is the amplifying degree of weak signal amplified by the vertical amplifier. Usually, vertical sensitivity is expressed as a mV value per division. The typical min. value a digital scopemeter can detected is about 5mV/Div.

Sampling Rate

Sampling rate is the frequency the input signal is sampled in a waveform or in a period. Usually, it is expressed as the sample dot number per second ($X \text{ Sa/s}$). When the sample rate increases, the resolution and sharpness of the displayed waveform will increase and the probability of missing important data and events will decrease.

If a user wants to observe a slowly changing signal within a relatively long time, the min. sampling rate will become more important.

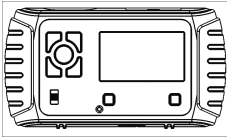



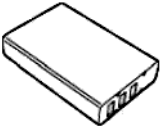
Bandwidth

Bandwidth is the frequency at which a measured sinusoidal input signal attenuates to 70.7% of its original level (-3dB). Bandwidth indicates input signal's frequency range within which the scopemeter can measure waveform accurately. With the increase of frequency, the scopemeter's ability to measure waveform accurately will decrease.



If the bandwidth is not big enough, the scopemeter can not detect high-frequency changes; in addition, the signal's amplitude will be distorted, edge will disappear, and some detailed information will be lost, and as a result, all the acquired characteristics, singing, diabolos, etc. of the measured signal will be meaningless.

E. Unpacking the Test Tool Kit

The following items are included in your test tool kit.

#	Description	Quantity	Equipped
1	Scopemeter 	1 pcs	✓
2	20MH (10:1) Probe 	1 pcs	✓
3	Test Lead 	1 pair	✓
4	Charger 	1 pcs	✓
5	Built-in Battery (about 1000mAh) 	1 pcs	✓

(continued)

#	Description	Quantity	Equipped
6	User Manual 	1 pcs	✓
7	Carrying Bag 	1 pcs	✓

F. The icons in the status area

Description:

1. Press the ► key to select the following items sequentially:
scope/multimeter, trigger type, trigger level adjustment, amplitude range, time base
2. Press the ◀ key to cycle through the following items sequentially:
scope/multimeter, time base, amplitude range, trigger level adjustment, trigger type

Items		Items			Items		Items		Items		Items	
Scope/Multimeter	Scope	Trigger Type	Trigger Level Adjustment	Amplitude Range	Time Base	Frequency	Voltage	RUN/HOLD	Coupling	Battery Charge Level	Scope	Multimeter
	Multimeter	Press ▲ or ▼ for selection.	Press ▲ or ▼ to adjust trigger level.	Press ▲ or ▼ to select desired amplitude range.	Press ▲ or ▼ to select desired time base.	Indicates the frequency of the waveform.	Move the Measurement Selector Switch for selection.	Press the $\frac{RUN}{HOLD}$ key for selection.	Press the $\frac{AC}{DC}$ key for selection.	Indicates the present battery charge level.		
<p style="text-align: center;">Scope</p>												
Scope/Multimeter	Scope	Measurement Functions					Function	RUN/HOLD	DC Voltage/ AC Voltage	Battery Level	Scope	Multimeter
	Multimeter	Press ▲ or ▼ to switch among resistance, diode and continuity measurement functions.	Resistance	Diode	Continuity	Voltage	Resistance/ Continuity/ Diode	Capacitance	Press the $\frac{DC}{AC}$ key for selection.	Indicates the present battery charge level.		
<p style="text-align: center;">Multimeter</p>												

NOTE

1. This manual is subject to change without notice.
2. Our company will not take the other responsibilities.
3. The contents of this manual can not be used as the reason to use the instrument for any special application.

DISPOSAL OF THIS ARTICLE

Dear Customer,

If you at some point intend to dispose of this article, then please keep in mind that many of its components consist of valuable materials, which can be recycled.

Please do not discharge it in the garbage bin, but check with your local council for recycling facilities in your area.



