1. Declaration

According to the international copyright laws, without permission and written consent, no content of this manual shall be copied in any form (including storage and retrieval or translation into languages of other countries or regions). Any change in future version of this manual will have no prior notice.

1.1. Safety statement

Caution

The “Caution” label indicates situation or operation which may damage instrument or equipment.

It requires to take caution when executing such operation, if any incorrect operation or violation of operation steps, it may cause damages to instrument or equipment. When such conditions are not met or not fully understood, do not proceed to execute any related operation specified by the “Caution” label.

Warning

The “Warning” label indicates situation or operation which may cause danger to users.

It requires to take caution when executing such operation, if any incorrect operation or violation of operation steps, it may cause human injury or loss of life. When such conditions are not met or not fully understood, do not proceed to execute any related operation specified by the “Warning” label.

Before using this instrument, please read the manual carefully and pay attention to related safety warning information.

1.2 Safety information

The instrument is designed according to safety requirements on electronic instruments according to international electrotechnical safety standard IEC61010-1. The design and manufacture of the instrument shall comply with IEC61010-1 CAT.III/1000V; CAT.IV/600V over-voltage safety standards and the provisions in pollution level 2.

1.3 Safety work specification

⚠ **Warning : In order to avoid safety accidents such as possible electric shock or personal injury, please abide by the following specification:**

- Before using the instrument, please read this manual carefully, and pay special attention to safety warning information.
- Before using the instrument, please check whether there's crack or damaged plastic part on instrument shell, if yes, please do not use again.
- Before using the instrument, please check whether the instrument works normally, if not or damaged, please do not use again.
- Before using the instrument, please check insulators around input terminals of the instrument, if damaged, please do not use again.

- Before using the instrument, please check whether the pen has any crack or damage, if yes, please replace with a pen of the same specification before using.
- Before using, please check whether the insulation layer of the pan is damaged, whether there's any exposed metal or sign of abrasion, and check connectivity of the pen, if damaged, please do not use again.
- Before using the instrument, please measure a known voltage with the instrument to verify the instrument is normal.
- Please use this instrument via strictly abiding by operation of this manual, otherwise, protection function provided by the instrument may be damaged or weakened.
- Please use this instrument according to measurement category, rated voltage or current specified by the instrument or manual.
- Please comply with local and national safety codes. Wear personal protective equipment (such as recognized rubber gloves, mask and flame retardant clothing etc.), to avoid injuries caused by electric shock or electric arc due to exposed live conductors.
- Before connecting the instrument to the circuit being tested, be sure to select correct input terminals and switch position.
- The voltage between input terminals or between any terminal and grounding point shall not exceed the rated value indicated on the instrument.
- When the instrument battery low indicator appears, please replace the battery timely, to avoid measurement error.

- Do not use this instrument around explosive gas or steam or under humid environment.
- When using the pen, please hold the back of probe finger guard with your fingers.
- Before opening the shell or battery cover, please remove the pen on the instrument. Do not use the instrument when the instrument is dismantled or the battery cover is open.
- Only the use of the instrument together with the pen equipped complies with requirements of safety standards. If the pen is damaged, it is required to replace with a pen of the same model and the same electrical specification.
- Please use the test fixture or test cable provided by the company, test fixtures or test cables made by the users themselves or other companies may cause incorrect measurement results. Keep the test fixture or test cable of the instrument clean, and keep pins of the device being tested clean, to guarantee sound contact between the device being tested and the fixture.

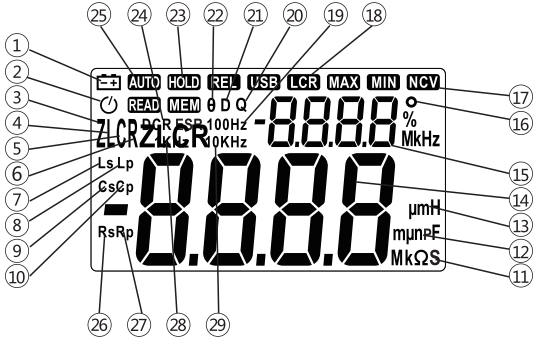
1.4 Safety symbols

	High pressure warning
	Alternating current (AC)
	Direct current (DC)
	AC or DC
	Warning, important safety sign
	Grounding
	Fuse
	The equipment is protected by dual insulation or enhanced
	Battery under voltage
	It indicates the product complies with regulations of all related
	The additional product label indicates it is not allowed to discard such electrical/electronic products into household waste.
CAT. III	Category III 1000 V over-voltage protection
CAT. IV	Category IV 600 V over-voltage protection

2. Overview

This instrument is a handheld measuring device, which possesses an intelligent measuring high precision digital electric bridge with a digital dual display. It is used to measure special instruments for inductance, capacitance and impedance. It has a lar ge screen LCD digital display , and back light, which is easy for users to read. With battery under voltage indication. No matter for professional personnel, factories, schools, fans or family use, it is an ideal multi-function instrument.

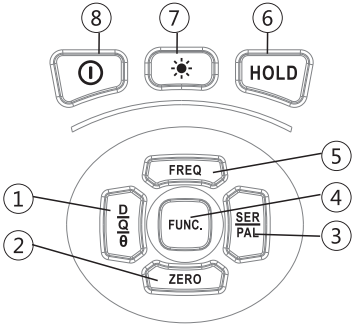
2.1 Display



1	Battery under voltage indicator	16	The unit of impedance phase angle
2	Automatic shutdown indicator	17	Open/short circuit calibration indicator
3	Impedance measurement indicator	18	LCR mode indicator
4	Inductance measurement indicator	19	The frequency of test signal is 100Hz.

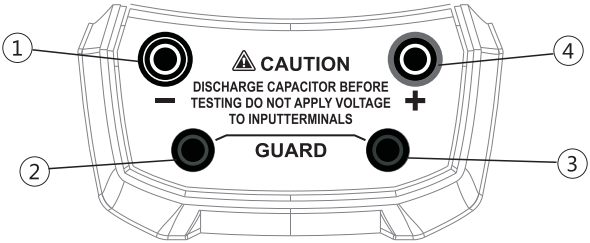
5	Capacitance measurement indicator	20	Quality factor indicator
6	Resistance measurement indicator	21	Dissipation factor indicator
7	Inductance series connection measurement mode indicator	22	Impedance phase angle indicator
8	Inductance parallel connection measurement mode indicator	23	Data hold indicator
9	Capacitance series connection measurement mode indicator	24	DC resistance measurement mode indicator
10	Capacitance parallel connection measurement mode indicator	25	Automatic range indicator
11	Resistance unit	26	Resistance series connection measurement mode indicator
12	Capacitance unit	27	Resistance parallel connection measurement mode indicator
13	Inductance unit	28	The frequency of test signal is 1KHz.
14	Master data display area	29	The frequency of test signal is 10KHz.
15	Slave data display area		

2.2 Keys



1	Select dissipation factor (D), quality factor (Q) or phase angle (θ)
2	Open/short circuit calibration key
3	Series and parallel connection measurement mode shift key
4	Main parameter selection keys, select “C→L→R→Z→DCR” accordingly.
5	Test frequency selection key
6	Data hold open key
7	Back light on key
8	On/off key

2.3 Input jack

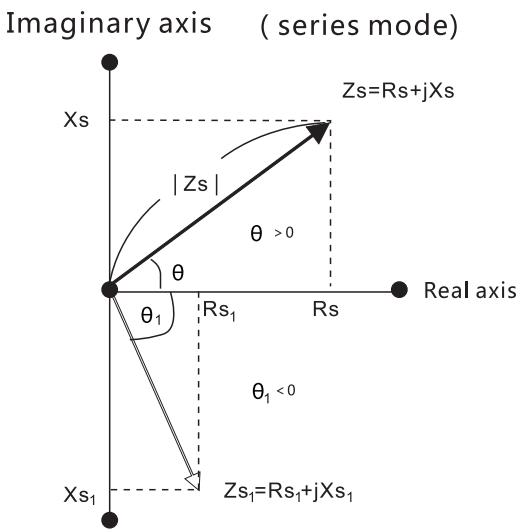


1	**DUT - jack**
2	**Shielding floor jack**
3	**Shielding floor jack**
4	**DUT + jack**

3. Measurement operation

3.1 AC impedance

The impedance measurement could be classified into two major categories of DC impedance and AC impedance on the basis of different measurement signals. General multimeter measurement adopts DC impedance, while digital bridge could measure AC impedance. The impedance is the most basic parameter to evaluate electronic components and circuit system. Under DC, the resistance at linear two terminals shall be defined by ohm's law. Under AC, the ratio of voltage to current is a negative. One impedance loss includes real part (resistance R) and imaginary part (reactance X). The impedance is represented with R+jx in a rectangular coordinate system, or represented with amplitude |Z| and phase angle θ in a polar coordinate, and the relation between them is shown in the following figure.



Rs=|Zs| cosθ

Xs=|Zs| sinθ

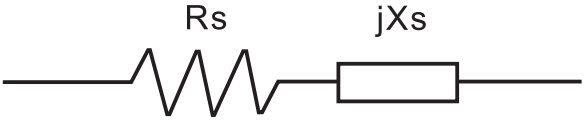
Xs/Rs=tanθ

$\theta=\tan^{-1}(Xs/Rs)$

If θ>0, reactance inductive. Otherwise, if θ<0, reactance capacitive.

The impedance could be measured in series connection or parallel connection mode. In parallel mode, impedance Z could be represented as the reciprocal of admittance Y, while admittance could be defined by Y=G+jB. While G is conductance, while B is admittance.

When impedance is in serial mode



$$Z=Rs+jXs$$

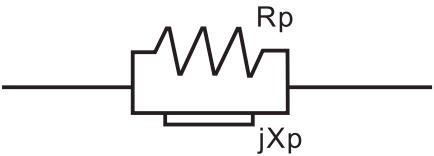
Rs: Resistance in serial connection mode

Xs: Reactance in series connection mode

Cs: Capacitance in series connection mode

Ls: Inductance in series connection mode

Admittance in series connection mode



$$Y=1/Z=\ 1/Rp+1/jXp=G+jB$$

3.2 Series/parallel connection mode selection

More accurate measurement data could be obtained via selecting a proper equivalent mode. In general, for low impedance components (i.e. Lower than 100Ω), select series connection equivalent mode directly; for high impedance components (i..e higher than 10K Ω), select parallel connection equivalent mode directly If in between, the impact of series/parallel connection equivalent mode in measurement results is minor.

In corresponding main parameter measurement mode, press “SET/PAL” to select “Series→Parallel→AUTO ” accordingly. Meanwhile corresponding characters show on the screen;

3.3 Measurement frequency selection

provides three frequency test points: 100Hz → 1kHz →10kHz. The boot default frequency is 1 KHZ, and press "FREQ" key to select different frequency points to measure "1kHz→10kHz→100Hz→1kHz” for cyclic display.

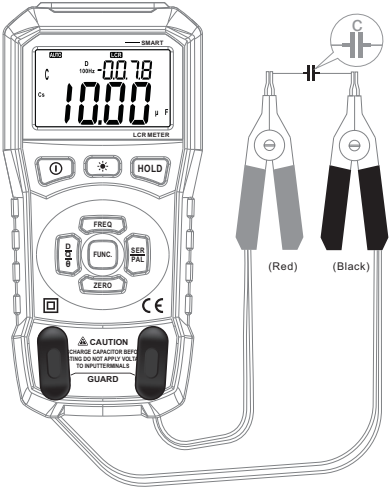
Note: When DC impedance measurement is conducted in “DCR” mode, no frequency will be measured.

3.4 Secondary parameter selection

In corresponding main parameter measurement mode, press “D/Q/θ”key, and select “D→Q→θ” accordingly for secondary parameters. Meanwhile corresponding characters will show on the screen.

3.5 Capacitance measurement

Warning! Before measurement, the capacitance shall be fully discharged.

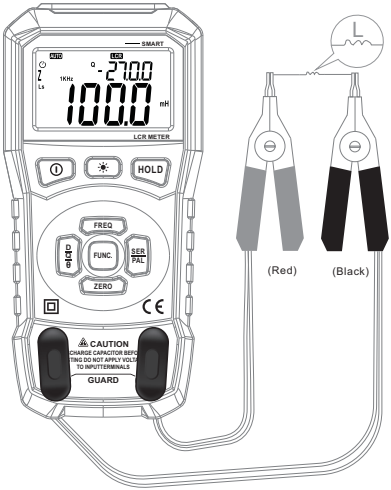


1. Press “ ⏻ ” to start.
2. Press the “FUNC” key “C” displays on LCD, and select capacitance measurement mode.
3. Insert the capacitance into component socket or connect the test clip to the component lead according to requirements.
4. Read content on display
5. The instrument will select test frequency, series/parallel connection mode automatically.
6. For accurate measurement, it is required to select test frequency and

series/parallel connection mode manually.

7. If the main parameter displays “-”, the component being tested is inductive.

3.6 Inductance measurement



1. Press “ ⏻ ” to start.

2. Press the “FUNC” key “L” displays on LCD, and select inductance measurement mode.

3. Insert the inductance into component socket or connect the test clip to the

component lead according to requirements.

4. Read content on display
5. The instrument will select test frequency, series/parallel connection mode automatically.
6. For accurate measurement, it is required to select test frequency and series/parallel connection mode manually.
7. If the main parameter displays “-”, the component being tested is capacitive.

3.7 Resistance measurement

1. Press “ ⏻ ” to start.
2. Press the “FUNC” key “R” displays on LCD, and select resistance measurement mode.
3. Insert the resistance into component socket or connect the test clip to the component lead according to requirements.
4. Read content on display

5. The instrument will select test frequency, series/parallel connection mode automatically.

6. For accurate measurement, it is required to select test frequency and series/parallel connection mode manually.

3.8 Impedance measurement

1. Press “ ⏻ ” to start.

2. Press the “FUNC” key “Z” displays on LCD, and select impedance measurement mode.

3. Insert the resistance into test terminal or connect corresponding accessories to the resistance being tested.
4. Read content on display
5. The instrument will select test frequency, series/parallel connection mode automatically.
6. For accurate measurement, it is required to select test frequency manually.

3.9 DC resistance measurement

1. Press “ ⏻ ” to start.
2. Press the “FUNC” key “DCR” displays on LCD, and select DC resistance measurement mode.
3. Insert the resistance into test terminal or connect corresponding accessories to the resistance being tested.
4. Read content on display

3.10 “ZERO” reset calibration function

The calibration function could effectively reduce disturbance to distribution parameters brought by test cable, and the calibration function includes short circuit calibration and open circuit calibration. Short circuit reset could eliminate the impact of residual impedance in series connection with component being tested, such as lead resistance or lead inductance. Open circuit reset could eliminate the impact of stray admittance (G,B) such as stray capacitance in parallel connection with component being tested.

1. For short circuit calibration, short-circuit the pen, and press “ZERO”, the " CAL " displays on screen. Wait till “ CAL ” disappears, the short circuit calibration is completed. The calibration data is saved in RAM, after shutdown, the calibration value is restored to factory value.

2. For open circuit calibration, separate two pens, and press "ZERO", the " CAL " displays on screen. Wait till “ CAL ” disappears, the open circuit calibration is completed. The calibration data is saved in RAM, after shutdown, the calibration value is restored to factory value.

4. Automatic shutdown function

- If there's no operation within 15 minutes after startup, the instrument will shut down automatically to save battery power.
- After automatic shutdown, press the " ⏻ " again to start.

5. Backlight function

The instrument is configured with backlight function. So that users could read measurement results accurately even under unsound lighting conditions. The operation of turning on or off backlight is as follows:

1. Press the key, to turn on backlight.
2. Press the key again, to turn off backlight manually; or turn off backlight automatically after about 5 seconds.

Note:

1. The backlight is LED, for its working current is large, although there's circuit set for this instrument (the timing is about 5 seconds, which is to turn off after about 5 seconds since the backlight is turned on automatically), however, frequent use of backlight will shorten battery life, so if unnecessary, avoid using backlight as far as possible.
2. When battery voltage ≤ 4.2V, the display shows "" (under voltage) symbol. However, if backlight is used, when battery voltage ≥ 4.2V, for its large working current, battery voltage drops, and the "  " symbol may display (when the "  " symbol displays, measurement accuracy could not be guaranteed), in this case, it is not required to replace the battery,

and use normally without using backlight till the “  ” symbol displays again, and then replace.

6. Data hold

1. During measurement, if reading hold is required, press the HOLD key, and the displayed value will be kept.
2. Press the HOLD key again, to resolve reading hold status.

7. General technical indicators

- Use environmental conditions:

  600V CAT.IV and 1000V CAT.III

  Pollution level: 2

  Altitude < 2000m.

  Working environment temperature and humidity: 0~40°C (<80% RH, <10°C non-condensation).

  Storage environment temperature and humidity: -10~60 ° C (<70% RH, battery taken off).
- Temperature coefficient:: 0.1×accuracy/°C (<18°C or >28°C).
- Sampling rate: About 3 times/second.
- Display: Dual 6000 count display . Display unit symbols automatically according to measurement function gear.
- Over range indication: Displays “OL”.
- Measurement frequency: 100Hz/1kHz/10kHz, measure the voltage: 0.5

Vrms

- Output impedance: 300 Ω
- Battery low voltage indication: When battery voltage is lower than normal operating voltage, the “  ” will display.
- Input polarity indication: It will display “–” automatically.
- Power supply: 4 x 1.5V AA battery.
- Dimension: 204(L)×94(W)×57(H) mm.
- Weight: About 410g (including battery).

8. Accurate indicators

Notices:

Environmental temperature is from 18°C to 28°C, and relative humidity is not greater than 75%, accuracy:±(%reading + characters).

Preheat for 10 minutes before testing.

Test on the slot of instrument terminal.

Conduct open/short circuit calibration before testing.

L, C and R indicators are for test of passive (fixed) components.

8.1 Inductance technical indicators:

Function	Frequency	Equivalentmode	Range	Input	Accuracy	Minimum resolution
Inductance	100Hz	LS	60.00mH	10.00mH	±2.0%+5d	0.01mH

			600.0mH	100.0mH	±1.0%+5d	0.1mH
			6.000H	1.000H	±1.0%+5d	0.001H
			60.00H	10.00H	±1.0%+5d	0.01H
			200.0H	100.0H	±1.5%+5d	0.1H
	1kHz	LS	6.000mH	1.000mH	±1.5%+5d	0.001mH
			60.00mH	10.00mH	±0.7%+5d	0.01mH
			600.0mH	100.0mH	±0.4%+5d	0.1mH
			6.000H	1.000H	±1.0%+5d	0.001H
			60.00H	10.00H	±1.5%+5d	0.01H
	10kHz	LS	600.0uH	100.0uH	±0.7%+5d	0.01uH
		LP	6.000mH	1.000mH	±0.7%+5d	0.001mH
			60.00mH	10.00mH	±1.0%+5d	0.01mH
			600.0mH	100.mH	±1.0%+5d	0.1mH

8.2 Capacitance technical indicators:

Function	Frequency	Equivalentmode	Range	Input	Accuracy	Minimum resolution
Capacitanc	100Hz	CS/CP	60.00nF	20.00nF	±2.0%+5d	0.01nF

	DCR		600.0Ω	200.0Ω	±1.0%+5d	0.1Ω
			6.000kΩ	2.000kΩ	±0.4%+2d	0.001kΩ
			60.00kΩ	20.00kΩ	±0.4%+2d	0.01kΩ
			600.0kΩ	200.0kΩ	±0.4%+3d	0.1kΩ
			6.000MΩ	2.000MΩ	±1.5%+5d	0.001MΩ
			20.00MΩ	20.00MΩ	±1.5%+5d	0.01MΩ

9. Maintenance

9.1 Clean the instrument

If there's any dust on terminals or terminals are humid, error measurement may occur. Please clean the instrument according to the following steps:

1 Power off the instrument, and remove the test pen.

2 Rotate the instrument and shake out dust accumulated in the jack. Wipe the instrument bright with wet cloth and detergent, please do not use any abrasives or solvents. Use a clean swab soaked with alcohol to wipe contacts in each input jack.

⚠ **Warning** : Please keep the inside of the instrument clean and dry, to avoid electric shock or damaged instrument.

Function	Frequency	Equivalentmode	Range	Input	Accuracy	Minimum resolution
Resistance	100Hz	RS/RP	60.00Ω	20.00Ω	±0.5%+5d	0.01Ω
		RS/RP	600.0Ω	200.0Ω	±0.4%+2d	0.1Ω
		RS/RP	6.000kΩ	2.000kΩ	±0.4%+2d	0.001kΩ
		RS/RP	60.00kΩ	20.00kΩ	±0.4%+2d	0.01kΩ
		RS/RP	600.0kΩ	200.0kΩ	±0.7%+3d	0.1kΩ
		RS/RP	6.000MΩ	2.000MΩ	±1.5%+3d	0.001MΩ
		RP	20.00MΩ	20.00MΩ	±2.0%+5d	0.01MΩ
	1kHz	RS/RP	60.00Ω	20.00Ω	±0.4%+2d	0.01Ω
		RS/RP	600.0Ω	200.0Ω	±0.4%+2d	0.1Ω
		RS/RP	6.000kΩ	2.000kΩ	±0.4%+2d	0.001kΩ
		RS/RP	60.00kΩ	20.00kΩ	±0.4%+2d	0.01kΩ
		RS/RP	600.0kΩ	200.0kΩ	±0.7%+3d	0.1kΩ
		RS/RP	6.000MΩ	2.000MΩ	±1.5%+5d	0.001MΩ
		RP	20.00MΩ	20.00MΩ	±2.0%+5d	0.01MΩ
	10kHz	RS/RP	60.00Ω	20.00Ω	±0.4%+2d	0.01Ω
		RS/RP	600.0Ω	200.0Ω	±0.4%+2d	0.1Ω
		RS/RP	6.000kΩ	2.000kΩ	±0.4%+2d	0.001kΩ
		RS/RP	60.00kΩ	20.00kΩ	±0.4%+2d	0.01kΩ
		RS/RP	600.0kΩ	200.0kΩ	±0.7%+3d	0.1kΩ
		RS/RP	6.000MΩ	2.000MΩ	±3.0%+3d	0.001MΩ

	DCR		600.0Ω	200.0Ω	±1.0%+5d	0.1Ω
			6.000kΩ	2.000kΩ	±0.4%+2d	0.001kΩ
			60.00kΩ	20.00kΩ	±0.4%+2d	0.01kΩ
			600.0kΩ	200.0kΩ	±0.4%+3d	0.1kΩ
			6.000MΩ	2.000MΩ	±1.5%+5d	0.001MΩ
			20.00MΩ	20.00MΩ	±1.5%+5d	0.01MΩ

9. Maintenance

9.1 Clean the instrument

If there's any dust on terminals or terminals are humid, error measurement may occur. Please clean the instrument according to the following steps:

1 Power off the instrument, and remove the test pen.

2 Rotate the instrument and shake out dust accumulated in the jack. Wipe the instrument bright with wet cloth and detergent, please do not use any abrasives or solvents. Use a clean swab soaked with alcohol to wipe contacts in each input jack.

⚠ **Warning** : Please keep the inside of the instrument clean and dry, to avoid electric shock or damaged instrument.

9.2 Replace the battery

Replace the battery:

1. Power off the instrument, and remove the pen inserted on the instrument.
2. Unfasten two screws fixing the battery cover with a screwdriver, and remove the battery cover.
3. Remove the old battery, and replace with a new one of the same specification. Please pay attention to battery polarity , while negative and positive polarity mark of each battery is inside the battery box.
4. Install the battery cover back to its original position, fix and lock the battery cover with screws.

Warning

1. **In order to avoid electric shock or personal injury possibly caused by err or r eading, please r eplace the battery immediately when battery is low. Please do not discharge the battery by means of battery short circuit or reversal of battery polarity.**
2. **In order to guarantee safety operation and maintenance of this instrument, when it is not used for a long term, please take out the battery , to avoid any damage to the pr oduct due to battery leakage.**

Warning

In order to prevent possible electric shock, personal injury or damage to the instrument, please use protective tube of the same specification or specified specification.