



**AMM-3320**

**Multi-function LCR**

**USER`S MANUAL**

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Thank you for purchasing the multi-function LCR from us. Please take a few minutes to browse through this user manual before you begin to operate the meter to ensure that you are fully familiarized with how best to operate the meter as accurately and safely as possible.

## Overview

This multi-function LCR is a portable instrument designed with microprocessor control and low power consumption. It can measure 6 basic parameters: inductance L, capacitance C, AC resistance R, DC resistance DCR, dissipation factor D and quality factor Q. The instrument can easily communicate with PC and realize remote control through USB interface.

With battery external power supply, the meter is ideal for field and portable applications, such as component inspection at fixed place, and immediate measurement by buyer and maintenance personnel.

### Cautions

- This instrument can only be used in indoor.
- Be sure to turn off the instrument when replacing the battery or DC power adapter.
- Although the instrument has a protection for shocks, inputting dc voltage or current will still damage the instrument. The capacitance requires completely discharge before measuring.
- If the instrument is idle for more than three months, please take the batteries out.
- Use AAA\*6 batteries. The instrument cannot work properly when low voltage indication appears.
- In order to ensure the measurement accuracy, open/short calibration should be carried out again after replacing the test fixtures.
- Do not using the instrument under dusty, vibration, direct sunlight and corrosion gas.

## Introduction

### Features

- 19,999/1,999 counts dual LCD display
- Basic accuracy: 0.3% with resolution of 0.01%
- Analog bar display
- Measurement frequency up to 100kHz
- Mini-USB interface (USB model only)
- AutoLCR smart check and measurement
- Sorting function
- Relative measurement
- Data hold
- Back light, full angle for LCD display
- 4-terminal measurement configuration
- Automatic power off
- Battery and external power supply
- Battery voltage indication

### Specification

Parameter	Primary	DCR : DC resistance Ls/Cs : series inductance/capacitance Lp/Cp : parallel inductance/capacitance
	Secondary	$\theta$ : phase angle    D : dissipation factor ESR : equivalent series resistance

		Q : quality factor Rp : equivalent parallel resistance	
Frequency	100/120/1K/10k/100kHz		
Display	Dual display + analog bar display		
Measurement range	L	100/120	20mH ~ 20kH
		1kHz	2000uH ~ 2000H
		10k	200uH ~ 20H
		100kHz	20uH ~ 200mH
	C	100/120	20nF ~ 20mF
		1kHz	2000pF ~ 2mF
		10k	200pF ~ 200uF
		100kHz	200pF ~ 20uF
	R	100/120	200Ω ~ 200MΩ
		1kHz	20Ω ~ 200MΩ
		10k	20Ω ~ 20MΩ
		100kHz	20Ω ~ 2MΩ
	DCR	200 ~ 200M	
	D/Q	0.001 ~ 1999	
θ	0.00° ~ ±180.0°		
Test level	0.6Vrms		
Range mode	Auto and Hold		
Equivalent Circuit	Parallel and Series		

Calibration function	Open/Short	
Interface	Mini-USB	
Measurement speed	Approx.1.2 times/second	
Measurement terminal	4-terminal	
Basic accuracy	0.3%	
Power	AAA*6 battery or external power supply	
Auto power off	5 min ( with batteries )	
Operating environment	temperature	0°C ~ 40°C
	humidity	≤90%RH (40°C, no condensation)
Storage temperature	-25°C ~ 50°C	

### Impedance accuracy Ae

The below-listed accuracies are guaranteed by the meter with normal use under the operating temperature of 18°C-28°C and relative humidity less than 80%.

Z Freq.	0.1- 1Ω	1 – 10Ω	10 – 100kΩ	100k – 1MΩ	1M – 20MΩ	20M– 200MΩ	Remark
DCR	1.0%+5d	0.5%+3d	0.3%+2d	0.5%+3d	1.0%+5d	2.0%+5d	D < 0.1
100/ 120Hz	1.0%+5d	0.5%+3d	0.3%+2d	0.5%+3d	1.0%+5d	2.0%+5d	
1kHz	1.0%+5d	0.5%+3d	0.3%+2d	0.5%+3d	1.0%+5d	5.0%+5d	
10kHz	1.0%+5d	0.5%+3d	0.3%+2d	0.5%+3d	2.0%+5d	N/A	
100kHz	2.0%+5d	1.0%+5d	0.5%+3d	1.0%+5d	2.0%+5d (1M – 2MΩ)		

*Note: All accuracy is guaranteed by proper ratio resistor calibration and open/short calibration.*

If  $D > 0.1$ , the accuracy should be multiplied by  $\sqrt{1 + D^2}$

$$Z_C = \frac{1}{2\pi f c} \quad \text{if } D \ll 0.1 \text{ in capacitance mode}$$

$$Z_L = 2\pi f L \quad \text{if } D \ll 0.1 \text{ in inductance mode}$$

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### Sub-display parameters accuracy:

Ae = impedance (Z) accuracy

$$\text{Definition: } Q = \frac{1}{D}$$

$$R_p = \text{ESR (or } R_s) \times (1 + \text{})$$

1. D value accuracy:  $D_e = \pm A_e \times (1 + D)$

2. ESR accuracy:  $R_{e} = \pm Z_M \times A_e (\Omega)$

ie.,  $Z_M = \text{impedance calculated by  or } 2\pi f L$

3. Phase angle  $\theta$  accuracy:  $\theta_e = \pm(180/\pi) \times A_e (\text{deg})$

**Note:** *D*: dissipation factor

*Q*: quality factor

*ESR*: equivalent series resistance

*R<sub>p</sub>*: equivalent series parallel resistance

*θ*: phase angle

## Explanation on Front Panel

The front panel is shown as figure 1.

### 1. Mini USB interface

Connect with PC, easily for data transmission and management.

### 2. LCD

Used for displaying the measuring results and various symbols.

### 3. key

Used for putting on or off the operating power for the meter.

### 4. **FUNC.** key

When **FUNC.** key is pressed, the main test mode could be selected sequentially: Auto-LCR mode→Auto-L mode→Auto-C mode→Auto-R mode→DCR mode→ Auto-LCR mode.

### 5. **CAL** key

Used to do OPEN/SHORT calibration.

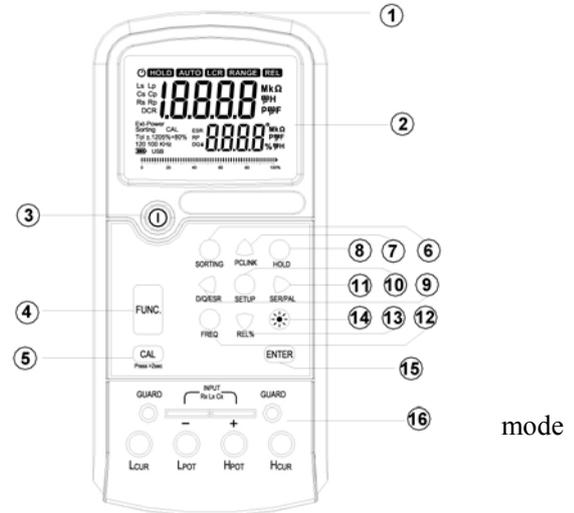
### 6. **SORTING** key

Press this key to enter into sorting mode, which could help the user to make a quick sort for a bunch of components.

### 7. **PCLINK** key

Press this key to communicate with PC.

Figure 1



mode

8. **HOLD** key

Used to maintain the measurement data unchanging, by pressing the key again it will resume the measurement.

9. **D/Q/ESR** key

In L/C measurement mode, press the key to select parameters of D/Q/ $\theta$ /ESR.

10. **SETUP** key

When sorting mode is active, press **SETUP** key to modify the reference value, range and the tolerance settings sequentially.

11. **SER/PAL** key

Used to select series and parallel mode.

12. **FREQ** key

Press **FREQ** key to select five different test frequencies in turn: 100/120/1k/10k/100kHz

13. **REL%** key

Press **REL%** key to enter into relative measurement mode. In auto LCR mode, this key is not available.

14.  key

By pressing this key for once, the backlight of the LCD screen will be opened and after 60 seconds the meter will automatically turn off the backlight. It is also possible to turn off the backlight by pressing this key before the 60 seconds.

15. **ENTER** key

In sorting mode, press **ENTER** key to confirm the data modification.

16. Measurement terminal

The instrument has 4-terminal measurement configuration, as shown in figure 2.

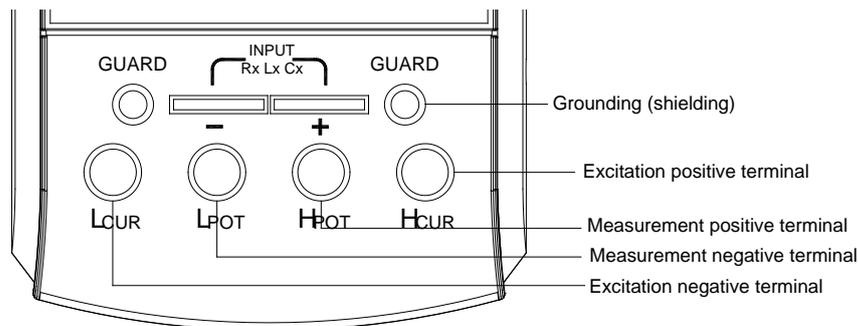


Figure 2

**Understanding Display Screen**

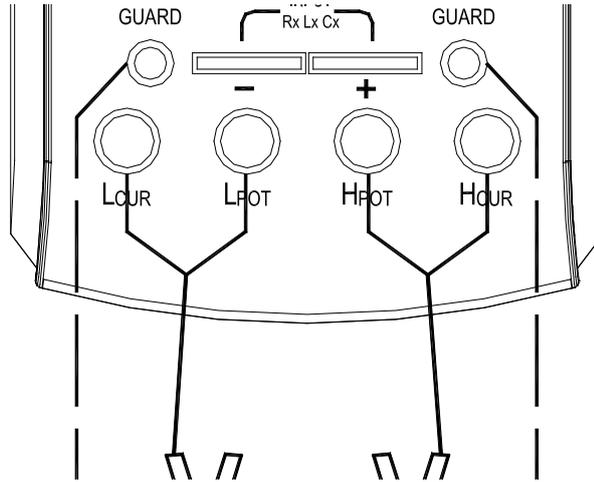


Figure 3

LCD screen is shown as in Figure 3, with its every symbol's meaning shown as in the Table 1:

NO.	Meaning	NO.	Meaning
1	Auto power off indication	11	Sub-display
2	Data hold	12	Analog bar indication
3	Auto mode indication	13	The Meter is in the data transmission mode.
4	Auto LCR mode indication	14	battery indication (with battery supply )
5	Range indication	15	Frequency indication
6	Relative Measurement mode.	16	Tolerance range
7	Main-display	17	Sorting mode indication
8	Unit for main parameters	18	External power supply
9	Secondary parameters	19	Open/Short calibration mode indication
10	Unit for secondary parameters	20	Primary parameters

## Operating instruction

### Power on the meter

Press **ⓘ** key to turn on the power. The default mode is AUTOLCR smart mode and the default test frequency is 1 kHz. When **ⓘ** key is pressed during power-on mode, the instrument will enter power-off mode. The LCD will show the “OFF” state before power off.

## Function Descriptions

### 1. Parameters setting

Press **FUNC.** key to select the following parameters sequentially: AUTO LCR, L-Q, C-D, R, DCR.

Parameter	Meaning
AUTO LCR	Auto LCR smart mode
L-Q	Inductance measurement , the parameter on sub-display is quality factor Q.
C-D	Capacitance measurement, the parameter on sub-display is dissipation factor D.
R	Resistance measurement
DCR	DC resistance measurement mode

L/C/R measurement readings can be positive or negative. In C-D measurement, if the main parameter is "-", the actual component being tested is inductive; In L - Q measurement, if the main parameter is "-", the actual component being tested is capacitive; Theoretically, R is positive, in some cases, R is "-", which may be calibration error, please re-calibrate the instrument.

### 2. Auto LCR smart mode

The default test mode is Auto LCR mode which could check the type of impedance smartly. If  $|\theta| < 11^\circ$ , the Auto-R mode is selected. The parameter on sub-display is  $\theta$ .

If  $\theta > 11^\circ$ , the Auto-L mode is selected. The parameter on sub-display is Q.

If  $\theta < -11^\circ$ , the Auto-C mode is selected. The parameter on sub-display is D.

If the  $C < 5\text{pF}$ , the parameter on sub-display is parallel resistance Rp.

*Note: In order to avoid damaging the instrument, the capacitance requires discharge before measuring.*

### 3. Frequency setting

Press **FREQ** key to select frequency value :100/120/1k/10k/100kHz. The LCR impedance scale ranges are depended on the test frequency.

### 4. Data hold

Press this key to hold the measurement data and press it again to resume the measurement.

### 5. Relative mode

During relative measurement the meter remembers the current readings on primary display(called initial value)when pressing the **REL%** key, and “REL” symbol appears on LCD. The secondary display will show the percentage of relative value REL%.

$$\text{The REL\%} = (\text{present value} - \text{initial value}) / \text{initial value} * 100\%.$$

Press **REL%** key again to show the current readings on primary display and the “REL” symbol will be blinking. The percentage range is from -99.9% ~ 99.9%. When the present value is larger than double of initial value, the “OL%” indication will be shown on the secondary display.

During relative measurement, analog bar is always indicating the present measurement value but not the relative value.

## 6. Open/Short calibration

- 1 ) Press **CAL** key larger than 2 seconds to start the open/short calibration procedure.
- 2) In open calibration mode, the secondary display will show “Open”. There are two ways for open state input:
  - a When using square terminals , the square terminals and  $L_{CUR}/L_{POT}/H_{POT}/H_{CUR}$  terminals hang in the air (shown in figure 4);
  - b When using  $L_{CUR}/L_{POT}/H_{POT}/H_{CUR}$  terminals , insert the black and red testing lines with alligator clip into the " $L_{CUR}$ " , " $L_{POT}$ " terminal and " $H_{CUR}$ " , " $H_{POT}$ " terminal respectively.(shown in figure 5).

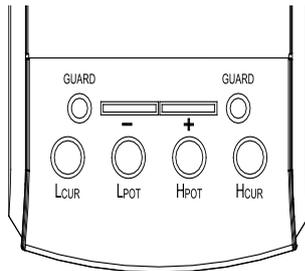


Figure 4

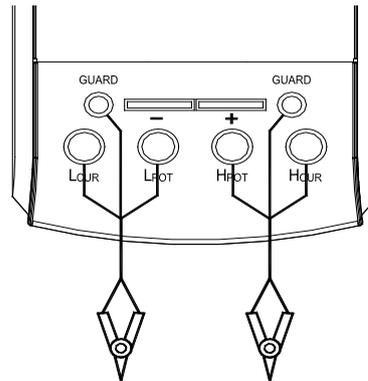


Figure 5

- 3) Press **CAL** key and the 30-second countdown will be shown on LCD panels. If the open calibration is finished, the PASS or

FAIL symbol will show on the primary display. Press **CAL** key again to save the calibration data and enter into the short calibration mode.

- 4) In short calibration mode, the secondary display will show “Srt”. There are two ways for short state input:
- When using square terminals, insert the short socket to the square terminals and make  $L_{CUR}/L_{POT}/H_{POT}/H_{CUR}$  terminals hang in the air (shown in figure 6);
  - When using  $L_{CUR}/L_{POT}/H_{POT}/H_{CUR}$  terminals, insert the black and red testing lines with alligator clip into the "L<sub>CUR</sub>", "L<sub>POT</sub>" terminal and "H<sub>CUR</sub>", "H<sub>POT</sub>" terminal respectively. Connect the mouth of clips. (shown in figure 7).

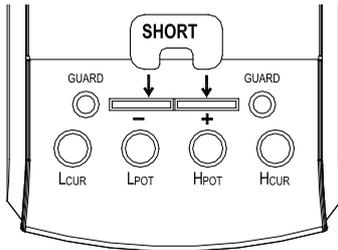


Figure 6

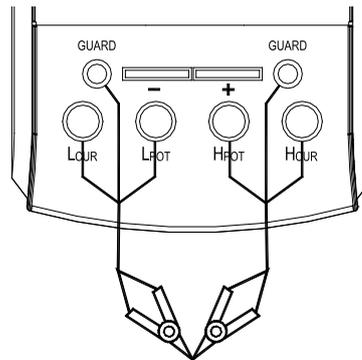


Figure 7

- 5) Press **CAL** key and the 30-second countdown will be shown on LCD panels. If the short calibration is finished, the PASS or

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FAIL symbol will show on the primary display. Press **CAL** key again to save the calibration data.

*Note: 1. To get the better accuracy, the open/short calibration should be done before measurement.*

*2. The purpose of open/short calibration is to reduce the parasitic effect of the test fixture.*

*3. Open or short circuit, is selected automatically according to the measurement terminal.*

*4. In short calibration, there may be FAIL situations, which may be caused by not using the low resistance short line or unreliable contact, please try again after reliable short-circuit*

### **7. Equivalent Circuit**

When any L/C/R functional mode is selected, the default measurement in series or parallel mode is auto selected and the AUTO segment will be shown on LCD display. It depends on the total equivalent impedance measured.

If the impedance is larger than  $10k\Omega$ , parallel mode is set and  $L_p/C_p/R_p$  is shown on the display.

If it is less than  $10k\Omega$ , series mode is set and  $L_s/C_s/R_s$  is shown on the display.

When SEL/PAL key is pressed, the impedance measurement will be set in series mode or in parallel mode sequentially.

*Note: The actual capacitance, inductance and resistance is not ideal component of pure reactance and pure resistance. Usually the resistance and reactance exist simultaneously. A practical impedance can be simulate by the ideal resistors and ideal reactor (inductor or capacitor) in series or parallel form.*

### **8. Sorting mode**

The sorting mode could help the user to make a quick sort for a bunch of components. The setting steps as following:

- 1) According to the component type, press **FUNC.** key to select L, C or R measurement mode.
- 2) Insert the standard component into the input terminal. Press **SORTING** key to enter into the sorting mode and the "Sorting" symbol appears on LCD. If the LCD reading is OL or less than 200 counts, the **SORTING** key is not available.
- 3) When sorting mode is active, press **SETUP** key to modify the range, reference value and the tolerance settings sequentially.
- 4) "Range" symbol is flashing when setting the range. Press **D/Q/ESR**( ← )key to shift the decimal point, unit to left and press **SER/PAL** ( → ) key to right. Press **ENTER** key to confirm and enter into the reference value setting mode automatically. At this time, "Range" symbol disappear.
- 5) When setting the reference value, press **D/Q/ESR** ( ← ) key and **SER/PAL** ( → ) key to shift the bit to left and right respectively. Press **PCLINK**( ↑ )key and **REL%**( ↓ )key to make the digit +1 or -1. The flashing bit is the current setting bit. The reference value setting is available from 20 to 1999 counts. Press **ENTER** key to confirm and enter into the tolerance setting mode automatically.
- 6) When setting the tolerance, press **D/Q/ESR** ( ← ) key and **SER/PAL** ( → ) key to select tolerance range:  $\pm 0.25\% \rightarrow \pm 0.5\% \rightarrow \pm 1\% \rightarrow \pm 2\% \rightarrow \pm 5\% \rightarrow \pm 10\% \rightarrow \pm 20\% \rightarrow \pm 80\% - 20\%$ . The default tolerance is  $\pm 1\%$ . Press **ENTER** key to confirm.
- 7) After setting the parameters, remove the standard component and insert the component to be measured. If the impedance measured does not exceed tolerance range, the primary display will show "PASS", otherwise show "FAIL". The current measurement result will be shown on the secondary display.
- 8) Press **SORTING** key again to exit the sorting mode.

*Note: In AUTO LCR mode, the SORTING key is not available.*

## 9. PC-LINK mode

Press **PCLINK** key and USB symbol appears on LCD. Connect the instrument to PC through USB interface, and the measured data can be recorded, analyzed, processed and printed by PC. Press **PCLINK** key again to cancel the data transmission. Then USB symbol disappears.

Due to the power consumption in data transmission, please extinguish USB display when there is no need to transmit data.

### Operating step

#### 1. Inductance measurement

- 1) Turn on the power.
- 2) There are two ways for inductance input:
  - a. Insert the measured inductance into the input terminal directly (shown in figure 8);
  - b. Connect the alligator clips to the ends of the measured inductance (shown in figure 9).
- 3) The default test mode is Auto LCR mode, the inductance value will show on primary display and the quality factor Q will show on secondary display. In Auto LCR mode, the **D/Q/ESR** key, **SEL/PAL** key, **SORTING** key and **REL%** key are not available.
- 4) Press **FUNC.** key to select Auto-L mode. The primary LCD display will show the inductance value. The secondary LCD display will show the quality factor Q. The equivalent resistance ESR/Rp, phase angle  $\theta$  or dissipation factor D can also be shown by pressing the **D/Q/ESR** key.
- 5) Press **FREQ** key to select frequency value: 100/120/1k/10k/100kHz.
- 6) Press **SER/PAL** key to select series or parallel mode.

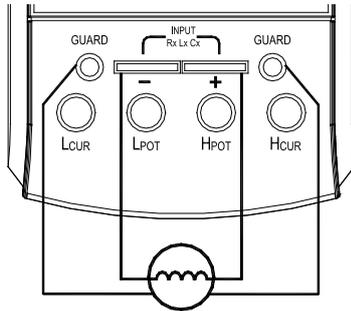


Figure 8

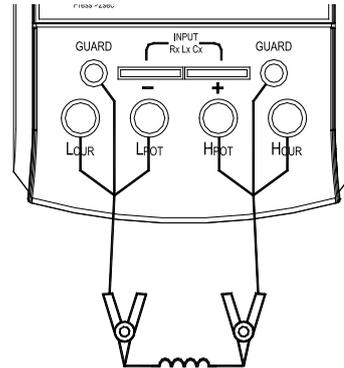


Figure 9

## 2. Capacitance measurement

- 1) Turn on the power.
- 2) If exists voltage in the capacity, connect the two ends of the capacitor for a short time to discharge.
- 3) There are two ways for capacitance input:
  - a. Insert the positive polarity of capacitance into the positive terminal and its negative polarity into the negative terminal (shown in figure 10);
  - b. Insert the black and red testing lines with alligator clip into the "L<sub>CUR</sub>", "L<sub>POT</sub>" terminal and "H<sub>CUR</sub>", "H<sub>POT</sub>" terminal respectively. Connect the alligator clips to the two ends of capacitance corresponding to its polarity (shown in figure 11).
- 4) The default test mode is Auto LCR mode, the capacitance value will show on primary display and the dissipation factor D will show on secondary display. In Auto LCR mode, the **D/Q/ESR** key, **SEL/PAL** key, **SORTING** key and **REL%** key

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are not available.

- 5 ) Press **FUNC.** key twice to select Auto-C mode. The primary LCD display will show the capacitance value. The secondary LCD display will show the dissipation factor D. The quality factor Q, equivalent resistance ESR/Rp or phase angle  $\theta$  can also be shown by pressing the **D/Q/ESR** key.
- 6 ) Press **FREQ** key to select frequency value: 100/120/1k/10k/100kHz.
- 7 ) Press **SER/PAL** key to select series or parallel mode.

*Note: 1. When Auto-LCR mode is active, the secondary parameter will show the equivalent resistance in parallel mode ( $R_p$ ) to replace the D factor if the C measured value is less than 5pF.*

**2. In order to avoid damaging the instrument, the capacitance requires discharge before measuring.**

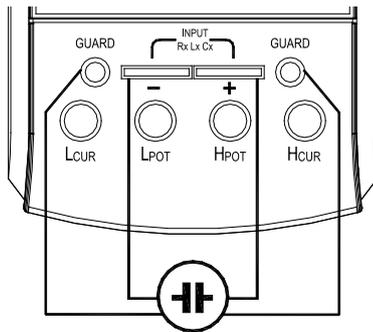


Figure 10

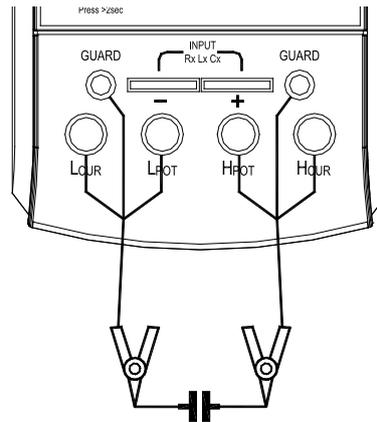


Figure 11

### 3. Resistance measurement

- 1) Turn on the power.
- 2 ) There are two ways for resistance input:
  - a. Insert the measured resistance into the input terminal directly (shown in figure 12);
  - b. Connect the alligator clips to the ends of the measured resistance (shown in figure 13).
- 3 ) The default test mode is Auto LCR mode, the resistance value will show on primary display and the phase angle  $\theta$  will show on secondary display. In Auto LCR mode, the **D/Q/ESR** key, **SEL/PAL** key, **SORTING** key and **REL%** key are not available.
- 4 ) Press **FUNC.** key three times to select Auto-R (ACR) mode. The primary LCD display will show the resistance value. The secondary parameter is omitted and the **D/Q/ESR** key is not available.
- 5 ) Press **FREQ** key to select frequency value: 100/120/1K/10k/100kHz.
- 6 ) Press **SER/PAL** key to select series or parallel mode.
- 7 ) Press **FUNC.** key four times to select DCR mode. The primary LCD display will show the resistance value. The secondary parameter is omitted and the **D/Q/ESR** key, **SEL/PAL** key and **FREQ** key are not available.

*Note: The phase angle  $\theta$  will show on secondary display only in Auto-LCR mode. During Auto-R mode or DCR mode, the secondary parameter is not available.*

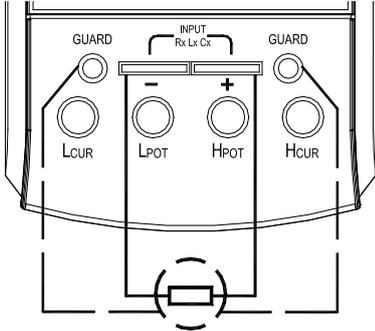


Figure 12

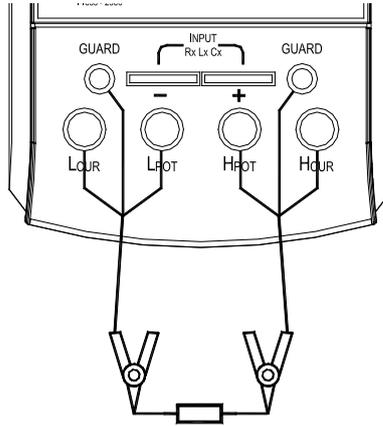
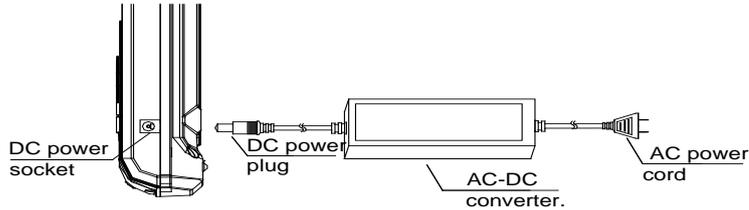


Figure 13

**To use Adapter** (Under external power adapter, the automatic power off function is not available.)

**Connecting the power adapter :**

- 1 , Connect the AC power cord to the AC-DC converter.
- 2 , Plug the AC power cord into an electrical outlet (100V-240V).
- 3 , Plug the DC power plug of the converter into DC power socket of the meter.

**AC/DC adapter information :**

Input : 100V-240VAC, 50-60Hz 1.8A

Output: DC 12V  2A MAX

Polarity :

**WARNING:**

1. Please use the original AC power adapter, using other AC power adapter may damage your instrument.
2. The AC power adapter can only be used indoors.
3. Please plug the AC power cord into an electrical outlet first and then firmly insert DC plug into DC input end in the right of the meter. When unplugged, firstly pull out the DC plug perpendicular to DC input end and then unplug the AC plug from the electrical outlet.
4. Do not use the AC power adapter in other equipment except this instrument.
5. In use, it is a normal phenomenon that the AC power adapter will be hot.
6. Do not demolish the AC power adapter. Otherwise, it may be dangerous.
7. Do not use the AC power adapter in a high temperature or wet place.

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8. Please make the AC power adapter avoid a strong bump.
9. It is normal when the AC power adapter make some noise in use.

## Maintenance

### Cleaning

Periodically wipe the case with a damp cloth and detergent; do not use abrasives or solvents.

### Calibration

Calibrate your instrument once a year to ensure that it performs according to its specifications.

### Replacing the Battery

Please change the battery when the battery symbol  is less than one segment.

Turn off the power of the instrument. When you change the battery, and screw off the breechblock on the battery cabinet cover, then take off it and instead the fresh battery.

## Accessories

- User's manual One piece
- AAA batteries Six pieces
- Shielding clip line One piece
- Kelvin 4-terminal measure line One piece
- Short socket One piece
- Open socket One piece
- USB line (USB model only) One piece
- PC-Link software CD (USB model only) One piece

If there are some changes in accessories, please refer to the real product as standard.

Note: To get the better accuracy, when using  $L_{CUR}/L_{POT}/H_{POT}/H_{CUR}$  terminals measured with the alligator clip-testing lines, Please insert the open socket to the square terminals (shown in figure 14).

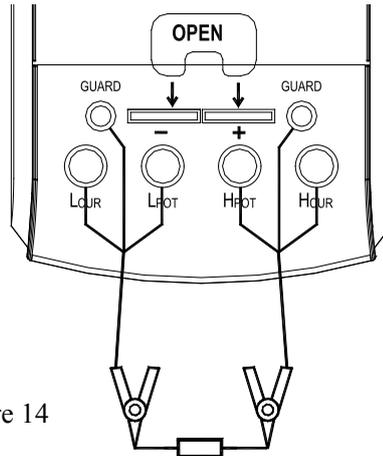


Figure 14