

# **USER`S MANUAL**

## **6000 COUNTS**

### **DIGITAL LCR METER**

#### **Table of Contents**

#### **1. GENERAL INSTRUCTIONS**

The meter is a hand-held, battery-operator instrument for testing inductance, capacitance and resistance. If this device is damaged or something is missing, contact the place of purchase immediately.

This instrument complies with the specifications set out in the IEC 61010-1, 2001, publication concerning safety requirements for electronic measuring apparatus.

This manual contains information and warnings must be followed to ensure safe operation as well as to maintain the meter in a safe condition.

To get the best service from this instrument, read carefully this user's manual and respect the detailed safety precautions.

#### **1.1 Precautions safety measures**

##### **1.1.1 Preliminary**

\* The meter is safety-certified in compliance with EN61010 (IEC 1010-1) Installation Category II (CAT. II) 50V, Pollution Degree 2 environment.

\* When using this Multimeter, the user must observe all normal safety rules concerning:

- protection against the dangers of electric current.
- protection of the Multimeter against misuse.

\* For your own safety, only use the test probes supplied with the instrument. Before use, check that they are in good condition.

##### **1.1.2 During use**

\* Use the meter only as specified in this manual; otherwise, the protection provided by the meter may be impaired.

\* Do not use the meter or test leads if they look damaged.

\* If the meter is used near noise generating equipment, be aware that display may become unstable or indicate large errors.

\* Use extreme caution when working around bare conductors or bus bars.


\* Do not operate the meter around explosive gas, vapor, or dust.

\* The instrument that used in dusty environment should be wiped and cleaned regularly.

\* Check the main function dial and make sure it is at the correct position before each measurement.




\* When the range of the value to be measured is unknown, check that the range initially set on the meter is the highest possible or, wherever possible, choose the autoranging mode.

\* To avoid damages to the instrument, do not exceed the maximum limits of the input values shown in the technical specification tables.

- \* When measuring within a circuit, the circuit must be de-energized before connecting the test leads.
- \* When making connections, connect the common test lead before connecting the live test lead; when disconnecting, disconnect the live test lead before disconnecting the common test lead.
- \* Before changing functions, disconnect the test leads from the circuit under test.
- \* When measuring in-circuit components, first de-energize the circuits before connecting to the test leads.
- \* Discharge capacitor before testing.
- \* Never perform resistance measurements on live circuits.
- \* Disconnect circuits power and discharge all high-voltage capacitors or inductances before testing resistance, inductance or capacitance.
- \* Change the battery when the  symbol appears to avoid incorrect data.

### 1.1.3 Symbols:

Symbols used in this manual and on the instrument:

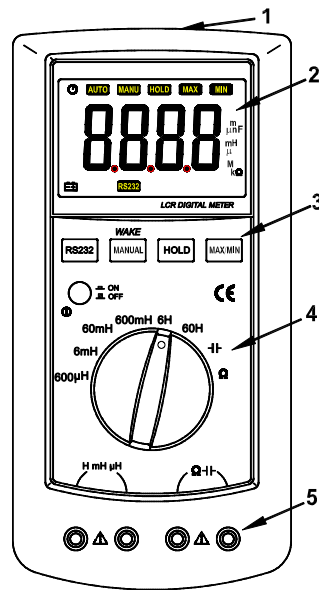
-  Caution: refer to the instruction manual. Incorrect use may result in damage to the device or its components.
-  Fuse
-  Conforms to European Union directives

### 1.1.4 Instructions

- \* Before opening up the instrument, always disconnect from all sources of electric current and make sure you are not charged with static electricity, which may destroy internal components.
- \* Any adjustment, maintenance or repair work carried out on the meter while it is live should be carried out only by appropriately qualified personnel, after having taken into account the instructions in this present manual.
- \* A "qualified person" is someone who is familiar with the installation, construction and operation of the equipment and the hazards involved. He is trained and authorized to energize and de-energize circuits and equipment in accordance with established practices.
- \* When the instrument is opened up, remember that some internal capacitors can retain a dangerous potential even after the instrument is switched off.
- \* Do not leave the instrument exposed to direct heat from the sun or heat source for long periods.
- \* Before removing the cover, ensure that the instrument is disconnected from any circuit and in power "OFF" position.
- \* If any faults or abnormalities are observed, take the instrument out of service and ensure that it cannot be used until it has been checked out.
- \* If the meter is not going to be used for a long time, take out the battery and do not store the meter in high temperature or high humidity environment.

## 2. DESCRIPTION

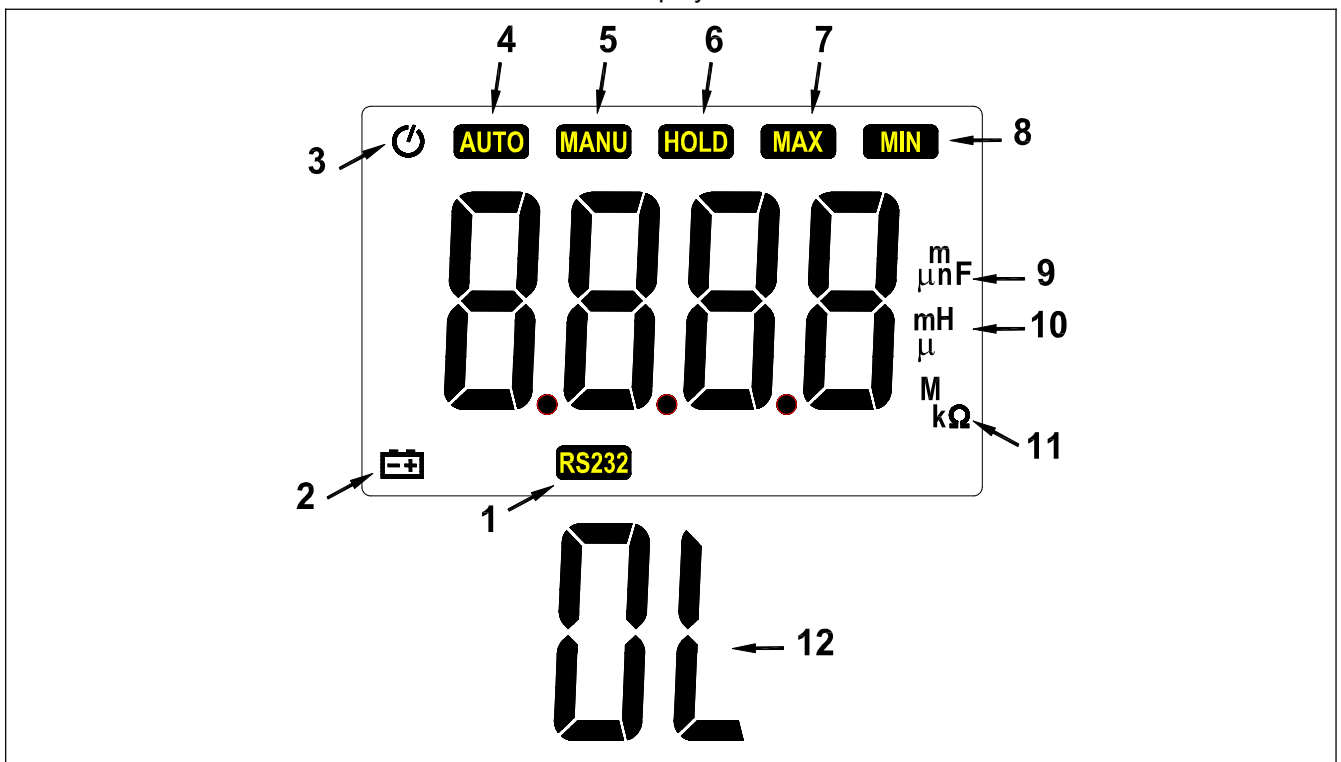
### 2.1 Instrument Familiarization



- ① ① Serial data output connector
- ② ② LCD display
- ③ ③ Keypad
- ④ ④ Rotary switch
- ⑤ ⑤ Terminals

## 2.2 LCD Display








See Table 1 indicated for information about the LCD display.



**Figure 1.**Display

**Table 1.** Display Symbols


Number	Symbol	Meaning
1	RS232	Serial data output is active.

2		The battery is low. <b>⚠ Warning: To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator appears.</b>
3		Auto power-off is enabled
4		The Meter is in the Autorange mode in which the meter automatically selects the range with the best resolution.
5		The Meter is in the Manual ranging mode
6		The Meter is in the Data Hold mode
7		Maximum reading displayed
8		Minimum reading displayed
9	<b>nF, <math>\mu</math>F, mF</b>	F: Farad. The unit of capacitance. mF Millifarad. $1 \times 10^{-3}$ or 0.001 farads. : Microfarad. $1 \times 10^{-6}$ or 0.000001 farads. $\mu$ F: Nanofarad. $1 \times 10^{-9}$ or 0.000000001 farads. nF:
10	<b><math>\mu</math>H, mH, H</b>	H: Henry. The unit of inductance. m Millihenry. $1 \times 10^{-3}$ or 0.001 henries. H: Microhenry. $1 \times 10^{-6}$ or 0.000001 henries. $\mu$ H :
11	<b><math>\Omega</math>, k<math>\Omega</math>, M<math>\Omega</math></b>	$\Omega$ : Ohm. The unit of resistance. k $\Omega$ : Kilohm. $1 \times 10^3$ or 1000 ohms. M Megohm. $1 \times 10^6$ or 1,000,000 ohms. $\Omega$ :
12	<b>OL</b>	The input is too large for the selected range.

### 2.3 Keypad

See Table 2 indicated for information about the keypad operations.

**Table 2. Keypad**

Key	Function	Operation performed
<b>ON/OFF</b> (green)	Any switch position	turn the meter on or off
<b>RS232</b>	Any switch position	Press RS232 to enable and disable serial data output.
<b>MANUAL/WAKE</b>	$\Omega$ and   Sleep mode	1. Selection of the autorange (default) or manual ranging mode: short press < 1 sec. on the key, the beep sounds briefly. 2. Switch from manual ranging to autorange mode: long press > 1 sec. on the key, the beep sounds briefly. 3. In manual mode, ranges selection: press successively < 1 sec. on the key.

		Re-power the meter on.
<b>HOLD</b>	Any switch position  MAX MIN recording	Press HOLD to enter and exit the Data Hold mode.  Stops and starts recording without erasing recorded values.
<b>MAX/MIN</b>	Any switch position	Starts recording of maximum and minimum values.

## 2.4 Rotary switch

See Table 3 indicated for information about the rotary switch positions.

**Table 3. Rotary Switch Positions**

Switch Position	Function	Page
$\Omega$	Resistance measurement	12
$\text{--}\text{  }\text{--}$	Capacitance measurement	13
<b>600<math>\mu</math>H</b>	Inductance measurements from 0.1 $\mu$ H to 600 $\mu$ H.	14
<b>6mH</b>	Inductance measurements from 600 $\mu$ H to 6mH.	14
<b>60mH</b>	Inductance measurements from 6mH to 60mH.	14
<b>600mH</b>	Inductance measurements from 60mH to 600mH.	14
<b>6H</b>	Inductance measurements from 600mH to 6H.	14
<b>60H</b>	Inductance measurements from 6H to 60H.	14

## 2.5 Terminals

See Table 4 indicated for information about the terminals.

**Table 4. Terminals**

Terminal	Description
$\Omega$ $\text{--}\text{  }\text{--}$	Red terminal receiving the red clip for resistance and capacitance measurements.
	Black terminal receiving the black clip as a common reference.
<b>H mH <math>\mu</math>H</b>	Terminals receiving the leads for Inductance measurement.

## 2.6 Accessories

Delivered with the multimeter:

¥ User's manual	.....	One piece
	.....	
¥ Test clips	.....	One piece
	.....	
¥ Carry case	.....	One piece
	.....	

Optional:

¥ Multi function socket	.....	One piece
	.....	
¥ RS232 interface line	.....	One piece
	.....	
¥ RS232 software	.....	One piece

.....

### 3. FUNCTION DESCRIPTION

#### 3.1 General Functions

##### 3.1.1 DATA HOLD mode

Data Hold mode makes the meter stop updating the display. Enabling Data Hold function in autorange mode makes the meter switch to Manual ranging mode, but the full-scale range remains the same. Data Hold function can be cancelled by changing the measurement mode or push HOLD again.

To enter and exit the Data Hold mode:

1. Press HOLD key (short press).

Fixes the display on the current value, **HOLD** is displayed.

2. A second short press returns the meter to normal mode.

##### 3.1.2 Manual ranging and Autorange mode

The Meter has both manual ranging and autorange options.

\* In the autorange mode, the Meter selects the best range for the input detected. This allows you to switch test points without having to reset the range.

\* In the manual ranging mode, you select the range. This allows you to override autorange and lock the meter in a specific range.

\* The Meter defaults to the autorange mode in measurement functions that have more than one range.

When the Meter is in the autorange mode, **AUTO** is displayed.

To enter and exit the manual range mode:

1. Press MANUAL key. The Meter enters the manual ranging mode. **AUTO** turns off. **MANU** is displayed. Each presses of MANUAL key increments the range. When the highest range is reached, the Meter wraps to the lowest range.

#### NOTE

If you manually change the measurement range after entering the Data Hold or MAX MIN recording modes, the Meter exits these modes.

2. To exit the manual ranging mode, press and hold down MANUAL key for two seconds. The Meter returns to the autorange mode and **AUTO** is displayed.

##### 3.1.3 Auto power-off / Disable auto power off

To preserve battery life, the Meter automatically turns off if you do not turn the rotary switch or press a key for more than 10 minutes.

To disable the auto power-off feature, hold down MAX/MIN key while turning the meter on.

After auto power-off, pushing the MANUAL/WAKE key can turn on the meter again.

In addition, When serial data output is active, the auto power-off function is also disabled.

The  on the display indicates whether the auto power-off is enable or not.

##### 3.1.4 MAX/MIN recording mode

The MAX MIN recording mode captures and stores the maximum and minimum input values detected.

To use MAX MIN mode, refer to Table 5.

In the MAX MIN mode, when the meter detects an input that is above the recorded maximum or below the recorded minimum, the Meter records the new maximum (MAX) or minimum (MIN) value.

The MAX MIN mode can be used to capture intermittent readings, record maximum readings while you are away, or record readings while you are operating the equipment under test and cannot watch the meter.

Table 5. Using MAX MIN functions

MAX MIN Function	Action
To enter the MAX MIN mode.	<ol style="list-style-type: none"> <li>1. Make sure that the Meter is in the desired measurement function and range.</li> <li>2. Press <b>MAX/MIN</b> key to enter the MAX MIN recording mode. The high (<b>MAX</b>) reading is displayed, and the meter is locked in the present range and <b>MAX</b> is displayed.</li> <li>3. Each time a new low or high value is recorded, the Meter displays a new reading.</li> </ol>
To view the high (MAX) or low (MIN) reading.	Press <b>MAX/MIN</b> to step through the high ( <b>MAX</b> ) and low ( <b>MIN</b> ).
To stop and resume recording without erasing stored values.	Press <b>HOLD</b> key to stop recording. Press <b>HOLD</b> key again to resume recording.
To exit the MAX MIN mode.	Press <b>MAX/MIN</b> key for 2 seconds. The Meter exits MAX MIN. Recorded values are erased and the meter stays in the selected range.

### 3.1.5 Serial data output

The data format complies with JIS 7Bits-transmission code with a baud rate of 19230. The host can use RS232 interface (see 6. RS232 interface) to read the data.

To enable and disable serial data output:

1. Press RS232 key (short press).  
Enables the serial data output. **RS232** is displayed.
2. A second short press disables serial data output. **RS232** turns off.

## 3.2 Measurement Functions

### 3.2.1 Resistance measurement

**⚠ To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before measuring resistance.**

Resistance is an opposition to current flow.

The Meter's resistance ranges are 600.0 $\Omega$ , 6.000k $\Omega$ , 60.00k $\Omega$ , 600.0k $\Omega$ , 6.000M $\Omega$  and 60.00M $\Omega$ .

To measure resistance (set up the Meter as shown in figure 2):

1. Press the "POWER" button to turn on the meter.
2. Set the rotary switch to  $\Omega$  range.
3. Connect the test clips to the  $\Omega$  terminals.
4. Connect the test clips to the component leads as required.  
(or you can measure the inductance by using Multi Function Socket)
5. read the displayed value.

**Some tips for measuring resistance:**

¥ The measured value of a resistor in a circuit is often different from the resistor's rated value. This is because the Meter's test current flows through all possible paths between the probe tips.

¥ In order to ensure the best accuracy in measurement of low resistance, short the test clips before measurement and memory the test probe resistance in mind. This necessary to subtract for the resistance of the test leads.

¥ The resistance function can produce enough voltage to forward-bias silicon diode or transistor junctions, causing them to conduct. To avoid this, do not use the 60M  $\Omega$  range for in-circuit resistance measurements.

¥ On 60M  $\Omega$  range, the meter may take a few seconds to stabilize reading. This is normal for high resistance measuring.

¥ When the input is not connected, i.e. at open circuit, the figure "OL" will be displayed for the overrange condition.

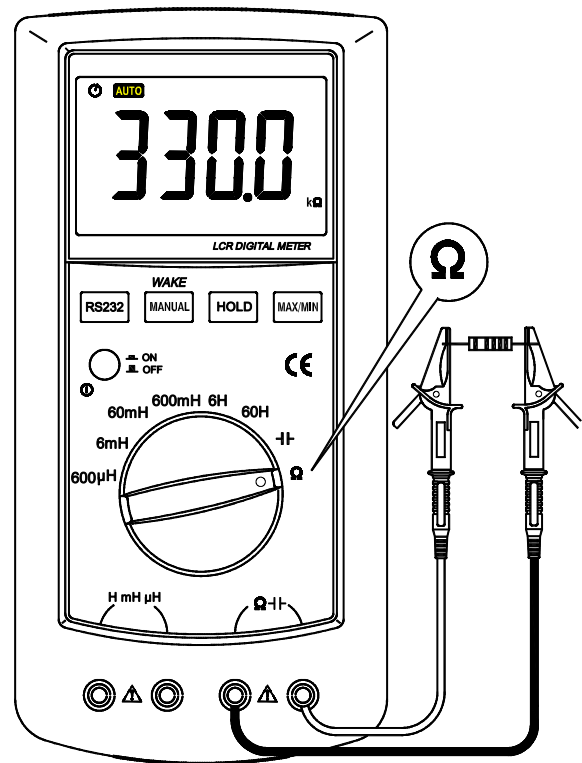


Figure 2. Measuring Resistance

### 3.2.2 Capacitance measurement

⚠ To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before measuring capacitance.



Capacitance is the ability of a component to store an electrical charge.

The Meter's capacitance ranges are 6.000nF, 60.00nF, 600.0nF, 6.000(F, 60.00(F, 600.0(F and 6mF.

To measure capacitance (set up the Meter as shown in Figure 3):

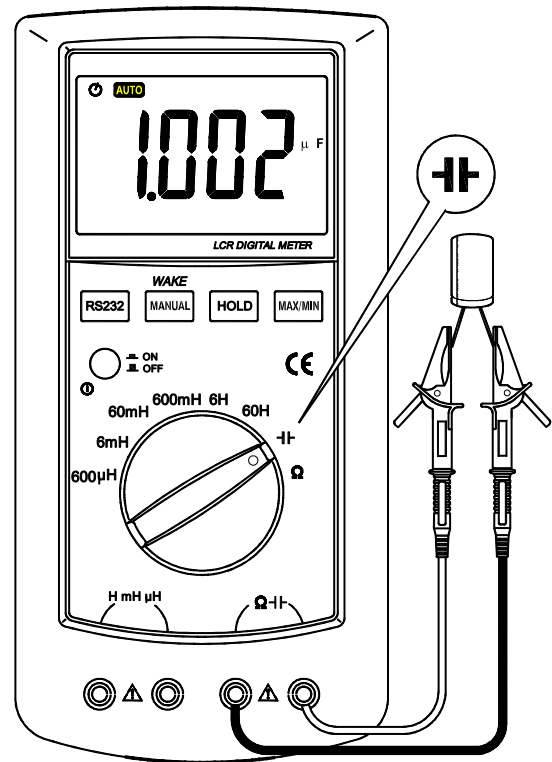
1. Press the "POWER" button to turn on the meter.
2. Set the rotary switch to  $\text{--}\text{||}\text{--}$  range.
3. Connect the test clips to the (  $\text{--}\text{||}\text{--}$  terminals.
4. Connect the test clips to the component leads as required.  
(or you can measure the capacitance by using Multi Function Socket)
5. Read the displayed value.

Some tips for measuring capacitance:

( To speed up measurements of similar values, manually select the proper range using the MANUAL key.

( The meter may take a few seconds to stabilize reading. This is normal for high capacitance measuring.

( To improve the accuracy of measurements less than 6nF, subtract the residual capacitance of the Meter and clips.



**Figure 3. Measuring Capacitance**

### 3.2.3 Inductance measurement

⚠ To avoid electrical shock and/or damage to the instrument, disconnect circuit power and discharge all high-voltage capacitors before measuring inductance.

The property of an electric circuit by which an electromotive force is induced in it or in a nearby circuit by a change of current in either circuit.

The Meter's inductance ranges are 600.0uH, 6.000mH, 60.00mH, 600.0mH, 6.000H and 60.00H.

To measure inductance (set up the Meter as shown in Figure 4):

1. Press the "POWER" button to turn on the meter.
  2. Set the rotary switch to the desired inductance range.
  3. Connect the test clips to the H mH uH terminals.
  4. Connect the test clips to the component leads as required.
- (or you can measure the inductance by using Multi Function Socket)
5. Read the display readings for inductance value.

Note:

( To save the power, don't short the test clips on the 6H and 60H ranges.

( On the 6H or 60H range, don't measure the inductance below 10% of full scale range. Otherwise the reading will be inaccuracy.

( In order to ensure the best accuracy in measurement of low inductance(<6mH), short the test clips before measurement and memory the test probe inductance in mind. This necessary to subtract for the inductance of the test clips

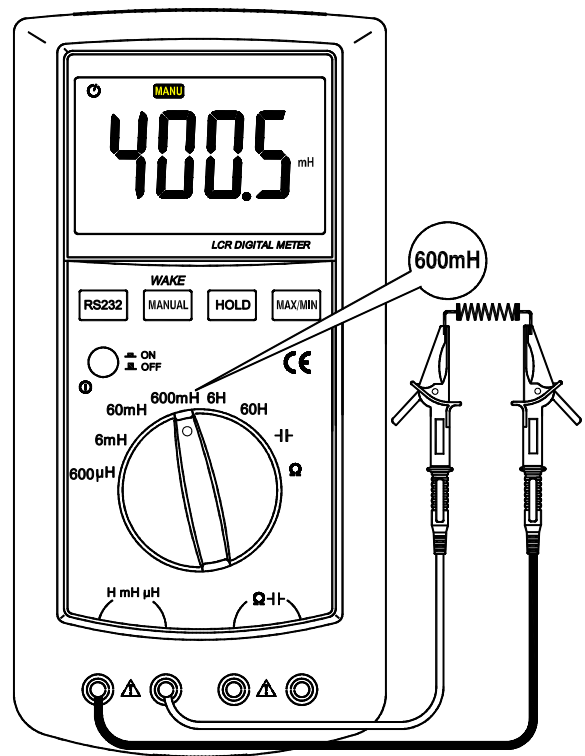


Figure 4. Measuring Inductance

## 4 TECHNICAL SPECIFICATIONS

### 4.1 GENERAL SPECIFICATIONS

( Environment conditions:

Pollution degree: 2

Altitude < 2000m

Operating temperature: 0~40°C, 32°F~122°F(<80% RH, <10°C non-condensing)



Storage temperature: -10~60 °C, 14°F~140°F(<70% RH, battery removed)

( Temperature Coefficient: 0.1((specified accuracy) / °C (<18°C or >28°C)

( Fuse Protection: (H、 mH and H: F 0.125A/250V (5/20

( Sample Rate: 3 times/sec for digital data.

( Display: 3 5/6 digits LCD display with max. reading 5999, Automatic indication of functions and symbols.

- ( Signal Output: RS232 Data Output
  - ( Range selection: automatic and manual.
  - ( Over Range indication: LCD will display "OL".
  - ( Low battery indication: The "⚡" is displayed when the battery is under the proper operation range.
  - ( Polarity indication: "-" displayed automatically.
  - ( Auto power off:
- If there is no key or dial operation for 10 minutes, the meter will power itself off to save battery consumption. The beeper will sound a beep before power off.
- ( Power source: 9V 
  - ( Battery type: 1.5V  AAA ) X 6.
  - ( Dimensions: 200(L) (100(W) (40(H) mm.
  - ( Weight: 550g. Approx. (battery included).

## 4.2 Measurement specifications

Accuracy is specified for one year after calibration, at operating temperatures of 18°C to 28°C, with relative humidity at 0% to 75%.

Accuracy specifications take the form of:  $\pm(\% \text{ of Reading} + \text{Number of Least Significant Digits})$

### 4.2.1 Resistance

Function	Range	Resolution	Accuracy
Resistance $\Omega$	600 $\Omega$	0.1 $\Omega$	$\pm(1.0\% \text{ of rdg} + 2 \text{ digits})$
	6k $\Omega$	1 $\Omega$	
	60k $\Omega$	10 $\Omega$	
	600k $\Omega$	100 $\Omega$	
	6M $\Omega$	1k $\Omega$	
	60M $\Omega$	10k $\Omega$	$\pm(1.5\% \text{ of rdg} + 5 \text{ digits})$
Overload protection: 250V dc or 250V ac rms.			

### 4.2.2 Capacitance

Function	Range	Resolution	Accuracy
Capacitance ⚡	6nF	1pF	±(2.0% of rdg+5 digits)
	60nF	10pF	±(1.0% of rdg+5 digits)
	600nF	100pF	
	6μF	1nF	
	60μF	10nF	±(1.5% of rdg+5 digits)
	600μF	100nF	
	6mF	1μF	
Overload protection: 250V dc or 250V ac rms.			

NOTE: This specification is based on the measurement performed at the Multi Function Socket.

#### 4.2.3 Inductance

Function	Range	Resolution	Accuracy	Test Frequency
Inductance	600.0μH	300μH	±(2.0% of rdg+8 digits)	1kHz
	6.000mH	3mH	±(1.0% of rdg+5 digits)	
	60.00mH	30mH		
	600.0mH	300mH		
	6.000H	3H	±(2.0% of rdg+8 digits)	100Hz
	60.00H	30H		
Overload protection: F 0.125A/250V fuse				

Note: The accuracy is applied from 10% to 100% of full scale range.

### 5. MAINTENANCE

This section provides basic maintenance information, including fuse and battery replacement instructions.

Do not attempt to repair or service your Meter unless you are qualified to do so and have the relevant calibration, performance test, and service information.

#### 5.1 General Maintenance

**⚠ To avoid electrical shock or damage to the meter, do not get water inside the case. Remove the test leads and any input signals before opening the case**

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

Dirt or moisture in the terminals can affect readings.

To clean the terminals:

( Turn the meter off and remove all test clips.

( Shake out any dirt that may be in the terminals.

( Soak a new swab with a cleaning and oiling agent (such as WD-40).

( Work the swab around in each terminal. The oiling agent insulates the terminals from moisture-related contamination.


#### 5.2 Fuse replacement

**⚠ Before replacing the fuse, disconnect test leads and/or any connectors from any circuit under test. To prevent damage or injury, replace the fuse only with specified ratings.**

To replace the Meter's fuse (see Figure 8.):

1. Turn the meter off.
2. Disconnect test leads and/or any connectors from the terminals.
3. Use a screwdriver to unlock the two lockers on the battery cover.
4. Take out the battery cover from the meter.
5. Remove the fuse by gently prying one end loose, then sliding the fuse out of its bracket.
6. Install the replacement fuses only with specified ratings: F 0.125A/250V (5/20
7. Rejoin the battery cover and lock the lockers.

### 5.3 Battery replacement

**⚠ To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator (  ) appears. Before replacing the battery, disconnect test leads and/or any connectors from any circuit under test, turn the meter off and remove test leads from the input terminals.**

To replace the battery (see Figure 5.):

1. Turn the meter off.
2. Disconnect test clips and/or any connectors from the terminals.
3. Use a screwdriver to unlock the two lockers on the battery cover.
4. Take out the battery cover from the meter.
5. Remove the used batteries from the battery connector..
6. Replace the batteries with new 1.5V batteries (AAA size).
7. Rejoin the battery cover and lock the lockers.

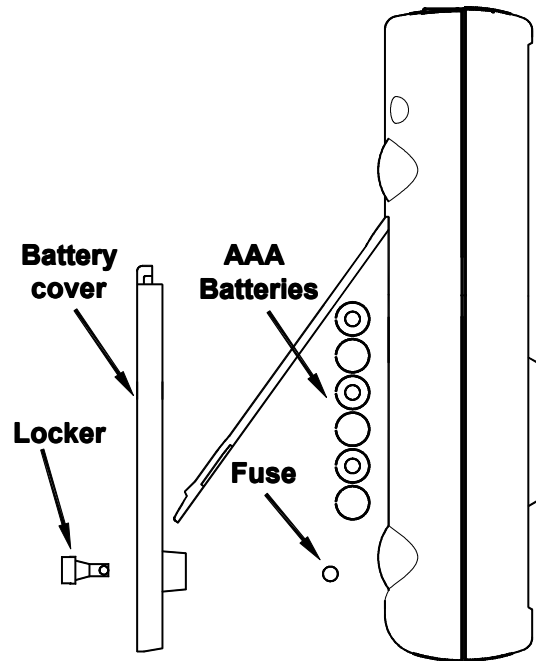


Figure 5. Battery and Fuse Replacement

### 6. RS232 interface (optional software)

#### 6.1 Welcome

This Software is designed to receive, record and graphically present measurement data. Please read this file to assist you in understanding the features, getting this software properly configured, and learning some helpful tips.

#### 6.2 System Requirements

**Hardware Requirements:** Pentium (or equivalent) CPU or later.  
**Operating System:** Microsoft Windows 98, XP or later.  
**Hard disk space:** at least 5 megabytes.

#### 6.3 Installation

If you received floppy disk, you can install it as follows:

1. Select Run from the taskbars Start menu
2. Type the full name of the file (for example, A:\Setup.exe)
3. Press the Enter key, and to finish step by step.

If you received CD disk, you can install it as follows:

1. Select Run from the taskbar Start menu
2. Type the full name of the file (for example, E:\Setup.exe)
3. Press the Enter key, and to finish step by step.

#### 6.4 Connect

Connect the meter to your computer's COM Port (Reference your computer hardware manual if

necessary). Make note of which port (COM1 to COM2) the meter has been connected. And select COM1 or COM2. Turn on Meter. Run DMM program.

### 6.5 Operation

Make sure the meter is properly attached to the computer, the meter is ON and the meter display is active. Run the DMM program. Click the desired measurement function or range in the FUNCTION frame. And then Click the "START" button. The reading on the meter should now be the same as on the computer display. If the software fails to display the reading, recheck the meter's connections to the computer. Also check the COM PORT settings are correct.

### 6.6 Interface Setting

Set the meter to the proper measurement and meter range before the 'START' button is pressed. Changing the DMM setting in the middle of a Graph Window mode run may cause a data interruption, a reset of the sweep in progress, or mis-scaled data readings.

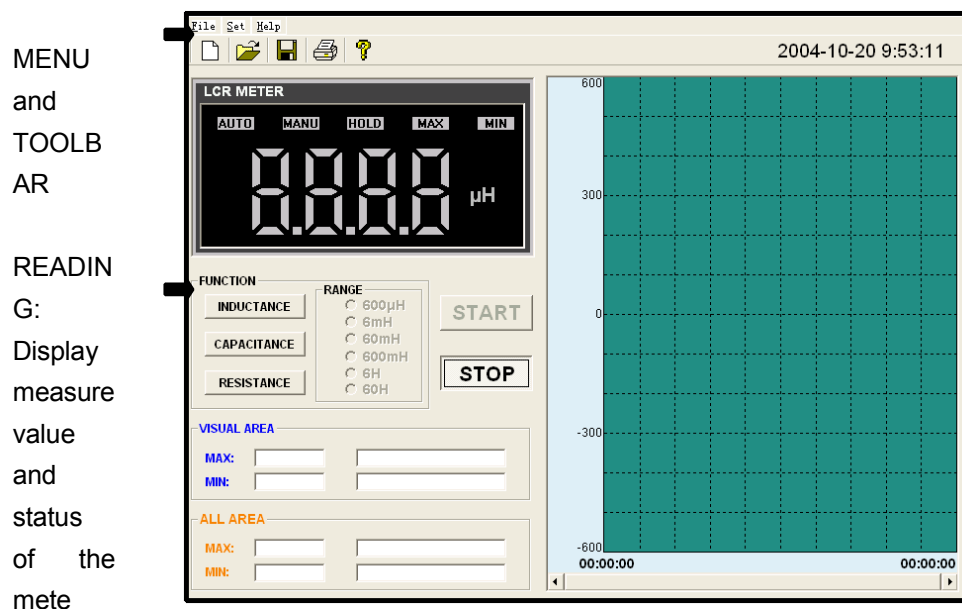
### 6.7 Sampling Time

Minimum Sampling Time of Meter Data: 1 sample/second. In auto mode, it is real time receive data from meter. In manual mode, you can set the sampling time in second.

20

RS232 interface (optional software)

### 6.8 MAIN INTERFACE



FUNCTI

ON: ➡

Use to  
Select  
the  
inductan  
ce  
measur  
ement  
function  
and  
range.

Real-ti ←

me  
Data  
Graph  
Windo  
w

VISUAL

AREA: ➡

Display

MAX. ➡

and

MIN.

Value of  
visual  
area on  
trend  
graph.

ALL

AREA:

Display

MAX.

and

MIN.

Value of  
all area  
on trend  
graph.