

UT612 Operating Manual



LCR Meter

I. Overview

Model UT612 LCR Meter is primarily designed to measure capacitance, inductance, resistance, DC resistance and their associated quality factor, dissipation and phase angle using a series or parallel measurement mode. There are five measurement frequency available: 100Hz, 120Hz, 1kHz, 10kHz and 100kHz. It is also equipped with excellent features: auto smart check, 19999/1999 dual display, HID type drive-free USB interface, PC record display, down to 15mA low power consumption, which altogether makes the meter a perfect solution for your needs.

Measurement range and Accuracy

L: 20mH --- 2000H Best accuracy: (0.5%+5) ;
 C: 200pF --- 20mF Best accuracy: (0.5%+5) ;
 R: 20Ω --- 200MΩ Best accuracy: (0.3%+5) ;

Impedance/frequency	DCR	100/120Hz	1kHz	10kHz	100kHz
0.1-1	1.0%	1.0%	1.0%	1.0%	1.0%
1-10	0.5%	0.5%	0.5%	0.5%	0.5%
10-100k	0.3%	0.3%	0.3%	0.5%	0.3%
100k-1M	0.5%	0.5%	0.5%	1%	
1M-20M	1.0%	1.0%	1.0%		
20M-200M	2.0%	2.0%	5.0%		
Remark		D ≤ 0.1			

Note: Please multiply by $\sqrt{1+D^2}$ if D exceeds 0.1
 Formula to convert capacitance to impedance: $Z_C = 1/2\pi fC$
 Formula to convert inductance to impedance: $Z_L = 2\pi fL$

II Safety Precautions

- Do not use the meter in environments exposed to flammables, explosives, dust, strong sunshine, high radiation.
- Do not open the bottom cover randomly if you are not professional personnel, please have the meter serviced by qualified personnel or your distributor if any maintenance, replacement or calibration is needed.
- Do not disassemble or modify the meter randomly, which may cause permanent damage to the meter.
- Cut off all the circuit power and discharge completely all capacitors before you measure in-line components.
- Prohibit inputting voltage into measurement terminals, capacitors or other live components must be discharged before being measured.
- There are two power supply methods available for the meter: 9V battery and USB-powered. When USB power adaptor is connected to USB port, the adaptor will supply power to the meter, if USB port is connected to PC, the meter is USB-powered and meanwhile communicates with PC for data collection.

III. Ambient Conditions

- Altitude: <2000 meters
- Storage humidity: = 75% RH
- Operating environment: 0°C ~ 40°C
- Storage environment: -20°C ~ +50°C

IV. Features

- Main display: 19999 count, Secondary display: 1999 count
- Measurement frequency: 100Hz/120Hz/1kHz/10kHz/100kHz
- Measurement voltage: 0.6Vrms
- Output impedance: 120Ω
- Basic accuracy: 0.5%
- LCR automatic identification/manual measurement
- DC resistance (DCR) measurement
- Open/short calibration
- Auto power off
- Relative measurement & sorting function
- Communicates with PC using Mini-USB interface to acquire, analyze and collect data.

V. Impedance Explanation

The impedance is classified into DC and AC impedance based on measured signal. Multimeters generally measure DC impedance, but LCR meters can measure both two types of impedance. Model UT 612 LCR meter is equipped with both DC and AC impedance measurements. Impedance parameter is a primary element used to assess electronic components and circuit system. When under DC condition, it is resistance measured between two ends of linear components, which can be defined by Ohm law. If under AC condition, the ratio of voltage to current is a complex. An impedance vector includes a real part (Resistance: R) and imaginary part (Reactance: X), during which impedance is expressed by $R+jX$ in rectangular coordinate or by the $|z|$ (amplitude) and θ (phase angle). Please see Figure 1 for details about the relationship.

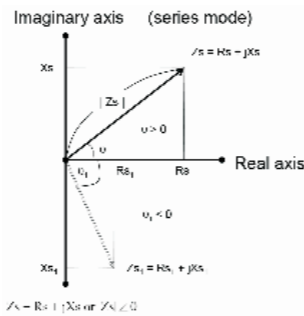


Figure 1

$$R_s = |Z_s| \cos \theta$$

$$X_s = |Z_s| \sin \theta$$

$$X_s/R_s = \tan \theta$$

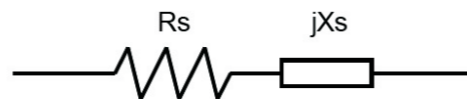
$$\theta = \tan^{-1}(X_s/R_s)$$

It is inductive resistance if $\theta > 0$, otherwise it is capacitive resistance if $\theta < 0$.

VI. Measurement Mode

Impedance can be measured in serial or parallel mode. Under parallel mode, impedance Z can be expressed in relation with the admittance Y and $Y=G+jB$. G is conductance and B is Admittance.

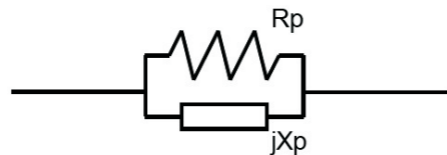
Serial Measurement



$$Z = R_s + jX_s$$

- Rs: Serial mode of resistance
- Xs: Serial mode of reactance
- Cs: Serial mode of capacitance
- Ls: Serial mode of inductance

Parallel Measurement



$$Y = 1/Z = 1/R_p + 1/jX_p = G + jB$$

- Rp: Parallel mode of resistance
- Xp: Parallel mode of reactance
- Cp: Parallel mode of capacitance
- Lp: Parallel mode of inductance

VII. LCD Description (See Figure 2)

Main LCD items:

- USB communication
 - Open/short calibration
 - Auto power off
 - Relative measurement
 - Main display
 - Secondary display
 - Analog bar
 - Sorting tolerance mode
 - Data hold
- Other definitions:
- LCR: Automatic identification mode
 - Lp: Parallel measurement mode for inductance
 - Ls: Serial measurement mode for inductance
 - Cp: Parallel measurement mode for capacitance
 - Cs: Serial measurement mode for capacitance
 - Rp: Parallel measurement mode for resistance
 - Rs: Serial measurement mode for resistance
 - DCR: DC resistance measurement mode
 - D: Dissipation factor
 - Q: Quality factor
 - θ: Phase angle
 - ESR: Equivalent serial resistance
 - EPR: Equivalent parallel resistance
 - DUT: Device under test
 - Short press (<1second), long press (>2 seconds): indicating the time to press a button.

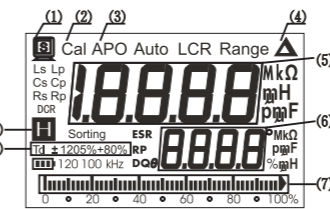


Figure 2

VIII. Meter Structure (See Figure 3)

- LCD zone
- Frequency /sorting button
- Open/short calibration button
- Power on/off button
- USB communication button
- D/Q/θ selection button
- Relative button
- Input terminals
- Guard terminals
- Serial/parallel selection button
- L/C/R Function button
- Enter/Hold button
- Sorting Setup button

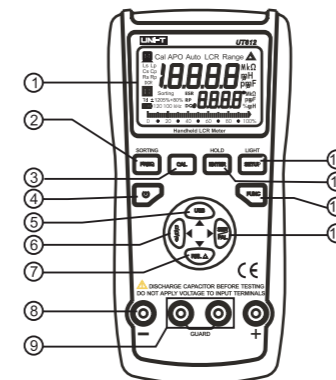


Figure 3

IX. Operation Guide

- Automatic measurement
 The meter defaults at AUTO LCR mode and at the frequency of 1kHz after power-on. Under auto mode, the meter can automatically check the impedance characteristics of tested object and then select L, C, or R main parameter, its associated secondary parameter and proper serial/parallel mode accordingly.

Correspondence between Main and secondary parameter under auto mode:
 Capacitance(C) — Dissipation (D);
 Inductance (L) — Quality Factor (Q);
 Resistance(R) — Phase Angle (θ).

Under auto measurement mode, serial/parallel mode is determined based on the impedance of tested object. The parallel mode is selected if the impedance is greater than 10kΩ. The serial mode is selected if the impedance is less than 10kΩ.

- Data hold
 Press "HOLD" button to freeze the data during measurement, and "H" displays. Press again to exit and return to normal measurement.

- Measurement parameter under L/C/R mode
 Please select corresponding parameters under manual L/C/R mode.
 1) Selection of main parameter: Default status is AUTO LCR after power-on. Please select "FUNC" key to select parameters of "AUTO LCR→AUTO L→AUTO C→AUTO R→DCR→AUTO LCR".

- Selection of secondary parameters: After a main parameter has been selected, press "SER/PAL" button to switch between serial and parallel mode. Press "D/Q/θ" button to select "D", "Q", "θ", "ESR" ("ESR" will show if under serial mode and "Rp" if parallel mode is selected). Under "AUTO R" or "AUTO DCR", the secondary parameter will be negligible.

Note:

- When measuring capacitance < 5pF under AUTO LCR mode, Rp will show on the secondary display instead of Dissipation factor (D).
- Some secondary parameters will not show on LCD even you have accessed "AUTO R" or "AUTO DCR" of "AUTO LCR" mode.

4. Measurement frequency

UT612 can provide 5 frequency testing points, namely, 100Hz/120Hz/1kHz/10kHz/100kHz. Default default frequency is 1kHz and user can press "FREQ" key to select from "1kHz→10kHz→100kHz→100Hz→120Hz→1kHz".

Note: DC impedance is measured under "AUTO DCR" mode and measurement frequency can be neglected.

5. REL% measurement

REL% mode is to measure % deviation between two components. The measured value of tested object shows on the main display, and % value on the secondary display. Set the main display value as the nominal reference.

% display range: -99.9%~99.9%

% calculation: $REL\% = (D_{cur} - D_{ref}) / D_{ref} * 100\%$

Dcur: Main display value of tested object

Dref: the reference value that have be set.

If $D_{cur} > 2D_{ref}$ or $2D_{cur} < D_{ref}$, "OL%" will display on the secondary display and the main display will show measured value of tested object.

1) Access REL Mode

Press "FUNC" button to select desired "AUTO L", "AUTO C", "AUTO R" or "AUTO DCR" mode. Connect tested object to input terminals. Press REL button to access REL % mode, Δ appears on the LCD, main display shows measured component value and secondary display shows % of deviation. Press "REL" again, the reference value shows on main display and Δ icon flashes, % value still shows on the secondary display. Press REL button again to return to normal REL% measurement mode.

2) Exit REL% Mode

Long press "REL" button to exit REL% measurement and return normal mode.

6. Sorting measurement

Sorting Mode is used to quickly select components with a specified limit. Press "FUNC" to select "AUTO L", "AUTO C", "AUTO R" or "AUTO DCR" desired mode. Connect tested object to input terminals. Long press "FREQ" for about 2 seconds to access sorting mode, "Sorting" appears on LCD. "PASS" shows on main display, and measured component value shown on secondary display is set to nominal value. Then connect another component, "PASS" will show if the component falls within the set limit and measured value shows on the secondary display. The buzzer sounds one time. If it is out of scope, "FAIL" shows and measured component value.

1) Set up sorting tolerance

Sorting tolerance can be settable to: ±0.25%, ±0.5%, ±1%, ±2%, ±5%, ±10%, ±10%, ±20%, ±80%~20%. The meter defaults at ±1%. To set up the sorting, get the meter under sorting mode first, then press "SETUP", "Range" icon flashes on the LCD, press "ENTER" button to confirm and set the main display parameter, the last digit of the parameter flashes, press ▼/▲ to decrease/increase the digit or ◀/▶ to select another flashing digit for the adjustment. Then press "ENTER" to enter into tolerance setup, "TOL±1%" icon flashes on LCD. Press ◀/▶ to adjust the tolerance. Press ENTER to confirm and you can begin the sorting measurement.

2) Exit sorting mode

Press "Sorting" to exit sorting measurement and return to normal mode.

7. Calibration function

Calibration function can reduce effectively stray impedance caused by test wires. The meter offers short and open calibration. Short calibration is to remove impact of contact resistance and test wire resistance that interferes low impedance measurement, and open calibration is to remove stray capacitance and resistance of test wire that interferes high impedance measurement.

