UNI-T

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 frequ -ency available:100Hz, 120Hz, 1kHz,10kHz and 100kKz. It is also equipped with excell -ent features: auto smart check, 19999/1999 dual display, HID type drive-free USB inte -rface, PC record display, down to 15mA low power consumption, which altogether ma -kes 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：Zc=1/2πfC
Formula to convert inductance to impedance：ZL=2πfL

Ⅱ Safety Precautions

1) Do not use the meter in environments exposed to flammables, explosives, dust, strong sunshine, high radiation.
2) 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.
3)Do not disassemble or modify the meter randomly, which may cause permanent dam -age to the meter.
4) Cut off all the circuit power and discharge completely all capacitors before you measure in-line components.
5) Prohibit inputting voltage into measurement terminals, capacitors or other live compo -nents must be discharged before being measured.
6) 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

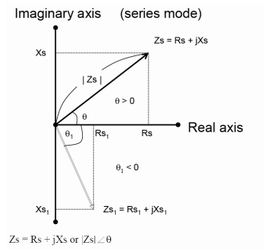
1）Altitude: <2000 meters
2）Storage humidity: = 75% RH
3）Operating environment: 0℃～40℃
4）Storage environment: -20℃～+50℃

Ⅳ. Features

1）Main display: 19999 count,Secondary display: 1999 count
2）Measurement frequency: 100Hz/120Hz/1KHz/10KHz/100KHz
3）Measurement voltage: 0.6Vrms
4）Output impedance: 120Ω
5）Basic accuracy：0.5%
6）LCR automatic identification/manual measurement
7）DC resistance(DCR) measurement
8）Open/short calibration
9）Auto power off
10）Relative measurement & sorting function
11）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 measures DC impedance, but LCR meters can measure both two types of impedance. Model UT 612 LCR meter is equipped with both DC and AC impe -dance measurements. Impedance parameter is a primary element used to assess elec -tronic components and circuit system. When under DC condition, it is resistance meas -ured 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. A 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.



Rs = |Zs| cosθ
Xs = |Zs| sinθ
Xs/Rs = tanθ
θ = tan⁻¹(Xs/Rs)

Zs = Rs + jXs or |Zs|∠θ

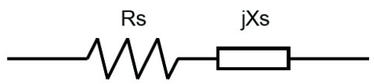
Figure 1

It is inductive resistance if θ＞0, otherwise it is capacitive resistance if θ＜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.

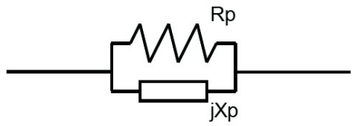
Serial Measurement



Z = Rs + jXs

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/Rp + 1/jXp = 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:
（1）USB communication
（2）Open/short calibration
（3）Auto power off
（4）Relative measurement
（5）Main display
（6）Secondary display
（7）Analog bar
（8）Sorting tolerance mode
（9）Data hold

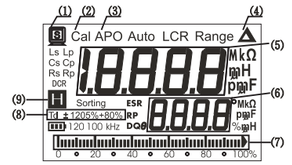


Figure 2

Other definitions：
1）LCR: Automatic identification mode
2）Lp: Parallel measurement mode for inductance
3）Ls: Serial measurement mode for inductance
4）Cp: Parallel measurement mode for capacitance
5）Cs: Serial measurement mode for capacitance
6）Rp: Parallel measurement mode for resistance
7）Rs: Serial measurement mode for resistance
8）DCR: DC resistance measurement mode
9）D: Dissipation factor
10）Q: Quality factor
11）θ: Phase angle
12）ESR: Equivalent serial resistance
13）EPR: Equivalent parallel resistance
14）DUT: Device under test
15）Short press(＜1second), long press(＞2 seconds): indicating the time to press a button.

Ⅷ. Meter Structure (See Figure 3)

(1) LCD zone
(2) Frequency /sorting button
(3) Open/short calibration button
(4) Power on/off button
(5) USB communication button
(6) D/Q/θ selection button
(7) Relative button
(8) Input terminals
(9) Guard terminals
(10) Serial/parallel selection button
(11) L/C/R Function button
(12) Enter/Hold button
(13) Sorting Setup button

Figure 3

Ⅸ. Operation Guide

1. Automatic measurement

The meter defaults at AUTO LCR mode and at the frequency of 1kH 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 para -meter 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 imped -ance 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.

2. Data hold

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

3、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 fter power-on. Please select "FUNC" key to select parameters of "AUTO LCR→AUTO L→ AUTO C→AUTO R→DCR→AUTO LCR" .

2) 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:
1.When measuring capacitance＜5pF under AUTO LCR mode, Rp will show on the secondary display instead of Dissipation factor(D).
2.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/100K Hz. 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%=(Dcur-Dref)/Dref*100%
Dcur: Main display value of tested object
Dref: the reference value that have be set.
If Dcur ＞2Dref or 2Dcur＜Dref, "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, △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 △ 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 comp -onent, "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 fla -shes, 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.

1) Access calibration function
Power on the meter and long press “CAL” button to access open calibration,“ OPEn ” shows on secondary display(See Figure 4), then press “CAL” button again to begin the calibration, the meter will count down 30 seconds on LCD, when it is zero, “ PASS ” icon appears(See Figure 5).

Figure 4

Figure 5

It indicates open calibration has finished. Then press “CAL” button and “ SrE ” appears on the secondary display(See Figure 6), insert short-circuit device into input terminals, press “CAL” button to begin, then the meter count down from 30seconds to zero, “ PASS ” shows(See Figure 7), indicating short calibration has completed. Press “CAL” button again to return to normal measurement mode.

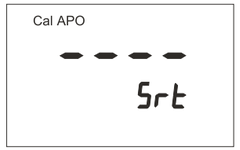


Figure 6

Figure 7

Note: If LCD shows “ FAIL ” under open calibration mode(See Figure 8),

Figure 8

It indicates the calibration failed. please check whether input terminals are opened or not. Make sure the circuit is open and do the calibration again.
If LCD shows “ FAIL ” under short calibration mode (See Figure 9),

Figure 9

It indicates the calibration failed. Please check if the short-circuit device has been inserted into the input terminals. Make sure the terminals are shorted and do the calibration gain.

8. PC communication
Press "USB" button to access communication function, and “ ” displays on LCD. Connect the meter to PC using USB wire and run the meter software on PC to start data transfer.
Press "USB" button again to exit and stop the data transfer.
9. Backlight
Long press "LIGHT" button to turn on/off LCD backlight. The backlight will switch off auto -matically after 60 seconds.

10. Auto power off
Power off after about 5 minutes of idling

X. Quick Application

1. Selection of serial/parallel mode
Suitable equivalent mode can be selected to gain more precise measurement data. In general, it is suggested to select serial equivalent mode for low-impedance element (such as less than 100Ω). It is suggested to select parallel equivalent mode for high-impedance element (such as more than 10 kΩ)

2. Inductance measurement
1）Press “⏻” to power on.
2）Press “FUNC” to display “Lp” on LCD and select inductance measurement range.
3）Insert the inductor into input terminals or connect the inductor to the meter using the test clamp(See Figure 10).
4）Press “FREQ” key to select suitable testing frequency.
5）Press “D/Q/θ” to select auxiliary parameter to measure.

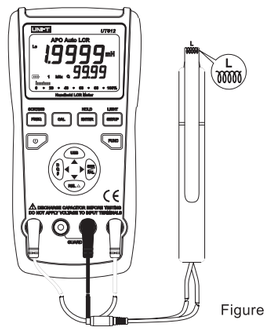


Figure 10

3. Capacitance measurement
⚠ Warning Capacitance must be discharged completely before measurement.
1）Press “⏻” to power on .
2）Press “FUNC” to display “Cp” on LCD and select capacitance measurement range.
3）Insert the capacitor into input terminals or connect the capacitor to the meter using the test clamp (See Figure 11).
4）Press “FREQ” key to select suitable testing frequency.
5）Press “D/Q/θ” to select auxiliary parameter to measure.

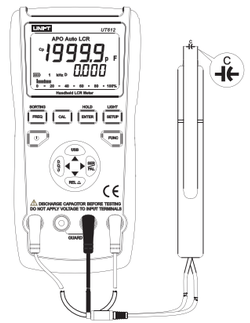


Figure 11

4. Resistance measurement
1）Press “⏻” to power on.
2）Press “FUNC” to display “Rp” on LCD and select resistance measurement range.
3）Insert the resistor into input terminals or connect the resistor to the meter using the test clamp(See Figure 12).
4）Press“FREQ” key to select suitable testing frequency.

Note:
When measuring resistance under auto mode, the secondary parameter θ will be activated. If under manual mode, secondary parameter of resistance will be neglected.

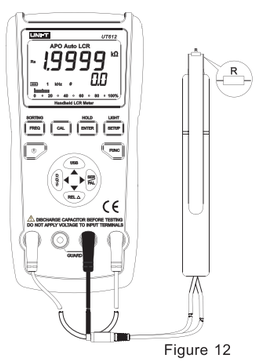


Figure 12

5. DCR measurement
1）Press “⏻” to power on.
2）Press “FUNC” to display “DCR” on LCD and select DCR measurement range.
3）Insert the resistor into input terminals or connect the resistor to the meter using the test clamp(See Figure 13).

Note:
The secondary parameter and the frequency is negligible under DCR measurement and doesn't show on LCD

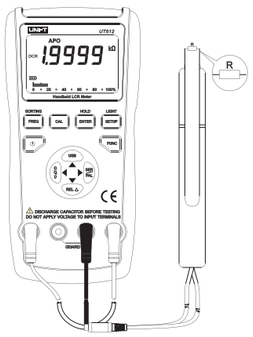


Figure 13

XI. PC Communication Protocol

Turn on communication function, connect the meter to PC using USB wire and begin the data transfer.
Communication parameters:
1）Baud rate: 9600
2）Data bit: 8
3）Start bit: 1
4）Stop bit: 1
5）Parity: None
Refer to connection diagram on the right:

XII. Technical Indicators

Note:
1）Testing ambient temperature: 23℃±5℃; Humidity: =75% R.H
2）Warm up for 10 minutes before test;
3）Test on the meter's terminals.
4）Perform short/open calibration before testing.
5）Measurement accuracy is not provided in the table below regarding the actual meas -urements that have gone beyond the specifications of the table.

Function	Measurement mode	Frequency	Range	Min. resolution	Accuracy: ±(a% of reading +b digits) (under 18℃ to 28℃)
L Inductance gear	Ls/Lp	100Hz/120Hz	20.000mH	1uH	± (1.0%+5)
			200.00mH	0.01mH	± (0.5%+5)
			2000.0mH	0.1mH	± (0.5%+5)
			20.000H	1mH	± (0.5%+5)
			200.0H	0.01H	± (1.0%+5)
			2000.0H	0.1H	± (1.0%+5)
		1KHz	2000.0uH	0.1uH	± (1.0%+5)
			20.000mH	1uH	± (0.5%+5)
			200.00mH	0.01mH	± (0.5%+5)
			2000.0mH	0.1mH	± (1.0%+5)
			20.000H	1mH	± (1.0%+5)
			200.00H	0.01H	± (2.0%+5)
		10KHz	20.000uH	0.01uH	± (1.0%+5)
			200.00uH	0.01uH	± (1.0%+5)
			2000.0uH	0.1uH	± (0.5%+5)
			20.00mH	1uH	± (0.5%+5)
		100KHz	20.000uH	0.001uH	± (2.0%+5)
			200.00uH	0.01uH	± (2.0%+5)
			2000.0uH	0.1uH	± (2.0%+5)

Note: The precision is evaluated if D is less than 0.1. $Ae = Ae * \sqrt{1+D^2}$ if D exceeds 0.1.(Ae: Precision)

Function	Measurement mode	Frequency	Range	Min. resolution	Accuracy: ±(a% of reading +b digits) (under 18℃ to 28℃)
CAP Capacitance gear	Cs/Cp	100Hz/120Hz	20.000nF	1pF	± (2.0%+5)
			200.00nF	0.01nF	± (0.5%+5)
			2000.0nF	0.1nF	± (0.5%+5)
			20.000uF	1nF	± (0.5%+5)
			200.00uF	0.01uF	± (1.0%+5)
			2000.0uF	0.1uF	± (2.0%+5)
			20.00mF	0.1mF	± (2.0%+5)
		1KHz	2000.0pF	0.1pF	± (1.0%+5)
			20.000nF	1pF	± (1.0%+5)
			200.00nF	0.01nF	± (0.5%+5)
			2000.0nF	0.1nF	± (0.5%+5)
			20.000uF	1nF	± (0.5%+5)
			200.00uF	0.01uF	± (1.0%+5)
			2000.0uF	0.1uF	± (1.0%+5)
		10KHz	2000.0pF	0.1pF	± (1.0%+5)
			20.000nF	1pF	± (1.0%+5)
			200.00nF	0.01nF	± (1.5%+5)
			2000.0nF	0.1nF	± (2.0%+5)
		100KHz	2000.0pF	0.1pF	± (2.0%+5)
			20.000nF	1pF	± (2.0%+5)
			200.00nF	0.01nF	± (5.0%+5)

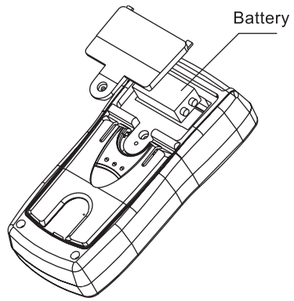
Note: The precision is evaluated if D is less than 0.1. $Ae = Ae * \sqrt{1+D^2}$ if D exceeds 0.1. (Ae: Precision)

Function	Measurement mode	Frequency	Range	Min. resolution	Accuracy: ±(a% of reading +b digits) (under 18℃ to 28℃)
R Resistance gear	Rs/Rp	100Hz/120Hz	200.00Ω	0.01Ω	± (1.0%+5)
			2.0000kΩ	0.1Ω	± (0.3%+5)
			20.000kΩ	1Ω	± (0.3%+5)
			200.00kΩ	0.01kΩ	± (0.5%+5)
			2.0000MΩ	0.1kΩ	± (1.0%+5)
			20.000MΩ	1kΩ	± (2.0%+5)
		1KHz	20.000Ω	0.001Ω	± (1.0%+5)
			200.00Ω	0.01Ω	± (1.0%+5)
			2.0000kΩ	0.1Ω	± (0.3%+5)
			20.000kΩ	1Ω	± (0.3%+5)
			200.00kΩ	0.01kΩ	± (0.5%+5)
			2.0000MΩ	0.1kΩ	± (1.0%+5)
			20.000MΩ	1kΩ	± (2.0%+5)
		10KHz	20.000Ω	0.001Ω	± (1.0%+5)
			200.00Ω	0.01Ω	± (1.0%+5)
			2.0000kΩ	0.1Ω	± (0.3%+5)
			20.000kΩ	1Ω	± (0.5%+5)
			200.00kΩ	0.01kΩ	± (1.0%+5)
			2.0000MΩ	0.1kΩ	± (2.0%+5)
		100KHz	20.000Ω	0.001Ω	± (2.0%+5)
			200.00Ω	0.01Ω	± (2.0%+5)
			2.0000kΩ	0.1Ω	± (1.0%+5)
			20.000kΩ	1Ω	± (2.0%+5)
	DCR		200.00Ω	0.01Ω	± (1.0%+5)
R Resistance gear	DCR		2.0000kΩ	0.1Ω	± (0.3%+5)
			20.000kΩ	1Ω	± (0.3%+5)
			200.00kΩ	0.01kΩ	± (0.5%+5)
			2.0000MΩ	0.1kΩ	± (1.0%+5)
			20.000MΩ	1kΩ	± (2.0%+5)
			200.0MΩ	0.1MΩ	± (2.0%+5)

Note: The precision is evaluated if D is less than 0.1. $Ae = Ae * \sqrt{1+D^2}$ If D exceeds 0.1. (Ae: Precision)

XIV. Battery Replacement

⚠ Warning
Please replace battery in a timely manner When “ ” prompt shows on the LCD to avoid any impact on measurement accuracy.
Please replace old battery by alkaline cell of 9V.



XV. Maintenance

1）Cleaning
Please power off and remove battery and external power before cleaning.
Clean the meter with soft cloth and mild detergent. Prevent the detergent from going inside the meter. Please use the meter only after it is completely dry.

2）Moisture prevention
Please use and store the meter in dry environment. Power it off and remove the battery quickly if the water goes inside the casing accidentally. Do not disassemble the meter randomly, have the meter checked or serviced by your dealer or service personnel.

3）Repair
If the meter cannot power on, please inspect the battery, external power and power input terminal for any anomaly, check whether POWER button is valid or not.
If the measurement doesn’t work normally, please check if the test wires are in good condition, component pin has been well contacted with the spring piece inside input terminals. Please make sure the meter is properly operated. If any servicing is needed, please contact your dealer or the service center of our company, do not disassemble the meter or replace the components or change the circuits randomly.

END

The Operating Manual will change without notice!

UNI-T
UNI-TREND TECHNOLOGY（CHINA）CO., LTD.
No6, Gong Ye Bei 1st Road,
Songshan Lake National High-Tech Industrial
Development Zone, Dongguan City,
Guangdong Province, China
Tel: (86-769) 8572 3888
http://www.uni-trend.com