

UNI-T®



Certificate No. 956661

UT612

Operating Manual



LCR Meter

P/N:110401102745



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I、 General Characteristics and Safety Notice

UNI-T UT612 LCR digital electric bridge with intelligent detection, double-LCD display measurement of 19999/1999, serial & parallel measurement modes can be used to select quality factor, loss factor, phase location angle and equivalent resistance of measured articles. There are 5 kinds of measurement frequency of 100Hz/120Hz/1kHz/10kHz/100kHz. It is based on HID kind drive-free USB interface, /PC display record, operating current of 15mA with low power consumption and power of 9V. Outline dimension is 224mm×172mm×59mm.

Measurement range and precision

L:20mH ---2000H The maximum precision (0.5%+5) ;
 C:200pF---20mF The maximum precision (0.5%+5) ;
 R:20Ω ----200MΩ The maximum precision (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: $Z_L=2\pi fL$

Please abide by 6 instructions as follows to guarantee safe use of instruments:

1) It is not allowed to use in combustible and explosive environment to avoid using in dusty environment with direct sunshine and high radiation.

- 2) Non-professional maintenance personnel are strictly prohibited to open rear cover. Professional personnel also shall contact related dealers and after-sales service of our company during element maintenance & replacement and instrument calibration.
- 3) It is not allowed to detach or modify instruments randomly because unauthorized modification may cause permanent damage for instruments.
- 4) Please measure circuits of wire elements after cut off the power and complete capacitance discharging.
- 5) Input voltage is strictly prohibited in measurement port. Be sure to discharge before measuring electrified elements such as capacitance.
- 6) 2 kinds of power supply can be used for instruments. The 1st is to supply power by battery of 9V. The 2nd is to supply power by USB interfaces. USB power adapter shall supply power to instruments when inserting it into USB interface. USB interface also can supply power to instrument during synchronous data acquisition with PC during connection so as to prolong service life of battery.

II、 Ambient Conditions

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

III、 Function Characteristics

- 1) Main display of 19,999 and auxiliary display of 1,999
- 2) Measurement frequency: 100Hz/120Hz/1KHz/10KHz/100KHz
- 3) Measurement voltage: 0.6Vrms
- 4) Output impedance: 120Ω
- 5) Basic precision: 0.5%
- 6) LCR automatic identification/manual measurement
- 7) Measurement of DCR DC resistance
- 8) Calibration compensation of open circuit/short-circuit
- 9) Automatic shutdown
- 10) Relative measurement & sieving function

11) Communication between Mini-USB and PC; Data acquisition/analysis/ statement

IV、 Impedance Parameters

Impedance measurement instruments can be classified into DC impedance and AC impedance kinds according to measurement signals. General multimeter measurement is DC impedance while digital electric bridge can be used to measure DC impedance and AC impedance. UT612 is not only an intelligent double-display portable LCR digital electric bridge with DC & AC impedance measurement functions. Impedance is one of the most fundamental parameters to assess electronic elements and circuit system. Resistance of linear crystal diode is defined by Ohm's Law under DC conditions. Ratio of voltage and current is a complex number under AC conditions. 1 impedance vector includes 1 real part (resistance R) and virtual part (reaction X). Impedance is expressed by $R+jX$ in rectangular coordinate system or expressed by amplitude of $|Z|$ and phase angle of θ in polar coordinate system. Please refer to Figure 1-1 for relationship.

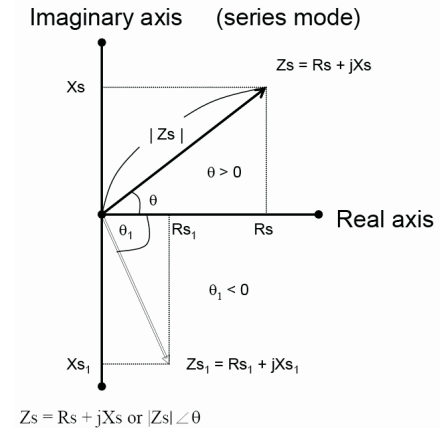


Figure 1-1

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

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

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

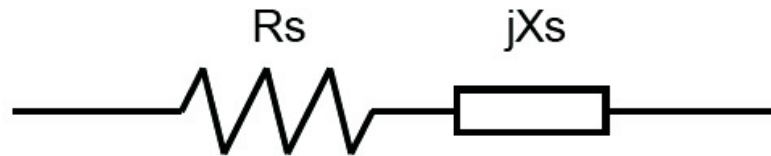
$$\theta = \tan^{-1}(X_s/R_s)$$

Reaction is inductive if θ exceeds 0. In other words, reaction is capacitive if θ is less than 0.

V、 Measurement Mode

Impedance can be used to measure serial or parallel mode. Impedance of Z under parallel link mode can be expressed by mutual access of Y. It can be defined as follows: $Y = G + jB$. G is conductance and B is admittance.

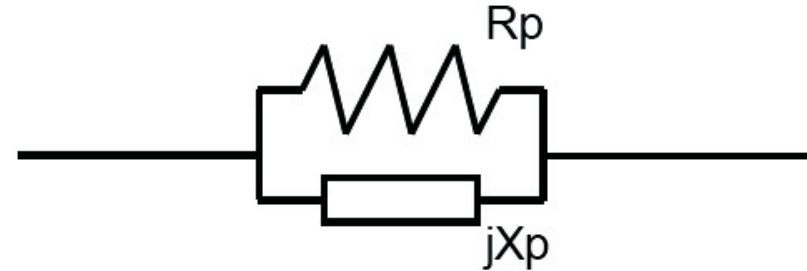
Impedance under serial link mode



$$Z = R_s + jX_s$$

Rs: Serial mode of resistance
 Xs: Serial mode of reaction
 Cs: Serial mode of capacitance
 Ls: Serial mode of inductance

Admittance parallel mode



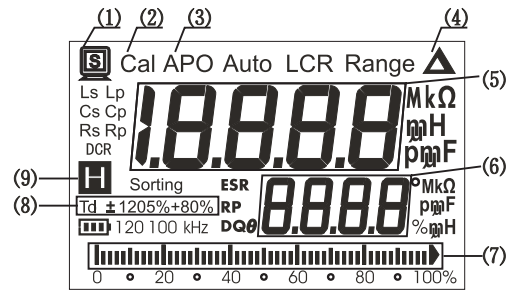
$$Y = 1/Z = 1/R_p + 1/jX_p = G + jB$$

Rp: Parallel mode of resistance
 Xp: Reaction under parallel mode
 Cp: Parallel mode of capacitance
 Lp: Parallel mode of inductance

VI、LCD Display Instructions (shown in Figure 2)

Main display instructions of LCD:

- (1) USB communication
- (2) Calibration of open circuit/
short-circuit
- (3) Automatic shutdown
- (4) Relative measurement
- (5) Main display
- (6) Auxiliary display
- (7) Analog bar
- (8) Sieving tolerance mode
- (9) Data retention



(shown in Figure 2)

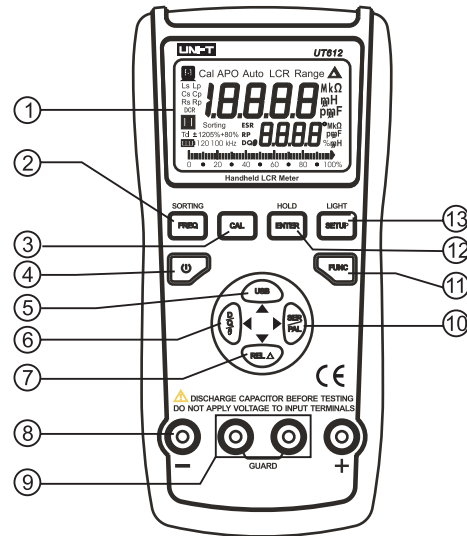
Other definitions:

- 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: Loss factor
- 10) Q: Quality factor
- 11) θ : Phase location angle
- 12) ESR: Equivalent serial resistance
- 13) EPR: Equivalent parallel resistance
- 14) DUT: Articles to measure
- 15) Key continuation can be expressed by pressing key for less than 1s or more than 2s.

VII、Instructions of key functions of UT612 front panel (shown in Figure 3)

- (1) LCD display zone
- (2) Frequency selection key/sieving function key
- (3) Calibration key of open circuit/short-circuit
- (4) Bootstrap/shutdown key
- (5) USB communication function
- (6) Selection function of auxiliary parameter
- (7) Relative measurement function
- (8) Testing input terminal
- (9) Shielding protection terminal
- (10) Serial/parallel function
- (11) Selection for inductance, capacitance & resistance measurement



(shown in Figure 3)

- (12) Confirmation key/data retention
- (13) Sieving setting

VIII、Operation Guideline

1、Automatic measurement

Default status is automatic identification mode, namely, AUTO LCR after bootstrap. Default frequency is 1K. Instrument will identify impedance characteristics of articles to measure automatically under automatic mode. It also will select main parameter, auxiliary parameter of L, C or R and suitable serial/parallel mode automatically.

Correspondence of main parameter and auxiliary parameter under automatic mode is as follows:

Capacitance C Loss Factor D


Inductance L Quality Factor Q

Resistance R Phase location angle θ

Serial/parallel mode can be determined according to impedance of articles to measure under automatic measurement mode. Parallel mode can be selected under higher impedance (of more than 10K Ω). Serial mode also can be selected

under lower impedance (of less than 10KΩ).

2、Data retention

Please press “HOLD” key for data retention during measurement. In the meanwhile, LCD can display data retention symbol of “”. Please press “HOLD” key again to exit data retention and return to normal measurement mode.

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 during bootstrap.

Please select “FUNC” key to select parameters of “AUTO LCR→AUTO L→AUTO C→AUTO R→DCR→AUTO LCR” .

2) Selection of auxiliary parameter: Please press “SER/PAL” key under corresponding main parameter measurement mode for switchover of serial/parallel measurement mode. Please press “D/Q/θ” key to select auxiliary parameters of “D” , “Q” and “ESR” (Note: Please select serial measurement mode of “ESR” or parallel measurement mode of “RP”) Auxiliary parameter can be neglected quantitatively under “AUTO R” or “AUTO DCR” mode.

Note:

A、Please measure capacitance under “AUTO LCR” mode. Please substitute loss factor of auxiliary parameter of D by equivalent parallel resistance of Rp if capacitance is less than 5pF.

B、Some parameters of auxiliary parameter will not be displayed on LCD when entering into “AUTO R” or “AUTO DCR” for measurement under “AUTO LCR” mode.

4、Measurement frequency

“1KHz→10KHz→100KHz→100Hz→120Hz→1KHz” 。

UT612 can provide 5 frequency testing points, namely, 100Hz/120Hz/1KHz/10KHz/100K Hz. Bootstrap default frequency is 1K and user can press “FREQ” key to select different frequency points for measurement of “1KHz→10KHz→100KHz→100Hz→120Hz→1KHz” .

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

5、Measurement of deviation proportion

Deviation measurement is used to compare with deviation ratio of 2 elements.

Main display is main value of measured elements. Auxiliary display is deviation percentage. Main LCD display can be typed in automatically as nominal value.

Percentage display scope: -99.9%~99.9%

Display percentage: $REL\% = (D_{CUR} - D_{REF}) / D_{REF} * 100\%$

DCUR : Main parameter of measured elements

DREF : Typed nominal value

Auxiliary display is “OL%” and main display is main parameter of measured elements if $D_{CUR} > 2D_{REF}$ or $2D_{CUR} < D_{REF}$.

1) Entry into deviation measurement

User can press “FUNC” key to select suitable modes of “AUTO L” , “AUTO C” , “AUTO R” or “AUTO DCR” . Please confirm that testing terminal has been connected to measured element and press “REL” key to enter into deviation proportion measurement mode. LCD will display “▲” symbol. Main display is main parameter of measured elements and auxiliary display is display percentage deviation by way of percentage. User also can press “REL” key for main display of nominal value. “▲” symbol on LCD will flicker and display. Percentage deviation also can display for auxiliary display by way of percentage. User also can press “REL” key to return to normal deviation measurement mode again.

2) Exit of deviation measurement

User can press “REL” key for a long time to exit deviation measurement and return to normal mode.

6、Sieving measurement

Sieving measurement mode is used to sieve elements of which main parameter is within a certain scope quickly. User can press “FUNC” key to select suitable modes of “AUTO L” , “AUTO C” , “AUTO R” or “AUTO DCR” .Please confirm that testing terminal has been connected to measured element and press

“FREQ” for a long time to enter into sieving mode. LCD will display “Sorting” symbol. Main display is “PASS” and auxiliary display is main value of measured elements with typed nominal value and buzzer rings. Main display is “FALL” and auxiliary display is main value of measured elements if exceeding extreme scope.

1) Setting of sieving scope

Sieving extreme scope can be set to $\pm 0.25\%$, $\pm 0.5\%$, $\pm 1\%$, $\pm 2\%$, $\pm 5\%$, $\pm 10\%$, $\pm 20\%$ and $+80\% \sim -20\%$. Default scope is $\pm 1\%$. User can press “SETUP” key for setup under sieving measurement mode. “Range” symbol on LCD flickers and displays. User can press “ENTER” to confirm entry into setting page of main parameter. Final character of main parameter on LCD flickers. User can press