UNI-T®

UT612

Certificate No. 956661

Operating Manual

LCR Meter

P/N:110401102745

Contents

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: Zc=1/2πfC
Formula to convert inductance to impedance: ZL=2πfL

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 in strument 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℃～40℃
4）Storage environment: -20℃～+50℃

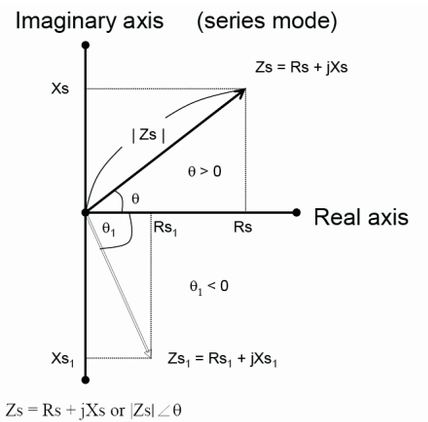
III、Function Characteristics

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.



$Zs = Rs + jXs$ or $|Zs| \angle \theta$

Figure 1-1

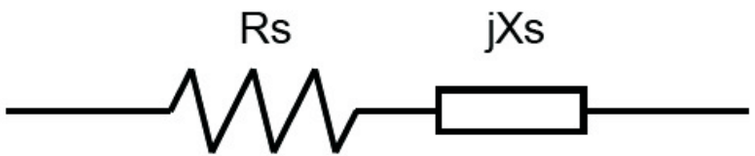
$Rs = |Zs| \cos\theta$
$Xs = |Zs| \sin\theta$
$Xs/Rs = \tan\theta$
$\theta = \tan^{-1}(Xs/Rs)$

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



$$Z = Rs + jXs$$

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

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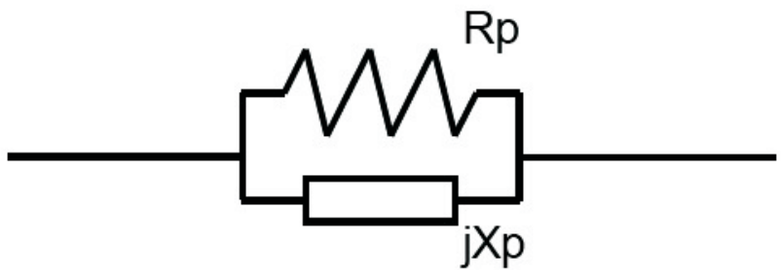
Admittance parallel mode



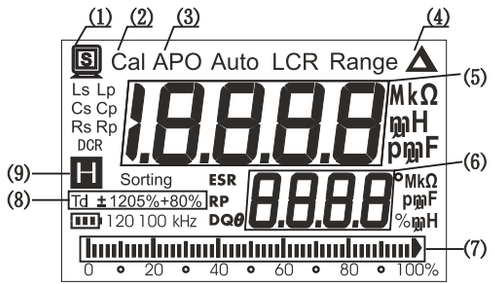
$$Y = 1/Z = 1/Rp + 1/jXp = G + jB$$

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)

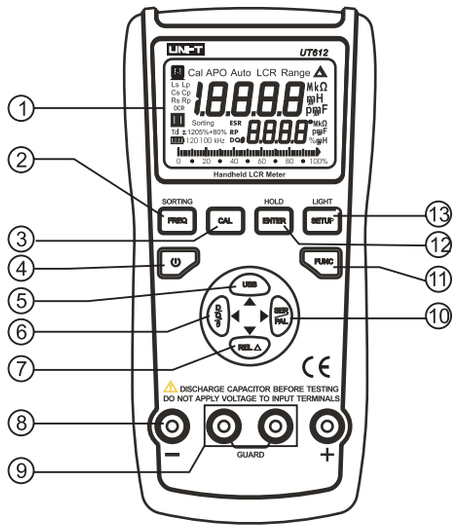
Other definitions:

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 CLoss Factor D
Inductance LQuality Factor Q
Resistance RPhase 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 10KΩ). 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 “ H ” . 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 “Δ” 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. “Δ” 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± 0.25%, ± 0.5%, ± 1%, ± 2%, ± 5%, ± 10%, ± 20% and +80%～-20%. Default scope is ± 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

value of " ▼ " key to decrease value one by one. He also can press " ▲ " to increase value one by one. He can press main parameter of " ▶ " key for rightward movement of flicker position. He can press " ◀ " key for leftward movement of flicker position of main parameter with corresponding value adjustment. He can press "ENTUP" key to enter into sieving scope for setting and flickering of "TOL" ±1%" symbol on LCD. He can press " ▶ " or " ◀ " key to adjust value within sieving scope. He also can press "ENTER" to confirm setting of sieving & measurement of elements.

2）Exit of sieving mode

User can press "Sorting" key to exit sieving & measurement mode and return to normal mode.

7、Calibration function

Calibration function can be used to reduce interference of distribution parameters brought in by testing wires effectively. Calibration function includes short-circuit calibration and open circuit calibration. Short-circuit calibration can be adopted to reduce influence of contact resistance and testing wire resistance to measure low-impedance elements. Open circuit calibration also can be adopted to reduce

influence of distributed capacitance and distributed resistance of testing wires to measure high-impedance elements.

1）Entry into calibration function (with inserting images)

User can press "CAL" key for a long time to enter into open circuit for calibration. (As shown in Figure 4,) auxiliary display on LCD can show " OPEn " . User also can press "CAL" to begin calibration. (As shown in Figure 5), LCD also will show " PASS " after countdown from 30s to 0.

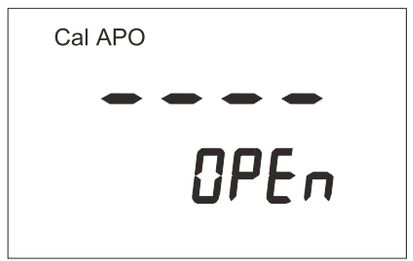


Figure 4

Figure 5

It refers to finishing calibration of open circuit. User can press “CAL” key to show “ SrE ” (shown in Figure 6) on auxiliary display of LCD. User can insert short-circuit pieces into testing terminal and then press “CAL” key to begin calibration. (As shown in Figure 7), LCD will show “ PASS ” after countdown from 30s to 0 to show finishing short-circuit calibration. User also can press “CAL” key to return to normal measurement mode.

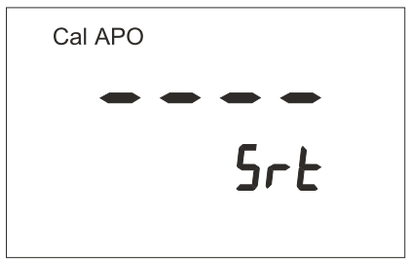


Figure 6

Figure 7

Note: (As shown in Figure 8,) LCD will show “ FAIL ” for open circuit calibration.

Figure 8

It refers to calibration failure. Please check if testing terminal is under open circuit status or not to guarantee re-calibration of open circuit.
(As shown in Figure 9), LCD will show “ FAIL ” for short-circuit calibration.

Figure 9

It refers to calibration failure. Check if testing terminals have been inserted into short-circuit pieces or not to guarantee normal short-circuit re-calibration.

8、PC communication
Press “PC” key to enter into communication function for “ ” display on LCD. Insert USB wire and start software of PC end upper host for data transmission. Press “PC” key to exit communication function and interrupt data transmission.

9、Backlight
Press “LIGHT” key for a long time and start LCD backlight to close backlight automatically after 60S. Press “LIGHT” key for a long time when starting backlight.

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

IX、Fast Application Guideline

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). Serial/parallel equivalent mode also has little influence for measurement result.

2、Inductance measurement
1）Press “⏻” for bootstrap.
2）Press “FUNC” to display “Lp” on LCD and select inductance measurement gear.
3）Insert inductance into testing port or connect corresponding fittings to measured inductance (shown in Figure 10).
4）To press “FREQ” key to select suitable testing frequency.
5）Press “D/Q/θ” to select auxiliary parameter to measure.

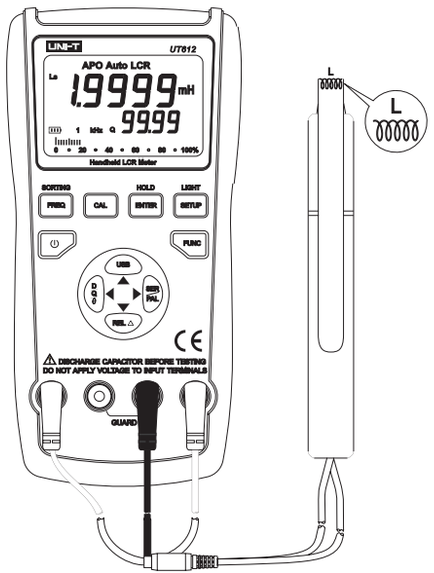


Figure 10

3、Capacitance measurement

Warning! Capacitance must be discharged completely before measurement.

1）Press “⏻” for bootstrap.

2）Press “FUNC” to display “Cp” on LCD and select capacitance measurement gear.

3）Insert capacitance into testing port or connect corresponding fittings to measured capacitance (shown in Figure 11).

4）To press “FREQ” key to select suitable testing frequency.

5）Press “D/Q/θ” to select auxiliary parameter to measure.

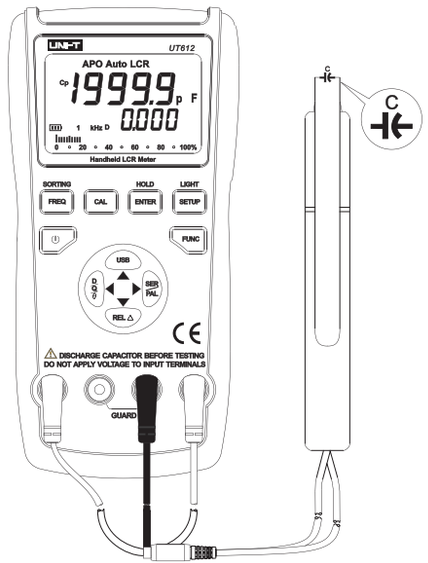


Figure 11

4、Resistance measurement
1）Press “ ⏻ ” for bootstrap.
2）Press “FUNC” to display “Rp” on LCD and select capacitance measurement gear.
3）Insert resistance into testing port or connect corresponding fittings to measured capacitance (shown in Figure 12).
4）To press “FREQ” key to select suitable testing frequency.

Note: Auxiliary parameter of resistance measurement will be neglected and auxiliary parameter will not be displayed on LCD.

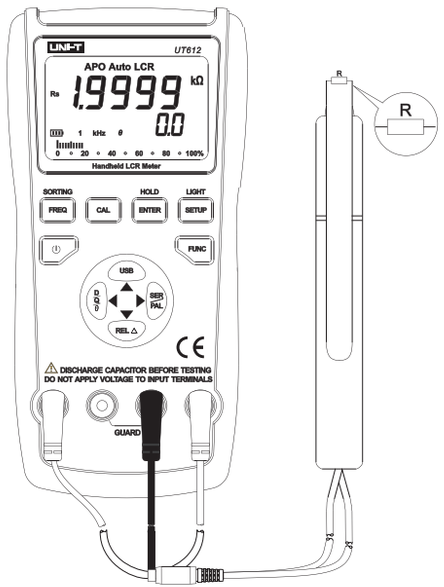


Figure 12

5、Measurement of DC impedance
1）Press “ ⏻ ” for bootstrap.
2）Press “FUNC” to display “DCR” on LCD and select measurement gear of DC resistance.
3）Insert resistance into testing port or connect corresponding fittings to measured resistance (shown in Figure 13).

Note: Auxiliary parameter and measurement frequency of DC resistance will be neglected and auxiliary parameter will not be displayed on LCD.

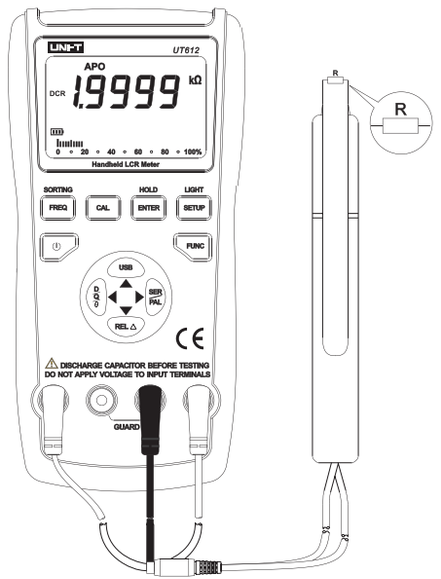


Figure 13

X、PC Communication Protocol

Start PC communication function to connect instrument and computer by USB wire for data acquisition.

Communication parameters:

1）Bit rate: 9600
2）Data bit: 8
3）Start bit: 1
4）Stop bit: 1
5）Inspection: Without

Connection mode is shown in the figure:

XI、Technical Indicators

Note:

1）Testing ambient temperature: 23℃±5℃; Humidity: =75% R.H
2）Pre-heat for 10 minutes before test;
3）Test on port slot of instruments;
4）Calibrate open circuit/short-circuit before test;
5) The actual measurement and displaying scope of the device go beyond the specified scope in the table; but no accuracy is specified for the measuring value

which goes beyond the scope in the table

Function	Measurement mode	Frequency	Range	The minimum resolution	Precision±(a% of reading + b of word quantity) (under 18℃ to 28℃)
L Inductance gear	Rs/Rp	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
			200.00H	0.01H	1.0%+5
			2000.0H	0.1H	1.0%+5
			20.000kH	0.001kH	2.0%+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
			2000.0H	0.1H	5.0%+5
		10KHz	200.00uH	0.01uH	1.0%+5
			2000.0uH	0.1uH	0.5%+5
			20.000mH	1uH	0.5%+5
			200.0mH	0.01mH	1.5%+5
			2000.0mH	0.1mH	2.0%+5
			20.000H	1mH	5.0%+5
		100KHz	20.00uH	0.001uH	1.0%+5
			200.00uH	0.01uH	2.0%+5
			2000.0uH	0.01uH	2.0%+5
			20.000mH	1uH	2.0%+5
			200.00mH	0.01mH	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	The minimum resolution	Precision±(a% of reading + b of word quantity) (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	0.01mF	2.0%+5
		1KHz	2000.0pF	0.01pF	1.0%+5
			20.000nF	0.1pF	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
			2000uF	1uF	1.0%+5
		10KHz	200.00pF	0.01pF	2.0%+5
			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	200.00pF	0.01pF	2.0%+5
			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	The minimum resolution	Precision±(a% of reading + b of word quantity) (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
			200.0MΩ	0.1MΩ	2.0% +5
		1KHz	20.000Ω	1mΩ	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
			200.0MΩ	0.1MΩ	5.0% +5
		10KHz	20.000Ω	1mΩ	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
		100KHz	20.000Ω	1mΩ	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% +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% +5
		20.000MΩ	1kΩ	2% +5
		200.00MΩ	0.1MΩ	2% +5

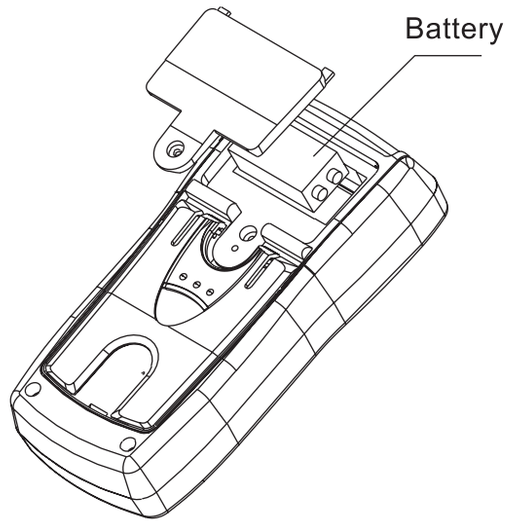
Note: The precision is evaluated if D is less than 0.1. $Ae \quad Ae*\sqrt{1 \quad D^2}$ If D exceeds 0.1. (Ae: Precision)

XII、Battery Replacement

⚠ Warning

Please replace battery in a timely manner When " ▭ " prompt shows on the LCD to avoid influence of measurement precision.

Please replace old battery by alkaline cell of 9V.



XIII、Maintenance

1）Cleaning

Please power off and remove battery and external power before cleaning. Please dip detergent to wipe off dirty location by soft clean cloth to prevent detergent from penetrating into shell inside. It cannot be used until shell cleaning and drying.

2）Moisture prevention

Please use instruments in dry environment and store them in dry locations after use. Please power off instantly and remove battery quickly if water penetrating into shell carelessly. It is not allowed to detach shell individually. Please submit it to related dealers or after-sales agents of our company for detection.

3）Repair

Please inspect battery, external power and power input jack firstly for instrument bootstrap failure. Please check if “ ⏻ ” key is invalid or not.

Please check if testing wires are excellent with excellent contact between clip in testing port and element foot or not for abnormal measurement result. Please confirm correct operation and use. It is not allowed to detach shell or replace element & circuit individually. Please contact related dealers or after-sales service agents of our company for repair confirmation failure.

Manufacturer:
Uni-Trend Technology (CHINA) Limited
Dong Fang Da Dao
Bei Shan Dong Fang Industrial Development District
Hu Men Town, Dongguan City
Guang Dong Province
China
Postal Code: 523 925

Headquarters:
Uni-Trend Group Limited
Rm901, 9/F, Nanyang Plaza
57 Hung To Road
Kwun Tong
Kowloon, Hong Kong
Tel: (852) 2950 9168
Fax: (852) 2950 9303
Email: info@uni-trend.com
http://www.uni-trend.com