East Tester®

ET1080A/1080B/1080C/1080D/1080E
Handheld LCR Meter
User Manual

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1. Safety

These security measures are applicable to the operation and maintenance personnel who should pay attention to them during service and maintenance.

- ***Do not use in explosive environments***

Avoid using it in dusty environment, in direct sunlight, in environment with high humidity or strong electromagnetic radiation or other harsh environments.

- ***Non-professional maintenance personnel should not open the back cover***

Maintenance, replacement of components or adjustment of the instrument should be done by professional maintenance personnel. Please contact the dealer and the service department of Hangzhou Zhongchuang Electronics Co., Ltd.

- ***Do not arbitrarily break down or modify the instrument***

Partial replacement or unauthorized modification may prevent the instrument from recovering its performance

- ***Security warning***

One should abide by the relevant terms in the manual regarding safety or injury to human body or damages to the product, as well as operation or environment which may result in test failure.

2. Instruction on safety

To allow safe use of equipment, follow these guidelines:

- The instrument is suitable for indoor use and an altitude of less than 2,000 meters. In case of short-term outdoor use, prevent it from direct sunlight, water, electromagnetic radiation, dust, etc.
- Before the use, please read and understand the warning and safety information mentioned in this manual.
- Use the instrument according to the function specified in the manual.
- If the component needs measurement, make sure the circuit is turned off and all capacitors in the circuit are discharged before the measurement.
- Before the measurement, components such as capacitors shall be discharged.
- The lithium battery of 5V and 2600mAh, or mini_USB is used to provide power for the instrument.Can be charged with mini_USB.

Safety Symbols

 Security warning to remind the user to following the instruction in the manual

Environmental conditions

Working environment: 0 ℃ ~ 40 ℃;

Humidity: 15% to 85% R.H;

Storage temperature: 0 ℃ ~ 40 ℃;

Pollution degree: 2;

3. Introduction

ET1080 Series handheld LCR is a portable hand-held measuring instrument for measuring the parameters of inductors, capacitors, resistors and other components. It is small with a 5V lithium battery, suitable for table-type application. It is also portable and mobile.

ET1080 Series provides a resolution of four and a half digits for main parameters and a resolution of 0.0001 for secondary parameter. Its highest measurement frequency is 100kHz, and can measure the level of 1Vrms, 0.6Vrms, 0.3Vrms, and 0.1Vrms(ET433 is 0～1V adjustable). Its automatic range can display the results in the fast, medium, or slow mode. It can automatically select the appropriate measurement parameters according to the characteristics of the component. Its measurement accuracy can reach 0.2%. It combines the convenience of a handheld instrument and good performance of a table-type one.

The operation is simple, and users can see the test frequency, parameters, and speed by pressing the corresponding key; it also has the recording mode to take readings; the convenient operation of open and short circuit correction function helps improve the measurement accuracy. The buzzer, automatic power off and languages can be set on the configuration menu

The standard instrument is equipped with remote communication function. The remote control and data acquisition are achieved by connecting it to the PC through Mini-USB cable.

Packing list

The packing box of ET1080 Series is equipped according to the following list:

- a handheld LCR (lithium battery installed)
- a guidance manual
- CD
- a Mini-USB communication cable
- an AC power adapter
- a pair of red / black rubber plugs –alligator clip test line
- a short-circuit bar
- a pair of 4-terminal Kelvin test clip (optional for ET430/430B, and other models standard)

Please check according to the packing list after the box is opened, if any component is missing, please immediately contact the company or the related dealer.

4. Overview of front panel

Figure 1 Front panel (with ET431 as an example)

4.1 Front panel

The front panel is described below, taking ET1080C as an example. See figure 1 (Note: the long press in the manual indicates to press and hold the key for more than 2 seconds. There is the short press and long press for the multifunction key, but only short press for other keys)

1 Display 2.8" TFT LCD screen, which displays all functions of the instrument.

2 Data holding recording multifunctional key short press to turn on or off the data holding function; long press to turn on or off the data recording function.

3 Power key long press it to turn on or off the instrument;

4 Main parameter shortcut key to switch the main parameters quickly.

5 Relative and correction multifunctional key short press to turn on or off the relative function, long press to turn on the correction function.

6 Secondary parameter shortcut key to quickly switch the secondary parameters.

7 Frequency and DCR mode multifunctional key short press to fast switch the frequency of fixed points; long press to enter the DCR mode.

8 Level shortcut key to quickly switch the fixed-point level.

9 Bias voltage and electrolytic capacitance mode multifunctional key short press to enter the electrolytic capacitance mode; long press to quickly select bias voltage.

10 Equivalent shortcut key to quickly switch equivalents.

11 Interface switch key to quickly switch between "measurement display" and "System Settings".

12 Comparator switch and tolerance limits shortcut multifunctional key short press to quickly switch deviation tolerance limit; long press to turn on or off the comparator.

13 Measuring speed shortcut key to quickly switch the required measurement speed.
14 Range shortcut key to quickly switch the required range.
15 Arrow keys *left and right arrow keys* to control the movement of the cursor; up and down arrow keys to select the parameter.
16 Enter key to confirm the selection of a certain parameter or function.
17 5-terminal test notch
18 3-terminal test jack
Note: please see the label on the adapter for its input parameters; use the supplied adapter, or purchase the specified power adapter from our company. The use of other adapters may cause unnecessary damage.
Reminder: after the external power supply is normal, the internal battery power supply circuit will be automatically cut off and charge the battery, ET43 Series has an independent charging management controller—even when the instrument is turned off, the charging control still works normally.

4.2 User's interface

4.2.1. Measurement interface

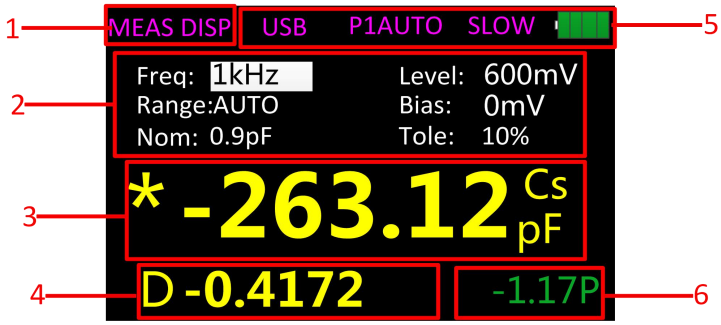


Figure 2 Measurement interface

1 Page title used to identify the page displayed.

2 Measurement parameter settings

3 Main parameter display "*" indicates the data holding state.

4 Secondary parameter display

5 Status Bar "USB": USB connection, displayed when it is connected to the PC and hidden at any other time;

"Main Parameter Auto": the main parameters are displayed in automatic mode and hidden at any other time;

"Slow": measurement speed display;

The icon of the battery indicates the remaining power to remind the user of charging the instrument.

6 Comparator display shows the deviation percentage of the value of the tested component to the nominal value, the green and P represent that it is within the set tolerance, and red and F indicate that it exceeds the set tolerance. The bar is closed when the comparator is turned off.

4.2.2 System settings interface

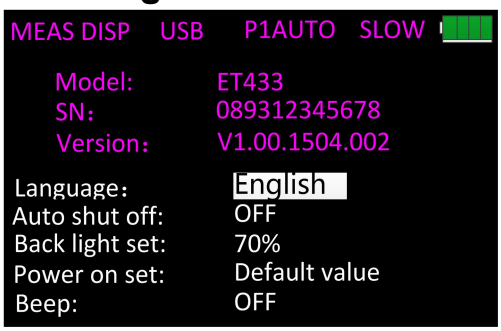


Figure 3 system settings interface

On the system settings interface users can view the product model, serial number and version number. The language, automatic power-off, brightness, power-on, and buzzer can be set.

4.3 Test port

ET1080 Series uses the 3- and 5-terminal test ports at the same time, which is to combine convenience and high accuracy for the test. See figure 4 for the test terminal.

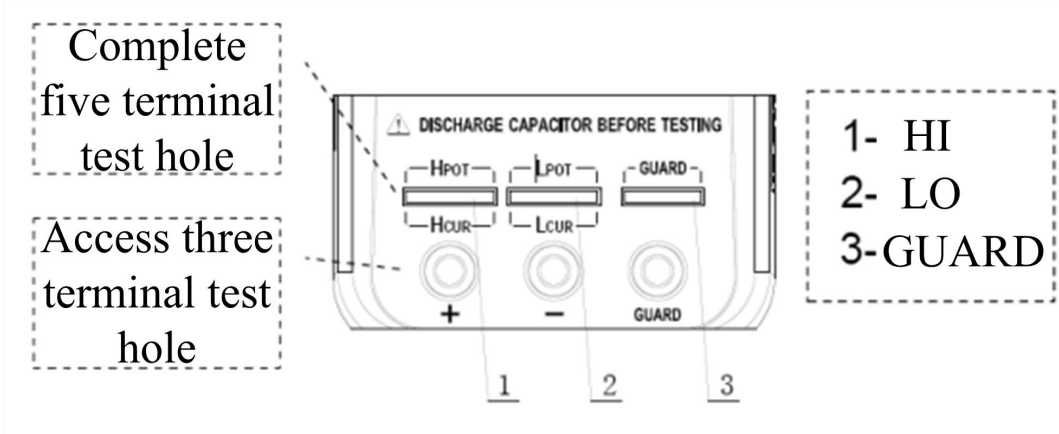


Figure 4 Test port

The three-terminal test port of the instrument uses the standard rubber jack; therefore the inexpensive rubber plug - alligator clip can be used as the test line. It is very convenient to apply the extended test, but it has the drawback of low testing accuracy.

To improve the accuracy of the test line when using the extension line, ET43 Series is also equipped with the five-terminal test notch for dedicated test fixture. It renders possible the complete four-terminal measurement of the extension line, so as to ensure the high testing accuracy.

5. Operation instruction

5.1 Startup and shutdown

Long press the power key to start the instrument and the measurement interface is shown (default); press and hold the key (for more than 2 seconds) to turn off the

instrument.

5.2 Selection of parameter

5.2.1 Selection of frequency

ET1080 Series handheld LCR applies AC test signal to the DUT for measurement. Frequency is one of the main parameters of the AC source. Due to the presence of the non-ideal and distributed parameters of elements, and the impact of the distributed parameters between the test end, the same element may have different results with different test frequencies. Therefore, before the measurement the appropriate frequency should be selected.

There are two ways to change the test frequency:

Method One: press FREQ to switch between different frequencies.

Method Two: Press the right and left arrow keys to select frequency on the interface as shown in figure 5, and press the up and down arrow keys to switch frequencies.

Figure 5

The following frequencies can be selected for different models:

ET1080 A/ET1080 C：100Hz、120Hz、1kHz、10kHz、

ET1080 C/ET1080 D：100Hz、120Hz、1kHz、10kHz、40kHz、100kHz；

ET1080 E:100Hz-100KHz,Continuously adjustable,a step of 1 Hz。

5.2.2 Selection of level

This Series handheld LCR applies AC test signal to the DUT for measurement. Both the frequency and signal level can be changed.

There are two ways to change the test signal level:

Method One: press LEVEL to switch between different test signals.

Method Two: Press the right and left arrow keys to select level on the interface as shown in figure 6, and press the up and down arrow keys to switch levels.

Figure 6

The following levels can be selected for different models:

ET1080C/ET1080D：1Vrms、0.6Vrms、0.3Vrms、0.1Vrms；

ET1080B: 0.6Vrms、0.3Vrms;

ET1080 A: 0.6Vrms;

ET1080E: 0-1V adjustable.

5.2.3 Selection of internal bias

ET1080Series offers internal bias 0-500mV, the DC bias voltage with stepping of 1mV (ET1080B/ET1080A has no such function). When the test function is DCR, the bias is 800mV.

There are two ways to change the bias voltage:

Method One: press the right and left arrow keys to set the bias, and press ENTER, press the up and down arrow keys to select the bias as shown in figure 7, and press ENTER to confirm.

Method Two: long press -|(- to select the bias, press the up and down arrow keys to select the required value of bias, and then press ENTER to confirm.

Figure 7

5.2.4 Selection of range

There are two ways to change the range:

Method One: turn on the instrument and the measurement display is shown, press the left and right arrow keys to move the cursor to the range, and the up and down arrow keys to switch the range (AUTO, 100Ω, 1kΩ, 10kΩ, 100kΩ).

Method Two: Press RANGE to switch directly to the next range, move the cursor to the range at the same time.

5.2.5 Selection of measurement speed

Turn on the instrument and the measurement display is shown, press SPEED to switch to the next measurement speed (fast, medium, slow). Above the status bar the corresponding measurement speed is displayed. Fast (4 times / s), the speed (2 times / s), Slow (1 time / s).

5.2.6 Selection of L/C/R/Z main parameters

Select the type of measurement parameter, and first select the main parameter.

Press AUTO/R/C/L/Z to switch between the following main parameters in sequence:

R (resistance), C (capacitance), L (inductance), Z (impedance) and AUTO (automatic). When AUTO is selected for the main parameter, "Automatic Main Parameter" is displayed above the status bar.

5.2.7 Selection of X/D/Q/θ/ESR secondary parameters

If necessary, press the secondary parameter key to select secondary parameter.

Press X/D/Q/θ/ESR to select the following secondary parameters:

D (loss), Q (quality factor), θ (phase angle), ESR (equivalent series resistance), X (reactance).

5.2.8 Selection of tolerance

ET1080Ahas no such function.

There are two ways to set the tolerance:

Method One: 1. Turn on the instrument and the measurement display is shown, and long press TOL% to open the comparator switch, at this moment the hidden "tolerance," "nominal" and deviation percentage are displayed, as shown in Figure 8;

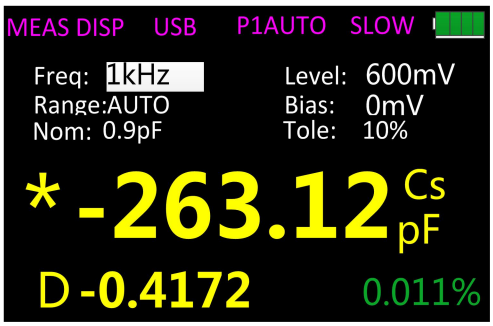


Figure 8

2. Short press TOL% to switch to the next tolerance (1%, 5%, 10%, 20%).

Method Two: 1. The same as Method One;

2. Use the left and right arrow keys to move the cursor at the tolerance, and then use the up and down arrow keys to switch to the last or next tolerance.

Method Three: 1. The same as Method One;

2. Use the left and right arrow keys to move the cursor at the tolerance,

short press ENTER to enter the interface for custom tolerance (1% to 50%, resolution ratio of 1%). Refer to the custom settings of frequency for the setting method.

5.2.9 Selection of nominal

The method of setting the nominal is as follows:

1. Turn on the instrument and the measurement display is shown, the element with required nominal should be placed on the test clip of the instrument.

2. Press TOL% to turn on the comparator, and the nominal value is the value of the measured element with one digit after the decimal point, but it cannot be less than the minimum unit (for example, if the measured element is 1.0694kΩ , then the nominal is 1kΩ; for example, if the measured element is 330.92Ω, then the nominal is 330Ω).

3. If the nominal value is not the required one, use the left and right arrow keys to move the cursor to the nominal, press ENTER to enter the interface for changing the nominal value.

5.2.10. Selection of equivalent

Due to the non-ideal and distributed parameters of elements, the actual elements tend to be equivalent with the combination of ideal elements. LCR tester generally uses two simple equivalent models—series and parallel. Selecting the proper equivalent model will lead to better measurement results. In general, low-impedance elements (such as that below 100Ω) should use the series equivalent model; a high impedance element (such as that above 10kΩ) should use the parallel equivalent model; the equivalent model affects less the measurement result of the one in between the two above models. Press AUTO/SER/PAL to switch to the next equivalent (SER, PAL).

5.3. DCR mode

ET1080 Series has the DCR mode except for ET1080B/ET1080A. Long press FREQ to enter the DCR mode, as shown in figure 9.

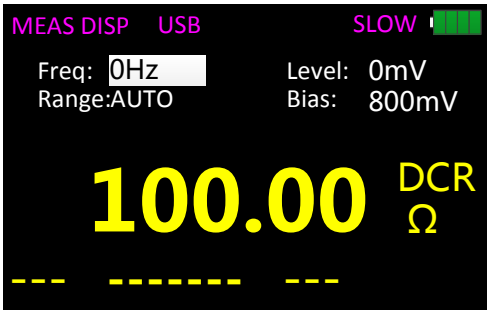


Figure 9

5.4. Electrolytic capacitance mode

ET1080 Series has the electrolytic capacitance mode except for ET1080A. Long

press -|(- to enter the electrolytic capacitance mode, as shown in figure 10.

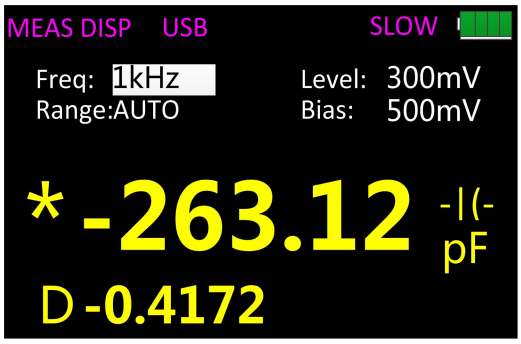


Figure 10

5.5. Relative mode

Short press ▲NULL to turn on the relative function and the current value is used as reference. The reference value and relative value will be shown respectively on the secondary and main display.

5.6. Reading hold mode (HOLD)

The data hold function is used to freeze the displayed data. The measurement is still in progress, but the data on the LCD is not updated as the measurements proceed.

Turn on reading hold:

To turn on the reading hold function, press the HOLD key, and "*" will be shown on the LCD to indicate that the data hold function is activated. And measurement results for the main and secondary parameters are those displayed before pressing the HOLD key.

Turn off reading hold:

To turn off the reading hold function, press again the HOLD key, and "*" disappears from the LCD; the instrument returns to normal measurement mode.

5.7 Data recording function (maximum, minimum, average)

If the measurement data of the DUT see poor stability and fluctuate within a certain range, use the data recording mode to acquire the readings. In the data recording mode, the maximum, minimum and average can be dynamically obtained within a certain range.

Turn on the recording function:

Long press HOLD to turn on the data recording function, and the recorded value is shown on the secondary display, and at this moment the HOLD function is not available, short press HOLD to select the display of the maximum, minimum, or average.

Turn off the recording function:

Long press HOLD to turn off the data recording function.

Reminder: After changing the type of the measurement parameter, it will automatically exit from the data recording function.

5.8 Comparator function

See 5.2.8 Selection of tolerance and 5.2.9 Selection of nominal value.

5.9 Correction function

The correction function applies to the open and short circuit. By correcting it can effectively reduce the error of distributed parameters caused by the test line. The short circuit correction can reduce the impact of the contact resistance and lead resistance on the measurement of low impedance element; and the open circuit correction can reduce the impact of the distributed capacitance and resistance between the two ends of the test line on the measurement of high impedance element.

The method of correction is shown as follows:

1. Before entering the correction function, please ensure that the test terminals are open- or short-circuited. Press ▲NULL to enter the correction interface, then the instrument automatically identify whether it is open or short circuit as shown in Figure 11;

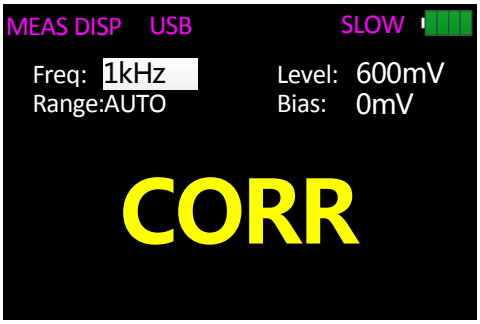


Figure 11

2. Short press ▲NULL for open (OPEN) or short (SHORT) circuit correction and the interface is shown as in Figure 12. If the correction is successful, the secondary display shows "SUCESS"; or it shows "FAILED".

Note: Do not change the state of the test terminals during the correction.

3. After the correction ends, short press ▲NULL to return to the measurement display.

Figure 12

6. Rapid application guide

Warning:

- **Do not measure the charged capacitor, or it may cause damage to the instrument.**
- **In case of measurement of on-board devices, make sure the power is turned off. The active circuit cannot be measured directly.**
- **When used in the dusty environment, the instrument is easy to gather dirt, so it should be cleaned periodically to protect the test port to prevent the dust from entering the instrument. The accumulation of dust will be conductive and affect the use of the instrument.**
- **Do not place the instrument directly in the environments with explosives, direct sunlight and excessive heat.**

Reminder: To achieve the proper measurement accuracy, refer to the "correction function" section for open and short circuit correction before the measurement. The test fixture can be rubber plug - alligator clip (see figure 13), Kelvin test fixture (figure 14), or the component can be directly inserted into the position 17 in figure 1 (notch). The rubber plug - alligator clips are mainly used in the following examples.

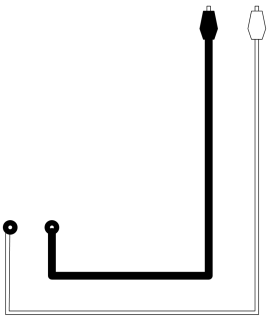


Figure 13

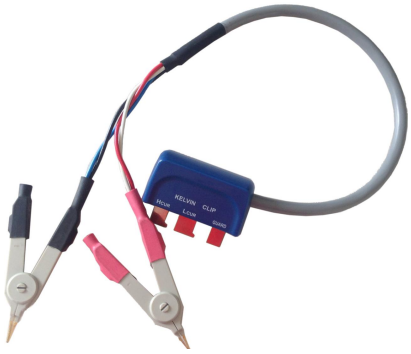


Figure 14

6.1 Resistance measurement

See figure 15 for the connection test.

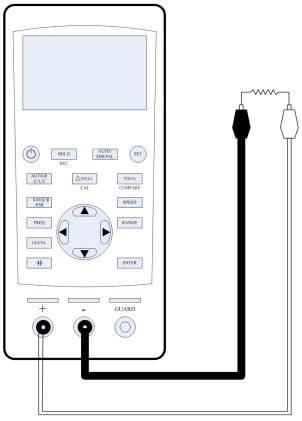


Figure 15

1. Long press the power key to start the instrument;
2. Press the AUTO/R/C/L/Z key until Rs is displayed on the interface which means to select resistance measurement, shown in figure 16;

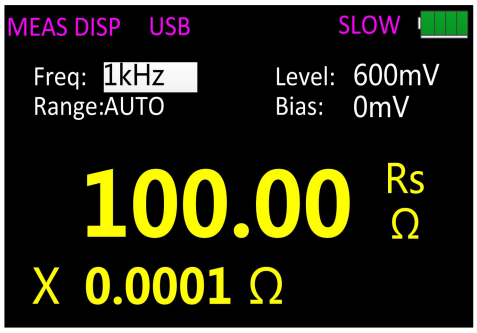


Figure 16

3. Insert the resistor into the test notch, or choose the appropriate test accessories (rubber plug - alligator clip, Kelvin test fixture, etc.) and connect it with the measured resistance;
4. Press the FREQ key to select the desired test frequency, press LEVEL to select the desired level;
5. To select another secondary parameter, press X/D/Q/θ/ESR
6. Read the measurement results from the screen.

Reminder: the AC signal is used by the instrument to measure the resistance, so the test result reflects the AC resistance characteristics of the instrument instead of its DC resistance.

6.2 Capacitance measurement

Warning: Make sure that the capacitor has been fully discharged before measuring.

See figure 17 for the connection test.

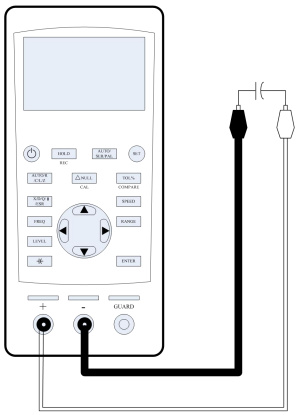


Figure 17

1. Long press the power key to start the instrument;
2. Press the AUTO/R/C/L/Z key until Cs is displayed on the interface which means to select capacitance measurement, shown in figure 18;

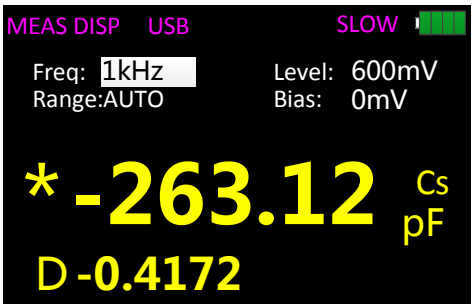


Figure 18

3. Insert the capacitor into the test notch, or choose the appropriate test accessories (rubber plug - alligator clip, Kelvin test fixture, etc.) and connect it with the measured capacitor;

4. Press the FREQ key to select the desired test frequency, press LEVEL to select the desired level;

5. To select another secondary parameter, press X/D/Q/θ/ESR

6. Read the measurement results from the screen.

Note: the capacitor or capacitive device must be fully discharged before the test; the capacitor with large capacity may need longer time to discharge. If the capacitive device not fully discharged is connected, it can damage the components inside the instrument.

6.3 Inductance measurement

See figure 19 for the connection test.

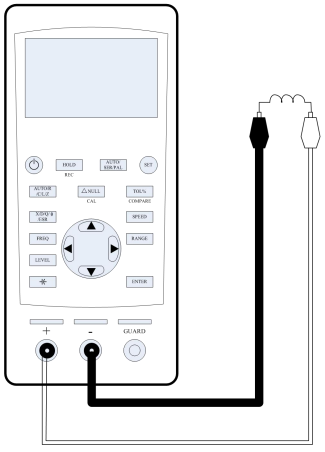


Figure 19

1. Long press the power key to start the instrument;

2. Press the AUTO/R/C/L/Z key until Ls is displayed on the interface which means to select inductance measurement, shown in figure 20;

Figure 20

3. Insert the inductor into the test notch, or choose the appropriate test accessories (rubber plug - alligator clip, Kelvin test fixture, etc.) and connect it with the measured inductor;

4. Press the FREQ key to select the desired test frequency, press LEVEL to select the desired level;

5. To select another secondary parameter, press X/D/Q/θ/ESR

6. Read the measurement results from the screen.

6.4 Impedance measurement

1. Long press the power key to start the instrument;

2. Press the AUTO/R/C/L/Z key until Zs is displayed on the interface which means to select impedance measurement, shown in figure 21;

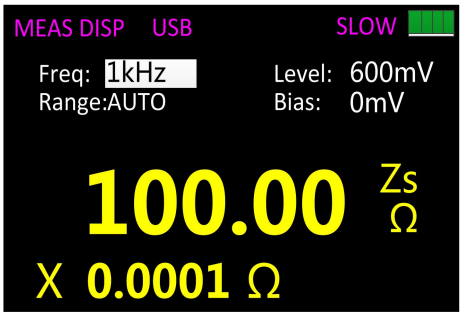


Figure 21

3. Insert the impeder into the test notch, or choose the appropriate test accessories (rubber plug - alligator clip, Kelvin test fixture, etc.) and connect it with the measured impeder;

4. Press the FREQ key to select the desired test frequency, press LEVEL to select the desired level;

5. To select another secondary parameter, press X/D/Q/θ/ESR

6. Read the measurement results from the screen.

7. Telecommunication

The instrument can be connected to PC through the Mini-USB interface. After installing the driver on the PC, the ET1080 Series handheld LCR can be controlled from or the test results acquired by the PC through the virtual serial port.

Connect the instrument to the PC:

1. Locate the USB driver software in the CD.

2. Use the Mini-USB cable to connect the instrument to the USB port of the PC, shown in Figure 22, press and hold the power key to start the instrument.

3. Install the USB drive;

4. After the installation is completed, check the serial number in Windows' Device Manager.

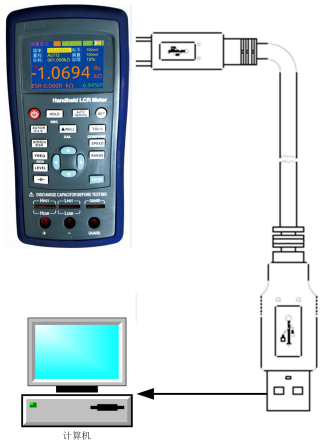


Figure 22

- Flow Control：None

Configuration of virtual serial port:

- ET1080 Series employ the serial communication parameters with variable Baud rates:
- Baud rate: 9600 or others;
- Data bits: 8
- Check: None
- Stop bit: 1
- Flow Control: None

Remote Control State:

When ET1080 Series receives the remote operation state instruction from the host, the instrument automatically enters into the remote control state. "RMT" is displayed on the LCD screen to show the entry into the remote control state. To exit the remote control state, send the "SYSTem: LOCal" command.

Command Protocol:

ET1080 Series handheld LCR uses SCPI command set to transfer control command and return query information and data with string. The terminator specified by the protocal shows the end of a command line or information enquiry line.

Using SCPI command set enables the interaction control of PC over the instrument by programming. The command format meets the standard which is easy to understand and use.

Public command: the command applied universally to various kinds of instrument defined by the public command IEEE488, the public command starts with *, ET1080 series supports only * IDN?

Terminator: the command line sent from the PC to the instrument must end with the specified terminator. Only after the instrument receives the terminator will it analyze and process the command string. The terminator is 0x0a.

Query return format: when the instrument responds to a query command, it will return the search results: <Result> + <NL>; Result is the results, NL the carriage return.

Data type: the data in the form of ASCII characters transmitted on the bus may have the following types

Type	Meaning	Example
<NR1>	Integer	+800,-200,100,-50
<NR2>	Decimal	+1.56,-0.001,10.5
<NR3>	Exponential floating number	+2.345678E+04 -1.345678E-01
<NRf>		NR1 NR2 NR3
<NL>	Enter	an integer of 10

Conventions for marks: These marks are part of the command which is in line with the rules of grammar:

Rules of grammar	Definition
:	Colon, enter the next level of the command
;	Semicolon, the same level of command
*	Asterisk, public command
,	Comma, multi-parameter separator
?	Question mark indicates the query
Spacing, separating commands and parameters	
“ ”	Quotes for quoted part

These marks are added in order to specify the command format, but are not part of the command

Marks	Definition
[ ]	The optional command parameters are given in the square brackets
|	Division mark—to select one from many
< >	The definition of the variable parameter is given or the variable parameters listed in the angle brackets
( )	Interpretation which is not seen in the actual command

Abbreviations and capitalization:

- The command has full format and abbreviated format, in the following descriptions of the command, capitalization represents abbreviation, and the abbreviated command has the same effect with the complete command;
- Abbreviations are generally expressed by four letters of the complete command, the random abbreviation which does not appear in the command table will be considered as the wrong command;
- There is no difference regarding capitalization for ASCII command actually transmitted on the bus and the letters of parameter.

Reference: Refer to the communication protocol of ET43 for specific commands.

8. Instrument parameters

Here are the general indicators and measurement accuracy indicators for ET43 series handheld LCR, which apply to the ET43 Series.

Disclaimer: These parameters are subject to change without notice!

8.1 General parameters

Model	ET1080B	ET1080A	ET1080C	ET1080D	ET1080E
Testing frequency	100Hz, 120Hz, 1KHz, 10KHz, 40kHz, 100KHz	100Hz, 20Hz, 1KHz, 10KHz	100Hz, 120Hz, 1KHz, 10KHz	100Hz, 120Hz, 1KHz, 10KHz, 40kHz, 100KHz	100Hz-100KHz Continuously adjustable, a step of 1 Hz
Basic accuracy	0.3%	0.3%	0.2%	0.2%	0.2%
Display screen	2.8” TFT LCD screen				
Number of display digits	Principal parameter: 5 digit Secondary parameter: 5 digit				
Measured parameter:	Principal parameter: L/C/R/Z Secondary parameter: X/D/Q/θ/ESR				
Electrolytic capacitor mode	×	√	√	√	√
DCR mode	×	×	√	√	√
Measurement range	L：0.000μH～2000H，C：0.000pF～20.000mF，R：0.0001Ω～20.000MΩ				
Measuring display speed	1 time/s (slow), 2 times/s (medium), 4 time/s (fast)				
Internal bias	×		0-500mV adjustable, at a step of 1mV.		
Testing level	0.6Vrms	0.3Vrms, 0.6Vrms	0.1Vrms, 0.3Vrms, 0.6Vrms,1Vrms		0-1V adjustable
Calibration function	Open circuit calibration, short circuit calibration				
Screening function	The limit range of screening can be set to 1%-50%, and the fixed points are 1%, 5%, 10% and 20%.				
Deviation measurement	Used for comparing and displaying deviation percentage of component and the set nominal value				
Others	Adjustment of backlight brightness, Chinese and English are optional,USB device and automatic power-off time				
Accessories					
Standard configuration	1. Mini-USB cable; 2. Power adapter; 3. Short circuit bar; 4. Red and black rubber plug; 5. High capacity lithium battery				
			Kelvin clips		
Optional configuration	Kelvin clips SMD clips		SMD clips		

8.2 Measurement accuracy

R, C, L, Z, X accuracy (when Dx≤0.1 the accuracy of L, C, X is applied, when Qx≤0.1 the accuracy of R is applied)

Ae is the relative accuracy:

$$Ae = \pm Ac + (Ab + 100 * Kz + Kl) * Kt[\%]$$

Ac-- calibration accuracy

Ab-- basic accuracy

Kz-- impedance scaling factor

Kl-- cable length factor

Kt-- temperature factor

The accuracy of D

The accuracy of D—De is:

when Dx≤0.1:

$$De = \pm Ae / 100$$

Dx-- D measured

Ae-- relative accuracy of R, C, L, Z, and X

When Dx> 0.1: multiply (1 + Dx) by De

The accuracy of Q (when **Q * De<1)**

The accuracy of Q—Qe is:

$$Qe = \pm \frac{Qx^2 * De}{1 \pm Qx * De}$$

Qx -- Q measured

De-- relative accuracy of D

The accuracy of θ

The accuracy of θ—θe is:

$$\theta e = \pm \frac{180 * Ae}{100\pi}[\deg]$$

Ae——relative accuracy of R, C, L, Z, and X

The accuracy of Rp (when Dx≤0.1)

Rpe—the accuracy of Rp is:

$$Rpe = \pm \frac{Rpx * De}{Dx \mp De}[\Omega]$$

Rpe --relative accuracy of Rp

Rpx-- measured Rp (Ω)

Dx-- D measured

De--relative accuracy of D

The accuracy of Rs (when Dx≤0.1)

Rse—the accuracy of Rs is:

$$Rse = \pm Xx * De[\Omega]$$

$$Xx = 2\pi fLx$$

Rse --relative accuracy of Rs

Dx-- D measured

Xx-- X measured (Ω)

De -- relative accuracy of D

f --test frequency (Hz)

Cx—measured C (F)

Lx—measured L (H)

The accuracy of ESR

ESR is the equivalent series resistance like Rs.

Basic accuracy

The basic accuracy of the instrument is 0.2; with the changes of the test frequency and the impedance of DUT, the basic accuracy will decline, the basic accuracy and its application are shown in the table below.

Slow mode

Test frequency（Hz）	Scope of impedance				
	Less than 1Ω	1Ω to 10Ω	10Ω to 100kΩ	100kΩ to 1MΩ	Greater than 1MΩ
10 to 30	0.3	0.15	0.15	0.2	0.5
30 to 10k	0.3	0.1	0.05	0.1	0.3
10k to 100k	0.5	0.1	0.05	0.15	0.5

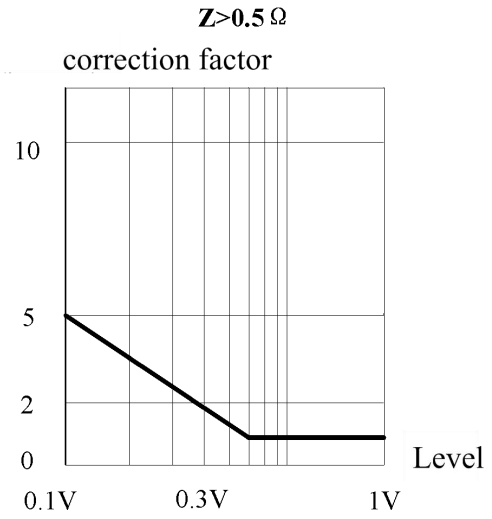
Medium mode

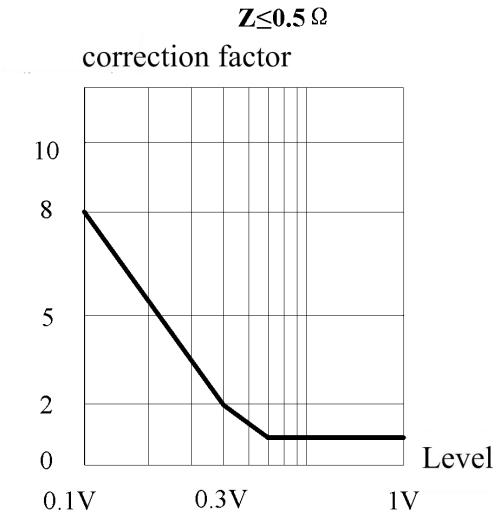
Test frequency（Hz）	Scope of impedance				
	Less than 5Ω	5Ω to 10Ω	10Ω to 20kΩ	20kΩ to 100kΩ	Greater than1MΩ
10 to 30	0.4	0.4	0.2	0.1	0.35
30 to 1k	0.8	0.2	0.15	0.15	0.3
1k to 30k	0.5	0.4	0.3	0.3	1
30k to 80k	1	0.6	0.3	0.6	3
80k to 100k	2	1	0.4	0.9	5

Fast mode

Test frequency（Hz）	Scope of impedance				
	Less than 1Ω	1Ω to 10Ω	10Ω to 100kΩ	100kΩ to 1MΩ	Greater than 1MΩ
10 to 30	0.6	0.3	0.3	0.4	1
30 to 10k	0.6	0.2	0.1	0.2	0.2
10k to 30k	1	0.2	0.1	0.3	1
30k to 100k	2	0.6	0.3	0.6	2

When the test level is less than 0.75V and greater than 0.5V, the basic accuracy is shown in the above table; in other cases, it needs to be multiplied by the level correction factor. The level correction factor is shown below:





Accuracy factor

This section contains all the accuracy correction factors: Impedance scaling factor Kz, temperature factor Kc, calibration factor Kf, cable length factor Kl.

Frequency/Hz	Kz（Zm<500Ω）	Kz（Zm≧500Ω）
Less than 100	$(\frac{1*10^{-3}}{\lvert Zm\rvert})(1+\frac{200}{Vs})(1+\sqrt{\frac{100}{fm}})$	$\lvert \mathrm{Zm}\rvert (1*10^{-9})(1+\frac{70}{Vs})(1+\sqrt{\frac{100}{fm}})$
100 to 100k	$(\frac{1*10^{-3}}{\lvert Zm\rvert})(1+\frac{200}{Vs})$	$\lvert \mathrm{Zm}\rvert (5*10^{-9})(1+\frac{70}{Vs})$
Greater than 100k	$(\frac{1*10^{-3}}{\lvert Zm\rvert})(2+\frac{200}{Vs})$	$\lvert \mathrm{Zm}\rvert (1*10^{-8})(1+\frac{70}{Vs})$

Note: fm in the table indicates the frequency of the test signal（unit：Hz），Zm is the impedance (unit: Ω), Vs the test level (unit: mV)

Temperature factor Kc

$$Kc = 0.25*(T-20)$$ **(When Kc <1, Kc = 1)**

T--room temperature

Calibration factor Kf

Range	Frequency /Hz	
	10 to 100	100 to 100k
10kΩ	0	0
1kΩ、100kΩ	0.02	0.01
100Ω	0.04	0.03

Cable length factor Kl

0 meter	1 meter	2 meters	4 meters

$5*10^{-4}*(1+0.05fm)$	0	$5*10^{-4}*(1+0.05fm)$	$1*10^{-3}*(1+0.05fm)$

Note: fm in the table indicates the frequency of the test signal（unit: kHz）

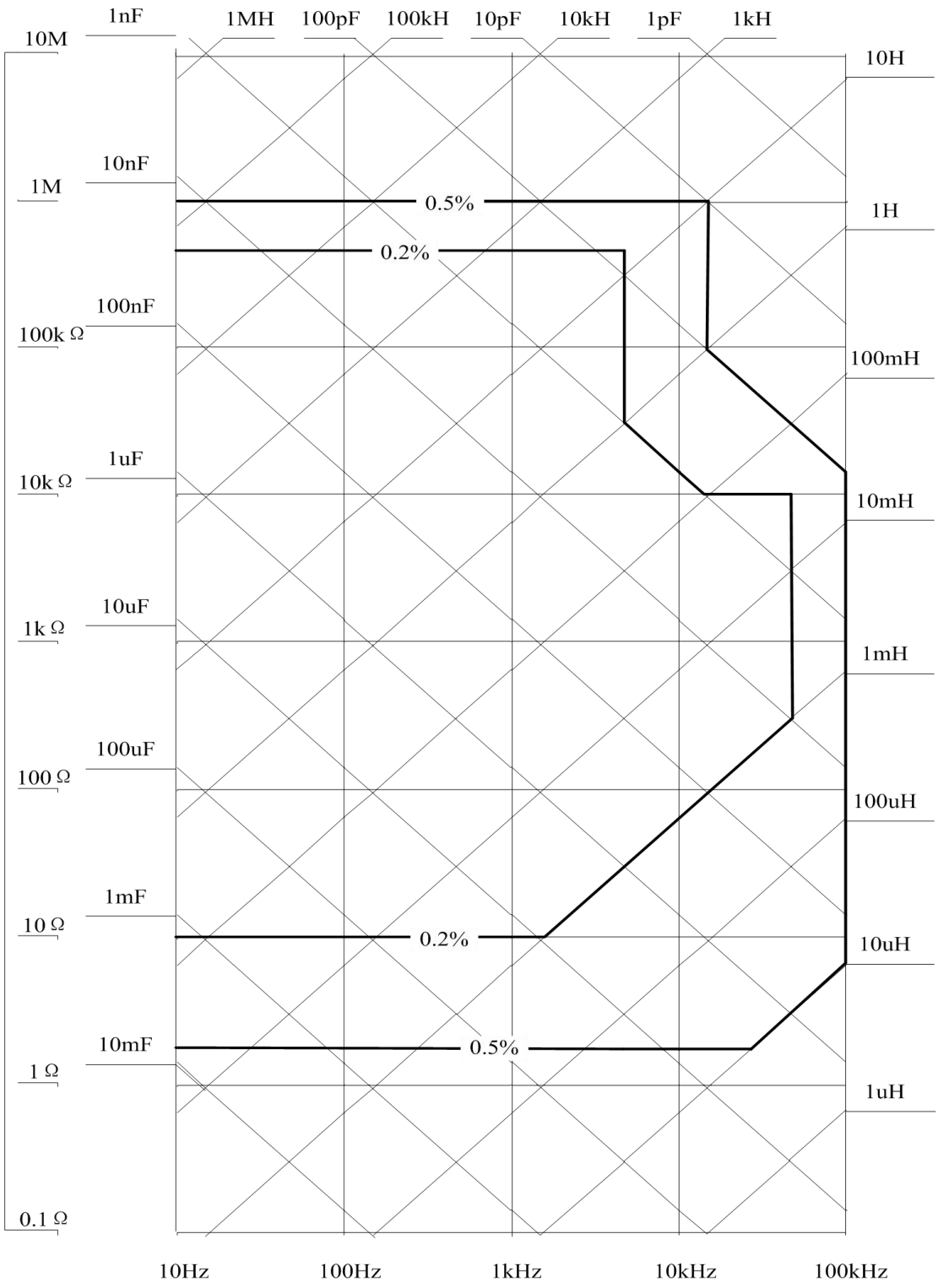
8.3 Accuracy indicator

Notes:

- ***Ambient temperature: 20 ℃ ± 2 ℃, humidity: ≤80% R.H;***
- ***Preheat the instrument for at least 30 minutes before the test;***
- ***Test at the test notch on the end face of the instrument;***
- ***It is better to conduct open and short circuit correction before the test;***
- ***Measure with the recommended equivalent mode;***
- ***The percentage in terms of error indicates:***
- ***± (% of the reading + last digit)***
- ***If the actual measurement of the instrument and the display exceeds the scope specified in the table, the accuracy of the excessive part will not be given;***
- ***The meaning of the subscript***
- ***S- series equivalent; p- parallel equivalent; e- accuracy***
- ***Some parameters cannot be given in the data table, and it can only be calculated based on the measurement results;***

8.3.1. Accuracy indicator 1(ET433)

When the test level is 0.6V, the measurement accuracy by using Kelvin test fixture is as follows:



8.3.2 Accuracy indicator 2(ET1080D/ET1080C)

- The following accuracy applies to the test level of 0.6Vrms, if the test level is 0.3Vrms, multiply the accuracy by 2; If the test level is 0.1Vrms, multiply the accuracy by 5 (Z> 0.5Ω) or by 8 (Z≤0.5Ω);

Capacitance C and loss D

■ 100Hz/120Hz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
20mF	4.000mF～20.000mF	5.00%+5 digits	0.0500	Series
4mF	400.0μF～3.9999mF	1.00%+3 digits	0.0100	Series
400μF	40.00μF～399.99μF	0.30%+2 digits	0.0030	Series
40μF	4.000μF～39.999μF	0.20%+2 digits	0.0020	Series
4μF	400.0nF～3.9999μF	0.20%+2 digits	0.0020	----
400nF	40.00nF～399.99nF	0.2%+2 digits	0.0020	Parallel
40nF	4.000nF～39.999nF	0.3%+3 digits	0.0030	Parallel
4nF	0pF～3.999nF	1.2%+5 digits	------	Parallel

■ 1kHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
1000uF	400.0uF～999.99uF	2.00%+5 digits	0.0200	Series
400μF	40.00μF～399.99μF	1.00%+3 digits	0.0100	Series
40μF	4.000μF～39.999μF	0.30%+2 digits	0.0030	Series
4μF	400.0nF～3.9999μF	0.20%+2 digits	0.0020	----
400nF	40.00nF～399.99nF	0.2%+2 digits	0.0020	Parallel
40nF	4.000nF～39.999nF	0.2%+3 digits	0.0030	Parallel
4nF	400.0pF～3.9999nF	0.3%+3 digits	0.0030	Parallel
400pF	0.0pF~399.9pF	1.2%+5 digits	------	Parallel

■ 10kHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
100μF	40.00μF～100.00μF	3.00%+5 digits	0.0300	Series
40μF	4.000μF～39.999μF	1.0%+3 digits	0.0100	Series
4μF	400.0nF～3.9999μF	0.30%+2 digits	0.0030	Series
400nF	40.00nF～399.99nF	0.2%+2 digits	0.0020	Series
40nF	4.000nF～39.999nF	0.2%+2 digits	0.0020	------
4nF	400.0pF～3.9999nF	0.2%+2 digits	0.0020	Parallel
400pF	40.00pF~399.99pF	0.3%+3 digits	0.0030	Parallel
40pF	0.00pF~39.99pF	1.2%+5 digits	------	Parallel

■ 40kHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended

100μF	40.00μF～100.00μF	4.00%+5 digits	0.0400	Series
40μF	4.000μF～39.999μF	2.0%+3 digits	0.0200	Series
4μF	400.0nF～3.9999μF	0.60%+2 digits	0.0060	Series
400nF	40.00nF～399.99nF	0.3%+2 digits	0.0030	Series
40nF	4.000nF～39.999nF	0.3%+2 digits	0.0030	------
4nF	400.0pF～3.9999nF	0..3%+2 digits	0.0030	Parallel
400pF	40.00pF~399.99pF	0.6%+3 digits	0.0060	Parallel
40pF	0.000pF~39.999pF	1.5%+5 digits	------	Parallel

■ 100kHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
10μF	4.000μF～10.000μF	6.0%+20 digits	0.0600	Series
4μF	400.00nF～3.9999μF	3.0%+10 digits	0.0300	Series
400nF	40.00nF～399.99nF	0.8%+5 digits	0.0080	Series
40nF	4.000nF～39.999nF	0.5%+2 digits	0.0050	Series
4nF	400.0pF～3.9999nF	0.5%+2 digits	0.0050	------
400pF	40.00pF~399.99pF	0.8%+2 digits	0.0080	Parallel
40pF	4.000pF~39.999pF	1.5%+5 digits	0.0150	Parallel
4pF	0.000pF~3.999pF	3%+10 digits	------	Parallel

Inductance L and quality factor

■ 100Hz/120Hz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
1000H	400.0H～999.9H	1.00%+3 digits	0.0100	Parallel
400H	40.00H～399.99H	0.30%+2 digits	0.0030	Parallel
40H	4.000H～39.999H	0.20%+2 digits	0.0020	Parallel
4H	400.0mH～3.9999H	0.20%+2 digits	0.0020	----
400mH	40.00mH～399.99mH	0.2%+2 digits	0.0020	Series
40mH	4.000mH～39.999mH	0.3%+3 digits	0.0030	Series
4mH	0uH～3.999mH	1.4%+5 digits	------	Series

■ 1kHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
100H	40.000H～100.00H	1.0%+3 digits	0.0100	Parallel
40H	4.000H～39.999H	0.30%+2 digits	0.0030	Parallel

4H	400.0mH～3.9999H	0.20%+2 digits	0.0020	Parallel
400mH	40.00mH～399.99mH	0.2%+2 digits	0.0020	------
40mH	4.000mH～39.999mH	0.2%+2 digits	0.0020	Series
4mH	400.0uH～3.9999mH	0.4%+3 digits	0.0040	Series
400uH	0.0uH~399.9uH	1.4%+5 digits	------	Series

■ 10kHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
1H	400.0mH～999.9mH	0.80%+3 digits	0.0080	Parallel
400mH	40.00mH～399.99mH	0.2%+2 digits	0.0020	Parallel
40mH	4.000mH～39.999mH	0.2%+2 digits	0.0020	------
4mH	400.0uH～3.9999mH	0.2%+2 digits	0.0020	Series
400uH	40.00uH~399.99uH	0.4%+3 digits	0.0040	Series
40uH	0.00uH~39.99uH	1.4%+5 digits	------	Series

■ 40kHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
1H	400.0mH～999.9mH	1.0%+4 digits	0.0100	Parallel
400mH	40.00mH～399.99mH	0.5%+2 digits	0.0050	Parallel
40mH	4.000mH～39.999mH	0.5%+2 digits	0.0050	------
4mH	400.0uH～3.9999mH	0.5%+2 digits	0.0050	Series
400uH	40.00uH~399.99uH	0.8%+3 digits	0.0080	Series
40uH	0.000uH~39.999uH	2.0%+5 digits	------	Series

■ 100kHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
100mH	40.00mH～399.99mH	1.2%+2 digits	0.0120	Parallel
40mH	4.000mH～39.999mH	0.8%+2 digits	0.0080	Parallel
4mH	400.0uH～3.9999mH	0.5%+2 digits	0.0050	------
400uH	40.00uH~399.99uH	0.5%+2 digits	0.0050	Series
40uH	4.000uH~39.999uH	0.8%+5 digits	0.0080	Series
4uH	0.000uH~3.999uH	2.5%+10 digits	------	Series

Note*: please calculate the quality factor according to the formula to calculate the accuracy of Q.

Impedance Z and phase angle θ

■ 100Hz, 120Hz, 1kHz, 10kHz

Range	Range of display	Accuracy Ze	Accuracy θ_e	Equivalent mode recommended
20MΩ	4.000MΩ~20.000MΩ	3.0%+5 digits	1.1°	Parallel
4MΩ	400.0kΩ~3.9999MΩ	1.2%+3 digits	0.7°	Parallel
400kΩ	40.00kΩ~399.99kΩ	0.3%+3 digits	0.2°	Parallel
40kΩ	4.000kΩ~39.999kΩ	0.2%+2 digits	0.1°	------
4kΩ	400.0Ω~3.9999kΩ	0.2%+2 digits	0.1°	Series
400Ω	40.00Ω~399.99Ω	0.2%+2 digits	0.1°	Series
40Ω	4.000Ω~39.999Ω	0.3%+3 digits	0.2°	Series
4Ω	0.4000Ω~3.9999Ω	1.2%+3 digits	0.7°	Series
0.4Ω	0.0000Ω~0.3999Ω	3.0%+3 digits	------	Series

■ 40kHz

Range	Range of display	Accuracy Ze	Accuracy θ_e	Equivalent mode recommended
20MΩ	4.000MΩ~20.000MΩ	5.0%+10 digits	1.4°	Parallel
4MΩ	400.0kΩ~3.9999MΩ	2.0%+3 digits	1.1°	Parallel
400kΩ	40.00kΩ~399.99kΩ	0.7%+4 digits	0.4°	Parallel
40kΩ	4.000kΩ~39.999kΩ	0.7%+4 digits	0.4°	------
4kΩ	400.0Ω~3.9999kΩ	0.3%+3 digits	0.2°	Series
400Ω	40.00Ω~399.99Ω	0.3%+3 digits	0.2°	Series
40Ω	4.000Ω~39.999Ω	0.5%+4 digits	0.3°	Series
4Ω	0.4000Ω~3.9999Ω	1.8%+6 digits	1.0°	Series
0.4Ω	0.0000Ω~0.3999Ω	4.5%+10 digits	------	Series

■ 100kHz

Range	Range of display	Accuracy Ze	Accuracy θ_e	Equivalent mode recommended
20MΩ	4.000MΩ~20.000MΩ	8.0%+20 digits	4.6°	Parallel
4MΩ	400.0kΩ~3.9999MΩ	3.0%+10 digits	1.7°	Parallel
400kΩ	40.00kΩ~399.99kΩ	1.2%+4 digits	0.7°	Parallel
40kΩ	4.000kΩ~39.999kΩ	0.8%+2 digits	0.5°	Parallel
4kΩ	400.0Ω~3.9999kΩ	0.5%+2 digits	0.3°	------
400Ω	40.00Ω~399.99Ω	0.5%+2 digits	0.3°	Series
40Ω	4.000Ω~39.999Ω	0.8%+5 digits	0.5°	Series
4Ω	0.4000Ω~3.9999Ω	2.5%+10 digits	1.4°	Series
0.4Ω	0.0000Ω~0.3999Ω	6%+20 digits	------	Series

Note 1: When the resistance value is less than 0.100Ω, please use the relative function.

8.3.3 Accuracy indicator 3(ET1080B and ET1080A)

See 8.2 for notes.

Capacitance C and loss D

■ 100Hz/120Hz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
20mF	4.000mF～20.000mF	8.00%+5 digits	0.0800	Series
4mF	400.0μF～3.9999mF	2.00%+3 digits	0.0200	Series
400μF	40.00μF～399.99μF	0.60%+2 digits	0.0060	Series
40μF	4.000μF～39.999μF	0.40%+2 digits	0.0040	Series
4μF	400.0nF～3.9999μF	0.40%+2 digits	0.0040	----
400nF	40.00nF～399.99nF	0.4%+2 digits	0.0040	Parallel
40nF	4.000nF～39.999nF	0.5%+3 digits	0.0050	Parallel
4nF	0pF～3.999nF	1.5%+5 digits	------	Parallel

■ 1kHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
1000uF	400.0uF～999.9uF	3.00%+5 digits	0.0300	Series
400μF	40.00μF～399.99μF	1.50%+3 digits	0.0150	Series
40μF	4.000μF～39.999μF	0.60%+2 digits	0.0060	Series
4μF	400.0nF～3.9999μF	0.40%+2 digits	0.0040	----
400nF	40.00nF～399.99nF	0.4%+2 digits	0.0040	Parallel
40nF	4.000nF～39.999nF	0.6%+3 digits	0.0060	Parallel
4nF	400.0pF～3.9999nF	0.6%+3 digits	0.0060	Parallel
400pF	0.0pF~399.9pF	3%+5 digits	------	

■ 10kHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
100μF	40.00μF～100.00μF	4.00%+5 digits	0.0400	Series
40μF	4.000μF～39.999μF	2.0%+3 digits	0.0200	Series
4μF	400.0nF～3.9999μF	0.60%+2 digits	0.0060	Series
400nF	40.00nF～399.99nF	0.4%+2 digits	0.0040	Series
40nF	4.000nF～39.999nF	0.4%+2 digits	0.0040	------
4nF	400.0pF～3.9999nF	0.4%+2 digits	0.0040	Parallel
400pF	40.00pF~399.99pF	0.6%+3 digits	0.0060	Parallel

40pF	0.00pF~39.99pF	2.5%+5 digits	------	Parallel

■ 40kHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
100μF	40.00μF～100.00μF	6.00%+5 digits	0.0600	Series
40μF	4.000μF～39.999μF	4.0%+3 digits	0.0400	Series
4μF	400.0nF～3.9999μF	1.0%+2 digits	0.0100	Series
400nF	40.00nF～399.99nF	0.6%+2 digits	0.0060	Series
40nF	4.000nF～39.999nF	0.6%+2 digits	0.0060	------
4nF	400.0pF～3.9999nF	0.6%+2 digits	0.0060	Parallel
400pF	40.00pF~399.99pF	1%+3 digits	0.0100	Parallel
40pF	0.000pF~39.999pF	3%+5 digits	------	Parallel

■ 100kHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
10μF	4.000μF～10.000μF	8.0%+20 digits	0.0800	Series
4μF	400.0nF～3.9999μF	5.0%+10 digits	0.050	Series
400nF	40.00nF～399.99nF	1.5%+5 digits	0.0150	Series
40nF	4.000nF～39.999nF	1%+2 digits	0.0100	Series
4nF	400.0pF～3.999nF	1%+2 digits	0.0100	------
400pF	40.00pF~399.99pF	1.5%+2 digits	0.0150	Parallel
40pF	4.000pF~39.999pF	2%+5 digits	0.0200	Parallel
4pF	0.000pF~3.999pF	5%+10 digits	------	Parallel

Inductance L and quality factor

■ 100Hz/120Hz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
1000H	400.0H～999.9H	2.00%+3 digits	0.0200	Parallel
400H	40.000H～399.99H	0.60%+2 digits	0.0060	Parallel
40H	4.000H～39.999H	0.40%+2 digits	0.0040	Parallel
4H	400.0mH～3.9999H	0.40%+2 digits	0.0040	----
400mH	40.00mH～399.99mH	0.4%+2 digits	0.0040	Series
40mH	4.000mH～39.999mH	0.6%+3 digits	0.0060	Series

4mH	0uH～3.999mH	3.0%+5 digits	------	Series

1kHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
100H	40.00H～100.00H	2.0%+3 digits	0.0200	Parallel
40H	4.000H～39.999H	0.60%+2 digits	0.0060	Parallel
4H	400.0mH～3.9999H	0.40%+2 digits	0.0040	Parallel
400mH	40.00mH～399.99mH	0.4%+2 digits	0.0040	------
40mH	4.000mH～39.999mH	0.4%+2 digits	0.0040	Series
4mH	400.0uH～3.9999mH	1%+3 digits	0.0100	Series
400uH	0.0uH~399.9uH	3.0%+5 digits	------	Series

10kHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
1H	400.0mH～999.9mH	1.50%+3 digits	0.0150	Parallel
400mH	40.00mH～399.99mH	0.4%+2 digits	0.0040	Parallel
40mH	4.000mH～39.999mH	0.4%+2 digits	0.0040	------
4mH	400.0uH～3.9999mH	0.4%+2 digits	0.0040	Series
400uH	40.00uH~399.99uH	0.8%+3 digits	0.0080	Series
40uH	0.00uH~39.99uH	3.0%+5 digits	------	Series

■ 40kHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
1H	400.0mH～999.9mH	2.0%+4 digits	0.0200	Parallel
400mH	40.00mH～399.99mH	0.8%+2 digits	0.0080	Parallel
40mH	4.000mH～39.999mH	0.8%+2 digits	0.0080	------
4mH	400.0uH～3.9999mH	0.8%+2 digits	0.0080	Series
400uH	40.00uH~399.99uH	1.5%+3 digits	0.0150	Series
40uH	0.000uH~39.999uH	4.0%+5 digits	------	Series

Note*: please calculate the quality factor according to the formula to calculate the accuracy of Q.

■ 100kHz

Range	Range of display	Accuracy Le	Accuracy De	Equivalent mode

				recommended
100mH	40.00mH~399.99mH	2.5%+2 digits	0.0250	Parallel
40mH	4.000mH~39.999mH	1.5%+2 digits	0.0150	Parallel
4mH	400.0uH~3.9999mH	1.0%+2 digits	0.0100	------
400uH	40.00uH~399.99uH	1.0%+2 digits	0.0100	Series
40uH	4.000uH~39.999uH	1.5%+5 digits	0.0150	Series
4uH	0.000uH~3.999uH	4%+10 digits	------	Series

Impedance Z and phase angle θ

■ 100Hz, 120Hz, 1kHz, 10kHz

Range	Range of display	Accuracy Ze	Accuracy θ_e	Equivalent mode recommended
20MΩ	4.000MΩ~20.000MΩ	3.0%+10 digits	3.4°	Parallel
4MΩ	400.0kΩ~3.9999MΩ	1.2%+3 digits	0.7°	Parallel
400kΩ	40.00kΩ~399.99kΩ	0.3%+3 digits	0.2°	Parallel
40kΩ	4.000kΩ~39.999kΩ	0.25%+2 digits	0.1°	------
4kΩ	400.0Ω~3.9999kΩ	0.25%+2 digits	0.1°	Series
400Ω	40.00Ω~399.99Ω	0.25%+2 digits	0.1°	Series
40Ω	4.000Ω~39.999Ω	0.5%+3 digits	0.3°	Series
4Ω	0.4000Ω~3.9999Ω	2.0%+3 digits	1.1°	Series
0.4Ω	0.0000Ω~0.3999Ω	4.0%+3 digits	------	Series

■ 40kHz

Range	Range of display	Accuracy Ze	Accuracy θ_e	Equivalent mode recommended
20MΩ	4.000MΩ~20.000MΩ	7.0%+41 digits	4.0°	Parallel
4MΩ	400.0kΩ~3.9999MΩ	2.5%+3 digits	1.4°	Parallel
400kΩ	40.00kΩ~399.99kΩ	1.0%+4 digits	0.6°	Parallel
40kΩ	4.000kΩ~39.999kΩ	1.0%+4 digits	0.6°	------
4kΩ	400.0Ω~3.9999kΩ	0.5%+3 digits	0.3°	Series
400Ω	40.00Ω~399.99Ω	0.5%+3 digits	0.3°	Series
40Ω	4.000Ω~39.999Ω	0.7%+4 digits	0.4°	Series
4Ω	0.4000Ω~3.9999Ω	2.0%+6 digits	1.1°	Series
0.4Ω	0.0000Ω~0.3999Ω	5.0%+10 digits	------	Series

■ 100kHz

Range	Range of display	Accuracy Ze	Accuracy θ_e	Equivalent mode recommended
20MΩ	4.000MΩ~20.000MΩ	9.0%+20 digits	5.2°	Parallel

4MΩ	400.0kΩ~3.9999MΩ	4.0%+10 digits	2.3°	Parallel
400kΩ	40.00kΩ~399.99kΩ	1.5%+4 digits	0.9°	Parallel
40kΩ	4.000kΩ~39.999kΩ	1.0%+2 digits	0.6°	Parallel
4kΩ	400.0Ω~3.9999kΩ	0.7%+2 digits	0.4°	------
400Ω	40.00Ω~399.99Ω	0.7%+2 digits	0.4°	Series
40Ω	4.000Ω~39.999Ω	1.0%+5 digits	0.6°	Series
4Ω	0.4000Ω~3.9999Ω	3.0%+10 digits	1.7°	Series
0.4Ω	0.0000Ω~0.3999Ω	7%+20 digits	------	Series

8.3.4 Accuracy indicator [4](DCR)

Range	Range of display	Accuracy Re
20MΩ	10.00MΩ~20.00MΩ	5.0%+10 digits
10MΩ	4.000MΩ~9.999MΩ	2.0%+5 digits
4MΩ	400.0kΩ~3.9999MΩ	1.2%+3 digits
400kΩ	40.00kΩ~399.99kΩ	0.3%+3 digits
40kΩ	4.000kΩ~39.999kΩ	0.2%+2 digits
4kΩ	400.0Ω~3.9999kΩ	0.2%+2 digits
400Ω	40.00Ω~399.99Ω	0.2%+2 digits
40Ω	4.000Ω~39.999Ω	0.3%+3 digits
4Ω	0.400Ω~3.999Ω	1.0%+3 digits
0.4Ω	0.000Ω~0.399Ω	3.0%+3 digits

9. Maintenance

Warning: Do not arbitrarily repair the instrument; it should be maintained and repaired by professionals.
Warning: keep the instrument away from liquid; do not leave articles especially conductive objects in the instrument.

9.1. Overhaul

If the equipment fails and cannot be switched on, you should first check the battery and external power supply, power jack, etc.; check whether the key is invalid;

If the test result is abnormal, first check if the test accessories have problems, and if there is damage of the spring in the test notch; at the same time review the specification to confirm if the operation is correct;

Do not arbitrarily replace the components and specific parts, please contact the relevant dealer or service company for problems which cannot be confirmed,.

9.2 Clean

Before cleaning, it must be shut down, the battery and external power supply should

be removed.

Prevent water or other liquids from entering the instrument through the test slot, keys, or other joints, if it happens by accident, you should immediately stop using it and remove the power supply and battery.

Please clean with a soft cloth and diluted neutral detergent, and carefully wipe the dirty parts to prevent scratches on the surface.

After cleaning, the instrument should be completely dry before used.