

Digital LCR Meter User's Manual

(Fixed Frequency)

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1 Install

This chapter describes some of the checks you must make after you receive the instrument, and the conditions you must know and have before you install it.

1.1 Unpacking

Thank you for buying and using our products. After unpacking, you should first check whether the instrument is damaged due to transportation. We do not recommend you to power the instrument under the condition of appearance damage.

Confirm that the bridge is attached with the following accessories. Optional accessories need to be ordered separately. If any items are missing, please contact the nearest sales office.

The standard accessories:

- A kelvin clamp.
- A power cord.
- A user manual.

Optional accessories:

- RS232 cable.
- USB cable.
- Handler cable

1.2 Power supply

- (1) Voltage: AC220V±10% or AC110V ±10%, optional.
- (2) Frequency: 45Hz-65Hz.

Warning: in order to prevent leakage of electricity from harming the instrument or people, the user must ensure that the earth wire of the power supply is connected to the earth reliably.

1.3 Fuse

The instrument is factory fused, users should use the company's fuse.

1.4 Surrounding environment

- (1) Please do not use in the environment with many dust, vibration, direct sunlight and corrosive gas.
- (2) The normal operating temperature of the instrument is 0-40 °C, and the working humidity is 15%-85% RH.
- (3) The instrument has been carefully designed to reduce the clutter caused by AC power input, however, it should still be used in a low-noise environment as far as possible. If it cannot be avoided, please install a power filter.
- (4) Keep away from strong electromagnetic field during instrument measurement, so as to avoid interference to the measurement.

1.5 Use Kelvin clamp

Please use the Kelvin clamp provided by our company. The Kelvin clamp and the pin of the tested part should be kept clean to ensure the good contact between the tested part and the Kelvin clamp.

The Kelvin clamp is connected to the four test terminal of Hcur, Hpot, Lpot and Lcur in the front panel of the instrument. For a test part with a shielded case, the shield may be connected to the earthing terminal of the front panel of the instrument. Two terminals of Hcur and Hpot are connected to the red clamp, while two terminals of Lpot and Lcur are connected to the black clamp.

1.6 Warm-up

(1) In order to ensure the accurate measurement of the instrument, the startup warm-up time should be no less than 30 minutes.

(2) Do not turn on and off the power of the instrument frequently, which may cause internal data confusion.

1.7 Other characteristics of the instrument

(1) Power: Less than 20W.

(2) Dimensions: 265mm×105mm×305mm(width × height ×length).

2 Brief

This series digital bridge adopts 3.5-inch LCD, has friendly user interface and various measurement functions, supports multiple test frequencies and test levels, with basic accuracy up to 0.1%. USB and RS232 can facilitate remote operation. The Handler interface facilitates the automatic sorting of components.

This manual takes “C Type”(100kHz) as an example.

2.1 Basic features

- Measuring frequency up to 100 kHz.
- Level range (100-2000) mVrms.
- Internal bias voltage (0-1500) mV.
- Automatic identification of component type.
- Range can be automatically or locked.
- Support DC resistance, electrolytic capacitance measurement.
- Basic accuracy 0.1%.
- Support open, short calibration.
- Data recording function.
- 3.5-inch LCD, support English and Chinese interface.
- USB, RS232 communication interface, support SCPI communication protocol.
- Handler interface, support comparator sorting, list scan.

Table 2- 1

Model	A Type	B Type	C Type
Excitation source frequency (Hz)	10 points (100、120、200、400、800、1k、2k、4k、8k、10k)	12 points (100、120、200、400、800、1k、2k、4k、8k、10k、15k、20k)	16 points(100、120、200、400、800、1k、2k、4k、8k、10k、15k、20k、40k、50k、80k、100k)
Digits	Main parameter: 5 digits; secondary parameter: 5 digits		
Parameter	Main parameter: L/C/R/Z; secondary parameter: X/D/Q/θ/ESR		
Range(L)	0.001μH - 9999H		
Range(C)	0.001pF - 9999μF		
Range(R)	0.0001Ω - 99.99MΩ		

Basic Accuracy	0.1%
Measurement Display Speed	2 times/second (slow), 5 times/second (medium speed), 10 times/second (fast)
Internal Bias	0-1500mV adjustable, 1mV stepping
Test Level(Vrms)	100mV、300mV、600mV、1000mV、1500mV、2000mV
Correction Function	Open circuit correction, short circuit correction
Screening function	Tolerance range: -100% ~ +100%, with fixed points of 10%, 25% and 50%
Selection of comparator	Five gear sorting, third gear qualified, one gear failed, one ancillary gear
Communication Interface	Standard configuration: USB, RS232 (or 485), Handle interface; Optional: GPIB, USB Host
Others	Support DCR, electrolytic capacitor measurement mode, adjustable backlight brightness, optional in English and Chinese

3 Quick reference

3.1The front panel



Figure 3- 1Front panel schematic

Table 3- 1

number	instructions
1	The power switch
2	3.5-inch LCD.
3	Grounding and test terminals.
4	Basic function keys.

3.2 The rear panel

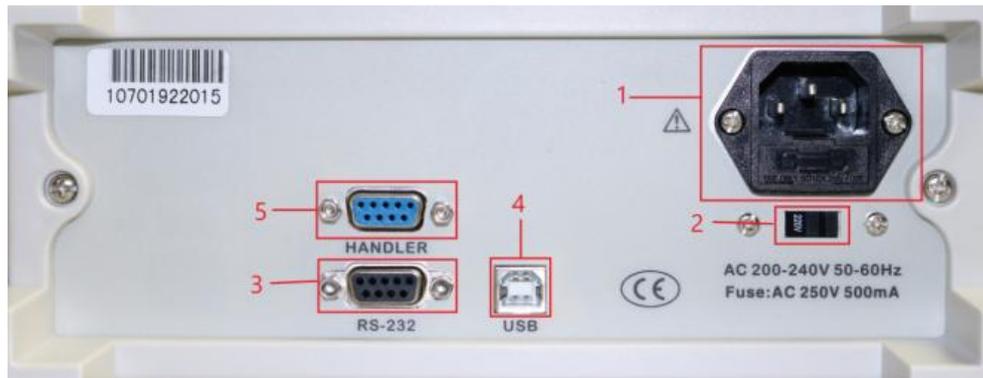


Figure 3- 2 Rear panel schematic

Table 3- 2

number	instructions
1	Power supply plug base and fuse case.
2	Voltage selector.
3	RS232 interface.
4	USB Device interface.
5	Handler interface

3.3 Keys

3.3.1 Power switch



Power switch: Press down to power on and pop up to power off.

3.3.2 The direction keys



Left and right direction keys to control cursor movement, up and down direction keys to select parameters.

3.4 Basic operations

- 1) Slide the voltage selector to select the voltage consistent with the power supply to be used. Example: the power supply to be used is 220V AC power, select the voltage selector to display 220V.
- 2) Connect the power supply.
- 3) Connect Kelvin clamp. Two terminals of Hcur and Hpot are connected to the red clamp, while two terminals of Lpot and Lcur are connected to the black clamp.
- 4) Press down the power switch, LCD of front panel light up.
- 5) Power on the default into the LCR measurement page. See figure 3-3. Where "--OL--" means the measurement data over the range.
- 6) Connect part to be measured to the kelvin clamp and start the measurement. Example: connect the resistance of about 1KΩ to the kelvin clamp, and the page is shown in figure 3-4.



Figure 3-3



Figure 3-4

3.5 LCR page



Figure 3-5 LCR page

1 Page title

Used to identify the page to display. LCR, DCR, ECA, COM SET, SYSTEM SET, LIST SCAN 6 pages.

The measurement page in the document refers to the pages of LCR, DCR, ECA.

2 Measurement conditions and parameter

3 Measurement result display

Main parameter is Rp, said parallel equivalent models to measure resistance, the measured results is 999.4 Ω; Secondary parameter is X, said the reactance, measuring result is 0.0567 Ω.

4 The message column

The LOCAL/REMOTE identification is displayed in the far right of the message column. The switch between local and remote needs to be carried out by SCPI command. In remote mode, the keyboard cannot be used. The instrument starts in local mode by default.

4 Basic function operation

4.1 Measurement conditions and parameters

4.1.1 Function



Figure 4- 1

Cp-D is displayed at the FUNC, as shown in figure 4-1. The first character "C" is the main parameter, represents capacitance measurement; the second character "p" represents parallel equivalent model; the last character "D" is the secondary parameter, represents loss factor.

4.1.1.1 Main parameter

The main parameters include AUTO, L (inductance), C (capacitance), R (resistance) and Z (impedance).

When selecting AUTO, the instrument will automatically judge whether the measurement is L, C or R according to the measured data. In this case, the secondary parameter cannot be set and the fixed combination is R-X, C-D and L-Q. The equivalent model is automatically switched according to the measurement data.

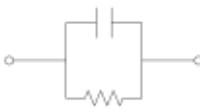
In the measurement page, Press  key to switch to the next main parameter (AUTO、R、C、L、Z) , Loop switching.

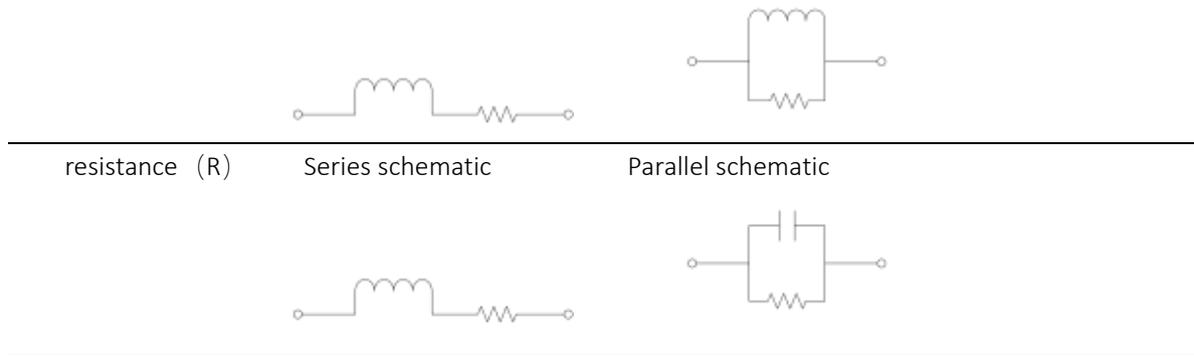
4.1.1.2 Equivalent model

Equivalent models include s (series) and p (parallel).

The actual inductance, capacitance and resistance are not ideal pure reactance or resistance parts. They are usually presented as a composite impedance element. Herein, the part to be measured is equivalent to a simple series or parallel model of two elements, then performs measuring and calculating.

Series/parallel model

	Series schematic	Parallel schematic
capacitance (C)		
inductance (L)	Series schematic	Parallel schematic



Note: generally, the series equivalent model is used for low impedance parts and the parallel equivalent model is used for high impedance parts.

In the measurement page, Press **AUTO /SER/PAL** key to switch the equivalent model (s、p) .

4.1.1.3 Secondary parameter

The secondary parameters include X (reactance), D (loss factor), Q (quality factor), θ (impedance Angle), and ESR (equivalent series resistance).

In the measurement page, Press **X/D/Q/ θ /ESR** key to switch to the next secondary parameter (X、D、Q、 θ 、ESR) , Loop switching.

4.1.2 Level

There are two ways to set the level.

Method one:

In the LCR page, move the cursor to the LEVEL item with the left and right keys, and then switch to the previous or next level point by pressing the up and down keys (100mV、300mV、600mV、1V、1.5V、2V) , Loop switching.

Method two:

In the LCR page, press **LEVEL** key to quickly switch to the next level point, Loop switching.

4.1.3 Bias

In the LCR page, move the cursor to the BIAS item with the left and right keys, press **ENTER** key to enter the input state. The page is shown in figure 4-2.



Figure 4- 2



Figure 4- 3

Display in the BIAS a current bias set (For example, if the front bias is 1V, the bias in the field is 1000mV), Select the numeric digit to be changed by left and right keys, and the selected digit will be displayed in reverse. Change the value of the digit by up and down keys (up keys +1, down keys -1). Press the key  to exit after setting.

4.1.4 Frequency

There are two ways to set the frequency.

Method one:

In the measurement page, move the cursor to the FREQ item with the left and right keys, and then switch to the previous or next frequency point by pressing the up and down keys (The fixed frequency point are:100Hz、120Hz、200Hz、400Hz、800Hz、1k、2k、4k、8k、10k、15k、20k、40K、50K、80K、100K) , Loop switching. The page is shown in figure 4-3.

Method two:

In the measurement page, press  key to quickly switch to the next frequency point, Loop switching.

4.1.5 Range

Instrument range can be set to automatic(AUTO) or locked(LOCK). When the measuring range is set to automatic, the instrument will automatically adjust the appropriate measuring range according to the impedance of the part to be measured. When locked, the range is locked at the current range.

In general, it is recommended to use automatic range. Range locked is used for batch testing in the factory to save the stable time of range switching. The usage is as follows: measure one of the part in the range automatically, then lock it in the current range and start batch measurement.

There are two ways to set the range.

Method one:

In the measurement page, move the cursor to the RANGE item with the left and right keys, and then switch by pressing the up and down keys (LOCK、AUTO) .

Method two:

In the measurement page, press  key to quickly switch.

4.1.6 Output impedance

The output impedance is the output impedance of the excitation source, the instrument provides two choices: 30 Ω and 100 Ω . By default, the output impedance is 100 Ω .

When output impedance select 30 Ω and the measured impedance is small, overcurrent may occur. As shown in figure 4-4, the main parameter location "-- OC --".

In the measurement page, move the cursor to the ROUT item with the left and right key, then by up and down key switch output impedance (30 Ω 、100 Ω).



Figure 4-4



Figure 4-5

4.1.7 Speed

There are two ways to set the measurement speed.

Method one:

In the measurement page, move the cursor to the SPEED item with the left and right keys, and then switch to the next speed point by pressing the up and down keys (FAST、MED、 SLOW) , Loop switching.

Method two:

In the measurement page, press **SPEED** key to switch to the next speed point, Loop switching.

4.2 DCR mode

Press **DCR** key enter DC resistance measurement mode and press again to exit. The page is shown in figure 4-5. The level, bias and frequency cannot be changed in DC resistance measurement mode.

DC resistance mode measures the DC impedance of coils, transformers, etc.



Figure 4-6



Figure 4-7

4.3 Electrolytic capacitor mode

Press **-|(-)** key enter electrolytic capacitor mode and press again to exit. The level and bias cannot be changed in electrolytic capacitor mode. The page is shown in figure 4-6.

It is necessary to pay attention to the connection polarity of electrolytic capacitor to be measured. The red clamp is connected to the positive electrode of electrolytic capacitor; the black clamp is connected to the negative electrode of electrolytic capacitor.

4.4 Δ function

In the measurement page, Press  key to turn on/off the Δ function.

When the Δ function is turned on, the instrument records the main parameter of the measured value at the time of turning on as the reference value and displays it at the position of the secondary parameter. The position of the main parameter displays the difference between the current measured value and the reference value. The page is shown in figure 4-7.

4.5 Data retention function

Press  key to turn on the data retention function, as shown in figure 4-8, the red "HOLD" is displayed in the upper right corner of the page and flashes, and the page data remains unchanged.

Press  key again to turn off the data retention function.



Figure 4- 8



Figure 4- 9

4.6 Data recording function

Press  key to show maximum, Press again cancel display. Press  key to show minimum, Press again cancel display. Press  key to show average. Press again cancel display. The page is shown in figure 4-9. The third column of the message column displays MAX (maximum value), MIN (minimum value), AVG (average value) label and data units, and the fourth column displays the corresponding data. The message column data in figure 4-9 shows that the maximum value is 1.5818pF, which is the maximum value of all measured data (main parameter) from the moment when the  key is pressed down to the current.

4.7 Calibration

Open and short circuit calibration is used to eliminate the measurement error introduced by the distributed parameters of the instrument and fixture. Open-circuit calibration is usually performed before large impedance measurements and short-circuit calibration before small impedance measurements. If

accurate measurements will be made, it is recommended to perform open and short circuit calibration prior to measurement.

4.7.1 Open circuit calibration

Open the test clamp (red and black clamps are not connected to any element). Stay away from human body and interference source more than 10 cm. Press **CAL** key to enter calibration, the page is shown in figure 4-10. As the calibration progresses, the right side number is automatically reduced by 1 until it is reduced to 0. When calibration is completed, the beep will give a alert and then automatically return to the measurement page.



Figure 4- 10



Figure 4- 11

4.7.2 Short circuit calibration

Short circuit the test clamp (red and black clamps together), Press **CAL** key to enter calibration, (The system automatically identifies open circuit, short circuit, both are not: display blank, two beeps of notes) ,The page is shown in figure 4-11, As the calibration progresses, the right side number is automatically reduced by 1 until it is reduced to 0. When calibration is completed, the beep will give a alert and then automatically return to the measurement page.

5 System settings

5.1 SYSTEM SET page

In the measurement page. Press the key **SET** to enter the SYSTEM SET page. The SYSTEM SET page has two pages, see figure 5-1 and figure 5-2. Left and right keys can move the cursor and turn pages.

Press **SET** again to exit the SYSTEM SET page.



Figure 5- 1

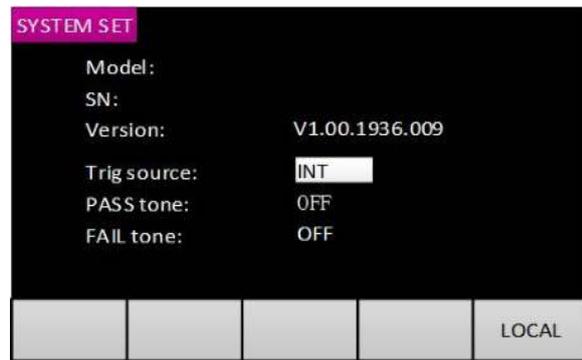


Figure 5- 2

5.2 System parameters

The options of system parameters is shown in the table below.

Table 5- 1

Items	Options
Language	中文/English
Brightness	30%,50%,70%,100%
Power on	Default set, Last set
Beep	OFF / ON
TRIG source	INT, MAN, EXT
PASS tone	Long, Short, Off
FAIL tone	Long, Short, Off

5.2.1 Language

Move the cursor to "Language" item by left and right keys, and select language (English, 中文) by up and down keys.

5.2.2 Brightness

Move the cursor to "Brightness" item by left and right keys, and select backlight brightness (30%, 50%, 70%, 100%) by up and down keys. Loop switching.

5.2.3 Power on

Move the cursor to "Power on" item by left and right keys, and select power on (Default set, Last set) by up and down keys.

When the power on is set to the Last value, the function, level, frequency, bias, range, output impedance and measurement speed of the measurement page are the setting parameters when the power off. If "Power on" is set to the Default set, these parameters revert to the default value.

5.2.4 Beep

Move the cursor to "Beep" item by left and right keys, and switch beep (OFF, ON) by up and down keys.

When switch beep on, a beep with a key (a short sound), switch beep off, no beep with a key. This parameter mainly controls the beep of the key, and has no effect on beep of notes and alerts.

5.2.5 TRIG source

Move the cursor to the "TRIG source" item by left and right keys., then switch the trigger source (INT, MAN, EXT) by the up and down keys. Loop switching.

When set as INT, trigger signal is generated inside the instrument. When the trigger source is set to MAN, press the "TOL%" key of the front panel to generate a trigger signal manually. When the trigger source is set to EXT, the Handler interface receives the trigger signal. Every time it is triggered, the data is updated.

When the trigger source selects MAN or EXT, exit SYSTEM SET and return to the measurement page, as shown in figure 5-3. The trigger mode is displayed in the first column of the message column, which represents MAN trigger. Press the "TOL%" key of the front panel each time to generate a trigger signal and then update the result data. A blank or last measured value is displayed at the page before the data is updated.



Figure 5-3

5.2.6 PASS tone

Move the cursor to the "PASS tone" item with the left and right keys, then switch the PASS tone style (Long, Short, Off) by the up and down keys. Loop switching. Each trigger signal with one beep, long style for 80 ms, short for 20 ms.

5.2.7 FAIL tone

Move the cursor to the "FAIL tone" item with the left and right keys, then switch the FAIL tone style (Long, Short, Off) by the up and down keys. Loop switching. Each trigger signal with one beep, long style for 80 ms, short for 20 ms.

6 Comparator

The comparator function is used for inspection of warehousing, and for the measurement, discrimination of components on production line. Together with the use of Handler interface, make it suitable for automatic sorting measurement system.

6.1 Comparator parameter setting

6.1.1 Nominal value

Step 1: In the measurement page, place the reference part on the instrument test clamp for measurement.

Step 2: Press **COMPARE** key to enter the COM SET page, the cursor position defaults to the "Nom" item, Nominal value obtained by taking 4 significant digits of reference part's value.

If the nominal value needs to be adjusted, move the cursor to the "Nom" item with the left and right key and press the key **ENTER** to enter input state, Select the numeric digit to be changed by left and right keys, and the selected digit will be displayed in reverse. Change the value of the digit by up and down keys (up keys +1, down keys -1). Press the key **ENTER** to exit after setting.

Note: every time you enter the COM SET page, the nominal value will be updated according to the current measurement value.

6.1.2 Comparator switch

Method one: In the COM SET page, move the cursor to the "Comp" item with the left and right keys, and then ON/OFF the comparator by the up and down keys.

Method two: In the measurement page, move the cursor to the "Comp" item with the left and right keys, and then ON/OFF the comparator by the up and down keys.

6.1.3 Tolerance

Method one:

Use the left and right keys to move the cursor to the Low and High limits of the set classification row(1, 2, 3, 2nd), press up and down keys to select the next tolerance point.. (-50%、-25%、-10%、0%、10%、25%、50%) . Loop switching.

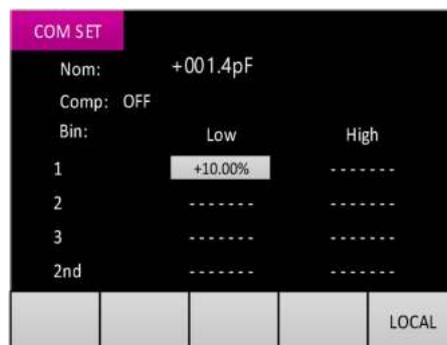


Figure 6- 1

Method two:

Use the left and right keys to move the cursor to the Low and High limits of the set classification row(1, 2, 3, 2nd), press **ENTER** to enter input state. (set range : -99.99%~+99.99%, resolution :0.01%) . Setting method can refer to bias input state setting.

Note: Press the key **SAVE** to store currently setting. and the setting after power down is not lost.

6.2Sorting mechanism

The machine provides five levels (BIN:1, BIN:2, BIN:3, BIN:AUX, BIN:OUT) for sorting. The sorting process is shown in figure 6-2. P is the main parameter of the measurement result, P_{n_L} is the low limit of the main parameter of n level (n=1,2,3), P_{n_H} is the high limit of the main parameter of n level

($n=1,2,3$), 2nd is the measurement result of the secondary parameter, 2nd_L is the low limit of the secondary parameter, and 2nd_H is the high limit of the secondary parameter.

When the main parameter of the measurement results meets the first level and the secondary parameter passes, the sorting result is BIN:1.

When the measurement results show that the main parameter does not meet the first level, but the second level, and the secondary parameter passes, the sorting results are BIN:2.

When the measured results show that the main parameters do not meet the first and second levels, but meet the third level, and the secondary parameters passes, the sorting results are BIN:3.

When the main parameters of measurement results do not meet the first, second and third levels, the sorting results are BIN:OUT.

When the main parameters of the measured results meet the first, second or third levels, and the secondary parameters does not pass, the sorting result is BIN:AUX.

When the comparator is opened, the sorting results are displayed on the measurement page, as shown in figure 6-3. At the same time, the sorting results are output through the Handler interface.

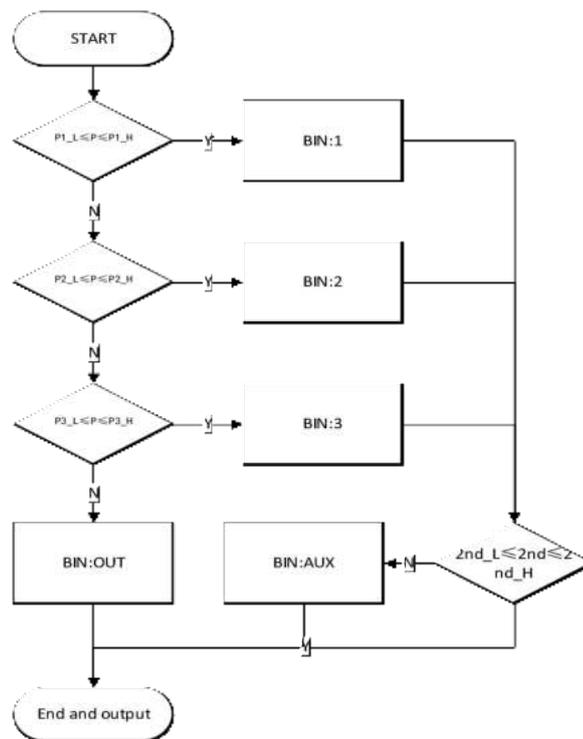


Figure 6-2



Figure 6-3

If the result of sorting is BIN:1, BIN:2, BIN:3, BIN:AUX file, the beep alert will prompt according to the PASS tone setting in the system setting. If the sorting result is BIN:OUT, a beep alert will prompt according to the FAIL tone setting in the system Settings.

7 List scan

The list scan function is mainly used to test the same part at different frequencies.

7.1 Parameter setting and operation

Step 1: Enter the LIST SCAN page.

In the LCR page, move the cursor to LIST item with the left and right keys, as shown in figure 7-1. Press the up and down keys to enter the LIST SCAN page, as shown in figure 7-2.

Note: When the FUNC item is AUTO, the LIST SCAN page cannot be entered.



Figure 7- 1



Figure 7- 2

Step 2: Set the scan mode.

On the LIST SCAN page, move the cursor to "Mode" item with the left and right keys, and switch modes by the up and down keys.

There are two modes, Seq and Step.

With the setting Seq, each start signal will automatically complete all measurement and comparison of sequence number 1-7.

With the setting Step, each start signal completes the measurement and comparison of the current sequence number. The current sequence number increased by 1 (if the current sequence number is 7, the sequence serial number becomes 1).

Step 3: Set parameters.

The parameters that can be set for each sequence number include frequency, high limit and low limit.

Setting of Low and High limits: As shown in figure 7-3, move the cursor to the high or low limit field to be set and press the key **ENTER** to enter input state. Select the numeric digit to be changed by left and right keys, and the selected digit will be displayed in reverse. Change the value of the digit by up and down keys (Up key value increases by 1, down key value decreases by 1). Press the key **ENTER** to exit after setting.

In the non-input state, press the up and down key to disable the field and display as "-----".

SCAN SET						
FUNC: Cp-D		LIST: ON		Mode: Seq		
Num	Freq	Low	High	Meas va	Comp	
1	001000	+000.0	-----	-----	--	
2	-----	-----	-----	-----	--	
3	-----	-----	-----	-----	--	
4	-----	-----	-----	-----	--	
5	-----	-----	-----	-----	--	
6	-----	-----	-----	-----	--	
7	-----	-----	-----	-----	--	

Figure 7-3

SCAN SET						
FUNC: Cp-D		LIST: ON		Mode: Seq		
Num	Freq	Low	High	Meas va	Comp	
1	001000	+1.426 p	+1.429 p	+1.428 p	I	
2	-----	+1.426 p	1.429 p	-----	--	
3	002000	+1.426 p	-----	+1.428 p	I	
4	003000	+1.429 p	-----	+1.428 p	L	
5	004000	-----	+1.426 p	+1.428 p	H	
6	-----	-----	-----	-----	--	
7	010000	-----	-----	+1.428 p	--	

Figure 7-4

The frequency setting is consistent with the frequency setting of the measurement page. In the non-input state, a disable option is added to the frequency options and displayed as "-----".

Step 4: Start scan.

It can be started by the external signal line (trigger signal of Handler) or by pressing the key TOL%. In this case, the internal trigger source(INT) is used, regardless of the TRIG source setting in SYSTEM SET page.

After each measurement and comparison, the measurement value and comparison result are displayed on the right side of the current sequence number row, as shown in Figure 7-4.

The comparison result is I, the measured value is within the low and high limits.

The comparison result is H, the measured value is higher than the high limit.

The comparison result is L, the measured value is lower than the low limit.

Note: when the frequency field is set to disable option, the current sequence number will be skipped directly. If both the high and low limits are in the disable state, there is no comparison result, which is displayed as "--".

Step 5: Output the scanning result in the Handler interface.

The list scan results can be output through the Handler. The comparison results of sequence number 1, 2, 3 and 7 can be directly output through the Handler. At the same time, the overall scan results of sequence number 1-7 can also be output through the Handler. At this time, as long as comparison results of H and L appear in sequence number 1-7, it will be judged as the overall unqualified. Clear all scan results each time the measurement of sequence number 1 is started. See 9.3 Handler interface for specific output signals and pins.

The list scan result can also give the beep prompt, the comparison result is I, and the beep prompt is based on the PASS tone setting; the comparison result is H, L, the beep prompt is based on the FAIL tone setting. The overall scan result are given in Seq mode, and the comparison results of current sequence numbers are given in Step mode.

Step 6: Exit the LIST SCAN page.

In the LIST SCAN page, move the cursor to the "LIST" item with left and right keys, and exit the LIST SCAN page by the up and down keys.

8 Characteristics

8.1 Basic accuracy

The following data were measured under the following conditions:

Temperature condition: 23°C ± 5°C

Humidity conditions: ≤ 65% R.H.

Calibration: open circuit and short circuit calibration before measurement

Warm-up time: >30 minutes

$$C: 0.10\% * (1 + C_x/C_{max} + C_{min}/C_x) (1 + D_x) (1 + k_s + k_v + k_f);$$

$$L: 0.10\% * (1 + L_x/L_{max} + L_{min}/L_x) (1 + 1/Q_x) (1 + k_s + k_v + k_f);$$

$$Z: 0.10\% * (1 + Z_x/Z_{max} + Z_{min}/Z_x) (1 + k_s + k_v + k_f);$$

$$R: 0.10\% * (1 + R_x/R_{max} + R_{min}/R_x) (1 + Q_x) (1 + k_s + k_v + k_f);$$

$$D: \pm 0.0010 * (1 + Z_x/Z_{max} + Z_{min}/Z_x) (1 + D_x + D_x * D_x) (1 + k_s + k_v + k_f);$$

$$Q: \pm 0.0010 * (1 + Z_x/Z_{max} + Z_{min}/Z_x) (Q_x + 1/Q_x) (1 + k_s + k_v + k_f);$$

Among them:

- 1 . L, C, R and Z are relative errors. D, Q are absolute errors.
- 2 . Where the subscript is x, is the measured value of this parameter; where the subscript is Max, is the maximum value; and min is the minimum value.
- 3 . Ks is the speed factor, kv is the voltage factor and kf is the frequency factor.

The maximum and minimum values of measurement parameters that affect accuracy, as shown in the following table.

Table 8- 1

frequency (Hz)	100	120	200	400	800	1K	2K	4K	8K
Cmax	15.9	13.25	7.95	3.98	1.99	1.59	0.795	0.398	0.199
Cmin	15.9	13.25	7.95	3.98	1.99	1.59	0.795	0.398	0.199
Lmax	159	132.5	79.5	39.8	19.9	15.9	7.95	3.98	1.99
Lmin	159	132.5	79.5	39.8	19.9	15.9	7.95	3.98	1.99
Z/Rmax	100000								
Z/Rmin	100								
frequency (Hz)	10K	15K	20K	40K	50K	80K	100K		
Cmax	0.159	0.106	0.0795	0.0398	0.0318	0.0199	0.0159		
Cmin	0.159	0.106	0.0795	0.0398	0.0318	0.0199	0.0159		
Lmax	1.59	1.06	0.795	0.398	0.318	0.199	0.159		
Lmin	1.59	1.06	0.795	0.398	0.318	0.199	0.159		
Z/Rmax	100000								
Z/Rmin	100								

Where, the unit of Cmax is uF; The unit of Cmin is nF. Lmax is in H; The unit of Lmin is mH. Zmax/Rmax, Zmin/Rmin unit is Ω;

Measurement speed factor ks:

speed	slow	middle	fast
ks	0	1	3

Measurement Frequency factor kf:

freq (Hz)	100-1K	2K-10K		15K	20K	40K-100K
kf	0	0.5		1		4

Measurement level error factor kv:

level (mV)	100	300	600	1000	1500	2000
kv	9	3	1	0	1	2

8.2 Accuracy diagram

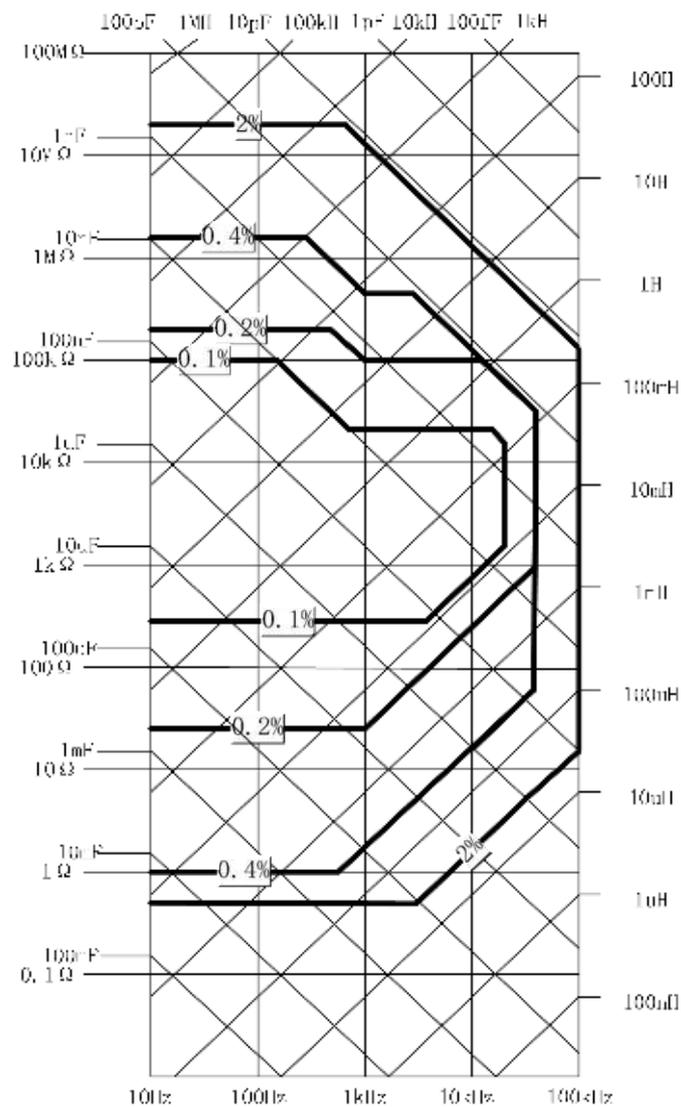


Figure 8-1

1Vrms, slow measurement.

8.3 DCR measurement accuracy

Range	Display range	Accuracy Re
100MΩ	20.00MΩ-99.99MΩ	10.0%+20 count
20MΩ	10.00MΩ-20.00MΩ	5.0%+10 count
10MΩ	4.000MΩ-9.999MΩ	2.0%+5 count
4MΩ	400.0kΩ-3.9999MΩ	1.2%+3 count
400kΩ	40.00kΩ-399.99kΩ	0.3%+3 count
40kΩ	4.000kΩ-39.999kΩ	0.2%+2 count
4kΩ	400.0Ω-3.9999kΩ	0.1%+2 count
400Ω	40.00Ω-399.99Ω	0.2%+2 count
40Ω	4.000Ω-39.999Ω	0.3%+3 count
4Ω	0.400Ω-3.999Ω	1.0%+5 count
0.4Ω	0.000Ω-0.399Ω	3.0%+10 count

8.4 Excitation source

8.4.1 frequency

10Hz-100kHz, $\pm 0.02\%$ of reading

8.4.2 level

100mVrms -2000mVrms , $\pm 10\%$ of reading

8.4.3 Bias

0mV-1500mV, $\pm(5\%$ of reading+20mV)

8.4.4 Output impedance

100 Ω /30 Ω $\pm 1\%$ of reading

9 External interface instructions

9.1 The USB interface

USB communication interface to achieve online communication with the computer. (reference SCPI part of communication protocol).

9.2 RS232 interface

9.2.1 RS232C interface introduction

Using asynchronous serial communication, the serial interface of the instrument is not strictly based on RS-232 standard, but only provides a minimal simplified subset. As shown in table 9-1, sending and receiving data is relative to the machine.

Table 9- 1

Single	Abbreviations	Pin
Send	TXD	3
Receive	RXD	2
Ground	GND	5

RS232C connector use black DB9 hole standard socket, pin sequence is shown in figure 9-1:

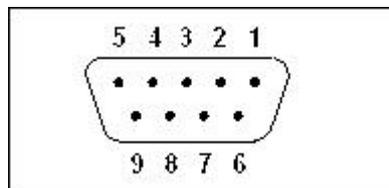


Figure 9- 1

Note: To avoid electrical shock, switch off the power when you plug and unplug the connector;

Note: Do not arbitrarily short connect the output terminal, or short connect with the housing, so as to avoid damage to the instrument.

9.3 Handler interface

The desktop bridge provides the user with a Handler interface that supports the output of the comparator sorting results and the output of the list scan results.

9.3.1 Technical description

Output signal: low effective, open collector output, Opto-couplers isolation.

Input signal: Opto-couplers isolation

DC power supply voltage supported by power pin: 3V-25V

9.3.2 Pin definition

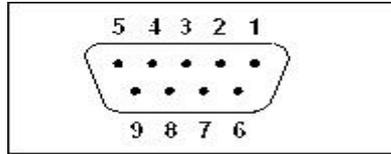


Figure 9- 2

The Handler interface uses blue DB9 hole standard socket, specific pin definitions and locations, as shown in figure 9-2 and table 9-2.

The following table "/" separates the output signals of the comparator and the list scan. If the comparator and the list scan have the same signal name, there is only one signal name.

Table 9- 2

pin	name	attribute	Describe
1	nBIN1	Output	Comparator function, result output, BIN:1; List scan function, result output of sequence number 1. if the comparison result is H or L, then output effective signal.
2	nBIN3	Output	Comparator function, result output, BIN:3; List scan function, result output of sequence number 3. if the comparison result is H or L, then output effective signal.
3	nAUX_BIN/ nBIN7	Output	Comparator function, result output, BIN :AUX; List scan function, result output of sequence number 7. if the comparison result is H or L, then output effective signal.
4	nEXT_TRIG	Input	External trigger signal, rising edge trigger. The high level voltage should be consistent with the external DC power source.
5	EXTCOM1	Ground	Reference ground for external DC power supply and output signal.
6	nBIN2	Output	Comparator function, result output, BIN:2; List scan function, result output of sequence number 2. if the comparison result is H or L, then output effective signal.
7	nOutOfBINs	Output	Comparator function, result output, BIN:OUT; List scan function, Overall comparison result, After startup, as long as one result of all sequence numbers is H or L, output effective signal.
8	nEOM	Output	End of Measurement signal.
9	EXTDC1	Power	External DC power source. Reference ground is EXTCOM1

9.3.3 Sequence diagram

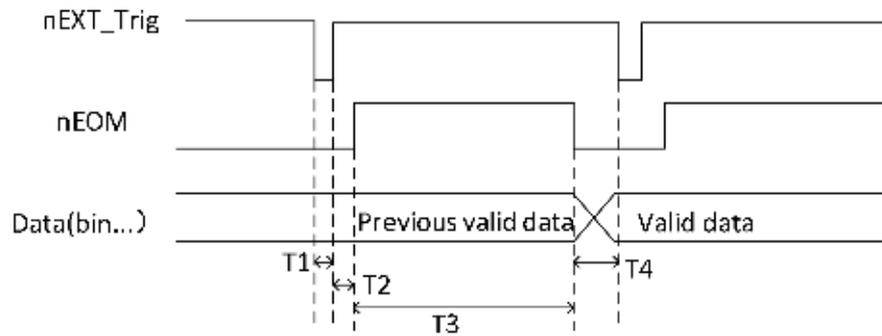


Figure 9- 3

Table 9- 3

Time	The minimum value	The largest number
T1	1ms	----
T2	----	Time of measurement
T3	Time of measurement	Time of measurement +1ms
T4	0	----

The value of one measurement time in the table is judged by the speed, for example, non-DCR mode, slow speed, and one measurement time is 0.5s.

10 SCPI Command reference

A little. (If necessary, please contact the manufacturer to ask for it.)

11 Precautions and warranty

11.1 Packaging

The measuring instrument should be packed with plastic bags together with accessories, spare parts, instruction manual and product qualification certificate in the strong packing case which is dustproof, shockproof and moisture-proof.

11.2 Transportation

The measuring instrument should be handled carefully in the transportation process, and be protected against moisture and rain.

11.3 The storage

The measuring instrument should be stored in the ventilation room with ambient temperature of 5°C-40°C and relative humidity of 15% to 85%RH. The air should not contain harmful impurities that corrode the measuring instrument.

11.4 The warranty

This instrument maintenance must be professional and technical personnel, otherwise the instrument damage or precision loss does not belong to the scope of warranty.

Please do not replace the internal components of the instrument during maintenance. The instrument must be re-measured and calibrated after maintenance.