OPERATION MANUAL

LCR-2100/2200

LCR Meter

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Announcement

The description of the manual may not cover all contents of the instrument, and our company is subject to change and to improve the performance, function, inner structure, appearance, accessory and package of the instrument without notice. If there is puzzle caused by inconsistency of manual and instrument, then you can contact with our company by the address on the cover.

Chapter 1 Out of Box Audit

When you receive the instrument, some inspections are necessary, and the condition must be understood and available before installing the instrument.

1.1 To Inspect the package

Inspect the shipping container for damage after unpacking it. It is not recommended to power on the instrument in the case of a damaged container.
If the contents in the container do not conform to the packing list, notify us or your dealer.

1.2 Power connection

1) Power-supplying voltage range: 198~242Vac.
2) Power-supplying frequency range: 47~63Hz.
3) Power-supplying power range: not less than 80VA.
4) Power supplying input phase line L, zero line N, ground lead E should be as same as the power plug of the instrument.
5) After careful design, the instrument can reduce the clutter jamming caused by AC power terminal input, however, it should be used under the environment with low-noise. Please install power filter if being unavoidable.

Warning: In order to prevent user and instrument from being hurt by leakage, it is necessary for user to guarantee the ground line of supply power being reliably grounded.

1.3 Fuse

The instrument has installed fuse, so operators should use the installed fuse of our company.

Warning: Be sure that the location of fuse is consistent with power-supplying voltage range before charging.

1.4 Environment

1) Please do not operate the instrument in the place that is vibrative, dusty, under direct sunlight or where there is corrosive air.

2) The normal working temperature is 0℃～40℃, relative humidity ≤75%, so the instrument should be used under above condition to guarantee the accuracy.
3) There is heat abstractor on the rear panel to avoid the inner temperature rising. In order to keep good airiness, please don't obstruct the left and right airiness holes to make the instrument maintain the accuracy.
4) Although the instrument has been specially designed for reducing the noise caused by ac power, a place with low noise is still recommended. If this cannot be arranged, please make sure to use power filter for the instrument.
5) Please store the instrument in the place where temperature is between 5℃ and 40℃, humidity is less than 85%RH. If the instrument will not be put in use for a time, please have it properly packed with its original box or a similar box for storing.
6) The instrument, especially the test cable should be far from strong electro-magnetic field, to avoid the jamming on measurement.

1.5 Use of Test Fixture

Please use the accessory test fixture or cable, **the test fixture made by user or from other company may cause the incorrect measurement result**. The test fixture or cable should be kept clean, as well as the pin of DUT, thus to guarantee the good connection between DUT and fixture.
Connect the fixture or cable to four test terminals Hcur, Hpot, Lcur, Lpot on the front panel. As for the DUT with shielding shell, connect shielding layer or ground "⊥".
Note: When test fixture or cable has not being installed, the instrument will display an unstable test result.

1.6 Warm-up

1) To guarantee the accurate measurement, the warm-up time is no less than 15min.
2) Please not turn on or off instrument frequently, in order to avoid the inner data fluster.

1.7 Other features

1) Power: consumption power≤80VA.
2) Dimension (W*H*D): 235mm*105mm*360mm
3) Weight: About 3.6 kg.

Chapter 2 Introduction

In this chapter, the basic operation features of LCR-2100 series are described. Please read the content carefully before using LCR-2100 series instruments, thus you can learn the operation of LCR-2100.

2.1 Introduction to front panel

Figure 2-1 shows the front panel of LCR-2100.

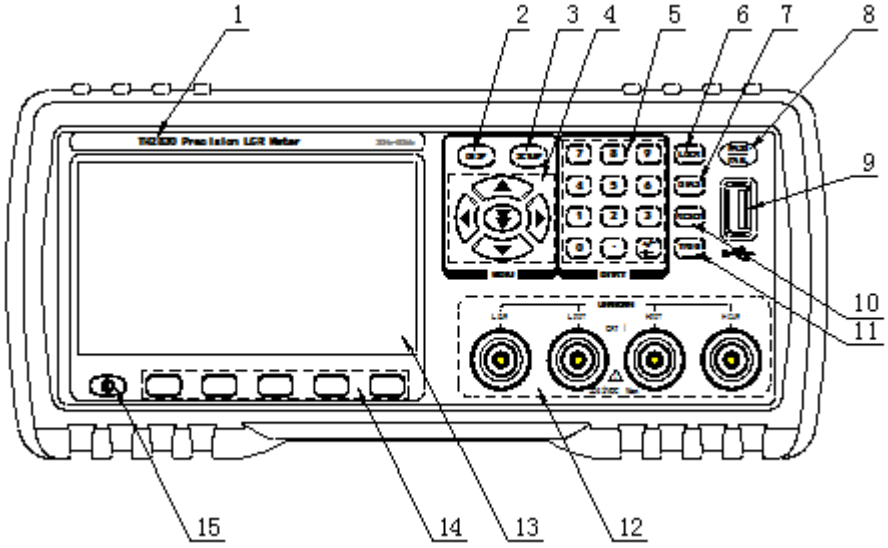


Figure 2-1 Front panel

1) Brand and model
   Brand and model.

2) [DISP]
   Press this key to enter into the corresponding measurement display page of instrument functions.

3) [SETUP]
   Press this key to enter into the corresponding measurement setup page of instrument functions.

4) CURSOR
   This key is used to move the cursor on the LCD displayed page. When the cursor moves to a zone, the corresponding zone will be lightened.

5) Numerical keys
   These keys are used to input data to the instrument. The key consists of numerical keys [0] to [9], decimal point [.] and [+/-] key.
   (NOTE: long press [.] key is equivalent to copying screen function)

6) [KEYLOCK]

Press [KEYLOCK], it will be lighted, which means the function of current panel is locked. Press it again, it will be off, which means discharging the lock status. If the password function is ON, it means correct password is necessary when discharging the key-lock, or the key cannot be unlocked.

When the instrument is controlled by RS232, [KEYLOCK] will be lighted. Press [KEYLOCK] again, it will be off, which means returning to the local discharging lock status.

7) [BIAS]

[BIAS] is used to permit or forbid the output of 0-50mA/5V DC bias source. Press this key, it will be lighted which means DC bias output is permitted. Press this key once more, it will be off which means DC bias output is prohibited. The key is useless in some pages where the DC BIAS cannot be added. (**No this function in LCR-2100 and LCR-2200**). When the FUNC is set as DCR, Lp-Rd, Ls-Rd, this function is invalid.

8) PASS/FAIL indicator

PASS LED indicator shows the test result has passed.

FAIL LED indicator shows the test result has failed.

9) USB HOST interface

Connect U flash disk so as to save or load the file.

10) [RESET]

Press this key to stop scanning only in transformer automatic scanning. No operation will be executed on other pages.

11) [TRIGGER]

When the trigger mode is set to MAN mode, press this key to trigger the instrument.

12) Test terminals (UNKNOWN)

4-teminal test pair is used to connect 4-terminal test fixture or cable to measure DUT.

The 4 terminals are respectively as follows: Hcur, Hpot, Lpot and Lcur.

13) LCD

480*272 colorful TFT LCD displays measurement results and conditions.

14) Soft keys

Five soft keys are used to select parameters. The corresponding function of each soft key has been displayed above. The function definition varies with different pages.

15) POWER

Power switch

2.2 Introduction to rear panel

Figure 2-2 shows the rear panel of LCR-2100.

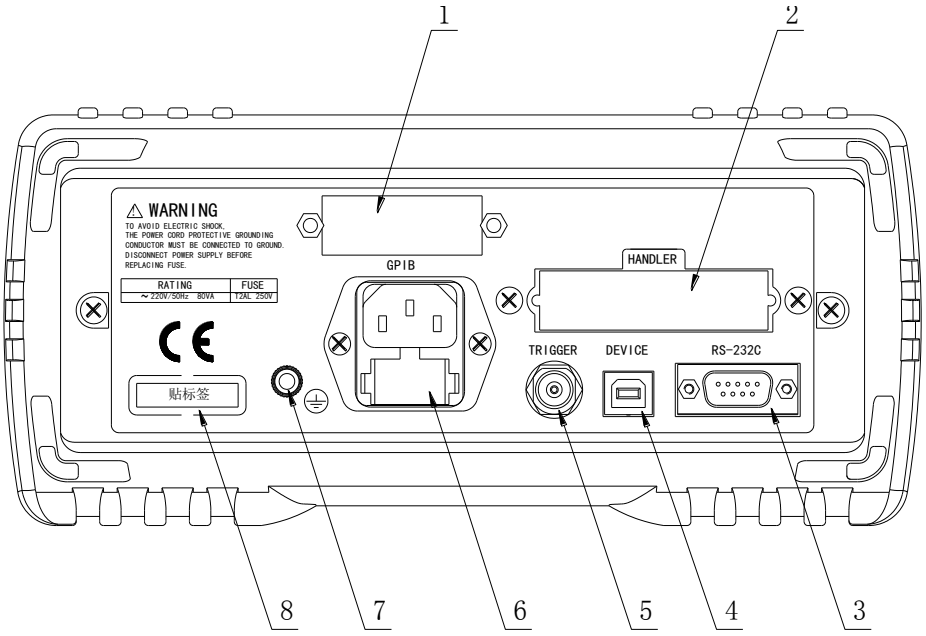


Figure 2-2 Rear panel

1) IEEE-488 (GPIB) interface
   The tester can communicate with PC through GPIB interface.

2) HANDLER interface
   Handler interface is used to realize the sorting output of test results.

3) RS232C interface
   Series communication interface can realize the communication with PC.

4) USB DEVICE interface
   The tester can communicate with PC through the USB DEVICE interface.

5) TRIGGER interface
   The tester can communicate with foot control and other external trigger devices.

6) Power socket
   Input AC power.

7) Ground terminal
   The ground terminal is connected with instrument casing, being available for protecting or shielding ground connection.

8) Nameplate

Information about production date, instrument number and manufacturer etc..

Warning: Be sure that the direction of fuse is accordant with power-supply voltage range before charging.

2.3 Introduction to display zone

LCR-2100 applies a 65k, 4.3-inch TFT display. The display screen is divided into the following zones:

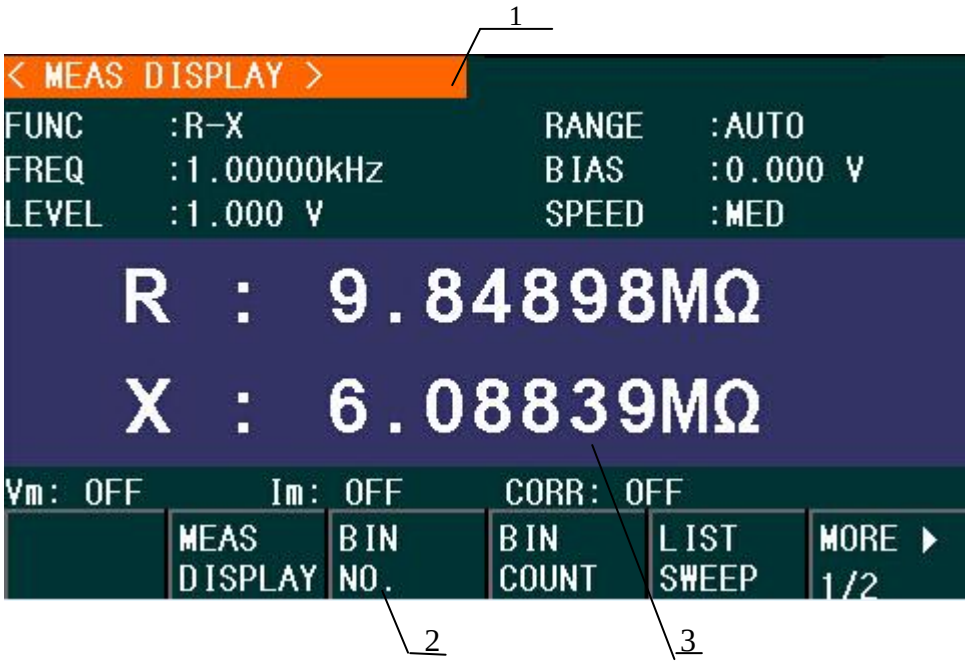


Figure 2-3 display zones

1) Display page name
   Indicate the name of the currently displayed page.
2) Soft keys
   The zone is used to display the function definition of soft key. The definition of soft key can be different as the difference of cursor's direction in the zone.
3) Test result/ condition display zone
   In this zone, test result information and current condition are displayed.

2.4 Main menu keys and corresponding displayed pages

2.4.1 [DISP]

When the LCR function is active, press this key-**[DISP]** to enter into the LCR measurement display page, the following soft keys will be displayed in the soft key zone.

<MEAS DISPLAY>
<BIN NO.>
<BIN COUNT>
<LIST SWEEP>
MORE ▶
1/2
<FILE MANAGE>
<SAVE LOG>
MORE ▶
2/2

NOTE: < SAVE LOG> key is valid in <MEAS DISPLAY> and <LIST SWEEP> interface. Press < SAVE LOG > after inserting the USB disk, the state changes to ON and the test data will be saved in .CSV format to the CSV directory in U disk. Press < SAVE LOG> again, the state changes to OFF and data storage is finished.

The instrument will automatically record the test data after inserting the USB disk in MEAS interface.

2.4.2 [SETUP]

When the LCR function is active, press this key-**[SETUP]**, the following soft keys will be displayed in the soft key zone on the LCR measurement setup page.

<MEAS SETUP>
<CORRECTION>
<LIMIT TABLE>
<LIST SETUP>
MORE ▶
1/2
<FILE MANAGE>
<SYSTEM SETUP>
<TOOLS>
MORE ▶
2/2

2.4.3 [SYSTEM SETUP]

This key-**[SYSTEM SETUP]** is used to enter into the system setup page. The following soft keys will be available:

<SYSTEM SETUP>
<MEAS SETUP>
<DEFAULT SETTING>
<SYSTEM RESET>

2.5 Basic Operation

Basic operation of LCR-2100 is as follows:

- Use menu keys ([DISP], [SETUP]) and soft keys to select the desired page.
- Use cursor keys ([←][→] [↑] [↓]) to move the cursor to the desired zone. When the cursor moves to a specified zone, the zone will become reverse expression.
- The soft key functions corresponding to the current zone of the cursor will be displayed in the soft key zone. Users can select and use the desired soft keys, numeric keys, [+/- ←] to input data.

  When a numeric key is pressed down, the usable unit soft key will be displayed in the soft key zone. You can choose a unit soft key to end data inputting. [+/- ←] are used to input positive and negative data or delete data.

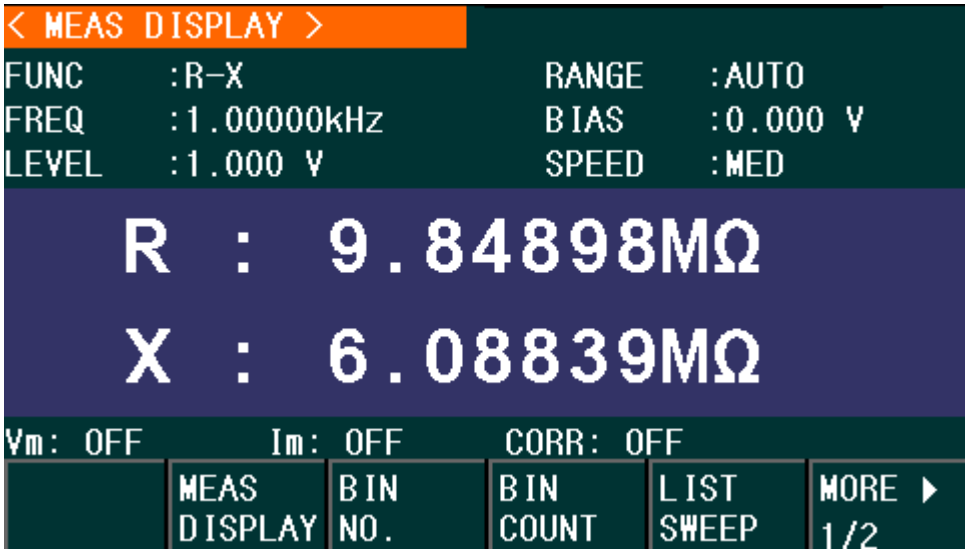
2.6 Start the instrument

Plug in 3-line power plug.
Caution: Keep the power-supply voltage and frequency conform to above specifications. Power input phase line L, zero line N, ground line E should be the same as that of the instrument.
Press the power switch at the left corner on the front panel and then a boot screen will appear which displays our company logo, instrument model, and the version number of the software.

Chapter 3 Introduction to [DISP]

3.1 <MEAS DISPLAY>

When the LCR function is applied, press [DISP], the <MEAS DISPLAY> page will be displayed on screen as shown in the following figure.



On this page, the test result is displayed in upper-case character. The measurement control parameters can be set on this page:

- Test function (FUNC)
- Test frequency (FREQ)
- Test level (LEVEL)
- Test range (RANGE)
- DC BIAS (BIAS)
- Test speed (SPEED)

There are 6 zones in this page: **FUNC, FREQ, LEVEL, RANG, BIAS** and **SPEED.** The details will be discussed later.

The test result/ condition display zone shows the information about test condition. These conditions can be set on <MEAS SETUP> page or <CORRECTION> page.

- Signal source voltage/ current monitor (**Vm, Im**)
- Open, short, load correction ON/OFF status (**CORR**)

3.1.1 Test function

In a measurement period, LCR-2100 can test two parameters for an impedance component: one primary parameter and one secondary parameter. Parameters that can be tested are as follows:

Primary parameters

- |Z| (Module of impedance)
- |Y| (Module of admittance)
- L (Inductance)
- C (Capacitance)
- R (Resistance)
- G (Conductance)
- DCR (DC resistance)

Secondary Parameters

- D (Dissipation factor)
- Q (Quality factor)
- R_s (Equivalent Series Resistance ESR)
- R_p (Equivalent Parallel Resistance)
- Rd (DC resistance)
- X (Reactance)
- B (Susceptance)
- θ (Phase Angle)

Test results of primary and secondary parameters are respectively displayed in two lines in the form of upper-case characters. The primary parameter displays in the upper line while the secondary parameter displays in the lower line.

Operation steps for setting test function:

1) Move the cursor to FUNC zone, the following soft keys will be displayed on the screen.
   - C_p—…→
   - C_s—…→
   - L_p—…→
   - L_s—…→
   - MORE→

     1/3

2) Press the soft key corresponding to C_p—…→, the following parameters will be shown for your choice.
   - C_p-D
   - C_p-Q
   - C_p-G
   - C_p-R_p
   - RETURN←

Press the soft key corresponding to your desired parameter. Then press RETURN← to return to upper soft key menu.

3) Press Cs—…→, the following parameters will be shown for your choice.
   - Cs-D
   - Cs-Q
   - Cs-Rs
   - RETURN←

Press the soft key corresponding to your desired parameter. Then press RETURN← to return to upper soft key menu.

4) Press L_p—…→, the following parameters will be shown for your choice.
   - L_p-Q
   - L_p-R_p
   - L_p-R_d
   - MORE→
     1/2
   - RETURN←

Press the soft key corresponding to your desired parameter. Then press RETURN← to return to upper soft key menu.

5) Press MORE→, the following parameters will be shown for your choice.
   - L_p-D
   - L_p-G
   - MORE→
     2/2
   - RETURN←

Press the soft key corresponding to your desired parameter. Then press RETURN← to return to upper soft key menu.

6) Press Ls—…→, the following parameters will be shown for your choice.
   - Ls-D
   - Ls-Q
   - Ls-Rs
   - Ls-Rd
   - RETURN←

Press the soft key corresponding to your desired parameter. Then press RETURN← to return to upper soft key menu.

7) Press MORE→, the following parameters will be shown for your choice.
   - Z—…→
   - Y—…→
   - R—…→
   - G-B
   - MORE→
     2/3

8) Press Z—…→, the following parameters will be shown for your choice.
   - Z-d
   - Z-r
   - RETURN←

Press the soft key corresponding to your desired parameter. Then press RETURN← to return to

upper soft key menu.

9) Press Y—…→, the following parameters will be shown for your choice.
   - Y-d
   - Y-r
   - RETURN←

Press the soft key corresponding to your desired parameter. Then press RETURN← to return to upper soft key menu.

10) Press R—…→, the following parameters will be shown for your choice.
   - R-X
   - Rp-Q
   - R_s-Q
   - RETURN←

Press the soft key corresponding to your desired parameter. Then press RETURN← to return to upper soft key menu.

11) Press MORE→, the following parameters will be shown for your choice.
   - DCR
   - MORE→
     3/3

Press DCR, choose the desired parameter. Then press MORE→ to return to the first page of soft key menu.

3.1.2 Test range

Measurement range should be selected in accordance with the impedance value of the tested LCR component.
LCR-2100 has 10 AC measurement ranges: 3Ω, 10Ω, 30Ω, 100Ω, 300Ω, 1kΩ, 3kΩ, 10kΩ, 30kΩ, 100kΩ.
LCR-2100 has 11 DCR measurement ranges: 1Ω, 3Ω, 10Ω, 30Ω, 100Ω, 300Ω, 1kΩ, 3kΩ, 10kΩ, 30kΩ, 100kΩ.

Operation steps for setting test range:

1) Move the cursor to the RANGE zone, the following soft keys will be displayed:
   - AUTO The soft key is used to set the range mode to AUTO.
   - HOLD The soft key is used to switch the AUTO mode to the HOLD mode. When the range mode is set to HOLD, the range will be locked in the current measurement range. The current measurement range will be displayed in the range zone.
   - DECR- The soft key is used to decrease the range under HOLD mode.
   - INCR+ The soft key is used to increase the range under HOLD mode.
2) Use soft keys to set measurement range.

3.1.3 Test frequency

The measurement range of LCR-2100 ranges from 20Hz to 200kHz with an increase or decrease of 0.01Hz. When the test function is set as DCR, the **FREQ** zone will display "---".

Model	Frequency range	Points
LCR-2100	50Hz-100kHz	34
LCR-2200	20Hz-200kHz	15025

Operation steps for setting test frequency:

LCR-2100 provides two methods to set measurement frequency. The first one is to use soft keys and the other one is to input data by using numeric keys.

1) Move the cursor to the **FREQ** zone, the following soft keys will be displayed.
   - INCR(++)

     This is a coarse adjustment soft key used to increase the frequency. Press this key, the frequency will change between the following six typical frequencies.

Model	Frequency point
LCR-2100	50Hz，100Hz，1kHz， 5kHz，100kHz，100kHz
LCR-2200	20Hz，100Hz，1kHz，10kHz，100kHz，200kHz

   - INCR(+)

     This is a fine adjustment soft key used to increase the frequency. Press this key, the frequency will switch between the following ones:

     20Hz 25Hz 30Hz 40Hz 50Hz 60Hz 75Hz
     100Hz 120Hz 150Hz 200Hz 250Hz 300Hz 400Hz 500Hz 600Hz 750Hz
     1 kHz 1.2kHz 1.5kHz 2kHz 2.5kHz 3kHz 4kHz 5kHz 6kHz 7.5kHz
     10kHz 12kHz 15kHz 20kHz 25kHz 30kHz 40kHz 50kHz 60kHz 75kHz
     100kHz 120kHz 150kHz 200kHz

     NOTE: according to the different frequency range, the minimum and maximum frequency of LCR-2100/2200 is different.

   - DECR(-)

     This is a fine adjustment soft key used to decrease the frequency. The selectable frequencies are the same as that of INCR(+).

   - DECR(--)

     This is a coarse adjustment soft key used to decrease the frequency. The selectable frequencies are the same as that of INCR(++).
2) Use soft keys or numeric keys to select or set frequency. When using numeric keys to input the required frequency value, the soft key displays the available frequency units (Hz, kHz and MHz). You can use unit soft key to input unit and data.

NOTE: if the frequency point input is not within the frequency range, the value will be

automatically modified to the nearest frequency point higher than the input frequency.

3.1.4 Test level

The measurement level of LCR-2100 can be set according to the RMS value of sine wave signal. The frequency of sine wave signal is the test frequency which is generated by inner oscillator. You can set measurement voltage or current. The output impedance of LCR-2100 signal source can be 30Ω or 100Ω. The test level range is 10mV-2V. When the value is input in current manner, the maximum current is equal to the maximum level divided by the source resistance.

Note: The measurement current is the output one when the tested terminal is short, while the measurement voltage is the output one when the tested terminal is open.

The auto level control function of LCR-2100 can realize the measurement of constant voltage or current. The auto level control function (ALC) can be set as ON in <MEASURE SETUP> page. When the auto level control function is set to ON, "*" will be displayed following the current level value. Refer to <MEASURE SETUP> for more information.

Operation steps for setting test level:

LCR-2100 provides two methods to set the level of test signal source. The first one is to use soft keys, while the second one is to input data by numeric keys.

1) Move the cursor to LEVEL, the following soft keys will be displayed.
   - INCR(+)
     This soft key is used to increase the level of test signal source.
   - DECR(-)
     This soft key is used to decrease the level of test signal source.

2) Soft or numeric keys are used to select or set the test level. When numeric keys are used to input the desired level, the available units (mV, V, μA, mA and A) will be displayed in the soft key zone. Users can use these unit keys to input unit and data.

NOTE: When you need to switch the level between current and voltage, numeric keys and unit soft keys must be used.

3.1.5 DC BIAS

LCR-2200 provides internal DC bias voltage from -1.5V to +1.5V (30Ω internal resistance) and -5V to 5V (100Ω internal resistance). LCR-2100 does not have this function. When the test function is selected as DCR, the BIAS zone will display "---".

Operation steps for setting DC bias:

LCR-2100 provides two methods to set the DC bias. The first one is to use soft keys, while the second one is to input data by numeric keys.

1) Move the cursor to BIAS, the following soft keys will be displayed.
   - INCR(+)
     This soft key is used to increase the output level of DC bias.
   - DECR(-)
     This soft key is used to decrease the output level of DC bias.

2) Soft or numeric keys can be used to select or set the DC bias source. When numeric soft keys are used to input the desired bias level, the available units ((mV, V, μA, mA and A) will be displayed in the soft key zone. Users can use these soft keys to input unit or data.

NOTE: When you need to switch the DC bias level between current and voltage, numeric keys and unit soft keys must be used.

Press the [BIAS] key on the front panel to allow the output of DC bias. When DC bias is permitted to output, the [BIAS] key will be lighted.

3.1.6 Test speed

The test speed of LCR-2100 is determined by the following factors:

- Integration time (A/D conversion)
- Average times (average test times per each test)
- Measurement delay (from startup to the start of measurement)
- Display time of test results

You can select test mode as FAST, MED or SLOW. Generally, the test result is more stable and accurate in SLOW test mode.

Operation steps for setting test speed:

1) Move the cursor to SPEED, the following soft keys will be displayed:
   - FAST
   - MED
   - SLOW
2) Use above soft keys to set the test speed.

3.1.7 Tools

The test result of LCR-2200 is displayed as 6 floating-point digits. Decimal point lock function can make LCR-2200 output the test result in fixed way. Meanwhile this function can change the displayed count of test result.

Operation steps for tools

Set the display mode of decimal point in fixed mode according to the following operation steps. Also the character size of test result can be set.

1) Move the cursor to **MEAS RESULT DISP** zone, the following soft keys will be displayed:
   - **D.P. AUTO**
   - **D.P. FIX**
   - **D.P.POS INCR +**
   - **D.P.POS DECRL-**
2) Press **D.P. AUTO** to reset the decimal position of the primary or the secondary parameter test result to its default setting.
3) Press **D.P. FIX** to lock the decimal location of primary parameter TEST result.
4) Press **D.P.POS INCR +** to increase the displayed digit by ten times.
5) Press **D.P.POS DECL -** to decrease the displayed digit by ten times

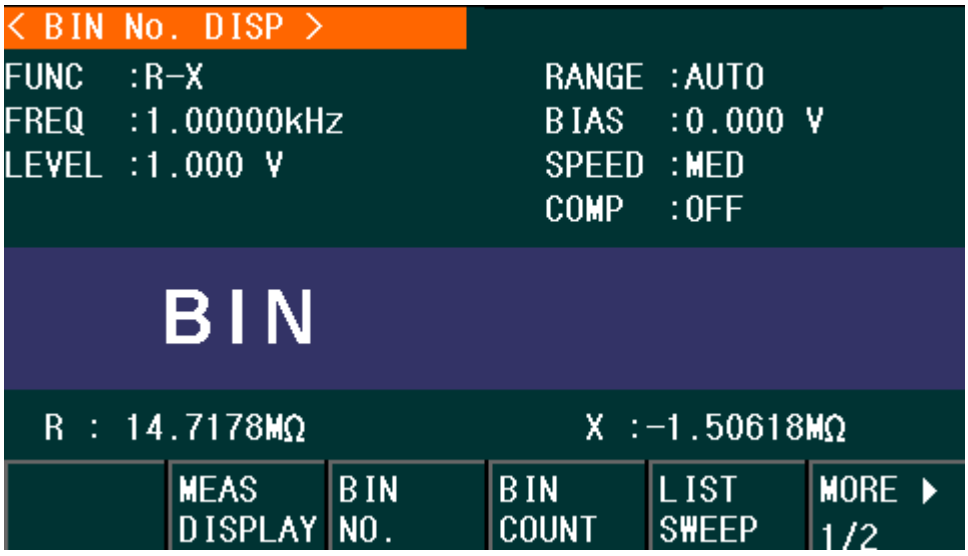
---

NOTE: Under the following circumstance, the function of decimal lock will be cancelled automatically to recover to floating decimal point status.

- Test function is changed.
- In deviation test, the deviation test mode (ΔABS, Δ%, OFF) is changed.

3.2 <BIN NO. DISP>

Press **[DISP]** firstly and then the **BIN NO.** soft key to enter into <BIN NO. DISP> display page. On this page, BIN NO. is displayed in upper-case character while the test result, in lower-case character.



The following control parameters can be set on <**BIN NO. DISP**>.

- Compare function ON/OFF (**COMP**)

There are 2 zones: **BIN NO. DISP**, **COMP**. Their detailed information will be introduced as below. The following test conditions are displayed in the measurement result/condition zone. These zones

cannot be set on this page but can be set on **<MEAS SETUP>**, **<MEAS DISP>** or **<CORRECTION>**.

- Test function (FUNC)
- Test frequency (FREQ)
- Test level (LEVEL)
- Test range (RANG)
- BIAS
- Test speed (SPEED)
- ON/OFF set state of OPEN, SHORT, LOAD (CORR)

3.2.1 Comparator function

LCR-2100 has an inserted compare function which can divide DUT to up to 10 bins (from BIN1 to BIN9 and BIN OUT). Users can set 9 pairs of primary parameter limit and one pair of secondary bin limit. If the primary parameter of DUT is within the range of the bin limit but the secondary parameter is outside of the bin limit, the DUT will be sorted into the auxiliary bin. When LCR-2100 has installed a HANDLER interface, the compare result will be output into the automatic test system and further realizing auto-sorting test. These limits can only be set on the <**LIMIT TABLE SETUP**> page. Users can set the compare function to ON or OFF in the **COMP** zone.

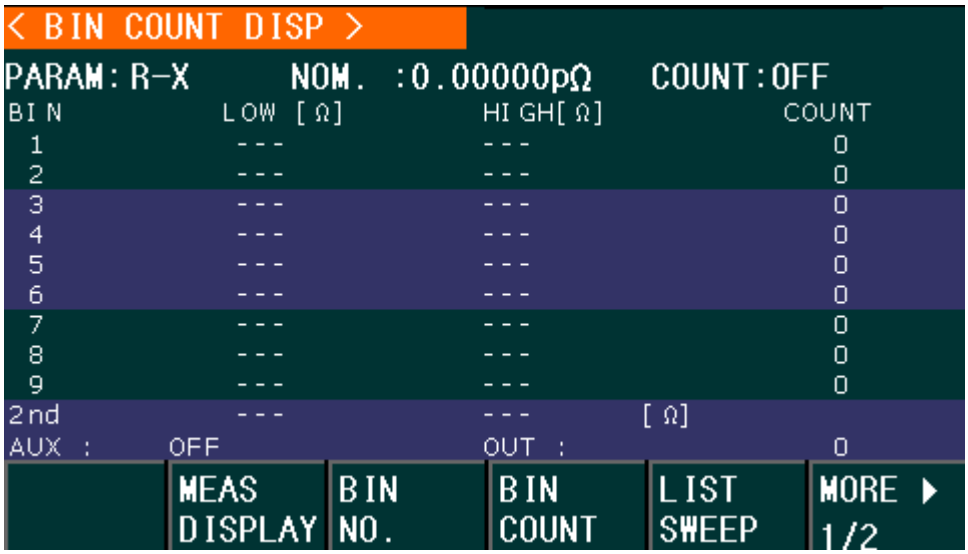
AUX ON	AUX ON	AUX OFF
Primary parameter PASS Secondary parameter PASS	BIN1～BIN9 PASS	BIN1～BIN9 PASS
Primary parameter FAIL Secondary parameter PASS	BIN AUTO FAIL	BIN1～BIN9 FAIL
Primary parameter PASS Secondary parameter FAIL	BIN AUX PASS	BIN OUT FAIL
Primary parameter FAIL Secondary parameter FAIL	BIN AUTO PASS	BIN AUTO FAIL

Operation steps for compare function

1) Move the cursor to **COMP**, the following soft keys will be displayed.
   - ON
   - OFF
2) Select one of above soft keys to set the compare function as ON or OFF.

3.3 <BIN COUNT DISP>

Press **[DISP]** and then select the soft key of **BIN COUNT** to enter into the <**BIN COUNT**> page which shows the count of each bin.



The following control parameters can be set on the <**BIN COUNT**> page.

- Count function ON/OFF (**COUNT**)

There are 2 zones are displayed in this page: **BIN COUNT DISP**, **COUNT**. The function of each zone will be introduced as below.

The following test result/ condition can be displayed in this page but cannot be set in this page. Users can set them on the **<LIMIT TABLE SETUP>** page.

- Test parameter (PARAM)
- Nominal value (NOM)
- Bin limit value (HIGH/ LOW)

3.3.1 PARAM

Parameter zone shows the "Function" parameter, if user selects primary and secondary parameter swap compare mode, the parameter will be displayed as swap parameter, such as: "Cp-D" is displayed as "D-Cp", which means the current D is compared as primary parameter while Cp is compared as secondary parameter.

3.3.2 NOM.

Nominal parameter is the nominal value used to make bin compare.

3.3.3 BIN

This zone shows the bin number of the limit list. "2nd" means the secondary parameter limit.

3.3.4 HIGH/LOW

This zone shows the high and the low limits of the limit list.

3.3.5 COUNT

This zone shows the count value of the current bin.

3.3.6 AUX

This zone shows the count value of the auxiliary bin.

3.3.7 OUT

This zone shows the count value of the out bin.

Operation steps for bin count function

Execute the following operations to set the bin count function ON/OFF on <**BIN COUNT DISP**> page.

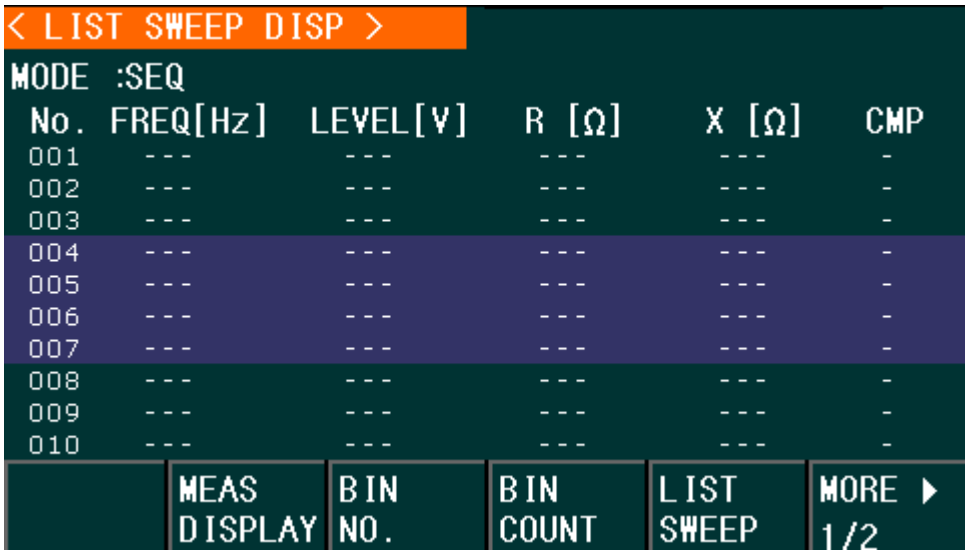
1) On < **BIN COUNT DISP**> page, move the cursor to **COUNT** zone, the following soft keys will be displayed.
   - **ON**
   - **OFF**
   - **RESET COUNT**
2) Press the soft key **ON** to turn on the count function.
3) Press the soft key **OFF** to turn off the count function.
4) Press the soft key **RESET COUNT**, "☺ : Reset count, Sure?" will be displayed in the help zone. Then the following soft keys will be displayed.

- **YES**
- **NO**

5) Press the soft key **YES** to reset all bin counts to 0.
6) Press the soft key **NO** to cancel the reset operation.

3.4 <LIST SWEEP DISP>

Press down the menu key **[MEAS DISPLAY]** and then the soft key **LIST SWEEP** to enter into the **<LIST SWEEP DISP>** page, shown as below.



Test points will be automatically tested in a scanning mode. Meanwhile, comparison will be made between test results and limit values. In the process of list sweep test, "►" denotes the current sweep test point. The following control parameters can be set on <**LIST SWEEP DISP**>.

- Sweep mode (**MODE**)

There are 2 zones on this page: **LIST SWEEP DISP** and **MODE**. List sweep points cannot be set on this page but can be set on <**LIST SWEEP SETUP**>.

3.4.1 Sweep mode

The list sweep function of LCR-2100 can make automatic sweep test for up to 201 points' test frequencies, test levels or DC bias. Two sweep modes are available on LCR-2100: SEQ and STEP. In SEQ mode, each press of [**TRIGGER**] will direct LCR-2100 to automatically test all list sweep test points. In STEP mode, each press of [**TRIGGER**] will direct LCR-2100 to test one list sweep point.

NOTE: When the trigger mode is set to **INT**, sweep test modes of SEQ and STEP will not be controlled by [**TRIGGER**].
When the trigger mode is set to **MAN**, [**TRIGGER**] can be used to trigger the list sweep test.

Operation steps for setting the list sweep mode:

Set the sweep mode on the <**LIST SWEEP DISP**> page as **SEQ** or **STEP**.

1) On the < **LIST SWEEP DISP** > page, move the cursor to the **MODE** zone, the following soft keys will be displayed:
   - **SEQ**
   - **STEP**

2) Press **SEQ** to set the sweep mode as sequential sweep test mode.
3) Press **STEP** to set the sweep mode as single step sweep test mode.

3.4.2 FREQ (Hz)

This zone shows the currently swept parameter mode and its unit. What are right below this item are parameters of the sweep list.

3.4.3 R[:] X[:]

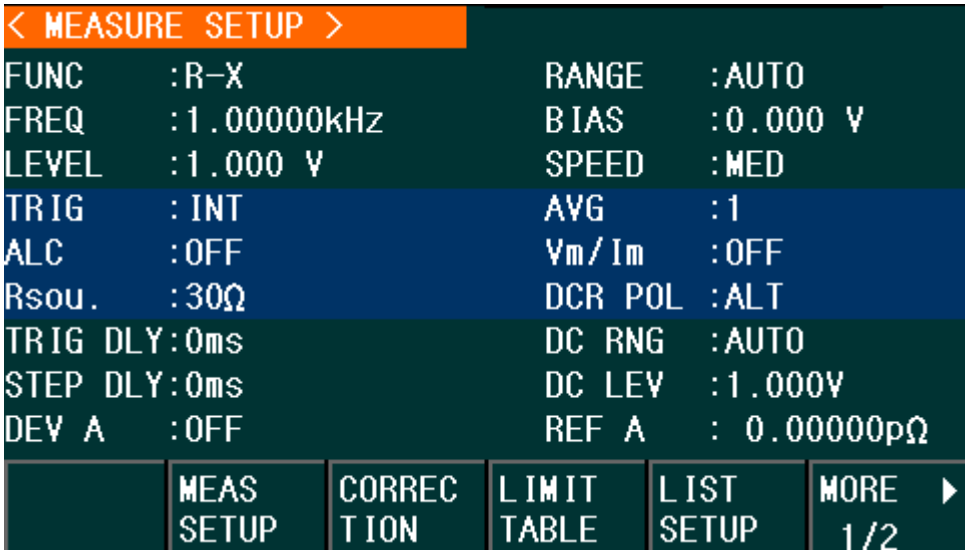
This zone is the currently swept Function parameter and its unit. What are right below this item are the sweep results.

3.4.4 CMP (Compare)

This zone indicates the compare results of the currently swept points. L means the result is lower than the standard and H is higher than the standard, while blank is medium.

3.5 <MEASURE SETUP>

Press **[SETUP]** to enter into the **<MEASURE SETUP>** page shown as below:



In this page, the following control parameters can be set. (Items in parenthesis can be set)

- Test function (**FUNC**)
- Test frequency (**FREQ**)
- Test level (**LEVEL**)
- Test range **(RANGE**)
- DC Bias (**BIAS**)

- Test speed (**SPEED**)
- Trigger Mode (**TRIG**)
- Auto Level Control (**ALC**)
- Output Resistance (**Rsou.**)
- Average times (**AVG**)
- Voltage/Current Level Monitor ON/ OFF (**Vm/Im**)
- DCR polarity (**DCR POL**)
- Trigger delay **(TRIG DLY)**
- Step delay **(STEP DLY)**
- DC range (**DC RNG**)
- DC level (**DC LEV**)
- Deviation Test Mode A (**DEV A**)
- Deviation Test Mode B (**DEV B**)
- Deviation Test Reference Value A (**REF A**)
- Deviation Test Reference Value B (**REF B**)

Some zones listed below are as same as that on **<MEAS DISPLAY>** page, so it is not necessary to introduce in this section, but others will be introduced briefly in the following sections.

- Test function (**FUNC**)
- Test frequency (**FREQ**)
- Test level (**LEVEL**)
- Test range **(RANGE**)
- Test speed (**SPEED**)
- DC Bias (**BIAS**)

3.5.1 Trigger mode

There are 4 trigger modes on LCR-2100: INT, MAN, EXT and BUS.
When the trigger mode is set as INT, LCR-2100 will make sequential and repeated tests.
When the trigger mode is set as MAN, press [TRIGGER] once, LCR-2100 will make one test.
When the trigger mode is set as EXT, once the HANDLER interface receives a positive impulse, LCR-2100 will execute one measurement.
When the trigger mode is set as BUS, once the IEEE 488 interface receives a **TRIGGER** command, LCR-2100 will execute a test. The BUS mode cannot be set on the front panel.

Note: In the process of testing, when LCR-2100 receives a trigger signal, it will be ignored. So the trigger signal should be sent after the test is done.
When optional HANDLER interface triggers LCR-2100, the trigger mode is set as EXT.

Operation steps for the trigger mode setup

Execute the operation of other trigger modes except BUS trigger. If BUS trigger mode is necessary, then use IEEE4888 interface to send **TRIGger:SOURce BUS** command.

1) Move the cursor to the **TRIGGER** zone, the following soft keys will be displayed:
   - **INT**

- **MAN**
- **EXT**

2) Use above soft keys to set the trigger mode.

3.5.2 Auto level control function

Auto level control function can adjust the real test level (voltage across or current through DUT) to the test level value. This function can guarantee the test voltage or current being constant.
When using this function, the test level can be set within the range below:
The range of constant voltage: 10 mV_{rms} to 1 V_{rms}
The range of constant current: 100 μA_{rms} to 10 mA_{rms}

NOTE: When the constant level function is valid, if the level exceeds above ranges, this function will be automatically set as OFF. The level value currently set is generally deemed as non-constant level value.

Operation steps for setting auto level control function
Execute the following steps and set the constant level function as ON or OFF.

1) Move the cursor to **ALC** zone, the following soft keys are displayed.
   - **ON**
   - **OFF**
2) Press **ON** to turn on the auto level control function.
3) Press **OFF** to turn off the auto level control function.

NOTE: LCR-2100 is set to OFF by default.

3.5.3 Output impedance

LCR-2100 provides two output impedances for your choice: 100 Ω and 30 Ω. When testing inductance, it is necessary to input the same output impedance so as to make data comparison with other instruments.

Note: When an optional bias board is selected, only 100Ω is available.

Operation steps for setting output resistance
Execute the following operations to set output impedance

1) Move the cursor to the **Rsou** zone, the following soft keys will be displayed.
   - **100 Ω**
   - **30 Ω**

2) Press **100Ω** to select the output impedance as 100Ω. Press **30Ω** to select the output impedance as 30Ω.

3.5.4 Average

The AVERAGE function can calculate the average value of two or more test results. The average times can be set from 1 to 255 with an increase or decrease of 1.

Operation steps for setting test average times.

1) Move the cursor to the **AVG** zone, the following soft keys are displayed.
   - **INCR（+）**
     This key is used to increase the average times.
   - **DECR（-）**
     This key is used to decrease the average times.
2) Use above soft keys to set the average times.

3.5.5 Voltage/Current Level Monitor function

The level monitor function can monitor the real voltage across DUT or real current through DUT. The monitored voltage value is displayed in **Vm** zone on <**MEASURE DISP**> page while the monitored current value is in **Im** zone.

Note: The correction function can influence the level monitor function, so when the correction data changes the level monitor value will change. When the correction is switched between OPEN or SHOR or LOAD, the level monitor value will be influenced as well

---

Operation steps for setting the level monitor function

Execute the following operation steps to set the level monitor function as ON or OFF.

1) Move the cursor to **Vm/Im** zone, the following soft keys will be displayed.
   - **ON**
   - **OFF**
2) Press **ON** to set the voltage monitor function as ON while press **OFF** to set the voltage monitor function as OFF.

3.5.6 DCR polarity

LCR-2100 can provide two DC resistance test mode: ALT and FIX. At present, only ALT mode can be used. ALT mode is positive and negative DC voltage measurement. FIX is to fix positive voltage measurement. ALT mode is conductive to the demagnetization when measuring the DC resistance of inductors, which makes the test more accurate.

Execute the following operation steps to set the DCR polarity.

1) Move the cursor to **DCR POL** zone, the following soft keys will be displayed.
   - **FIX**
   - **ALT**
2) Press ALT to select alternate mode. Press FIX to select lock of positive level mode. At present,

only ALT mode can be used.

3.5.7 Trigger Delay

LCR-2100 trigger delay means the delay time from triggering to test-start. Delay function can set the trigger delay time. When the list sweep test function is used, all set delay time will be delayed at each sweep test point. The range of the trigger delay time can be set from 0s to 60s with 1ms as the resolution. The trigger delay function is great useful when the instrument is applied in an auto test system. When the instrument is triggered by HANDLER interface, the trigger delay time can ensure DUT and test terminal has a reliable contact.

Operation steps for setting the delay function

Execute the following steps to set the measurement delay time.

1) Move the cursor to the **DELAY** zone.
2) Use numeric keys to input delay time. After pressing a numeric key, the following unit keys will be displayed.
   - **msec**
   - **sec**

3.5.8 Step delay

LCR-2100 step delay means the delay time from outputting drive signal to test-start. Delay function can set the step delay time. The range of the step delay time can be set from 0s to 60s with 1ms as the resolution. When measuring DCR or Rd parameter, such as Lp-Rd, the step delay time can ensure accurate measurement while alternate measuring inductive devices by two drive signals.

Operation steps for setting the delay function

Execute the following steps to set the measurement delay time.

1) Move the cursor to the **STEP DLY** zone.
2) Use numeric keys to input delay time. After pressing a numeric key, the following unit keys will be displayed.
   - **msec**
   - **sec**

3.5.9 DC resistance range

LCR-2100 can set the DC resistance range separately. The specific range is the same as the LCR range, please refer to **3.1.2**.

3.5.10 DC level

The DC level of LCR-2100 is fixed at 1V. The DC level of LCR-2200 ranges from 50mV-2V with 1mV as the resolution.

Operation steps for setting the DC level

Execute the following steps to set the measurement delay time.

1) Move the cursor to the **DC LEV** zone.
2) Use numeric keys to input level. After pressing a numeric key, the following unit keys will be displayed.
   - **mV**
   - **V**
3) After pressing the numeric key and choosing the unit, the result will be automatically converted to the final level.

3.5.11 Deviation test function

The deviation test function can make the deviation value (instead of real test value) be directly displayed on the screen. The deviation value is equivalent to the real test value subtracting the pre-set reference value. This function brings great convenience to observe variations of component parameters with temperature, frequency, bias. Bias test function can be used for primary or secondary parameter or primary and secondary parameters meanwhile. The instrument provides two deviation test modes as below:

- ΔABS (Absolute Deviation mode)
  The deviation currently displayed is the difference between the test value of the DUT and the preset reference value. The formula of calculating ΔABS is as below:
  ΔABS=X-Y
  Where, X is the test value of DUT
  Y is the preset reference value.
- Δ% (Percentage deviation mode)
  The deviation currently displayed is the percentage of the difference between the test value of DUT and the preset reference value divided by the reference value. Its calculating formula is as below:
  Δ% = (X-Y)/Y*100[%]
  Where, X is the test value of DUT.
  Y is the preset reference value.

Operation steps for setting deviation test function

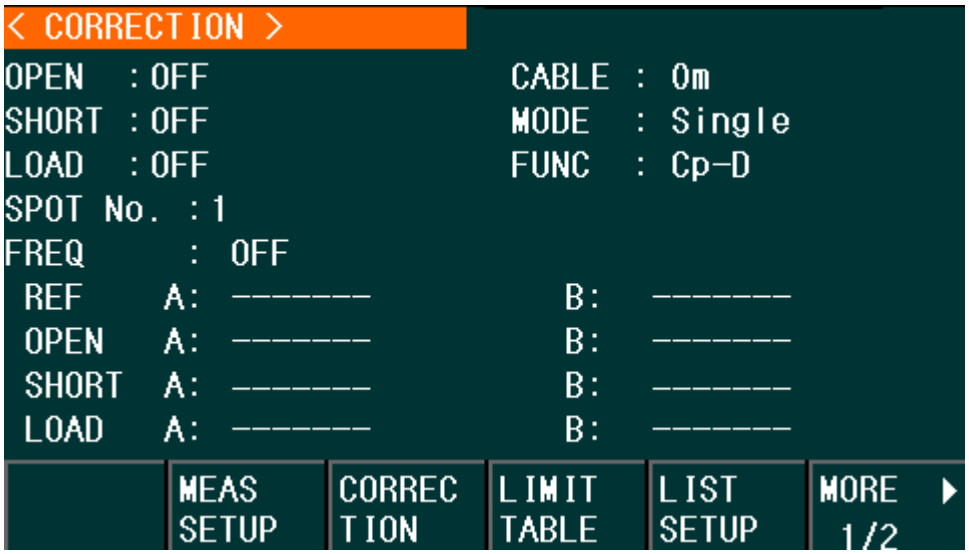
1. Move the cursor to the **REF A** zone to input the reference value of the primary parameter, the following soft key will be displayed.
   - **MEASURE**

   When the reference component is connected with the test terminal, you should press **MEASURE**. Then LCR-2100 will test the reference component and the test result will be automatically input as the value of **REF A**.
2. Use **MEASURE** or numeric keys to input the reference value of primary parameter.
3. Move the cursor to the **REF B** to input the reference value of the secondary parameter, the following soft key will be displayed.
   - **MEASURE**

   When the reference component is connected to the test terminal, you should press **MEASURE**. Then LCR-2100 will test the reference component and the test result will be automatically input as the value of **REF B**.
4. Use MEAS or numeric keys to input the reference value of the secondary parameter. If the reference values of primary and secondary parameters have been set in steps 2), you can skip this step.
5. Move the cursor to the **DEV A** zone, the following soft keys will be displayed:
   - **ΔABS**
   - **Δ%**
   - **OFF**
6. Use above soft keys to se the deviation mode of the primary parameter.
7. Move the cursor to the **DEV B** zone, the following soft keys will be displayed.
   - **ΔABS**
   - **Δ%**
   - **OFF**
8. Use above soft keys to set the deviation mode of the secondary parameter.

3.6 <CORRECTION>

Press **[SETUP]** to select **CORRECTION** to enter into the **<CORRECTION>** page.



Open, short and load correction on the **<CORRECTION>** page can be used to eliminate the distribution capacitance, spurious impedance and other measurement errors. LCR-2100 provides two correction modes: the first one is executing open and short correction on all frequency points through interpolation method; the other one is executing open, short and load correction on the frequency point currently set. There are 201 calibration spots. The following measurement control parameters can be set on the **<CORRECTION>** page.

- Open correction (**OPEN**)
- Short correction (**SHORT**)
- Load correction (**LOAD**)
- Cable length selection (**CABLE**)
- Single/ multiple correction mode selection (**MODE**)
- Load correction test function (**FUNC**)
- Calibration spot numbers **(SPOT No.)**
- Frequency points of OPEN, SHOR and LOAD (**FREQ**)
- Reference values for frequency points (**REF A**, **REF B**)
- Open values for frequency points (**OPEN A**, **OPEN B**)
- Short values for frequency points (**SHORT A**, **SHORT B**)
- Load values for frequency points (**LOAD A**, **LOAD B**)

There are 16 zones on this page: **Correction**, **Open**, **Short**, **Load**, **Cable**, **Mode**, **Function**, **SPOT No.**, **FREQ**, **REF A**, **REF B**, **OPEN A**, **OPEN B**, **SHORT A**, **SHORT B,** **LOAD A**, **LOAD B** .Each control function zone will be introduced in the following paragraphs.

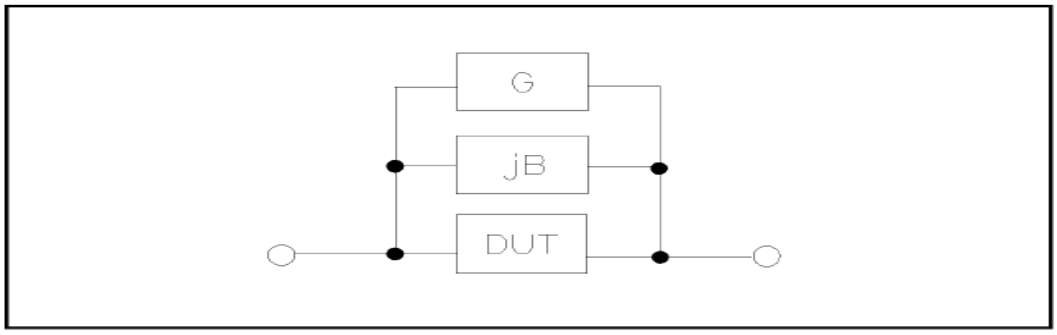
Besides above setting zones, the <**CORRECTION**> page will also display the following monitoring zones. The monitoring zones are similar with the setting zones, but the monitoring zones can only provide reference information and you cannot change state or parameter of these zones.

- Real test results of the open correction (**OPEN A**, **OPEN B**)
- Real test results of the short correction (**SHORT A**, **SHORT B**)
- Real test results of the load correction (**LOAD A**, **LOAD B**)

NOTE: The rule of user calibration is that if the open or short circuit is ON and the measurement frequency corresponding to the point frequency clearing is ON, the data of point frequency correction will be used first.

3.6.1 OPEN

The open correction function of LCR-2100 can eliminate the error caused by the stray admittance (G, B) parallel-connected with DUT, shown as figure below.



Stray Admittance

LCR-2100 adopts the following two kinds of open correction data:

- LCR-2100 will automatically make open correction test on 34 fixed frequency points within 50Hz~100kHz, no matter what the currently set frequency is. Move the cursor to **OPEN** and then used **MEAS OPEN** to execute full frequency open correction.

  NOTE: LCR-2200 will automatically make open correction test on 41 fixed frequency points within 20Hz~200kHz. Besides the 41 fixed frequency points, the instrument will adopt interpolation method to calculate the open correction data of different test frequencies which correspond to different ranges.
- 201 open correction spots can be set in **FREQ** and **SPOT No.** on **<CORRECTION>**. Move the cursor to **FREQ** and then use the **MEAS OPEN** soft key to execute open correction at the currently set frequency respectively.

Operation steps of open correction function

The following steps are executing open correction on all frequency points through interpolation method. The operation method of open correction on single frequency, please refer to "load correction".

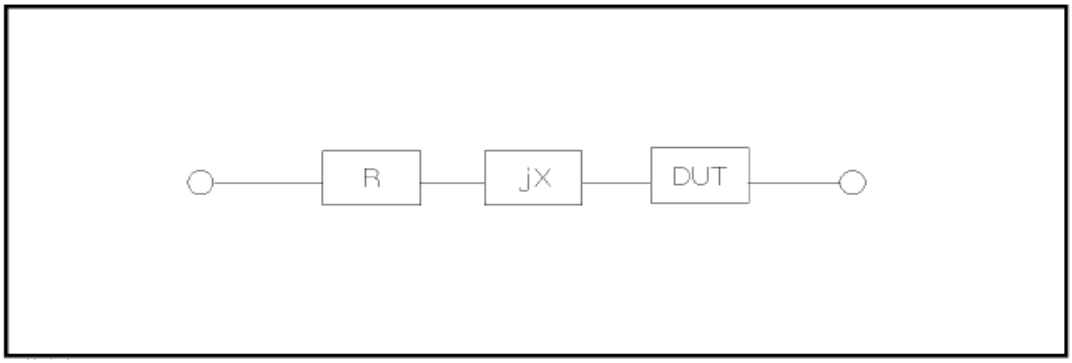
1) Move the cursor to OPEN, the following soft keys will be displayed:
   - **ON**
   - **OFF**
   - **MEAS OPEN**
   - **DCR OPEN**
2) Connect test fixture to test terminal. The fixture is open and not connecting to any DUT.
3) Press **MEAS OPEN,** LCR-2100 will test the open admittance (capacitance and inductance) under 34 frequencies. It will take about 50 seconds to finish the open full-frequency correction. In the process of correction , the following soft key will be displayed:
   - **ABORT**

   This soft key can be used to terminate the current open correction operation and reserve the formal open correction data.
4) Press **DCR OPEN**, LCR-2100 will test the open-circuit resistance under the DC resistance function.
5) Press **ON** to turn on the function of open-circuit correction, then LCR-2100 will perform open-circuit correction calculation in the later testing process. If FREQ is set as OFF, the open-circuit correction data of the current frequency will be calculated by interpolation method. When FREQ is set as ON, the value of the current test frequency will be that of FREQ, in this case, the open correction data of FREQ will be used to the calculation of open correction.

6) Press **OFF** to turn off the open correction function. In later measurement, no open correction calculation will be taken.

3.6.2 SHORT

The short correction function of LCR-2100 can eliminate the error caused by spurious inductance (R, X) in serial with DUT as shown in figure below.



Spurious Inductance

LCR-2100 adopts two kinds of short correction data.

- LCR-2100 will automatically make short correction test on 34 fixed frequency points within 50Hz~100kHz, no matter what the currently set frequency is. Move the cursor to **SHORT** and then used **MEAS SHORT** to execute full frequency short correction.

NOTE: LCR-2200 will automatically make short correction test on 41 fixed frequency points within 20Hz~200kHz. Besides the 41 fixed frequency points, the instrument will adopt interpolation method to calculate the short correction data of different test frequencies which correspond to different ranges.

- 201 short correction spots can be set in **FREQ** and **SPOT No.** on **<CORRECTION>**. Move the cursor to **FREQ** and then use the **MEAS OPEN** soft key to execute short correction at the currently set frequency respectively.

Operation steps of short correction function

The following steps are executing open correction on all frequency points through interpolation method. The operation method of open correction on single frequency, please refer to "load correction".

1) Move the cursor to the **SHORT** zone, the following soft keys will be displayed:
   - **ON**
   - **OFF**
   - **MEAS SHORT**
   - **DCR SHORT**
2) Connect the test fixture to the test ports. Short the test fixture by using short plate.
3) Press the **MEAS SHORT** soft key, LCR-2100 will test the short spurious impedances (resistance and reactance) of 34 frequencies. Short full frequency correction takes about 50 seconds and in this process, the following soft keys will be displayed.
   - **ABORT**

This soft key can be used to cancel the current short correction operation and reserve the formal open correction data.

4) Press **DCR SHORT**, LCR-2100 will test the short resistance under DC resistance function.
5) Press **ON** to validate the short correction function. LCR-2100 will make short correction calculation in latter test. If FREQ is set as OFF, the short-circuit correction data of the current frequency will be calculated by interpolation method. When FREQ is set as ON, the value of the current test frequency will be that of FREQ, in this case, the short correction data of FREQ will be used to the calculation of short correction.
6) Press **OFF** to turn off the short correction function. In latter test, no short correction calculation will be performed.

3.6.3 LOAD

By using transport coefficient between the real test value and the standard reference value at the preset frequency (**FREQ**), the load correction of LCR-2100 can eliminate the test error. It is obvious that open, short, and load correction can be performed at preset frequencies. 201 calculation points can be set in **SPOT No.** and the frequency can be set in the setup zones of **FREQ**. The standard reference values can be set in the setup zones of **REF A** and **REF B**. The standard test function must be set in the **FUNC** zone before setting standard reference value. When the cursor moves to **FREQ**, the **MEAS LOAD** soft key will be displayed. Press **MEAS LOAD** to perform the load correction test.

Operation steps for setting load correction

According to the following steps, perform open/ short/ load correction test at preset frequencies.

1) Move the cursor to **FREQ**, the following soft keys will be displayed:
   - **ON**
     Press this soft key to make the open/short/load correction data be available.
   - **OFF**
     Press the soft key to make the open/short/load correction data be unavailable.
   - **MEAS OPEN**
     Press this soft key to execute open correction at FREQ.
   - **MEAS SHORT**
     Press this soft key to execute short correction at FREQ.
   - **MEAS LOAD**
     Press this soft key to execute the load correction at FREQ.
2) Press the soft key **ON**, the original preset open/short/load correction frequency is displayed on the frequency setting zone.
3) Use numeric keys to input the correction frequency. After pressing any numeric key, the available unit keys (**Hz**, **kHz** and **MHz**) will be displayed on the soft key zone and press these soft keys to input correction frequency.
4) Connect the test fixture to the test terminal.
5) Make the test fixture be open.
6) Press **MEAS OPEN** to perform open correction at the current set frequency. The test result (G,

B) of the open correction test will be displayed in the help line (the bottom line).

7) Move the cursor to **OPEN**.
8) Press **ON** to perform the open correction calculation at preset frequency in latter measurements.
9) Move the cursor to **FREQ** to set the required correction frequency.
10) Make the test fixture be short.
11) Press **MEAS SHORT** to perform short correction at preset frequency. The test result (R, X) of the short correction will be displayed in the help line (the bottom line).
12) Move the cursor to **SHORT**.
13) Press **ON** to perform the short correction calculation at preset frequency in latter measurements.
14) Prepare a standard test component.
15) Move the cursor to **FUNC**.
16) Set the function parameters required to be set.
17) Move the cursor to **REF A**.
18) Use numeric keys and unit keys to input the primary reference values of the standard component.
19) Move the cursor to **REF B**.
20) Use numeric keys and unit keys to input the secondary reference value of the standard component.
21) Move the cursor to the corresponding **FREQ**.
22) Connect the standard component to the test fixture.
23) Press **MEAS LOAD**, the instrument will execute a load correction. The real test results of the standard component will be displayed in **MEAS A** and **MEAS B**.
24) Move the cursor to **LOAD**.
25) Press **ON** to perform load correction calculation at preset frequencies in latter measurements.

3.6.4 Load correction test function

When performing load correction, the reference value of the standard component is required to be input in advance. The test parameters of reference value should be the same as the preset load correction test function.

Load correction function adopts the transport coefficient between the real test value of preset frequency and the standard reference value to eliminate the test error. Load correction function is only available for calculating transport coefficient.

3.6.5 Point-frequency correction

The instrument provides up to 201 point frequency clearing function. The specific steps refer to 3.6.3 load calibration process. Firstly, select the calibration point and then move the cursor to FREQ, select ON and input the corresponding frequency. Press **MEAS SHORT** to perform short correction at preset frequency. Press **MEAS OPEN** to perform open correction at the current set frequency.

Note: Since the status display of only one frequency point can be selected at a time, the complete

status of 201 points could not be checked. Please pay attention to the problem, avoiding unknown error correction data reference.

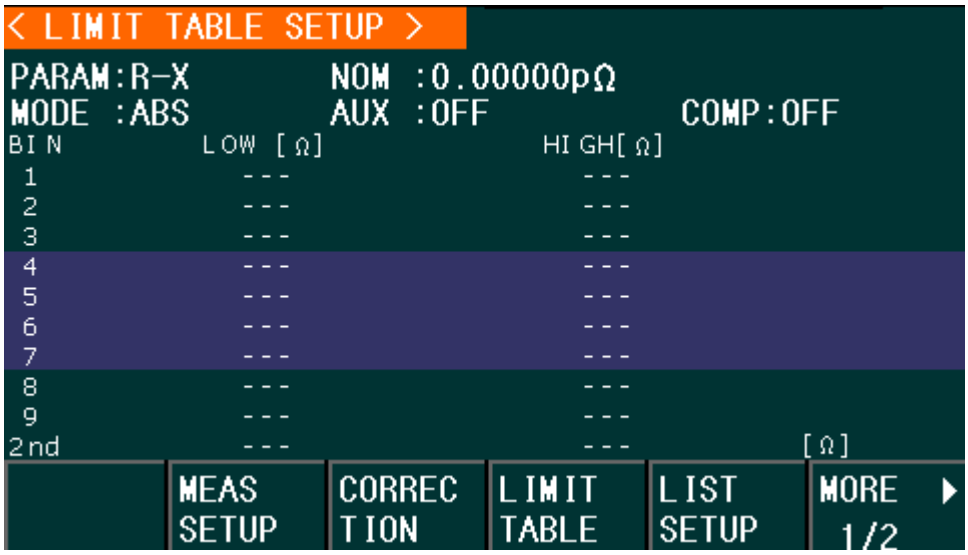
In response to the problem, the instrument provides rapid clearance and reset function for 201 dot frequency correction data. With **CLEAR CORR** function in **TOOLS** page, you can reset and close the calibration data of 201 points.

3.6.6 Cable length selection

The available cable length is 0m.

3.7 <LIMIT TABLE>

Press **[SETUP]** and then **LIMIT TABLE** to enter into the **<LIMIT TABLE SETUP>** page as the following figure shown.



Compare function can be set on this page. LCR-2100 can set 9 bin limits of primary parameters and one of secondary parameters. The tested result can be divided into up to 10 bins (BIN 1 to BIN 9 and BIN OUT). If the primary parameter of DUT is within the limit range from BIN1 to BIN9, but the secondary parameter is out of the limit range, in this case the DUT will be sorted into aux bin. When LCR-2100 installs the HANDLER interface and it is used in automatic sorting system, the compare function will be especially useful. The following limit parameter of compare function only be set on **<LIMIT TABLE SETUP>** page.

- Test parameter (**PARAM**)
- Limit mode of compare function (**MODE**)
- Nominal value (**NOM**)
- Auxiliary bin ON/OFF (**AUX**)
- Compare function ON/OFF (**COMP**)
- Low limit of each bin (**LOW**)
- High limit of each bin (**HIGH**)

3.7.1 Swap parameter

The swap parameter function can swap the primary and the secondary parameter in **PARAM**. For example, when the test parameter is Cp-D, the swap parameter function can change the test parameter as D-Cp. Then user can set 9 pairs of compare limits for D, but only 1 pair of compare limit can be set for Cp.

Operation steps for the swap parameter function

Execute the following operations to swap the primary and the secondary parameters.

1) Move the cursor to **PARAM**, the following soft key will be displayed.
   - **SWAP PARAM**
2) Press **SWAP PARAM** to swap the primary and the secondary parameters.
3) Press **SWAP PARAM** to swap the primary and the secondary parameter, which is to recover the formal setup.

3.7.2 Limit modes of compare function

Compare functions has two limit setup modes for primary parameters as shown in figure 3-3.

- Tolerance mode

Under tolerance mode, set the deviation value of the nominal one (be set in the **NOM** zone) as the compare limit value. Deviation value has two modes: percentage deviation and absolute deviation.

- Sequential mode

Under sequential mode, the range of the test value is the compare limit value. The compare limit value should be set in the order from small to large.

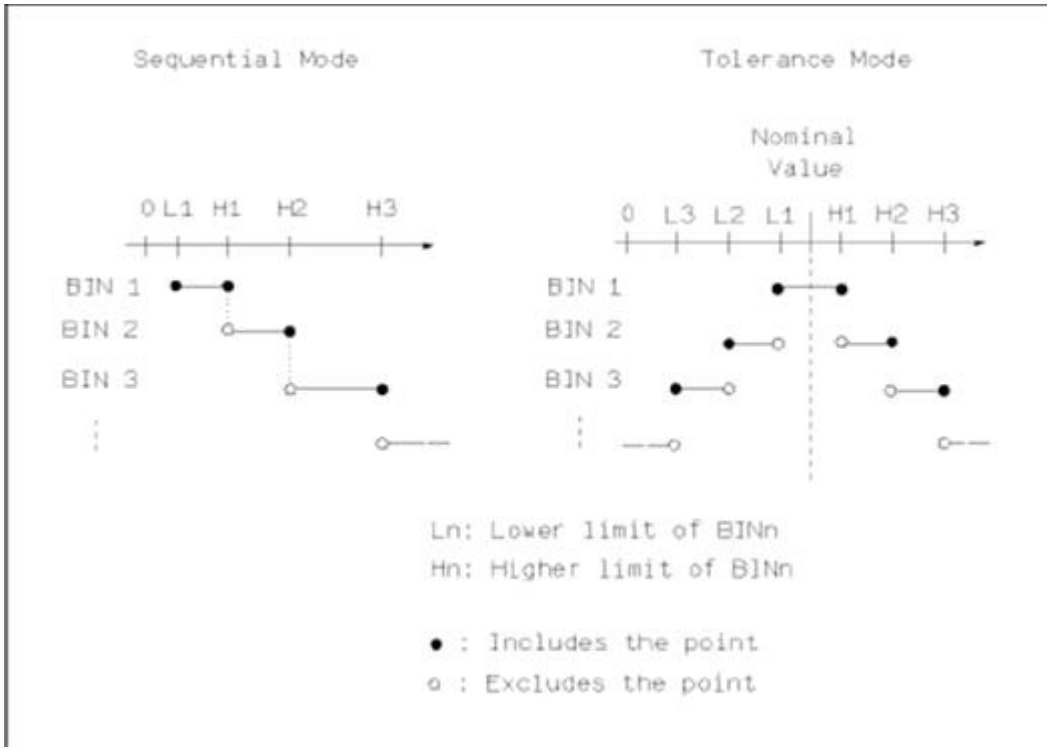


Figure 3-3 Tolerance mode and Sequential mode

Note: When setting limit values of tolerance mode, the error range should be set in the order from small to large. If the error range of BIN1 is the largest one, then all DUT will sort into BIN 1.
Under tolerance mode, the low limit is not necessary to be smaller than the nominal value and the high limit is not necessary to be larger than the nominal value. The limit range of each bin can be discontinues or overlapped.

Operation steps for setting the limit mode of the compare function

1) Move the cursor to the **MODE** zone, the following soft keys will be displayed.
   - **%TOL**

     This soft key is used to set the limit mode as the tolerance mode of percentage deviation (% TOL).
   - **ABS TOL**

     This soft key is used to set the limit mode as the tolerance mode of absolute deviation (ABS TOL).
   - **SEQ MODE**

     This soft key is used to set the limit mode as sequential mode.
   - **TWO ABS**

2) Use above soft keys to set the limit mode.

3.7.3 Set nominal value of tolerance mode

When the tolerance mode is selected as the limit mode of the primary parameter, it is necessary to set the nominal value. The nominal value can be any one within the display range.
When the sequential mode is selected as the limit mode the primary parameter, the nominal value can be set, but it is not necessary to use it under this mode.

Operation steps for setting the nominal value

1) Move the cursor to **NOM**.
2) Use numeric keys to input nominal value. After inputting the data, the following soft keys (**p**, **n**, **μ**, **m**, **k**, **M**, ***1**) can replace the **[ENTER]** key to input the nominal value. When using [ENTER] to input the nominal value, the default unit is the same as that input last time. Press ***1** to input nominal value, the instrument will select F, H or Ω as the default unit of the nominal value according to primary parameter.

3.7.4 Comparator function ON/OFF

LCR-2100 can set 9 bin limits of primary parameters and 1 bin limit of secondary parameters. The tested results can be sorted into 10 bins (BIN 1 to BIN 9 and BIN OUT) at most. If the primary parameter of DUT is within the limit range from BIN 1 to BIN 9, but the secondary parameter is out of the limit range, in this case the DUT will be sorted into aux bin. When LCR-2100 installs the

HANDLER interface and it is used in the automatic sorting system, the compare function will be especially useful.

Operation steps for setting the compare function ON/OFF

1) Move the cursor to **COMP**, the following soft keys will be displayed.
   - **ON**
   - **OFF**
2) Use above soft keys to set the compare function as ON or OFF.

3.7.5 Auxiliary bin ON/OFF

When it is necessary to sort the secondary parameters, the limits of the secondary parameter can be set in **HIGH** and **LOW** of 2nd.

Three cases may occur in the process of secondary parameter sorting:

- On **<LIMIT TABLE SETUP>** page, no low / high limit of the secondary parameters has been set.
- On **<LIMIT TABLE SETUP>** page, the low/high limit of secondary parameters has been set but **AUX** function is set as OFF.

In this case, only those components whose secondary parameters are qualified can perform primary parameter sorting according to sorting limits. If the secondary parameters are unqualified and the corresponding primary parameters are within limit ranges, those components will be sorted into BIN OUT.

- On <**LIMIT TABLE SETUP**> page, the low/high limit of the secondary parameters has been set and the **AUX** function is set as ON.

If the primary parameter is out of the limit range, it is sorted into BIN OUT. If the primary parameter of DUT is within the limit range but its secondary parameter is out of the limit range, the DUT will be sorted into the **AUX** bin.

Note: When the secondary parameter only has low limit and the auxiliary bin is set as ON, if the primary parameter of DUT is within the limit range and the secondary parameter is smaller than or equal to its low limit, the DUT will be sorted into the auxiliary bin. When the secondary parameter only has high limit and the auxiliary bin is set as ON, if the primary parameter of DUT is within the limit range and the secondary parameter is larger than or equal to its high limit, the DUT will be sorted into the auxiliary bin.

Operation steps for setting the auxiliary bin function ON/OFF

1) Move the cursor to **AUX**, the following soft keys will be displayed.
   - **ON**
   - **OFF**
2) Use above soft keys to set the auxiliary function as ON or OFF.

3.7.6 HIGH/LOW

LCR-2100 can set bin limits of 9 primary parameters and one secondary parameter. The test results

can be sorted into 10 bins at most (BIN 1 to BIN 9 and BIN OUT). The high/low limits of primary parameters can be set in high limit and low limit of bins from BIN 1 to BIN 9. The limit of the secondary parameter can be set in **HIGH** and **LOW** of 2nd.

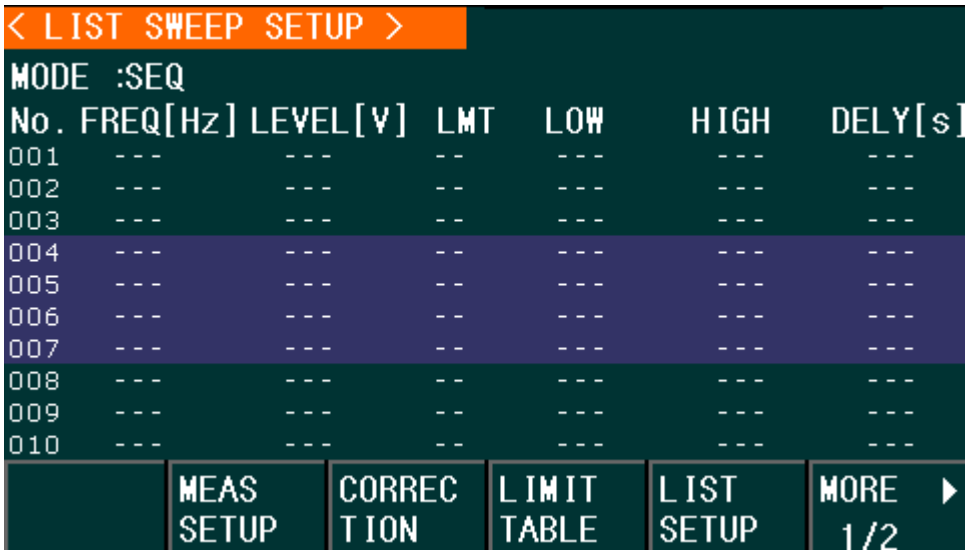
Operation steps for setting high/low limit

Execute the following steps to set sorting limits.

1) Set **PARAM** and **NOM** in the compare function menu and the limit **MODE** of the primary parameter.
2) Move the cursor to Low limit of BIN 1. If you select tolerance mode, the following operation steps should be from step 3 to step 6; if you select sequential mode, the following operation steps should be from step 7 to step 11.
3) User numeric keys to input low limit value in Low limit. After inputting the data, you can use (**p**, **n**, **μ**, **m**, **k**, **M**, ***1**) to input the limit value. When pressing ***1**, the default unit will be F, H or Ω. After inputting limit value in **LOW** of BIN 1, the low limit of BIN 1 will be automatically set as – (absolute limit) and the high limit will be + (absolute limit).
4) The cursor will automatically move to **LOW** of BIN 2. Repeat step 3 until the limits of BIN 9 are input. Then the cursor will automatically move **LOW** of 2nd.
5) After inputting the low limit of the secondary parameter, the cursor will automatically move to **HIGH** of 2nd.
6) Input the high limit of the secondary parameter.
7) In Low limit of BIN 1, use numeric keys to input the low limit. After inputting the data, you can use (**p**, **n**, **μ**, **m**, **k**, **M**, ***1**) to input the limit value. When pressing ***1**, the default unit will be F, H or Ω.
8) After inputting the low limit of BIN 1, the cursor will automatically move to **HIGH** of BIN 1. Input the high limit of BIN 1.
9) The cursor will automatically move **HIGH** of BIN 2. For the limit mode is sequential mode, the low limit of BIN 2 will be the high limit of BIN 1. Input the high limit of BIN 2.
10) Repeat step 9 until the high limit of BIN 9 is input. Then the cursor will automatically move to **LOW** of 2nd. Input the low limit of the secondary parameter.
11) The cursor will automatically move to **HIGH** of 2nd. Input the high limit of the secondary parameter.

3.8 <LIST SWEEP SETUP>

Press **[SETUP]** and then **LIST SETUP** to enter into the **<LIST SWEEP SETUP>** page as shown below.



The list sweep function of LCR-2100 can perform auto sweep test for the test frequency, test level or bias voltage of 201 points. On **<LIST SWEEP SETUP>** page, the following list sweep parameters can be set.

- Sweep mode (**MODE**)
- Sweep parameter setup (frequency **[Hz]**, level **[V]**, level **[I]**, bias **[V]**, bias **[I]**)
- Sweep test point setup (sweep point)
- Selection of limit parameter (**LMT**)
- High/low limit (**HIGH**, **LOW**)

3.8.1 MODE

Mode menu is the same as the mode on <List sweep display> page.

3.8.2 Test parameter

Sweep parameters can be: frequency **[Hz]**, level **[V]**, level **[I]**, bias **[V]**, bias **[I]**. LCR-2100 provides double sweep parameters. The two parameters must be different and set values.

Operation steps for setting test parameter

1) Move the cursor the line following **MODE**; the following soft keys will be displayed.
   - FREQ [Hz]
   - LEVEL [V]
   - LEVEL [A]
   - BIAS [V]
   - BIAS [A]
2) Press one of above soft keys to select the list sweep parameter.

3.8.3 Sweep parameter setup

Move the cursor to the table to perform the setup of each sweep parameter: **FREQ (HZ)**, **LMT**, **HIGH** and **LOW**. Use numeric keys on the front panel to input the data of test frequency/level/bias and high/low limit used to compare, as well as the selected primary/secondary use to compare. After setting, if some inputs are unnecessary, you can execute the function of "Delete line" in the soft key zone to delete the corresponding value.

In the bottom of the **LMT** zone, parameter A indicates that the primary parameters of the measurement result are use to compare with the high and low limits of the table. Parameter B indicates that the secondary parameters of the measurement result are used to compare with the high and low limits of the table. "---" means no compare. The soft key zone has corresponding items. Press the soft key **LMT DATA A**, "A" will be displayed in the **LMT** zone. When press the soft key **LMT DATA B**, "B" will be displayed in the **LMT** zone. While press the soft key **OFF**, data in LMT zone and the corresponding high and low limits will be cleared and be displayed as "---".

3.9 TOOLS

Press [SETUP] and press **TOOLS** to enter into the **<TOOLS>** page shown as below.



The TOOLS interface of LCR-2100 provides several specific functions and some custom design functions.

- CORR DATA
- NULL FIXTURE
- HOLD NOM RNG
- AUTO FETCH
- HDL VALID TIME

3.9.1 CORR DATA

Move the cursor to **CLEAR CORR**, press the softkey to clear all the correction data of 201 spots.

The prompt box of operation instruction will be displayed.

3.9.2 NULL FIXTURE

This function helps check poor contact or short circuit conditions of the test fixture. If this function is enabled, the instrument automatically assumes NOM as the nominal value in the LIMIT TABLE interface, takes the value after the nominal value multiplied by 0.05 as the lower limit, and multiplies the nominal value by 100 as the upper limit. Values exceeding this upper and lower limit range are considered as open or short circuit of the fixture. The instrument will stop outputting the HANDLER sorting result signal to prevent the output of the wrong judgment result.

3.9.3 HOLD NOM RNG

This function is to lock the range for quick measurement. If this function is enabled, the instrument will lock the corresponding range according to the nominal value in the LIMIT TABLE interface. Whether the range in the measurement setting interface is AUTO, the instrument will measure in locked range.

3.9.4 AUTO FETCH

This function works for data communication and transmits data through the RS-232C or USB interface. The general data transmission mode is to send the FETCH? command to the instrument and the instrument sends the measurement data through the communication port. Once AUTO FETCH is enabled, each measured data is automatically sent through the communication port without the FETCH? command.

Note: When using this function, please make sure the host computer is ready to accept the data continuously sent by the instrument.

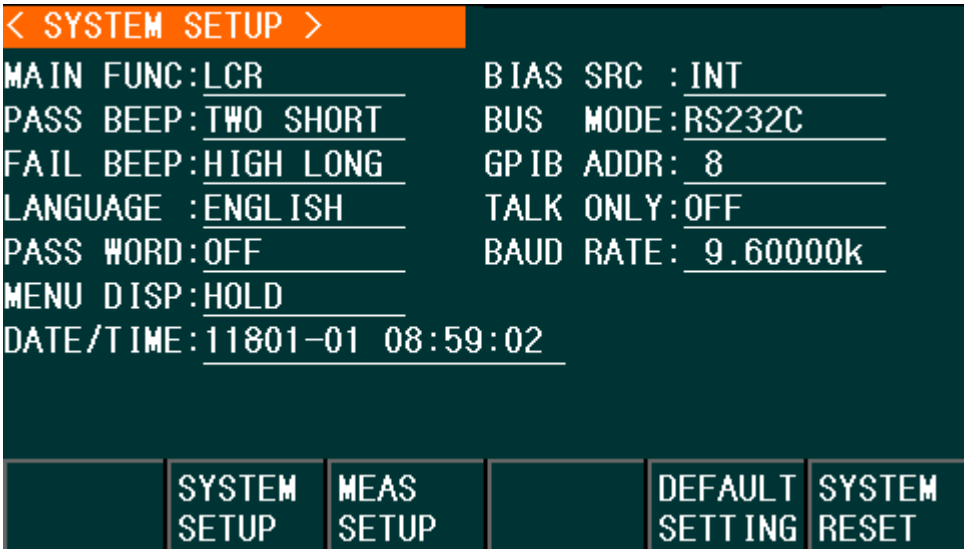
3.9.5 HDL VALID TIME

It is to set the level hold time for the output signal of the HANDLER interface. The HOLD state indicates that the output signal of the interface is maintained until there is a new change. Use the keyboard to input the hold time from 0 ~ 2S, 0 is the HOLD state.

Chapter 4 [SYSTEM] and <FILE MANAGE>

4.1 <SYSTEM SETUP>

Press **[SETUP]** and then **SYSTEM SETUP** to enter into the **<SYSTEM SETUP>** page shown as below.



On this page, most system setup items are displayed, such as instrument main function, beeper, PASS beeper, FAIL beeper, language, PASS word, bus mode, GPIB address, TALK only, Bias SRC, baud rate, menu display and data/time.

NOTE: system setup items will be saved automatically after finishing setting all the system items in this interface.

4.1.1 MAIN FUNC

This item is reserved function.

4.1.2 PASS BEEP

This zone is used to control and display the beep mode when the test result is qualified.

Operation steps for setting PASS BEEP

1) Move the cursor to **PASS BEEP**, the following soft keys will be displayed.

- **HIGH LONG**

  This soft key is used to select high and long beep.

- **HIGH SHORT**

  This soft key is used to select high and short beep.

- **LOW LONG**

This soft key is used to select low and long beep.

- **TWO SHORT**

This soft key is used to select two low and short beeps.

- **OFF**

This soft key is used to set the pass beep function OFF.

4.1.3 FAIL BEEP

This zone is used to control and display the beep mode as **FAIL BEEP** when the test result is unqualified.

Operation steps for setting FAIL BEEP

1) Move the cursor to **FAIL BEEP**, the following soft keys will be displayed.

- **HIGH LONG**

This soft key is used to select high and long beep.

- **HIGH SHORT**

This soft key is used to select high and short beep.

- **LOW LONG**

This soft key is used to select low and short beep.

- **TWO SHORT**

This soft key is used to select two low and short beeps.

- **OFF**

This soft key is used to set the fail beep mode OFF.

4.1.4 LANGUAGE

This zone is used to control and display the current language mode of the operating instrument.

Operation steps for setting language

1) Move the cursor to **LANGUAGE**, the following soft keys will be displayed.

- **ENGLISH**

This soft key is used to select English as the operation language.

- **CHINESE**

This soft key is used to select Chinese as the operation language.

4.1.5 PASS WORD

This zone is used to display the password–protection mode.

Operation steps for setting the password

1) Move the cursor to **PASS WORD**, the following soft keys will be displayed.

- **OFF**

This soft key is used to turn off the password protection mode.

- **LOCK SYSTEM**

This soft key is used to turn on the password protection function including file protection and starting up password.

■ **LOCK FILE**

This soft key is used to protect user's file.

■ **MODIFY**

This soft key is used to modify the password. The operation steps are as follows:

Press **MODIFY** to input a new password. After inputting, the prompt information will appear on the screen to prompt you to confirm the new password. Input the new password again till the modification finishes.

Note: The default password is 0147852.

4.1.6 BUS MODE

This mode is used to select RS232C, GPIB, USBTMC or USBCDC.

Operation steps for setting bus mode

1) Move the cursor to **BUS**, the following soft keys will be displayed.
   - ■ **RS232C**
   - ■ **GPIB**
   - ■ **USBTMC**
   - ■ **USBCDC**
2) Use above soft keys to select the required interface bus.

Note: GPIB optional must be installed before GPIB mode is available.

4.1.7 GPIB ADDR (Reserved function)

This zone is used to control and display the current GPIB address.

Operation steps for setting GPIB address:

1) Move the cursor to **GPIB ADDR**, the following soft keys will be displayed.
   - ■ ↑ (+)

   This soft key is used to increase the GPIB address.
   - ■ ↓ (-)

   This soft key is used to decrease the GPIB address.

4.1.8 TALK ONLY

The Talk only function is used to control the instrument to send each measurement result to bus through its interface of RS232C, GPIB, USBTMC or USBCDC. When the talk only function is ON, the instrument cannot be controlled by PC.

Operation steps for setting the talk only function

1) Move the cursor to **TALK ONLY**, the following soft keys will be displayed.
   - **ON**
   - **OFF**
2) Press **ON** to turn on the talk only function or **OFF** to turn off this function.

4.1.9 BIAS SRC

Bias source is used to select the DC bias power. (LCR-2200: internal bias source)

- INT mode

The standard internal DC bias voltage source:
30Ω output resistance (-1.5V to +1.5V); DC bias current source (-50mA to 50mA)
100Ω output resistance (-5V to +5V); DC bias current source (-50mA to 50mA)

- TH1778

It can be connected with TH1778 Bias current source and supports up to 120A bias current with 6 sets of TH1778.
NOTE: when bias source is enabled, only 100Ω can be used.

4.1.10 BAUD RATE

Baud rate is used select the baud rate of the RS232C interface. The available baud rate of this instrument is from 9.600k to 115.200k.

Operation steps for setting the baud rate

Move the cursor to **BAUD RATE**, the following soft keys will be displayed.

- ↑ (+)

  This soft key is used to increase the baud rate.
- ↓ (-)

  This soft key is used to decrease the baud rate.

4.1.11 MENU DISP

The soft key area can be set as HOLD or fixed time. When **MENU DISP** is set to HOLD, the soft key area will be displayed all the time. When **MENU DISP** is set to fixed time, the soft key area will be auto hided after holding to the setting time. When triggering any key in the operation panel again, the soft key area will be displayed again and restart timing.

Operation steps for setting the menu display

Move the cursor to **MENU DISP**, the following soft keys will be displayed.

- ↑ (+)

  This soft key is used to increase the menu display.
- ↓ (-)

  This soft key is used to decrease the menu display.

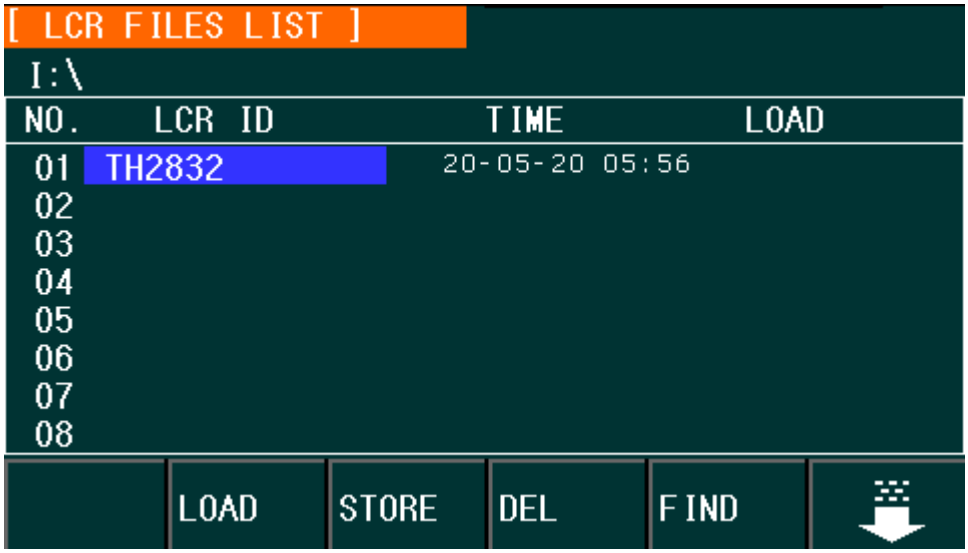
4.1.12 DATA/TIME

When moving to the time zone, users can modify the system time.

4.2 LCR <FILE MANAGE>

LCR-2100 series instrument can save the user-set parameter to the nonvolatile memory in the form of file, so when use the same setting next time user can load a corresponding file to obtain the parameter set and used last time. By doing so, it can save the time of setting parameter and improve the production efficiency.

Press [FILE MANAGE] to enter into the file manage page, shown as below:



4.2.1 Setup file for single-group component (*.STA)

40 groups of different single groups of component set file (*.STA file) can be saved in the instrument, but external storage U-disk can display/operate 500 groups of different single groups of component set file (note: U-disc is an optional accessory).

Use **FILE MANAGE** function on the following File menus, the following data will be saved or loaded in the form of file, which are called *.STA file.

- Control and setting parameter on <MEASURE SETUP> page
  - FUNCA
  - FREQ
  - LEVEL
  - RANGE
  - SPEED
  - Voltage BIAS
  - Current BIAS
  - TRIG
  - ALC

- TRIG DLY
- STEP DLY
- DCR POL
- DC RNG
- DC LEV
- Rsou
- AVG
- Vm
- Im
- DEV A
- DEV B
- REF A
- REF B

- Control and set parameters on <BIN COUNT DISP> page
  - BIN COUNT (ON/OFF)
- Control and set parameter on <LIMIT TAABLE SETUP> page
  - PARAM (swap parameter)
  - NOM (reference value)
  - MODE (%-TOL/ABS-TOL/SEQ-MODE)
  - AUX (ON/OFF)
  - COM (ON/OFF)
  - High and low limits of each bin
- Control and set parameters on <List Sweep Setup> page
  - List Sweep Mode (SEQ/STEP)
  - List Sweep Parameter (Frequency/Level/Bias)
  - Test points of all sweep parameters
  - High and low limits of all test points, including limit parameters (LIMIT-DATA A/LIMIT-DATA B)
- Page format currently displayed

4.2.2 U-disk manage performance

As described above, LCR-2100 has a standard configuration of USB HOST interface, so the external U-disk can be used as the memory media. In this condition, it breaks the memory limit of 40 groups of *.LCR files. Meanwhile those files can be copied to IBM PC or compatible desk-top computer, laptop with USB interface to reach the infinite extension.

LCR-2100 supports the USB memory devices as below:

- Meet the USB 1.0/1.1 standard
- Capacity: 32MB/256MB/2GB/4GB
- File format: FAT16, FAT32 (Format the USB memory on Microsoft Windows operation system)

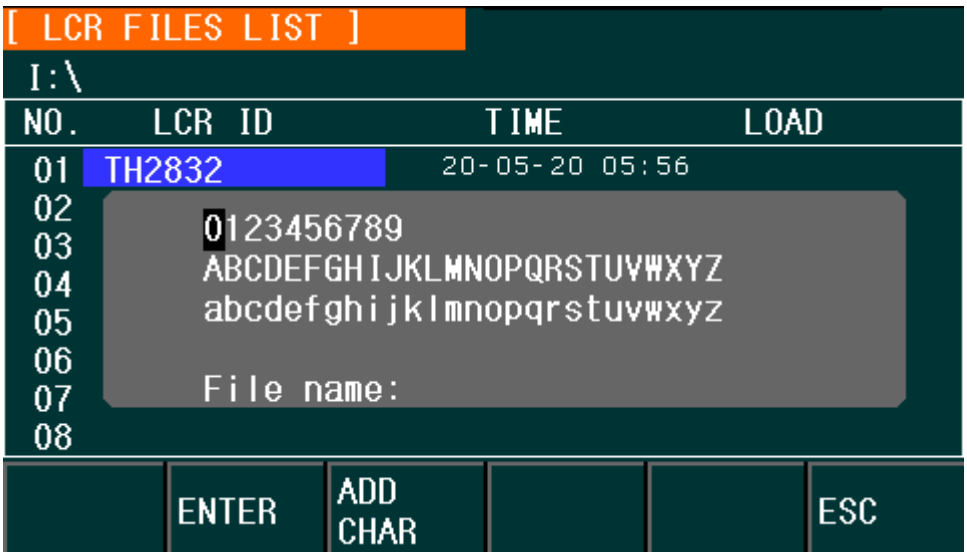
4.2.3 Operation steps for file management

A. Search an existed file

1) Use the [↑] and [↓] to view one by one.
2) Use the [←] and [→] to view one page by one page.
3) Press the soft key **FIND**. Input the file character and then press the [ENTER] to search the target file.
4) Input the page number and press the [ENTER] to search the file.

B. Save the following control and setting parameters to a file by the following steps

1) Select and set all control and setting parameters on the desired page.
2) Move the cursor to **FILE MANAGE**, the following soft keys will be displayed.
   - **LOAD**
   - **STORE**
   - **DEL**
   - **FIND**
   - ⇩
   - **COPY TO E:**
   - **EXT. FILE**
   - ⇧
3) In the file list, move the cursor to the file-saved position or input the file number directly.
4) Press **STORE**, the following soft keys will be displayed.
   - **Yes**
   - **No**
5) Press **No** to cancel the current save operation and return step 2.
6) Press **Yes**, and LCR file name input operation interface will be displayed.



7) Move the cursor to select the character and press **ADD CHAR** to input the character. Press **ENTER** to save the current file name. Press **ESC** to quit the file name input interface.

C. Load the control and setting parameters from a file by the following steps

1) Press **FILE MANAGE**, the file list and the following soft keys will be displayed.
   - **LOAD**
   - **STORE**
   - **DEL**
   - **FIND**
   - ⇩
   - **COPY TO E:**
   - **EXT. FILE**
   - ⇧
2) In the file list, move the cursor to the file-saved position or input the file number directly.
3) Press **LOAD**, the following soft keys will be displayed.

- **Yes**
- **No**

4) Press **No** to cancel the current load operation and return step 1.
5) Press **Yes** to load the currently selected file. Then LCR-2100 will return the current display page.

D. Copy a file to an U disk by the following steps

1) Assuming that it is necessary to copy internal files 2 to external U-disk.
2) Press **FILE MANAGE**, the file list and the following soft keys will be displayed.
   - **LOAD**
   - **SAVE**
   - **DEL**
   - **FIND**
   - ⇩
   - **COPY to E:**
   - **EXT. FILE**
   - ⇧
3) Move the cursor the file to be copied and press [ ] to confirm (multiple files can be selected).
4) Press **COPY to E:** to copy the file the instrument.
5) While copying the file, the progress bar will present the progress of the file copy. When the progress bar is disappeared, the operation of the file copy is finished.

NOTE: Please make sure that your U-disk meets the standard that described in this chapter and no write-read protection.

Chapter 5 Execute LCR operation and some examples

5.1 Correction operation

To execute correction operation (in order to prevent the stray impedance from affecting the test accuracy, it is necessary to make open/short correction), users can select one of the two correction modes.

5.1.1 Sweep correction

a) Press the menu key **[SETUP]** and then the soft key **CORRECTION**, the instrument will enter into the **< CORRECTION>** page.
b) Move the cursor to the **OPEN** zone. **ON**, **OFF**, **MEAS OPEN** and **DCR OPEN** will be displayed in the soft key zone.
c) Keep the test fixture in the open status, and then press **MEAS OPEN** to execute open correction till the prompt information zone displays that open correction is finished.
d) Press **ON** to turn on the open correction function.
e) Insert the short plate (26010) to the test fixture.
f) Move the cursor to the **SHORT** zone. **ON**, **OFF**, **MEAS SHORT** and **DCR OPEN** will be displayed in the soft key zone.
g) Press **MEAS SHORT** to execute the short correction till the prompt information zone displays that the short correction is finished.
h) Press **ON** to turn the short correction function.
i) Move the cursor to the **LOAD** zone. **ON**, **OFF** will be displayed in the soft key zone.
j) Press **OFF** to turn off the load correction function.
k) Move the cursor to the **FREQ** zone, **ON**, **OFF**, **MEAS OPEN**, **MEAS SHORT** and **MEAS LOAD** will be displayed in the soft key zone.
l) Press **OFF** to turn off the point-frequency correction function of **FREQ**.

5.1.2 Point-frequency correction

This function will gain better results in single-frequency test.
If the test frequency is 5kHz,

a) Press the menu key **[SETUP]** and then **CORRECTION**, then instrument will display the **<CORRECTION>** function.
b) Move the cursor to the **OPEN** zone, **ON**, **OFF**, **MEAS OPEN** and **DCR OPEN** will be displayed in the soft key zone.
c) Press **ON** to turn on the open correction function.
d) Move the cursor to the **SHORT** zone, **ON**, **OFF**, **MEAS OPEN** and **DCR SHORT** will be displayed in the soft key zone.
e) Press **ON** to turn on the short correction function.

f) Move the cursor to the **LOAD** zone, **ON**, **OFF** will be displayed in the soft key zone.
g) Press **OFF** to turn off the load correction function.
h) Move the cursor to the **Spot No.** zone to select the correction point.
i) Move the cursor to the **FREQ** zone, **ON**, **OFF**, **MEAS OPEN**, **MEAS SHORT** and **MEAS LOAD** will be displayed in the soft key zone.
j) Press **ON** to turn on the point-frequency correction function of **FREQ**.
k) Press [5], at the bottom of the screen meanwhile the available units (**Hz**, **kHz** and **MHz**) will be displayed in the soft key zone. Press **kHz**, the **FREQ** zone will be changed as 5.00000kHz (be the same as that of test frequency).
l) Keep the test fixture be in open status and press **MEAS OPEN** to execute open correction.
m) Insert the short plate (26010) to the test fixture.
n) Press **MEAS SHORT** to execute short correction.

5.2 Correct connection of DUT

There are 4 pairs of test terminal: Hcur, Lcur, Hpot, Lpot and corresponding shielding terminal of each terminal.

Each terminal contains shielding layer whose function is to reduce the influence of the ground stray capacitance and the interference of the electromagnetic field. In the process of testing, Hcur, Hpot and Lpot, Lcur should be connected with DUT lead to form a complete 4-terminal measurement, thus reducing the effect of the lead and the connection points on the test results (especially the dissipation measurement). When testing low-ohm components, Hpot, Lpot should be connected to the lead terminal so as to avoid the impedance being added to the lead impedance and the connection principle is that the Hpot and Lpot test should be the actual existed voltage on DUT.

In other words, before connecting to DUT, it is not recommended to connect Hcur, Hpot with Lpot, Lcur, for doing this will increase test error.

If the connection point and the lead resistance R lead are far weaker than the tested impedance (for example: $R_{lead}<Z_x/1000$, the accuracy error is required to be less than 0.1%), before connecting to DUT, it is recommended to connect Hcur, Hpot and Lpot, Lcur (Two terminal test).

In the test with high accuracy requirement, using Kelvin test fixture (standard accessory) will gain better results than using test leads. When Kelvin test lead is used under 10kHz, a better measurement result can be obtained. However, when the frequency is higher than 10kHz, it cannot meet the measurement demand. In high frequency, the change of the clearance between test leads will directly change stray capacitance and inductance on test terminals and this problem is unavoidable, because the test leads cannot be fixed in a position.

So, the use of the test fixture should be used as possible in high frequency. If the test fixture is unavailable or cannot be used, the status of test leads should be the same in the processes of correction and test.

No matter the standard Kelvin test fixture or Kelvin test leads or user-made fixture is used, the following requirements should be met.

1. Distribution impedance must be reduced to the Min. especially when testing high impedance components.
2. Contact resistance must be reduced to Min.
3. Short and open must be available between contact points. Open and short correction can easily

reduce the influence of distribution impedance of the test fixture on measurement. For open correction, the clearance between test terminals should be the same with that when they connects with DUT. For short correction, the short plate of low impedance should be connected between test terminals. Another way is to directly connect Hc with Lc or Hp with Lp, then connect both.

Note: When the DUT is a polarity component, before testing, the high potential terminal should be connected to the terminal with mark "+", "Hc" or "Hp" and the low terminal should be connected to the terminal with mark "-", "Lc" or "Lp".

Warning: Before testing, please discharge the tested polarity component so as to avoid the damage to the instrument.

5.3 Eliminate the influence of stray impedance

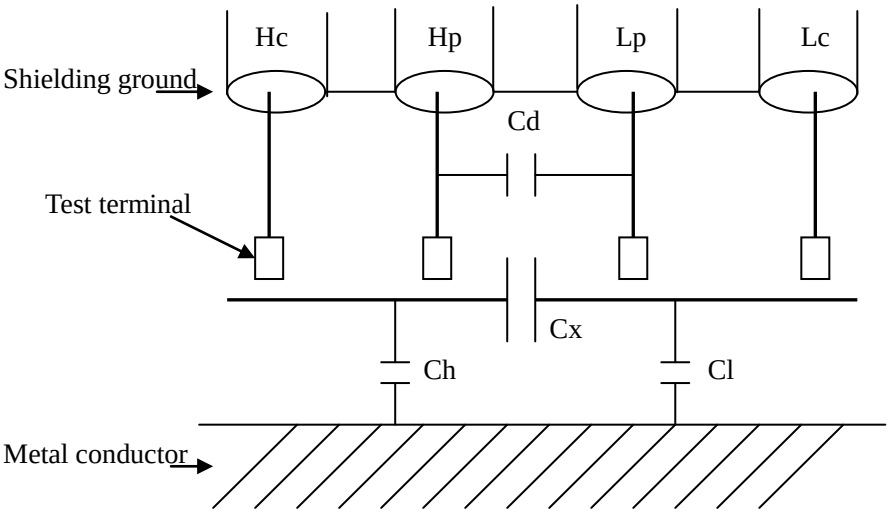


Figure 5-1 Influence of stray capacitance

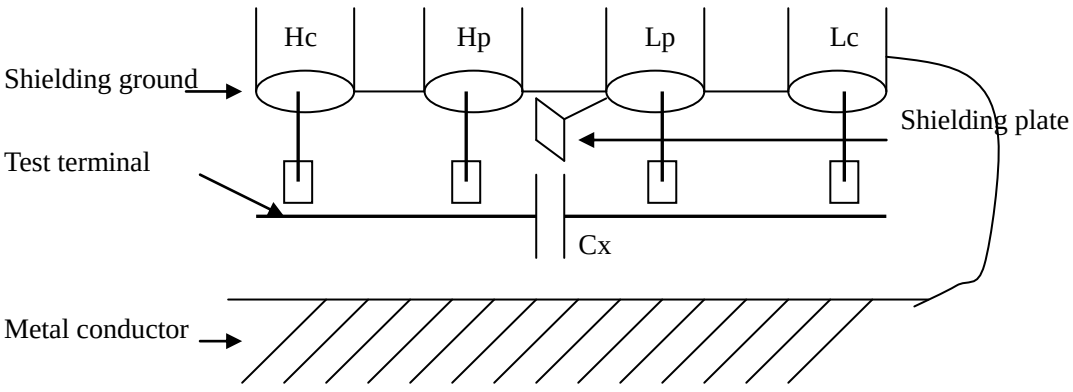


Figure 5-2 Eliminate the influence of stray capacitance

When the DUT has high impedance(such as small capacitance), the influence of stray capacitance cannot be ignored. Figure 5-1 is an example of the use of 4 terminal pair measurement. In this figure, Cd is connected with Cx in a parallel way and when a conductance plate is positioned under DUT, capacitance Ch will connect with Cx in parallel after connecting with Cl in series and by this way the measurement result will have errors. If a ground conductor is installed between high and low terminals, Cd can be reduced to Min. Meanwhile if the ground terminal is connected to the conductance plate, the influence of Ch and Cl will be eliminated.

When the DUT is low impedance (such as small inductance, large capacitance), a large current will flow through test leads Hc and Lc. In this case, **electromagnetic coupling between test leads becomes the main source of test errors** except the influence of the contact resistance on test terminals. If this coupling cannot be eliminated, it will bring unexpected influence on test results. Generally, contact resistance affects the resistance of impedance and electromagnetic affects the reactance of impedance. Test terminals can adopt 4TP connection method. For 4TP connection, the currents flow though Hc and Lc are equal in value and opposite in direction with those flowing through each shielding terminals. By this way, the magnetic fields produced by these currents can be mutually offset and further eliminate the influence of mutual inductance coupling on test results.

5.4 Operation example for testing inductance with LCR-2100

Test Condition

Function: Ls-Q
Frequency: 5kHz
Level: 1.5Vrms
Internal impedance: 100Ω

Operation steps

1) Turn on the instrument.
2) Set basic parameters
   a) Press [DISP] to enter into the <MEAS DISP> page.
   b) Move the cursor to FUNC, the current item is displayed as Cp-D. Meanwhile Cp—…→, Cs—…→, Lp—…→, Ls—…→, Z—…→, ↓ will be displayed in the soft key zone.
   c) Press the soft key Ls—…→, Ls-D, Ls-Q and Ls-Rs will be displayed.
   d) Press Ls-Q to select the Ls-Q function.
   e) Move the cursor to **FREQ**, the current frequency is 1.0000kHz.
   f) Press [5], 5 will be displayed in the prompt information zone at the bottom of the screen. The available units Hz, kHz and MHz will be displayed in the soft key zone. Press kHz, the frequency will be changed as 5.00000kHz.
   g) Move the cursor to **LEVEL**, the current displayed level will be 1.000V.
   h) Press [1][.][5], +1.5 will be displayed in the prompt information zone at the bottom of the screen. The available units mV, V, μA, mA and A will be displayed in the soft key zone. Press [V], the level will be changed as 1.5V.
   i) Press [SETUP] to enter into the <MEAS SETUP> page.
   j) Move the cursor to R_{sou} zone, 100Ω, 30Ω will be displayed in the soft key zone.
   k) Press 100Ω to select 100Ω as the signal internal impedance.

3) Connect the test fixture (26005) to the test terminals of LCR-2100.
4) Execute correction (To avoid the influence of stray impedance on measurement accuracy, Open/ Short correction must be operated) (refer to 5.1.2 “Point-frequency correction”)
5) Mount the tested inductance to the test fixture.
6) Execute test operation.

Press [DISP] to enter into the <MEAS DISP> page. The instrument can test continuously and the test result will be displayed in upper case character in the center of the page.

7) If the test result is obviously incorrect, please check the following items.
a) Check the tested inductance is in good connection with the test fixture or not.
b) Check the test fixture is in good connection with the test terminals of the instrument or not.
c) Redo the open/short correction.

❋**NOTE:** When the sweep open/short correction is used, the point-frequency correction function should be set as OFF. Refer to Correction operation in this chapter.

5.5 Operation example of testing capacitance by multi-frequency list sweep

Test condition:

Function: Cp-D
Level: 1Vrms
Other parameters

Frequency	Compare parameter	Low limit	High limit
1kHz	Cp(capacitance)	325.0nF	333.0nF
10kHz	D（Dissipation）	0.0001	0.0003
100kHz	D（Dissipation）	0.0060	0.0100

Beep: HIGH LONG
Alarm mode: OUT

Operation steps

1) Turn on the instrument.
2) Set basic parameters.
   a) Press [DISP] to enter into the <MEAS DISP> page.
   b) The **FUNC** zone is currently displayed as Cp-D and the Level zone is 1.000V.
   c) Press [SETUP] to enter into the <MEAS SETUP> page, meanwhile the following soft keys will be displayed in the soft key zone: MEAS SETUP, CORRECTION, LIMIT SETUP, SWEEP SETUP and FILE MANAGE.
   d) Press LIST SETUP to enter into the <LIST SWEEP SETUP> page.
   e) Move the cursor to the **SWEEP PARAM** zone. Then this zone will be displayed as FREQ[Hz].
   f) Move the cursor to the parameter zone of sweep point 1, then this zone will displayed as ---.
   g) Press [1], +1 will be displayed in the prompt information zone and the soft key zone will display available units: Hz, kHz and MHz. Press kHz, this zone will be changed as

1.00000k.

h) Press [→] to move the cursor to the LMT zone of sweep point 1, then this zone will be displayed as ---. The soft key zone will display: LIMIT DATA A, LIMIT DATA B and OFF.

i) Press LIMIT DATA A to select the compare primary parameter Cp function. This zone will be display A and the cursor will automatically move the low limit zone of sweep point 1.

j) Press [3][2][5], +325 will be displayed in the prompt information zone and the following available units will be displayed in the soft key zone: p, n, μ, m and k. Press n, this zone will be changed as 325.000n. Then the cursor will automatically move the high limit zone of the sweep point 1.

k) Press [3] [3] [3], +333 will be displayed in the prompt information zone and the following units will be displayed in the soft key zone: p, n, μ, m and k. Press n, this zone will be changed as 333.000n and the cursor will automatically move to the parameter zone of sweep point 2.

l) Press [10], +10 will be displayed in the prompt information zone and the soft key zone will display the following available units: Hz, kHz and MHz. Press kHz, this zone will be displayed as 10.0000k.

m) Press [→] to move the cursor to the LMT zone of sweep point 2, this zone will be displayed as---. The following soft key will be displayed in the soft key zone: LIMIT DATA A, LIMIT DATA B and OFF.

n) Press LIMIT DATA B to select the compare secondary parameter D function. This zone will be displayed as B and the cursor will be automatically moved to the low limit zone of the sweep point 2.

o) Press [0][.][0][0][0][1], +0.0001 will be displayed in the prompt information zone and the soft key zone will display the following available units: p, n, μ, m and k, M, *1. Press [*1], this zone will be changed as 100.000μ and the cursor will automatically move to the high limit zone of sweep point 2.

p) Press [0][.][0][0][0][3], +0.0003 will be displayed in the prompt information zone and the soft key zone will display the following available units: p, n, μ, m and k, M, *1. Press [*1], this zone will be changed as 300.000μ and the cursor will automatically move to the parameter zone of sweep point 3.

q) Based on 1-p steps, input 100kHz, B, 0.0060 and 0.0100 for the 3rd sweep point.

3) Alarm setup

a) Press [SYSTEM] to enter into the <System Setup> page.

b) Move the cursor to the FAIL BEEP zone to select HIGH LONG.

4) Mount the test fixture (26005) to the test terminals of LCR-2100.

5) Execute correction function (To avoid the influence of the stray impedance on the measurement accuracy, it is necessary to execute open/short correction (refer to chapter 5.1.1 Sweep Correction)).

6) Insert the tested capacitor to the test fixture.

7) Execute test operations.

Press [DISP] and then press List Sweep to enter into the <List Sweep Display> page. The instrument will test continuously and then display the test and the compare results on page. If the

compare result is H (higher than the high limit) or L (lower than the low limit), there is a beep alarm. The following figure shows the measurement display page.

8) If the test result is obviously incorrect, please check the following items.
   a) Check the tested inductance is in good connection with the test fixture or not.
   b) Check the test fixture is in good connection with the test terminals of the instrument or not.
   c) Redo the open/short correction.

❋**NOTE:** When the sweep open/short correction is used, the point-frequency correction function should be set as OFF. Refer to Correction operation in this chapter.

5.6 Setup example of comparator

LCR-2100 provides complete comparator function. It is convenient for component measurement and judgment, incoming and outgoing quality inspection in production line. Standard configuration of HANDLER interface makes it realize automatic sorting measurement system.

The concept and specific operation of the comparator has been described in the preceding chapter. Here are two setup examples.

5.6.1 Capacitor sorting

Capacitor type: 0805CG271
Basic requirements: the capacitance is divided into two bins: BIN J and BIN K. When the capacitance passes and the loss fails, it will be sorted additionally.
Measurement parameters: frequency of 100kHz, level of 1Vrms, SLOW, FAIL alarm and external trigger.
Sorting parameters: J bin -4.6% ~ +4.8%, K bin -9% ~ +10%, loss tgδ < 0.15%.

The parameters needed to be set in this example are listed below:

Primary parameter（FUN1）	Cp
Secondary parameter（FUN2）	D
Frequency（FRQ）	100kHz
Level（LEV）	1V
Speed（SPEED）	SLOW
Switch of auxiliary bin（AUX）	ON
Tolerance Mode of primary parameter（MODE）	%TOL (percentage tolerance mode)
Nominal value（NOMINAL）	270pF
Lower limit of BIN1（BIN1 LOW）	-4.6%
Upper limit of BIN1（BIN1 HIGH）	4.8%
Lower limit of BIN2（BIN2 LOW）	-9%
Upper limit of BIN2（BIN2 HIGH）	10%
Lower limit of secondary parameter（2nd LOW）	0.0000

Lower limit of secondary parameter（2nd LOW）	0.0015
Trigger mode（TRIG）	EXT（external）
Alarm mode（CMP ALARM）	POOR ALARM（HIGH LONG）

Instruction:

1. For small capacitance, its impedance of 100kHz is over 1 kΩ, so equivalent parallel mode should be selected.
2. When any bin of the capacitance passes but loss fails, it will be archived additionally. Now, auxiliary bin should be set as ON and it will be sorted into AUX BIN. If the AUX BIN is set as OFF, it will be judged as FAIL when loss fails.
3. Because the given upper and lower limit is based on the percentage tolerance of nominal value 270pF, the primary parameter should select %TOL percentage mode.

Specific setup:

1) In MEAS DISP page, select Cp-D and set the frequency, level and speed.
2) Press SETUP key to enter into the MEAS SETUP page and change the TRIGGER MODE as EXT (external trigger).
3) Press SETUP---LIMIT to enter into the LIMIT TABLE SETUP page and set the nominal value, primary parameter tolerance mode, upper/lower limit parameter, comparator switch and auxiliary bin switch.
4) Press SYSTEM key to enter into the SYSTEM SETUP page (System Config), find FAIL BEEP item and set it as HIGH LONG.
5) Return to the MEAS DISP page after setup.

5.6.2 Operation example of load correction

1) Operation steps

Test condition

Frequency: 100kHz

Cp: 11nF

D: 0.0005

a) Press [SETUP], the following soft keys will be displayed in the soft key zone: MEAS SETUP, CORRECTION, LIMIT TABLE, LIST SETUP, FILE MANAGE and TOOLS.
b) Press CORRECTION to enter into the <CORRECTION> page.
c) Move the cursor to **OPEN**, the following soft keys will be displayed in the soft key zone: ON, OFF and MEAS OPEN And DCR OPEN.
d) Press ON to turn on the open correction function.
e) Move the cursor to **SHORT**, the following soft keys will be displayed in the soft key zone: ON, OFF and MEAS SHORT And DCR SHORT.
f) Press ON to turn on the short correction function.
g) Move the cursor to **LOAD**, the following soft keys will be displayed in the soft key zone: ON and OFF.
h) Press ON to turn on the load correction function.

i) Move the cursor to **FUNC**, this zone will display Cp-D. Meanwhile Cp—…→， Cs—…→， Lp—…→， Ls—…→， Z—…→， ↓ will be displayed in the soft key zone.

j) Press Cp-D to select the Cp-D function.

k) Move the cursor to FREQ zone, the following soft keys will be displayed in the soft key zone: ON, OFF, MEAS OPEN, MEAS SHORT and MEAS LOAD.

l) Press ON to turn on the point-frequency correction function of **FREQ**.

m) Press [1][0][0], +100 will be displayed in the prompt information zone and the soft key zone will display the following available units: Hz, kHz and MHz. Press kHz, the **FREQ** zone will be changed as 100.000kHz (the same with the test frequency).

n) Move the cursor to the **REF A:** zone of the frequency 1. Press [1][1], +11 will be displayed in the prompt information zone and the following available units will be displayed in the soft key zone: p, n, μ, m and k. Press n, this zone will be changed as 11.0000nF.

o) Move the cursor the **REF B:** zone of the frequency 1. Press [0][.][0][0][0][5], +0.0005 will be displayed in the prompt information zone and the following available units will be displayed in the soft key zone: p, n, μ, m and k. Press [ENTER], this zone will be changed as 0.00050.

p) Move the cursor to Freq 1. The following soft keys will be displayed: ON, OFF, MEAS OPEN, MEAS SHORT and MEAS LOAD.

q) Hold the test fixture in open status and keep user's hands or other interference source far away from the test fixture. Press the soft key MEAS OPEN to execute open correction.

r) Insert the short plate (26010) into the test fixture. Please ensure that the short plate and the reeds of the test fixture have good contact.

s) Press the soft key MEAS SHORT to execute short correction.

t) Insert a standard capacitance into the test fixture. Please ensure that the pins of the standard capacitance have good connection with the reeds of the test fixture.

u) Press the soft key MEAS LOAD to execute load correction.

2) Note

a) Because of the different software editions, the soft keys and status information may be different form this book, but it may not affect users' understanding.

b) The load correction is only valid for the components with the same specification. If the specification is changed, it is required to redo load correction.

Chapter 6 Performance and Test

6.1 Test function

6.1.1 Parameter and symbol

C：capacitance L：Inductance
R：resistance Z：impedance Y：admittance
X：reactance B：susceptance G：conductance
D：dissipation θ：phase angle Q：quality factor
DCR: DC resistance

Test combination

Parameters described above are combined in the following modes:

Primary parameter	Z, Y	L, C	R	G
Secondary parameter	θ(deg phase), θ(rad radian)	D, Q, RS, RP, G, Rd	X	B

There is no combination for DCR.

Mathematical operation

Operation between the measurement value and the programmable nominal value: absolute deviation ΔABS and percent deviation Δ%.

6.1.2 Equivalent mode

Series and parallel

6.1.3 Range

Auto, Manual (Hold, increase and decrease)

6.1.4 Trigger

Internal, external and manual

Internal: Test DUT constantly and display the result

Manual: Press TRIGGER to test once then the result will be displayed.

External: After HANDLER receiving “start” signal, perform a measurement and output test result.

6.1.5 Delay time

Delay time: time from trigger to start. 0 to 60s are programmable with a resolution of 1ms.

6.1.6 Connection modes of test terminals

LCR-2100 adopts 4-terminal test method.
HD(Hcur): current sample high terminal
LD(Lcur): Current sample low terminal
HS(Hpot)：voltage sample high terminal
LS(Lpot): Voltage sample low terminal

6.1.7 Test speed (Frequency>=10kHz)

Fast：about 75 times/s（13ms/time）
Medium：about 12 times/s（83ms/time）
Slow：about 6 times/s（167ms/time）
The fast and middle speed will be slow down when frequency <10kHz.

6.1.8 Average

Be programmable from 1 to 255.

6.1.9 Display digit

6 digits, max. displayed digit: 999999

Test signal

6.1.10 Test signal frequency

Test signal is sine wave, accuracy：0.01％
Frequency range：
50Hz～100kHz（LCR-2100）
20Hz～200kHz （LCR-2200）
Min. resolution：0.01Hz

6.1.11 Signal mode

Normal: When testing, on measurement display page, voltage across test terminals may be smaller than preset voltage.

Constant level: The auto adjustment of internal level makes the voltage of DUT accordant with preset voltage.

6.1.12 Test signal level

	Mode	Range（100Ω）	Accuracy	Resolution
Voltage	Normal constant level	$10mV_{RMS}$—$2V_{RMS}$ $10mV_{RMS}$—$1V_{RMS}$	±（10%×preset value+2mV） ±（6%×preset value+2mV）	10mV
Current	Normal constant current	$100\mu A_{RMS}$ —$20mA_{RMS}$ $100\mu A_{RMS}$ —$10mA_{RMS}$	±（10%×preset value+ $10\mu A_{RMS}$） ±（6%×preset value+ $10\mu A_{RMS}$）	100μA

6.1.13 Output impedance

30Ω and 100Ω±1% are selectable.

6.1.14 Monitor for test signal level

Mode	Range	Accuracy
Voltage	$5mV_{RMS}$—$2V_{RMS}$ $0.01mV_{RMS}$—$5mV_{RMS}$	±（3%×reading+0.5mV） ±（12%×reading +0.1mV）
Current	$50\mu A_{RMS}$—$20mA_{RMS}$ $0.001\mu A_{RMS}$—$10\mu A_{RMS}$	±（3%×reading +5μA） ±（12%×reading +1μA）

6.1.15 Maximum measurement display range

Parameter	Measurement display range
L、Lk	0.00001μH ～ 99.999kH
C	0.00001pF ～ 9.99999F
Z、R、X、DCR	0.00001Ω～ 99.9999MΩ
Y、B、G	0.00001μs ～ 99.9999S
D	0.00001 — 9.99999
Q	0.00001 — 99999.9
θ	Deg -179.999°～179.999° Rad -3.14159 ～ 3.14159

6.1.16 DC bias voltage source

100Ω 0V—±5V Minimum resolution: 1mV,
Accuracy: 1% x preset voltage+5mV

	0mA—±50mA	Minimum resolution: 10μA
30Ω	0V—±1.5V	Minimum resolution: 1mV,
		Accuracy: 1% x preset voltage+5mV
	0mA—±50mA	Minimum resolution: 10μA

Measurement accuracy

Test accuracy includes stability、temperature coefficient、linear degree、test repeatability and calibration inter-error.

Check the accuracy of instrument should be under the following circumstances：

a. warm-up time：≥ 30 min
b. cable：0m, 1m
c. correct open and short correction after warming up
d. DC bias is in the position of "OFF"
e. The range works in "AUTO" to select correct test range

6.1.17 Accuracies of │Z│, │Y│, L, C, R, X, G, B

The accuracy Ae of │Z│, │Y│, L，C，R，X，G and B are expressed as：

$$\mathbf{A_e = \pm[A+(K_a+K_b+K_c)\times 100+ K_d + K_f]\times K_e\ [\%]}$$

A： basic test accuracy（figure A）

K_a：impedance rate factor（table A）

K_b：impedance rate factor（table A）

K_c：calibrated inter-factor（table B）

K_d：cable length factor（table D）

K_e：temperature factor（table E）

Kf：scan fixture modification factor（no add：Kf = 0, add：Kf = 0.2）

L, C, X, B accuracy using condition：D_x（Test value）≤0.1

R, G accuracy using condition：Q_x（Q test value）≤0.1

WhenD_x≥0.1, L, C, X, B accuracy factor A_e should be multiplied by $\sqrt{1+D_x^2}$

When Q_x≥0.1, R, G accuracy factor A_e should be multiplied by $\sqrt{1+Q_x^2}$

Accuracy of G can only be available in G-B combination.

6.1.18 Accuracy of D

The accuracy of D is given by D_e：

$$D_e = \pm\frac{A_e}{100}$$

The formula is only available when D_x≤0.1.

When D_x>0.1, D_e should be multiplied by（1+D_x）

6.1.19 Accuracy of Q

The accuracy of Q is given by the formula below：

$$Q_e = \pm \frac{Q_x \times D_e}{1 \mp Q_x \times D_e}$$

Where，Q_x is the value of the tested Q.

D_e is the accuracy of D

Above formula should be used when $Q_x \times D_e < 1$.

6.1.20 Accuracy of θ

The accuracy of **θ** is given by the formula below：

$$\boldsymbol{\theta e} = \frac{180}{\pi} \times \frac{A_e}{100} \qquad [\text{deg}]$$

6.1.21 Accuracy of G

When D_x (tested value of D)≤0.1

The accuracy of G is given by the formula below：

$$G_e = B_x \times D_e \qquad [S]$$

$$B_x = 2\pi f C_x = \frac{1}{2\pi f L_x}$$

Where, B_x is the value of tested B with the unit [S].

C_x is the value of tested C with the unit [F].

L_x is the value of tested L with the unit [H].

D_e is the accuracy of D.

F is test frequency.

The accuracy of G is only available in C_p-G and L_p-G combination

6.1.22 Accuracy of Rp

When D_x（value of tested D）≤0.1

The accuracy of R_p is given by the formula below：

$$R_p = \pm \frac{R_{px} \times D_e}{D_x \mp D_e} \qquad [\Omega]$$

Where, R_{px} is the value of tested R_p with the unit [S].

D_x is the value of test D with the unit [F].

D_e is the accuracy of D.

6.1.23 The accuracy of Rs

When D_x（value of tested D）≤0.1

The accuracy of R_s is given by the formula below：

$$R_{se} = X_x \times D_e \qquad [\Omega]$$

$$X_x = 2\pi f L_x = \frac{1}{2\pi f C_x}$$

Where, X_x is the value of test X with the unit [S].

C_x is the value of test C with the unit [F].

L_x is the value of test L with the unit [H].

D_e is the accuracy of D

F is test frequency

6.1.24 Accuracy factor

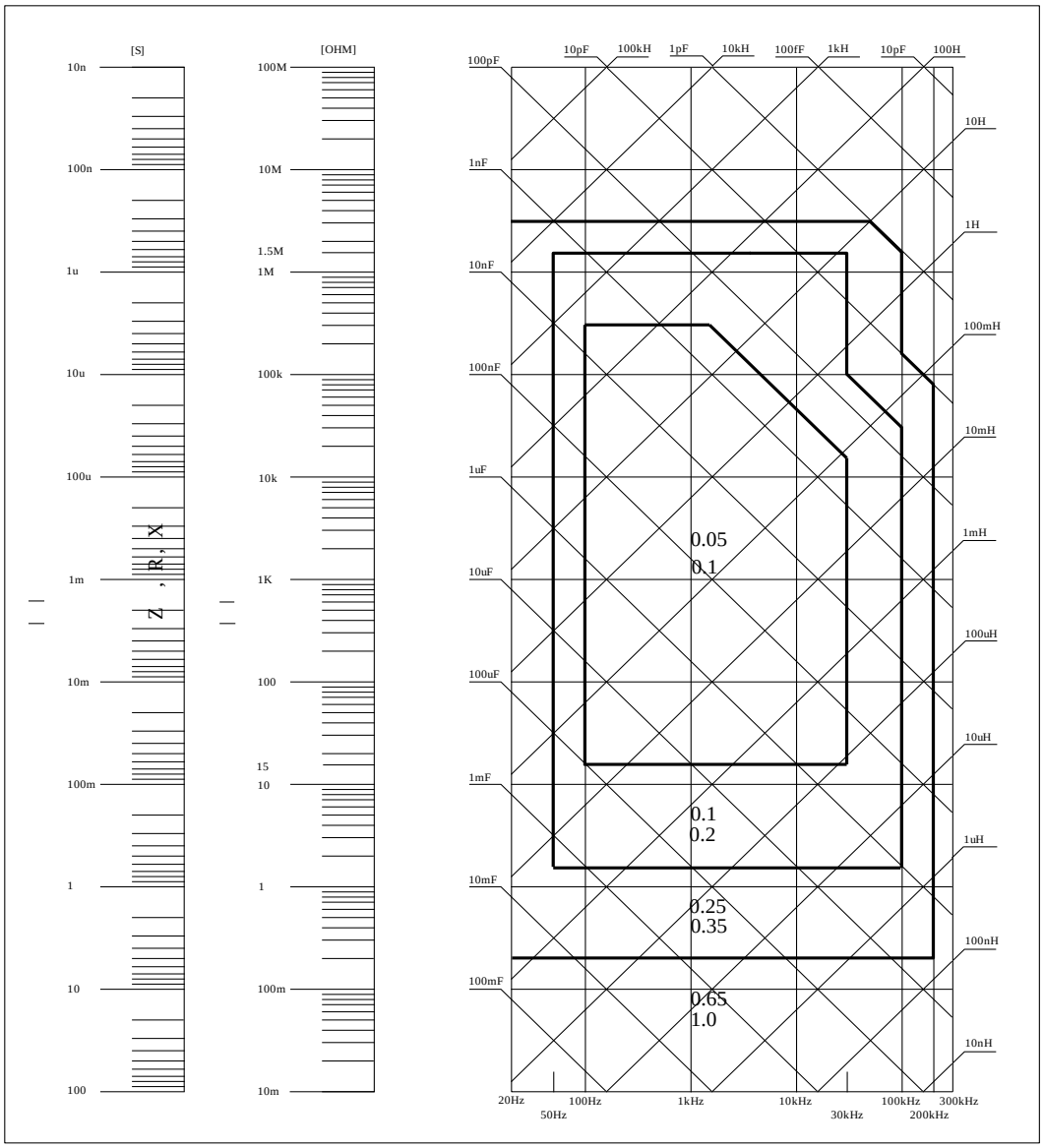


Figure A shows the basic measurement accuracy A.

In figure A, select a smaller value on boundary line.

In this figure, the basic accuracy value A can be obtained by the following methods:

0.05---When $0.4V_{rms} \leq V_s \leq 1.2V_{rms,}$ the test speed is the value A of medium, slow and fast.

0.1---When $0.4V_{rms} \leq V_s \leq 1.2V_{rms,}$ the test speed is the value A of fast.

When $V_s < 0.4V_{rms}$ or $V_s > 1.2V_{rms}$, the calculation method of value A is as the following steps:

1. Obtain A according to the current measurement speed;
2. According to the current test signal voltage to select the accuracy modification coefficient A_r (refer to figure B), the current basic measurement accuracy A is obtained by multiplying A got in step 1 with A_r.

Figure B is the basic accuracy modification curve, where V_s is the test signal voltage.

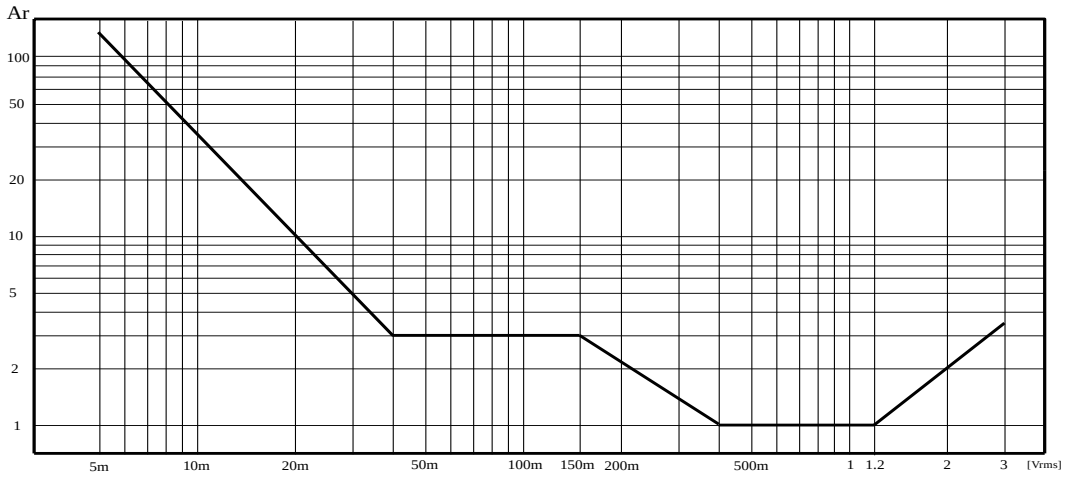


Table A Impedance rate factors: K_a, K_b

Speed	Frequency	K_a	K_b
Medium Slow	f_m<100Hz	$(\frac{1\times10^{-3}}{\lvert Z_m\rvert})(1+\frac{200}{V_s})(1+\sqrt{\frac{100}{f_m}})$	$\lvert Z_m\rvert(1\times10^{-9})(1+\frac{70}{V_s})(1+\sqrt{\frac{100}{f_m}})$
	100Hz≤f_m ≤100kHz	$(\frac{1\times10^{-3}}{\lvert Z_m\rvert})(1+\frac{200}{V_s})$	$\lvert Z_m\rvert(1\times10^{-9})(1+\frac{70}{V_s})$
	100kHz<f_m ≤200kHz	$(\frac{1\times10^{-3}}{\lvert Z_m\rvert})(2+\frac{200}{V_s})$	$\lvert Z_m\rvert(3\times10^{-9})(1+\frac{70}{V_s})$
Fast	f_m<100Hz	$(\frac{2.5\times10^{-3}}{\lvert Z_m\rvert})(1+\frac{400}{V_s})(1+\sqrt{\frac{100}{f_m}})$	$\lvert Z_m\rvert(2\times10^{-9})(1+\frac{100}{V_s})(1+\sqrt{\frac{100}{f_m}})$
	100Hz≤fm ≤100kHz	$(\frac{2.5\times10^{-3}}{\lvert Z_m\rvert})(1+\frac{400}{V_s})$	$\lvert Z_m\rvert(2\times10^{-9})(1+\frac{100}{V_s})$

	100kHz<fm ≤200kHz	$(\frac{2.5\times10^{-3}}{\lvert Z_m\rvert})(2+\frac{400}{V_s})$	$\lvert Z_m\rvert(6\times10^{-9})(1+\frac{100}{V_s})$

Where, f_m is the test frequency and the unit is [Hz].
The unit of the tested impedance is [Ω].
The unit of the test signal voltage is [mV_{rms}].
When the impedance is smaller than 500Ω, K_a, K_b is unavailable.
When the impedance is larger than 500Ω, K_b, K_a is unavailable.

Table B calibrated interpolating factor K_C

Test frequency	K_c
Direct calibrated frequency	0
Other frequency	0.0003

Table C Direct Calibrated frequency

			20	25	30	40	50	60	80	[Hz]
100	120	150	200	250	300	400	500	600	800	[Hz]
1	1.2	1.5	2	2.5	3	4	5	6	8	[kHz]
10	12	15	20	25	30	40	50	60	80	[kHz]
100	120	150	200							[kHz]

Table D Cable length factor K_d

Test signal level	Cable length		
	0m	1m	2m
≤1.5V_{rms}	0	2.5×10^{-4}（1+50×f_m）	5×10^{-4}（1+50×f_m）
>1.5V_{rms}	0	2.5×10^{-3}（1+16×f_m）	5×10^{-3}（1+50×f_m）
f_m: test frequency [MHz]			

When using the scan jig, take the correction factor K_d when the cable length is 2m.

Table E Temperature factor K_e

Temperature（℃）	5	8	18	28	38
K_e	6	4	2	1	2	4

6.1.25 Accuracy of DCR

A (1+R_x/5MΩ+16mΩ/R_x)[%] ±0.2mΩ
When the instrument is in Middle and slow speed, A=0.1

In Fast speed, A=0.25
Where, R_x is the tested resistance.

6.2 Safety requirement

The instrument is the Ⅰ class safety instrument.

6.2.1 Insulation resistance

Under reference working condition， the insulation resistance between power terminal and instrument jacket should not be smaller than 50MΩ.
Under humility condition, the insulation resistance between voltage terminal and instrument jacket should not be smaller than 2 MΩ.

6.2.2 Insulation intensity

Under reference working condition, the insulation between the power terminal and the instrument jacket should bear an AC voltage (50Hz frequency and 1.5kV rated voltage) for 1 minute and there is no breakdown and flashover.

6.2.3 Leakage current

The leakage current should not be larger than 3.5mA (AC effective value).

6.3 Electromagnetic compatibility

- Transient sensitivity, based on the requirement of GB6833.4.
- Conductive sensibility, based on the requirement of GB6833.6.
- Radiated interference, based on the requirement of GB6833.10.

6.4 Performance test

6.4.1 Working condition

All tests should be performed under the working condition listed in Chapter 1. In this part, only the main indexes are listed. Users can make test under the specified condition mentioned in this manual. Performance test can be worked in the warm up conditions discussed in Chapter 1.

6.4.2 The used instruments and devices

No.	Instrument and Device		Specification
1	Standard capacitor	100pF	0.02％ D is known
		1000pF	
		10000pF	
		10nF	
		0.1uF	
		1uF	
2	AC standard resistor	10Ω	0.02％
		100Ω	
		1kΩ	
		10kΩ	
		100kΩ	
3	DC standard resistor	0.1Ω	0.02％
		1Ω	
		10Ω	
		100Ω	
		1kΩ	
		10kΩ	
		100kΩ	
4	Standard inductor	100μH	0.02%
		1mH	
		10mH	
		100mH	
5	Frequency counter		（0～1000）MHz
6	Digital Multimeter		0.5％
7	Insulation resistance meter		500V 10 levels
8	Hipot Tester		0.25kW （0～500）V

6.4.3 Function check

Ensure function keys, displayer and terminal etc. can work normally.

6.4.4 Test signal level

Adjust multimeter in AC voltage range, where one test cable is connected to H_{CUR} and the other is connected to ground terminal. Change level as: 10mV, 20mV, 100mV, 200mV, 1V, 2V, the reading should meet the demand of test signal level in this chapter.

6.4.5 Frequency

Connect frequency meter to ground terminal. The test terminal of the frequency meter is connected with $H_{CUR.}$ Change the frequency as: 20Hz, 100Hz, 1kHz, 10kHz, 100kHz（LCR-2100 is 100kHz）. The reading of frequency meter should meet the demand of the test signal frequency in this chapter.

6.4.6 Measurement accuracy

Basic parameters are R, L, C and D, so measurement accuracy is mainly about R, L, C and D.

6.4.7 Accuracy of C and D

Function	C_p-D				
Test frequency	100Hz	1kHz	10kHz	100kHz	Test respectively
Level	1V				
Range	AUTO				
Bias	0V				
Speed	Slow				

Open and short correction should be made before testing. Connect standard capacitors: 100pF, 1000pF, 10nF, 0.1uF, 1uF and change the frequency. The error capacitance C between reading and nominal value should be in the range ruled in this chapter, dissipation D should be in the range ruled in this chapter.

6.4.8 Accuracy of L

Test condition:

Function	L_s-Q		
Test frequency	100Hz	1kHz	Test respectively
Level	1V		
Range	AUTO		
Bias	0V		
Speed	Slow		

Open and short correction should be made before testing. Connect standard inductors: 100μH, 1mH, 10mH, 100mH and change the frequency. The error between reading and nominal value should be in the range ruled in this chapter.

6.4.9 Accuracy of Z

Test condition:

Function	Z-θ				
Test frequency	100Hz	1kHz	10kHz	100kHz	Test respectively
Level	1V				

Range AUTO
Bias 0V
Speed Slow
Open and short correction should be made before testing. Connect standard AC resistors: 10Ω, 100Ω, 1kΩ, 10kΩ, 100kΩ and change the frequency. The error between reading and nominal value should be in the range ruled in this chapter.

6.4.10 Accuracy of DCR

Test condition
Function DCR
Test frequency -----
Level -----
Range AUTO
Bias -----
Speed Slow
Short correction should be made before testing. Connect standard DC resistors: 0.1Ω, 1Ω, 10Ω, 100Ω, 1kΩ, 10kΩ, 100kΩ. The error between reading and nominal value should be in the range ruled in this chapter.

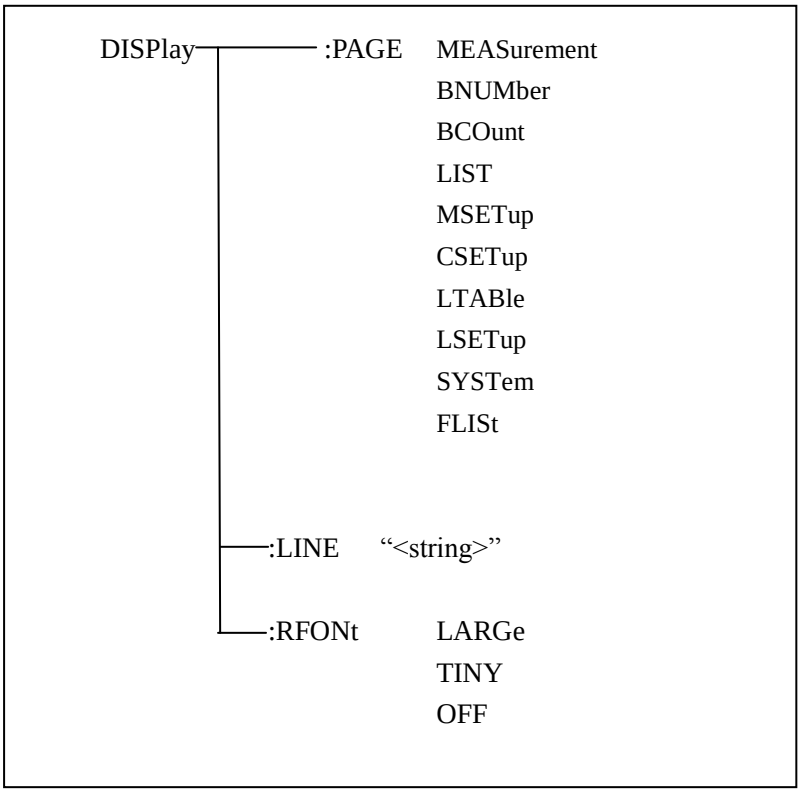
Chapter 7 Command Reference

The signs in this manual are as follows:
NR1: integer, e.g.:123
NR2: fix-point number, e.g.: 12.3
NR3: floating-point number, e.g.: 12.3E+5
NL: carriage key, ASCII code: 10
^END: EOI signal in IEEE-488

7.1 Subsystem commands for LCR-2100

7.1.1 DISPlay subsystem commands

MEASlay subsystem commands are mainly used to set the display page for the instrument. The :DISPlay? Query returns the current page.
Command tree:



The :PAGE command sets the display page.
The :DISPlay:PAGE? query returns the current page.
Command syntax: DISPlay:PAGE<page name>
<Page name> can be set as the following items:
MEASurement Set the display page as the LCR measurement display.

BNUMber	Set the display page as the bin number display.
BCOunt	Set the display page as the bin count display.
LIST	Set the display page as the list sweep display.
MSETup	Set the display page as the measurement display.
CSETup	Set the display page as the correction setup.
LTABle	Set the display page as the limit table setup.
LSETup	Set the display page as the list sweep setup.
SYSTem	Set the display page as the system setup page.
FLISt	Set the display page as the file list page.

For example: WrtCmd("DISP:PAGE MEAS"), Set the display page as the LCR measurement display page.

Query syntax:DISPlay:PAGE?
Return format: <page name><NL^END>
<page name> can be set as the following items:

<LCR MEAS MEAS>	The current page is the LCR measurement display page.
<BIN No. MEAS>	The current page is the bin number display page.
<BIN COUNT MEAS>	The current page is the bin count display page.
<LIST SWEEP MEAS>	The current page is the list sweep display page.
<MEAS SETUP>	The current page is the measurement setup page.
<CORRECTION>	The current page is the correction page.
<LIMIT TABLE SETUP>	The current page is the limit table setup page.
<LIST SWEEP SETUP>	The current page is the list sweep setup page.
<SYSTEM SETUP>	The current page is the system setup page.
<FILE LIST>	The current page is the file list page.

The :LINE command is used to set the current measurement item which can be a substring with up to 16 characters. The :LINE? query returns the current measurement item. The character string of the measurement item can be used as the file name when saving a file.
Command syntax: DISPlay:LINE"<string>"
Where,
<string> can be an ASCII character string (maximum number is 16).
For example: WrtCmd("DISP:LINE" Resistor meas"")
Query syntax: DISPlay:LINE?
Return format: <string><NL^END>

The :ResultFONt command is used to set the current font of the measurement result. The :ResultFONt? Query returns the current font of the measurement result.
Command syntax: DISPlay:RFONt <font>
<font> can be the following information:
LARGe: Use large character to display the measurement result, 12ms/meas.
TINY: Use tiny character to display the measurement result, 5ms/meas.
OFF: Measurement result will not be displayed but can be read from the bus.

Query syntax: DISPlay:FRONt?
Return format: <font><NL^END>
<font> can be the following information:
LARGE
TINY
OFF

7.1.2 FREQuency subsystem commands

The FREQuency subsystem commands are mainly used to set the measurement frequency of the instrument. The :FREQuency query returns the current measurement frequency.

Command syntax: FREQuency { <value> | MIN | MAX }

Where,
<value> NR1, NR2 or NR3 data format followed by Hz, kHz, MHz.
MIN Set the measurement frequency as 50Hz (the minimum frequency of LCR-2200 is 20Hz)
MAX Set the measurement frequency as 100kHz (the maximum frequency of LCR-2100 is 100kHz and the maximum frequency of LCR-2200 is 200kHz)
For example: WrtCmd("FREQ 1KHZ") Set the frequency as 1000Hz.

Query syntax: FREQuency?
Return format: <NR3><NL^END>

7.1.3 VOLTage subsystem commands

The VOLTage subsystem commands are mainly used to set the measurement voltage. The VOLTage? query returns the current measurement voltage.
Command syntax:
VOLTage { <value> | MIN | MAX }
Where,
<value> NR1, NR2 or NR3 data format followed by V.
MIN Set the measurement voltage as 5mV.
MAX Set the measurement voltage as 2V.

For example: WrtCmd("VOLT 1V") Set the measurement voltage as 1V.

Query syntax: VOLTage?
Return format: <NR3><NL^END>

7.1.4 CURRent subsystem commands

The CURRent subsystem commands are mainly used to set the measurement current. The CURRent? query returns the current measurement current.

Command syntax:

CURRent { <value> | MIN | MAX }

Where,

<value> NR1, NR2 or NR3 data format followed by MA.

MIN Set the measurement current as 50μA.

MAX Set the measurement current as 20mA.

For example: WrtCmd (“CURR 10MA”) Set the measurement current as 10mA.

Query syntax: CURRent?

Return format:<NR3><NL^END>

7.1.5 AMPLitude subsystem commands

The :AMPLitude subsystem commands are mainly used to set the auto level control (ALC) function as ON or OFF. The :AMPLiture? query returns the current status of the ALC function.

Command systax:

AMPLitude:ALC { ON | OFF | 1 | 0 }

Where,

Character 1 (49) is equal to ON.

Character 0 (48) is equal to OFF.

For example: WrtCmd (“AMPL:ALC 0”) Set the ALC function as OFF.

Query syntax: AMPLitude:ALC?

Return format: <NR1><NL^END>

(NOTE: LCR-2200 can use this command, while LCR-2100 can not use this command.)

7.1.6 Output RESister subsystem commands

The Output RESister subsystem commands are mainly used to set the output internal resistor mode. The Output RESister? query returns the current output internal resistance status.

Command syntax:

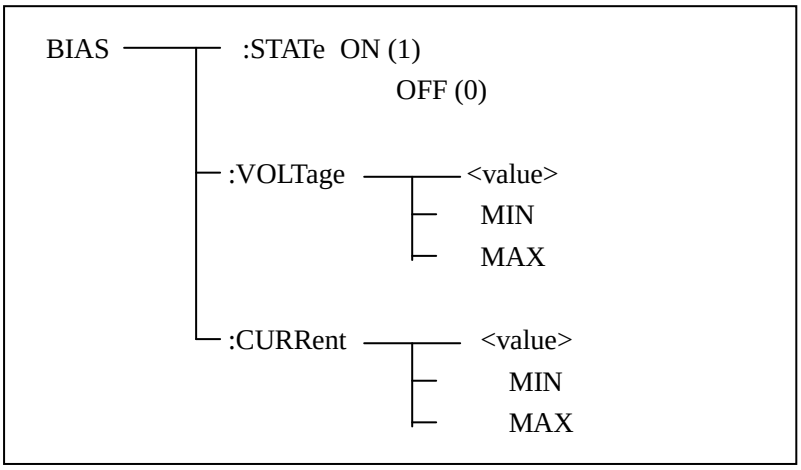
ORESister { 30 ... 100

For example: WrtCmd (“ORES 30”); Set the output internal resistance is 30 OHM.

Query syntax: ORESister?
Return format: <NR1><NL^END>

7.1.7 BIAS subsystem commands

The :BIAS subsystem commands are mainly used to set the internal bias voltage and the bias status (only work in LCR-2200).
Command tree:



The BIAS:STATe command is used to set the bias status. The :STATe? query returns the current bias status.

Command syntax:

BIAS:STATe { ON / OFF / 1 / 0

Where,

Character 1 (49) is equal to ON.

Character 0 (48) is equal to OFF.

For example: WrtCmd (“BIAS:STATe 0”) Set the DC bias function as OFF.

Query syntax: BIAS:STATe?
Return format: <NR1><NL^END>

The BIAS:VOLTage command is used to set the internal bias voltage. The BIAS:VOLTage? query returns the current bias voltage.

Command syntax:

BIAS:VOLTage { <value> | MIN | MAX }

Where,

<value> NR1, NR2 or NR3 data format.

MIN Set the bias voltage as 0V.

MAX Set the bias voltage as 5V.

For example: WrtCmd ("BIAS:VOLT MIN") Set the DC bias voltage as 0V.

Query syntax: BIAS:VOLTage?

Return format: <NR3><NL^END>

The BIAS:CURRent command is used to set the external bias current. The BIAS:CURRent? query returns the bias current. The external bias current is controlled by the serial interface of the instrument, so only GPIB interface supports this command.

Command syntax:

BIAS:CURRent { <value> | MIN | MAX }

Where,

<value> NR1, NR2 or NR3 data format

MIN Set the bias current as 0A.

MAX Set the bias current as 50mA.

For example: WrtCmd ("BIAS:CURR MIN") Set the DC bias current as 0A.

Query syntax: BIAS:CURRent?

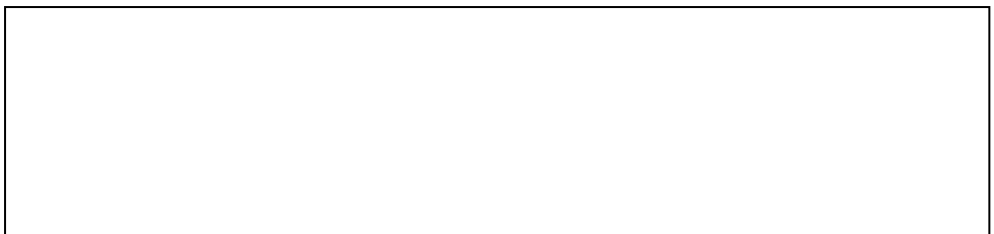
Return format: <NR3><NL^END>

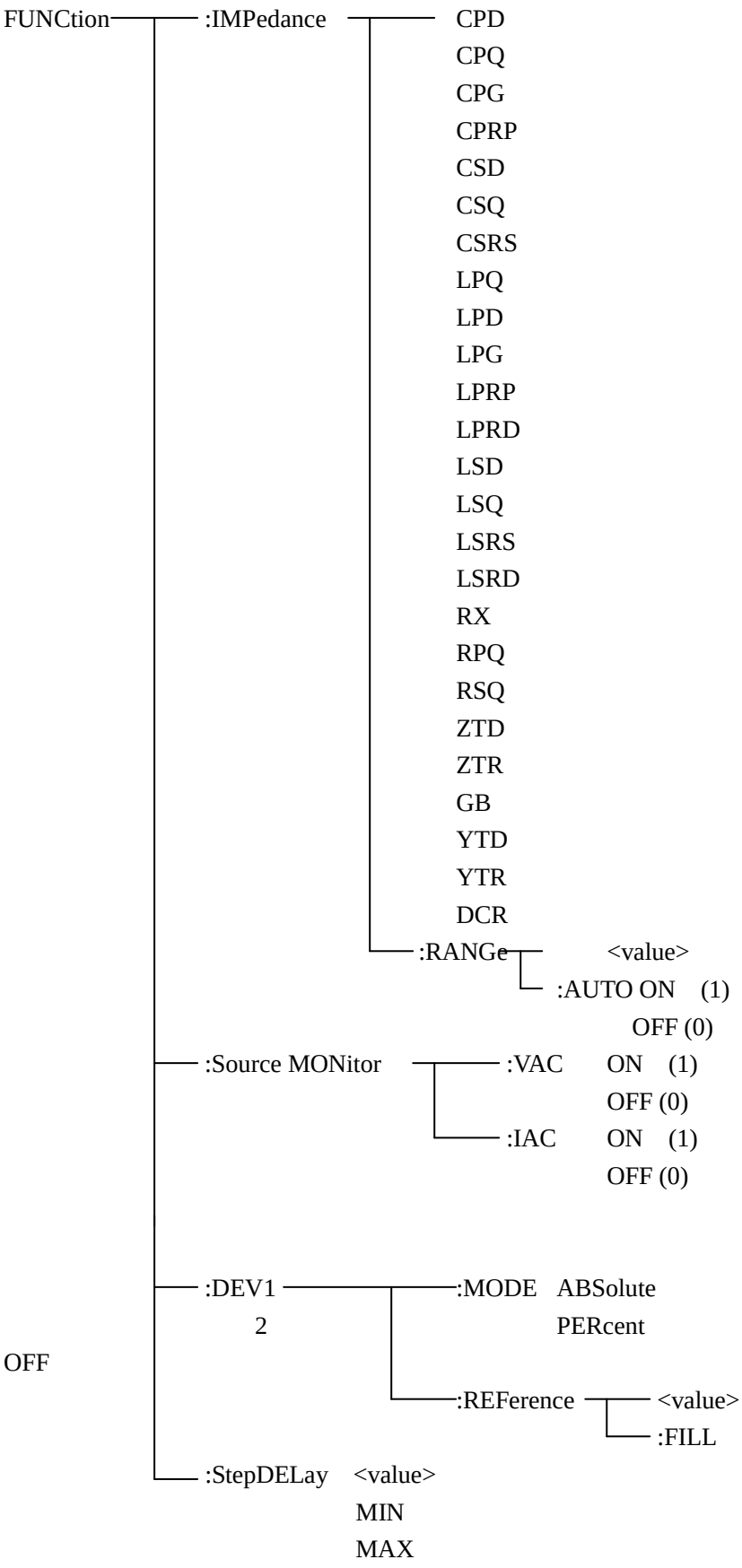
(NOTE: when the internal resistance is 30Ω, the range of bias voltage is ±1.5V and the range of bias current is ±100mA; when the internal resistance is 100Ω, the range of bias voltage is ±5V and the range of bias current is ±50mA.)

7.1.8 FUNCtion subsystem commands

The FUNCtion subsystem commands are mainly used to set measurement functions, range, current/voltage monitor ON/OFF, deviation display mode, nominal setting.

Command tree:





The FUNCtion:IMPedance command is used to set instrument functions. The FUNCtion:IMPedance?

query returns the current function parameters.

Command syntax: FUNCtion:IMPedance <function>
<function> can be one of the following items.

CPD	Set the function as Cp-D	LPRP	Set the function as Lp-Rp
CPQ	Set the function as Cp-Q	LSD	Set the function as Ls-D
CPG	Set the function as Cp-G	LSQ	Set the function as Ls-Q
CPRP	Set the function as Cp-Rp	LSRS	Set the function as Ls-Rs
CSD	Set the function as Cs-D	RX	Set the function as R-X
CSQ	Set the function as Cs-Q	ZTD	Set the function as Z-θ°
CSRS	Set the function as Cs-Rs	ZTR	Set the function as Z-θr
LPQ	Set the function as Lp-Q	GB	Set the function as G-B
LPD	Set the funxtion as Lp-D	YTD	Set the function as Y-θ°
LPG	Set the function as Lp-G	YTR	Set the function as Y-θr
LPRD	Set the function as Lp-Rd	RPQ	Set the function as Rp-Q
LSRD	Set the function as Ls-Rd	RSQ	Set the function as Rs-Q
DCR	Set the function as DCR		

For example: WrtCmd ("FUNC:IMP RX") Set the function as R-X.

Query syntax: FUNCtion:IMPedance?
Return format: <function><NL^END>

The FUNCtion:IMPedance:RANGe command is used to set the range. The FUNCtion:IMPedance:RANGe? query returns the current range.

Command syntax: FUNCtion:IMPedance:RANGe <value>
Where, <value> can be the impedance of the DUT or NR1, NR2 or NR3 data format followed by OHM or KOHM.
For example: WrtCmd ("FUNC:IMP:RANG 1KOHM") Set the range as 1kOHM.

Query syntax: FUNCtion:IMPedance:RANGe?
Return format: <value><NL^END>
Where, <value> can be

3	10	30	
100	300	1000	3000
10000	30000	100000	

The FUNCtion:IMPedance:RANGe:AUTO command is used to set the automatic range selection status. The FUNCtion:IMPedance:RANGe:AUTO? query returns the current range status.

Command syntax:

FUNCtion:IMPedance:RANGe:AUTO { ON (1) / OFF (0) }

Where,

Character 1 (49) is equal to ON.

Character 0 (48) is equal to OFF.

For example: WrtCmd (“FUNC:IMP:RANG:AUTO ON”) Set the automatic range as ON.

Query syntax: FUNCtion:IMPedance:RANGe:AUTO?

Return format: <NR1><NL^END>

The FUNCtion:Source MONitor:VIAC command is used to set the voltage monitor ON or OFF. The FUNCTtion:Source MONitor:VIAC? query returns the current voltage monitor status.

FUNCtion:SMONitor:VIAC { ON (1) / OFF (0) }

Where,

Character 1 (49) is equal to ON.

Character 0 (48) is equal to OFF.

For example: WrtCmd (“FUNC:SMON:VIAC ON”) Set the voltage monitor as ON.

Query syntax: FUNCtion:SMONitor:VIAC?

Return format: <NR1><NL^END>

The FUNCtion:DEV<n>:MODE command is used to set the deviation measurement mode. The FUNCtion:DEV<n>:MODE? query returns the current deviation measurement mode.

Command syntax:

FUNCtion:DEV<n>:MODE { ABSolute / PERCent / OFF }

Where,

ABSolute Absolute value deviation display

PERCent Percent deviation display

OFF Real value display

Where, <n> is

Character 1 (49) is equal to the nominal value of primary parameter.

Or character 2 (50) is equal to the nominal value of the secondary parameter.

For example: WrtCmd (“FUNC:DEV1:MODE ABS”)

Query syntax: FUNCtion:DEV<n>:MODE?

Return format:

{ ABX / PERC / OFF } <NL^END>

The FUNCtion:DEV<n>:REFerence<value> command is used to set the nominal value of the deviation. The FUNCtion:DEV<n>:REFernece<value>? query returns the current nominal value of the deviation.

Command syntax: FUNCtion:DEV<n>:REFerence<value>
Where,
<value> is NR1, NR2 or NR3 data format.
<n> is
Character 1 (49) is equal to the nominal value of primary parameter.
Or Character 2 (50) is equal to the nominal value of the secondary parameter.
For example: WrtCmd ("FUNC:DEV1:REF 10")

Query syntax: FUNCtion:DEV<n>:REFerence?
Return format：<NR3><NL^END>

The FUNCtion:DEV<n>:REFerence:FILL command is used to set the nominal value of the deviation. This command directs the instrument to make a test and then copies the results of the primary and the secondary parameters as the nominal values of the deviation.

Command syntax: FUNCtion:DEV<n>:RERerence:FILL
Where,
Character 1 (49) or character 2 (50) is equal to the nominal values of the primary and secondary parameters.

For example: WrtCmd ("FUNC:DEV1:REF:FILL")

The FUNCtion:StepDELay command is used to set the step delay time. The :StepDELay? query returns the step delay time.

Command syntax:

StepDELay { <value> | MIN | MAX }

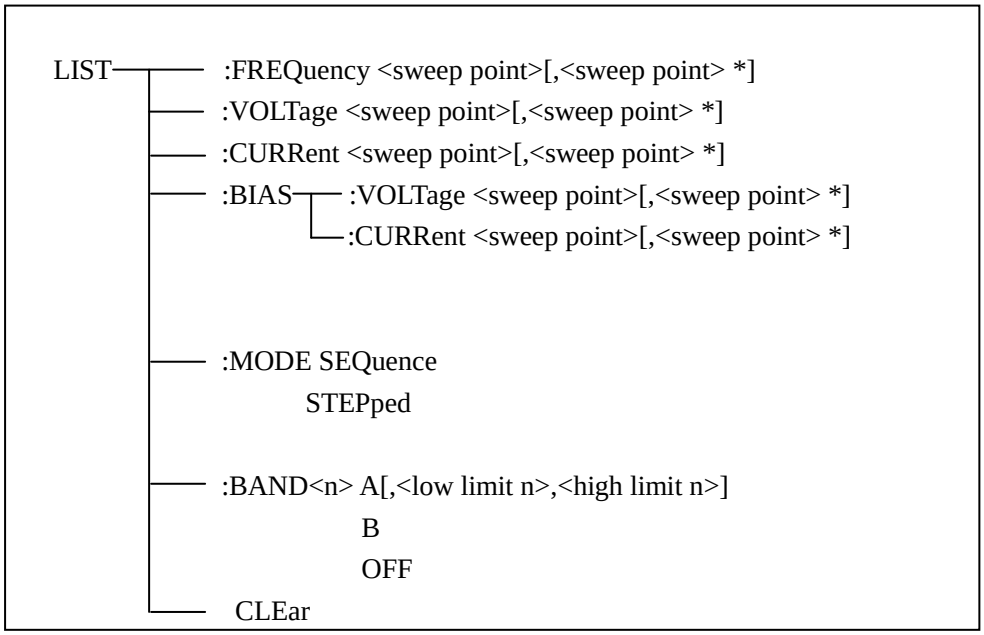
Where,
<value> NR1, NR2 or NR3 data format, 0-60s with the resolution of 1mS.
MIN Set the delay time as 0s.
MAX Set the delay time as 60s.
For example: WrtCmd("FUNC:SDEL 5S") Set the delay time as 5s.

Query syntax: FUNC:SDEL?
Return format: <NR3><NL^END>

7.1.9 LIST subsystem commands

The LIST subsystem commands are mainly used to set the list sweep function, sweep points, sweep mode, sweep limits.

Command tree:



The LIST:FREQuency command is used to clear the original sweep points and set the frequencies of the sweep points. The LIST:FREQuency? query returns the current frequency of each sweep point.

Command syntax: LIST:FREQuency<value>[,<value>*]

NOTE: * part means 201 sweep points at most can be set.

Where,

<value> is NR1, NR2 or NR3 data format.

<value> should be set from 20HZ to 200KHZ, or return format will report errors.

For example: WrtCmd("LIST:FREQ 1E3, 2E3, 3E3, 4E3")

Set the frequency of the sweep point 1 as 1KHZ;

Set the frequency of the sweep point 2 as 2KHZ;

Set the frequency of the sweep point 3 as 3KHZ;

Set the frequency of the sweep point 4 as 4KHZ;

NOTE: HZ(hertz) is the suffix unit, MAHZ and MHZ is MHz (1E6 Hz).

Query syntax: LIST:FREQuency?

Return format: <NR3>, [,<NR3>*]<NL^END>

The LIST:VOLTage command is used to clear the original voltage of the each sweep point and reset the voltage. The LIST:VOLTage? query returns the current voltage of each sweep point.

Command syntax: LIST:VOLTage<value>[,<value>*]

NOTE: * part means 201 sweep points at most can be set.

Where,

<value> is NR1, NR2 or NR3 data format.

For example: WrtCmd ("LIST:VOLT 1.5")

Set the frequency of the sweep point 1 as 1.5V.

WrtCmd ("LIST:VOLT 1E-2, 2E-2, 3E-2, 4E-2")

Set the frequencies of sweep point 1, 2, 3 and 4 respectively as 10mV, 20mV, 30mV and 40mV.

NOTE: This command can be followed by suffix unit V.

Query syntax: LIST:VOLTage?

Return format:<NR3>[,<NR3>*]<NL^END>

NOTE: <value> should be set from 10mV to 2V, or return format will report errors.

The LIST:CURRent command is used to clear the measurement current of each sweep point and reset the current. The LIST:CURRent? query returns the current of each sweep point.

Command syntax: LIST:CURRent<value>[,<value>*]

NOTE: * part means 201 sweep points at most can be set.

Where,

<value> is NR1, NR2 or NR3 data format.

For example: WrtCmd ("LIST:CURR 10MA")

Set the measurement current of the sweep point 1 as 10mA.

WrtCmd ("LIST:CURR 1E-2, 2E-2, 3E-2, 4E-2")

Set the currents of sweep points 1, 2,3 and 4 respectively as 10mA, 20mA, 3mA and 4mA.

NOTE: This command can be followed by a suffix unit A (ampere).

Query syntax: LIST:CURRent?

Return format: <NR3>[,<NR3>*]<NL^END>

NOTE: The current of each sweep point should be set from 100μA to 20mA when the internal resistance is 100Ω, 333μA to 66.7mA when the internal resistance is 30Ω, or return format will report errors.

The LIST:BIAS:VOLTage command is used to clear the original DC bias voltage of each sweep point and reset the voltage. The LIST:BIAS:VOLTage? query returns the current DC bias voltage of each sweep point.

Command syntax: LIST:BIAS:VOLTage<value>[,<value>*]

NOTE: * part means 201 sweep points at most can be set.

Where,

<value> is NR1, NR2 or NR3 data format.

For example: WrtCmd ("LIST:BIAS:VOLT 1.5V")

Set the DC bias voltage of sweep point 1 as 1.5V.

Query syntax: LIST:BIAS：VOLTage?

Return format: <NR3> [, <NR3>*] <NL^END>

The LIST:BIAS:CURRent command is used to clear the original DC bias current of each sweep point and reset them. The LIST:BIAS:CURRent? query returns the the DC bias current of each sweep point.

Command syntax: LIST:BIAS:CURRent<value>[,<value>*]

NOTE: * part means 201 sweep points at most can be set.

Where,

<value> is NR1, NR2 or NR3 data format.

For example: WrtCmd ("LIST:BIAS:CURR 100MA")

Set the DC bias current of the sweep point 1 as 100mA.

WrtCmd ("LIST:BIAS:CURR 1E-2, 2E-2, 3E-2,4E-2")

Set the DC bias currents of sweep points 1, 2, 3 and 4 respectively as 10mA, 20mA, 30mA and 40mA.

Query syntax: LIST:BIAS:CURRent?

Return format: <NR3> [,<NR3>*]<NL^END>

NOTE: Only LCR-2200 has installed internal DC bias current source. LCR-2100 has no internal DC bias current source. External DC bias current source is needed.

The LIST:MODE command is used to set the list sweep mode. The LIST:MODE? query returns the current list sweep mode.

Command syntax:

LIST:MODE { SEQuence | STEPped }

Where,

SEQuence means sequential mode.

STEPped means single step mode.

For example: WrtCmd ("LIST:MODE SEQ")

Query syntax: LIST:MODE?

Return format:

{ SEQ | STEP } <NL^END>

The LIST:BAND<n> command is used to set the limits of list sweep table. The LIST:BAND<n>? query returns the current limits.

Command syntax: LIST:BAND<n><parameter>[,<low limit n>,<high limit n>]

Where,

<n> 1 to 201 (NR1 format): sweep points on the n_{th} line

<parameter> A Compare the primary parameter of the test results with the high and the low limits.

B Compare the secondary parameter of the test results with the high and the low limits.

OFF No comparison

<low limit n> NR1, NR2 or NR3 data format, low limit of the sweep point on the n_{th} line.

<high limit n> NR1, NR2 or NR3 data format, high limit of the sweep point on the n_{th} line.

For example: WrtCmd ("LIST:BAND1 A, 10, 20")

WrtCmd ("LIST:BAND3 OFF")

Query syntax: LIST:BAND<n>?

Return Format: <parameter>, <low limit n>, <high limit n>

The LIST:CLEar command is used to clear all the data in list sweep mode.

Command syntax:

LIST: CLEar

For example: WrtCmd("LIST:CLEAR")

7.1.10 APERture subsystem commands

The APERture subsystem commands are mainly used to set the measurement speed, average times used in measurement. The APERture? query returns the current measurement speed, average times.

Command syntax:

APERture { FAST | MEDium | SLOW } [,<value>]

Where,

FAST: 75 times/sec

MEDium: 11 times/sec

SLOW: 2.7 times/sec

<value> 1 to 255 in NR1

For example: WrtCmd ("APER MED, 55")

Query syntax: APERture?

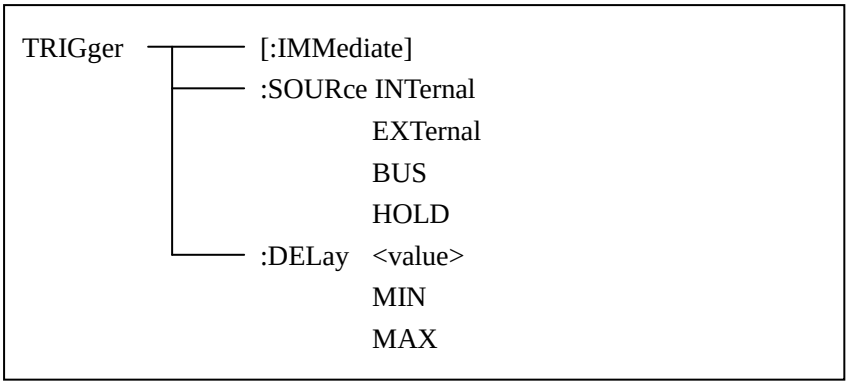
Return format:

{ FAST / MED / SLOW } , <NR1><NL^END>

7.1.11 TRIGger subsystem commands

The TRIGger subsystem commands are mainly used to set the instrument trigger source, trigger delay and trigger measurement.

Command tree:



The TRIGger[:IMMediate] command is used to trigger a test.

Command syntax: TRIGger[:IMMediate]

For example: WrtCmd("TRIG")

The TRIGger:SOURce command is used to set the trigger source mode. The TRIGger:SOURce? query returns the current trigger source mode.

Command syntax:

TRIGger:SOURce { INTernal / EXTternal / BUS / HOLD }

Where,

INTernal	The default trigger mode.
EXTernal	Triggered by HANDLER interface.
BUS	Triggered by RS232C interface or GPIB interface
HOLD	Triggered by pressing TRIGGER.

For example: WrtCmd ("TRIG:SOUR BUS")

Query syntax: TRIGger:SOURce?

Return format:

{ INT / EXT / BUS / HOLD } <NL^END>

The TRIGger:DELay command is used to set the delay time after triggering. The TRIGger:DELay? query returns the current delay time.

Command syntax:

TRIGger:DELay { <value> | MIN | MAX }

Where,

<value> In NR1, NR2 or NR3 data format, from 0 to 60s with 1ms as the resolution.

MIN Set the delay time as 0s.

MAX Set the delay time as 60s.

For example: WrtCmd ("TRIG:DEL 5s") Set the delay time as 5s.

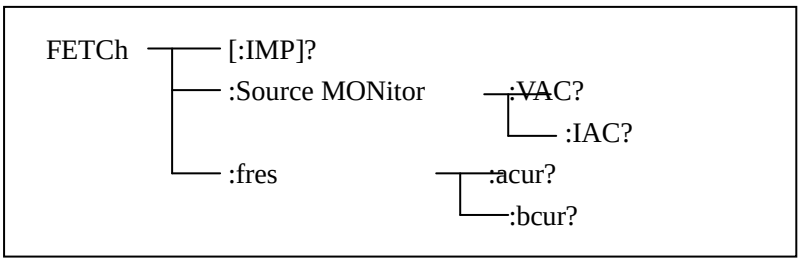
Query syntax: TRIGger:DELay?

Return format: <NR3><NL^END>

7.1.12 FETCh? subsystem commands

The FETCh? subsystem commands are mainly used to direct LCR-2100 to input a measurement result.

Command tree:



The FETCh[:IMP]? query directs LCR-2100 to input the last measurement result to the output buffer zone.

Query syntax: FETCh[:IMP]?

For example: WrtCmd ("TRIG:SOUR BUS")

WrtCmd ("TRIG")

WrtCmd ("FETC?")

LCR-2100 applies ASCII to delivery result, details are follows.

On measurement display page, bin NO. display page, bin count display page, ASCII data output format are described as below:

SN.NNNNNESNN	,	SN.NNNNNESNN	,	SN	,	SN or SNN	NL^END
<DATA A>		<DATA B>		<Status>		<BIN number>	

Where,

<DATA A>, <DATA B> format: <DATA A> (primary measurement data), <DATA B> (secondary measurement data)

12-digits ASCII format are as below:

SN.NNNNNESNN
(S:+/-,N: from 0 to 9, E: Exponent Sign)

Status	Description
-1	(In data buffer memory) no data
0	Common measurement data
+1	Analog LCR unbalance
+2	A/D converter is not working.
+3	Signal source is over loading.
+4	Constant voltage cannot be adjusted.

<status> format: When above measurement data is used, <status> data will display measurement status.

The output format of the <Status> display data uses 2-digits ASCII: SN (S: +/-, N: from 0 to 4)

NOTE: When <status> is -1, 1 or 2, the measurement data is 9.99999E37. When <status> is 0, 3 or 4, the real measurement data is beyond the limits.

Data	Sort result
0	Out of tolerance
+1	Bin 1
+2	Bin 2
+3	Bin 3
+4	Bin 4
+5	Bin 5
+6	Bin 6
+7	Bin 7
+8	Bin 8
+9	Bin 9
+10	Auxiliary bin

<Bin No.> format: The data displays the sorting results of the displayed bin, shown as above.
Only when the instrument compare function is set as ON, <bin No.> data can be displayed.
The output format of <bin No.> data applies 2 to 3 digits ASCII: SN or SNN (S: +/_, N: from 0 to 9).

On list sweep display page, the ASCII data output format is shown as below, that is, the return-circuit replaces sweep point number.

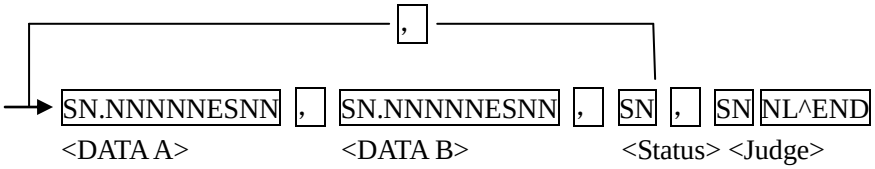


Figure 6 ASCII format 2 (list sweep)

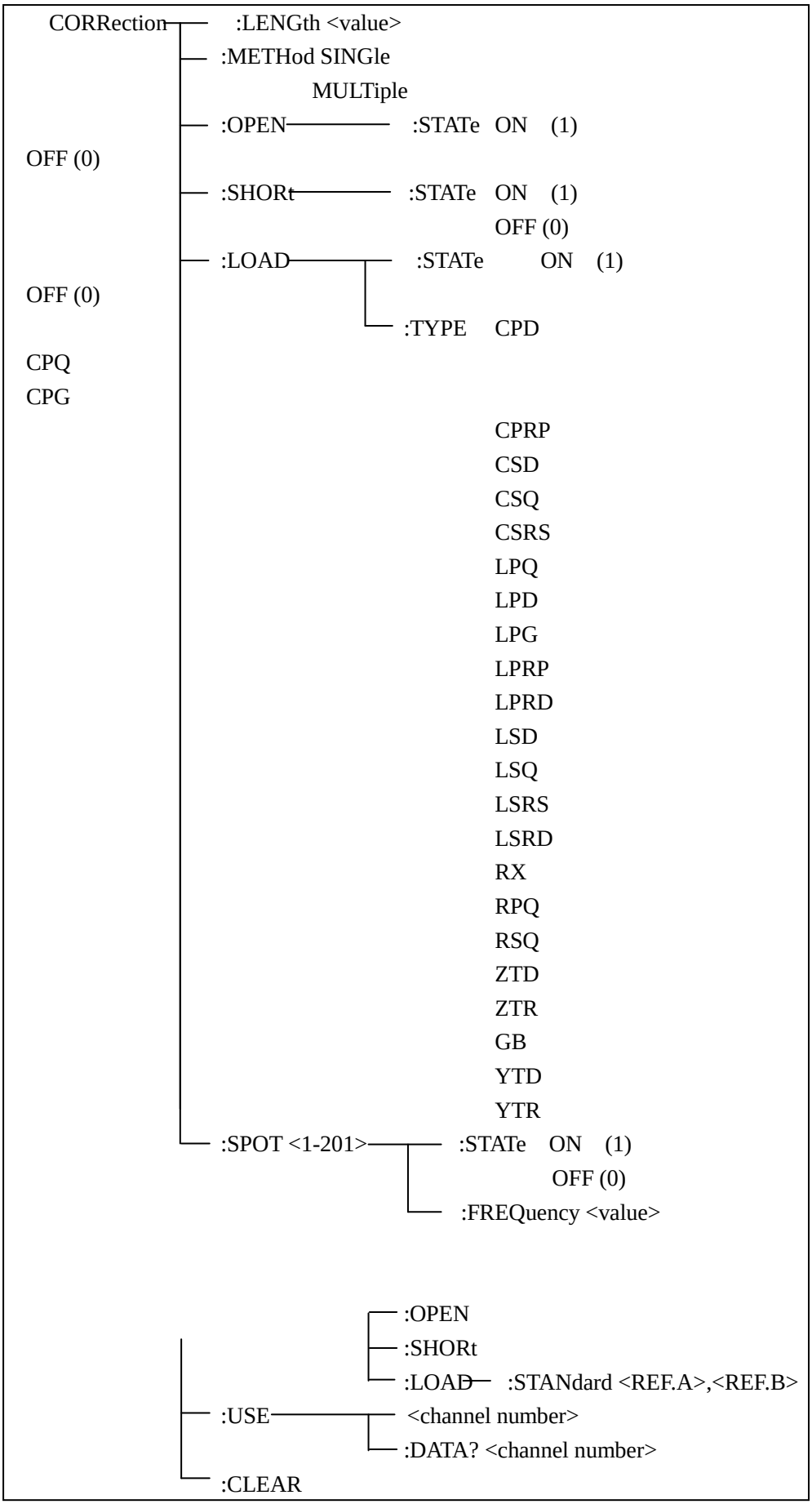
Where,
Descriptions for <DATA A>, <DATA B>, <Status> are the same described before. <Judge> format is as below:
<Input/Output> format: The data displays the compare result of the list sweep..

Data	Result
-1	low
0	pass
+1	high

When the compare function of the list sweep measurement is turned off, the output result of <Input/Output> is 0.
<Input/Output> data output format applies 2-digits ASCII format: SN (S: +/_, N: from 0 to 1)

7.1.13 CORRection subsystem commands

The CORRection subsystem commands are mainly used to set the correction function, OPEN, SHORT, LOAD.
Command tree:


CORRection
:LENGth <value>
:METHod SINGle
MULTiple
:OPEN
:STATe ON (1)
OFF (0)
:SHORt
:STATe ON (1)
OFF (0)
:LOAD
:STATe ON (1)
OFF (0)
:TYPE CPD
CPQ
CPG
CPRP
CSD
CSQ
CSRS
LPQ
LPD
LPG
LPRP
LPRD
LSD
LSQ
LSRS
LSRD
RX
RPQ
RSQ
ZTD
ZTR
GB
YTD
YTR
:SPOT <1-201>
:STATe ON (1)
OFF (0)
:FREQuency <value>
:OPEN
:SHORt
:LOAD
:STANdard <REF.A>,<REF.B>
:USE
<channel number>
:DATA? <channel number>
:CLEAR

The CORRection:LENGth command is used to set the correction cable length. The CORRection:LENGth? query returns the current set cable length.
Command syntax: CORRection:LENGth<value>
Where,
<value> is 0, 1, 2 or 4 followed by M.
For example: WrtCmd ("CORR:LENG 1M") Set the cable length as 1 meter.
(At present, only 0M data is available.)

Query syntax: CORRection:LENGth?
Return format: <NR1><NL^END>

The CORReciton:METHod command is used to set the correction mode. The CORRection:METHod? query returns the current correction mode.
Command syntax: CORRection:METHod { SINGle | MULTi }
Where,
SINGle Set or return single channel mode.
MULTi Set or return multi channel mode.
For example: WrtCmd ("CORR:METH MULT") Set the instrument as multi channel mode.
Query syntax: CORRection:METHod?
Return format: { SINGle | MULTi } <NL^END>

The CORReciton:OPEN command is used to execute open correction for 41 preset test points (LCR-2200 has 41 preset test points).
Command syntax: CORRection:OPEN
For example: WrtCmd ("CORR:OPEN")

The CORRection:OPEN:STATe command is used to set the open correction ON or OFF. The CORReciton：OPEN:STATe? query returns the current open correction status.
Command syntax:
CORRction:OPEN:STATe { ON | OFF | 1 | 0 }
Where,
1 (decimal 49) is equal to ON.
0 (decimal 48) is equal to OFF.
For example: WrtCmd ("CORR:OPEN: STAT ON")

Query syntax: CORRection:OPEN:STATe?
Return format: <NR1><NL^END>

The CORRection:SHORt command is used to execute short correction for 41 preset test points (LCR-2200 has 41 preset test points).
Command syntax: CORRection:SHORt
For example: WrtCmd ("CORR:SHOR")

The CORRection:SHORt:STATe command is used to set the short correction status. The CORRection:SHORt:STATe? query returns the current short correction status.
Command syntax:

CORRection:SHORt:STATe { ON | OFF | 1 | 0 }

Where,
1 (decimal 49) is equal to ON.
0 (decimal 48) is equal to OFF.
For example: WrtCmd ("CORR:SHOR:STAT ON")

Query syntax: CORRection:SHORt:STATe?
Return format: <NR1><NL^END>

The CORRecition:LOAD:STATe command is used to set load correction. The CORRection:LOAD:STATe? query returns the current load correction status.
Command syntax:

CORRection:LOAD:STATe { ON | OFF | 1 | 0 }

Where,
1 (decimal 49) is equal to ON.
0 (decimal 48) is equal to OFF.
For example: WrtCmd ("CORR:LOAD:STAT ON")

Query syntax: CORRection:LOAD:STATe?
Return format: <NR1><NL^END>

The CORRection:LOAD:TYPE command is used to set the tested parameter type. The CORRection:LOAD:TYPE query returns the current parameter type.
Details of function are as follows:

CPD	Set the function as Cp-D	LPRP	Set the function as Lp-Rp
CPQ	Set the function as Cp-Q	LSD	Set the function as Ls-D
CPG	Set the function as Cp-G	LSQ	Set the function as Ls-Q
CPRP	Set the function as Cp-Rp	LSRS	Set the function as Ls-Rs
CSD	Set the function as Cs-D	RX	Set the function as R-X

CSQ	Set the function as Cs-Q	ZTD	Set the function as Z-θ°
CSRS	Set the function as Cs-Rs	ZTR	Set the function as Z-θr
LPQ	Set the function as Lp-Q	GB	Set the function as G-B
LPD	Set the function as Lp-D	YTD	Set the function as Y-θ°
LPG	Set the function as Lp-G	YTR	Set the function as Y-θr
LPRD	Set the function as Lp-Rd	RPQ	Set the function as Rp-Q
LSRD	Set the function as Ls-Rd	RSQ	Set the function as Rs-Q

For example: WrtCmd ("CORR:LOAD:TYPE CPD")

Query syntax: CORRection:LOAD:TYPE?
Return format: <function><NL^END>

The CORRection:SPOT<n>:STATe command is used to set the specific frequency spots. The CORRection:SPOT<n>:STATe query returns the current state of each frequency spot (FREQ 1, FREQ 2).
Command syntax:

CORRection:SPOT<n>:STATe { ON | OFF | 1 | 0 }

Where,
1 (decimal 49) is equal to ON.
0 (decimal 48) is equal to OFF.
<n>:
1 refers to frequency spot 1.
2 refers to frequency spot 2.
For example: WrtCmd ("CORR:SPOT1:STAT ON")

Query syntax: CORRection:SPTO<n>:STATe?
Return format: <NR1><NL^END>

The CORRection:SPOT<n>:FREQuency command is used to set the specific correction point frequency. The CORRection:SPOT<n> query returns the current specific correction point frequency.
Command syntax: CORRection:SPOT<n>:FREQeuency<value>
Where,
<value> can be NR1, NR2 or NR3 data format followed by HZ, KHZ and MHZ.

For example: WrtCmd ("CORR:SPOT1:FREQ 2KHZ") Set the frequency of frequency spot 1 as 2KHZ.
NOTE: <value> should be ranged from 20HZ to 200KHZ (LCR-2200), or return format will report errors.

Query syntax: CORRection:SPOT<n>:FREQuency?

Return format: <NR3><NL^END>

The CORRection:SPOT<n>:OPEN command is used to execute open correction for specific correction point.
Command syntax: CORRection:SPOT<n>:OPEN
Where,
<n>: 1-201

For example: WrtCmd ("CORR:SPOT1:OPEN") Execute open correction for correction point 1.

The CORRection:SPOT<n>:SHORt command is used to execute short correction for specific correction point.
Command syntax: CORRection:SPOT<n>:SHORt
Where,
<n>:1-201

For example: WrtCmd ("CORR:SPOT1:SHOR") Execute short correction for correction point 1.

The CORRection:SPOT<n>:LOAD:STANdard command is used to set the standard reference of specific correction point which are taking load correction. The CORRection:SPOT<n>:LOAD:STANdard query returns the current standard reference of specific correction point.

Command syntax: CORRection:SPOT<n>:LOAD:STANdard <REF. A><REF. B>
Where,
<n>:1-201

<REF. A> can be NR1, NR2 or NR3 data format and taken as the standard reference of the primary parameter.
<REF. B> can be NR1, NR2 or NR3 data format and taken as the standard reference of the secondary parameter.
For example: WrtCmd ("CORR:SPOT1:LOAD:STAN 100.7, 0.0002")

Query syntax: CORRection:SPOT<n>:LOAD:STANdard?
Return format: <NR3><NL^END>

The CORRection:USE:DATA? query returns the OPEN/SHORT/LOAD correction measurement data of all the correction points.
Command syntax: CORRection:USE:DATA?

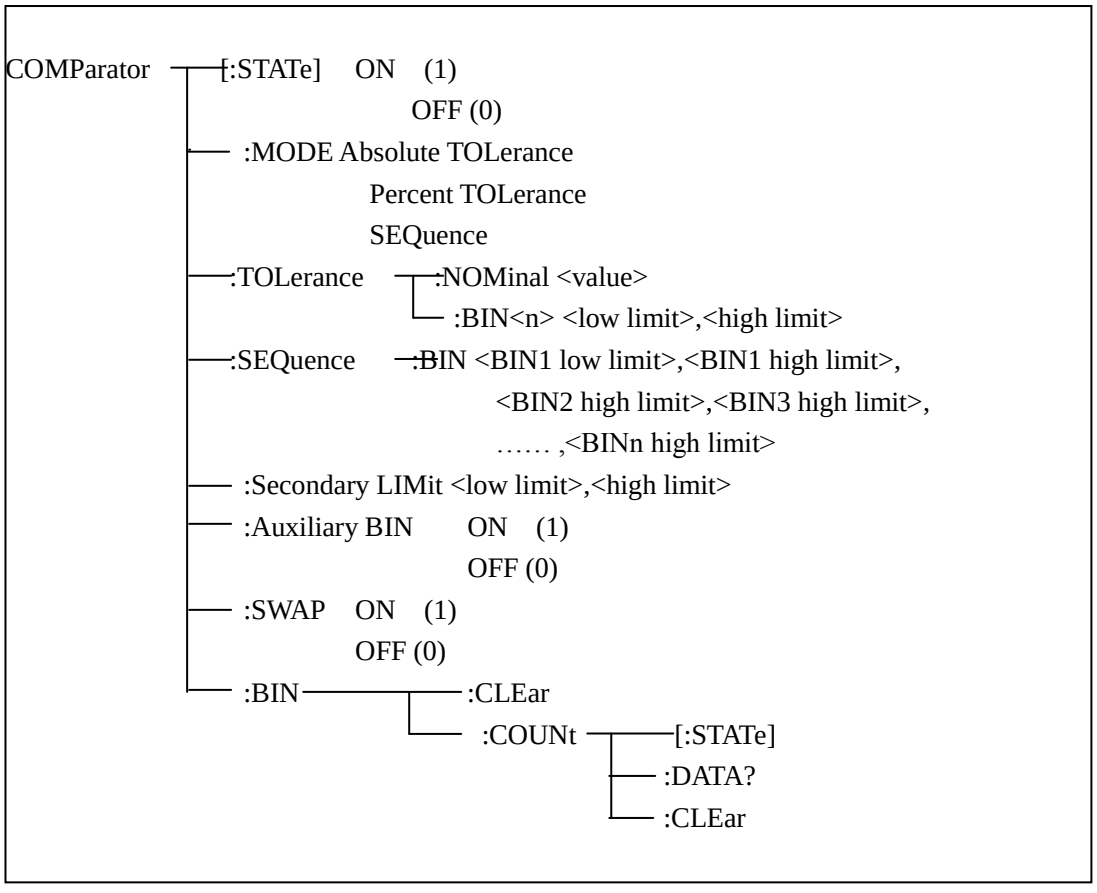
Return format: <open (n) A>,<open(n) B>,<short (n) A>,<short (n) B>,<load (n) A>,<load (n) B>

Where,
<open (n) A> is NR3 data format and the primary open correction data at frequency spot.
<open (n) B> is NR3 data format and the secondary open correction data at frequency spot.
<short (n) A> is NR3 data format and the primary short correction data at frequency spot.
<short (N) B> is NR3 data format and the secondary short correction data at frequency spot.
<load (n) A> is NR3 data format and the primary load correction data at frequency spot.
<load (n) B> is NR3 data format and the secondary load correction data at frequency spot.

The CORRection:CLEAR query is used to clear all the correction data.
Query syntax: CORRection:CLEAR

7.1.14 COMParator subsystem commands

The COMParataor subsystem commands are used to set the bin comparator function including ON/OFF setting, Limit table setting.
Command tree:



The COMParator[STATe] command is used to set the comparator function as ON or OFF. The COMParator[STATe]? query returns the current comparator state.
Command syntax:

COMParator[:STATe] { ON | OFF | 1 | 0 }

Where,
1 (decimal 49) is equal to ON.
0 (decimal 48) is equal to OFF.
For example: WrtCmd (“COMP ON”)

Query syntax: COMParator[:STATe]?
Return format: <NR1><NL^END>.

The COMParator:MODE command is used to set the comparator mode. The COMParator:MODE? query returns the current mode.
Command syntax:

COMParator:MODE { ATOLerance | PTOLerance | SEQuence }

Where,
ATOLerance means absolute tolerance mode.
PTOLerance means proportional tolerance mode.
SEQuence means sequential tolerance mode.
For example: WrtCmd (“COM:MODE ATOL”)

Query syntax: COMParator:MODE?
Return format: { ATOL | PTOL | SEQ } <NL^END>

The COMParator:TOLerance:NOMinal command is used to set the nominal value (this function is valid only when the limit mode is set as deviation mode). The COMParator:TOLerance:NOMinal? query returns the current nominal value.
Command syntax: COMParator:TOLerance:NOMinal<value>
Where,
<value> is a nominal value in NR1, NR2 or NR3 data format.
For example: WrtCmd (“COMP:TOL:NOM 100E-12”)

Query syntax: COMParator:TOLerance:NOMinal?
Return format: <NR3><NL^END>

The COMParator:TOLerance:BIN<n> command is used to set the high and the low limits of each bin (this function is valid only when the limit mode is set as deviation mode). The COMParator:TOLeance:BIN<n>? query returns the current high and the low limits of each bin.
Command syntax: COMParatro:TOLerance:BIN<n><low limit><high limit>

Where,

<n> is the bin number from 1 to 9.

<low limit> is the low limit in NR1, NR2 or NR3 data format.

<high limit> is the high limit in NR1, NR2 or NR3 data format.

NOTE: The low limit should be smaller than the high limit, or error information will be reported.

For example: WrtCmd ("COMP:TOL:BIN1 -5,5")

WrtCmd ("COMP:TOL:BIN2 -10,10")

Query syntax: COMParator:TOLerance:BIN<n>?

Return format: <low limit><high limit><NL^END>

The COMParator:SEQuence:BIN command is used to set the high and the low limits of sequential mode (this function is valid only when the limit mode is set as the sequential mode.). The COMParator:SEQuence:BIN? query returns the current high and the low limits of each bin.

Command syntax: COMParator:SEQuence:BIN <BIN1 low limit>, <BIN 1 high limit>, <BIN2 high limit>, …, <BINn high limit>

Where,

<BIN1 low limit> is the low limit of BIN 1 in NR1, NR2 or NR3 data format.

<BIN1 high limit> is the high limit of BIN1 in NR1, NR2 or NR3 data format.

<BINn high limit> is the high limit of BINn (the maximum of n is 9) in NR1, NR2 or NR3 data format.

NOTE: The low limit should be smaller than the high limit, or error information will be reported.

For example: WrtCmd ("COMP:SEQ:BIN 10, 20, 30, 40, 50")

Query syntax: COMParator:SEQuence:BIN?

Return format: <BIN1 low limit>, <BIN1 high limit>, <BIN2 high limit>, …,

<BINn high limit><NL^END>

The COMParator:Secondary LIMit command is used to set the high and the low limits of the secondary parameter. The COMParator:Secondary LIMit query returns the current high and the low limits of the secondary parameter.

Command syntax: COMParator:SLIMit<low limit><high limit>

Where,

<low limit> is the low limit in NR1, NR2 or NR3 data format.

<high limit> is the high limit in NR1, NR2 or NR3 data format.

NOTE: The low limit should be smaller than the high limit, or error information will be reported.

For example: WrtCmd ("COMP:SLIM 0.001, 0.002")

Query syntax: COMParator:SLIMit?

Return format: <NR3>, <NR3> <NL^END>

The COMParator:Auxiliary BIN command is used to set the auxiliary bin as ON or OFF. The COMParator:Auxiliary BIN? query returns the current auxiliary bin state.
Command syntax:

COMParator:Auxiliary BIN { ON | OFF | 1 | 0 }

Where,
1 (decimal 49) is equal to ON.
0 (decimal 48) is equal to OFF.
For example: WrtCmd ("COMP:ABIN ON")

Query syntax: COMParator:Auxiliary BIN?
Return format: <NR1><NL^END>

The COMParator:SWAP command is used to set the swap mode ON or OFF. For example: the original function parameter is Cp-D, after the SWAP mode is set as ON, the function parameter will be changed as D-Cp. In this case, the limits from BIN1 to BIN9 become the high and the low limits of D, the original secondary limits become that of Cp. That is to say, this function is to make swap comparison between the primary and the secondary parameters. On the contrary, If OFF is selected, the comparison will be made according to the original sequence. The COMParator:SWAP? query returns the current state of the swap function.
Command syntax:

COMParator:SWAP { ON | OFF | 1 | 0 }

Where,
1 (decimal 49) is equal to ON.
0 (decimal 48) is equal to OFF.
For example: WrtCmd ("COMP:SWAP ON")

Query syntax: COMParator:SWAP?
Return format: <NR1><NL^END>

The COMParator:BIN:CLEar command is used to clear all limits on limit table setup page.
Command syntax: COMParator:BIN:CLEar
For example: WrtCmd ("COMP:BIN:CLE")

The COMParator:BIN:COUNt[:STATe] command is used to set the bin count function as ON or

OFF. The COMParator:BIN:COUNt[:STATe]? query returns the current state of the bin count function.

Command syntax:

COMParator:BIN:COUNt[:STATe] { ON | OFF | 1 | 0 }

Where,

1 (decimal 49) is equal to ON.

0 (decimal 48) is equal to OFF.

For example: WrtCmd (“COMP:BIN:COUN ON”)

Query syntax: COMParator:BIN:COUNt[STATe]?

Return format: <NR1><NL^END>

The COMParator:BIN:COUNt:DATA? query returns the current comparison result of the bin count.

Query syntax: COMParator:BIN:COUNt:DATA?

Return format: <BIN1 count>, <BIN2 count>, …, <BIN9 count>, <OUT OF BIN count>, <AUX BIN count><NL^END>

Where,

<BIN1-9 count> is the count result of BIN1-9, in NR1 data format.

<OUT OF BIN count> is the count result of the OUT OF BIN, in NR1 data format.

<AUX BIN count> is the count result of the auxiliary bin, in NR1 data format.

The COMParator:BIN:COUNt:CLEar command is used to clear all bin count results.

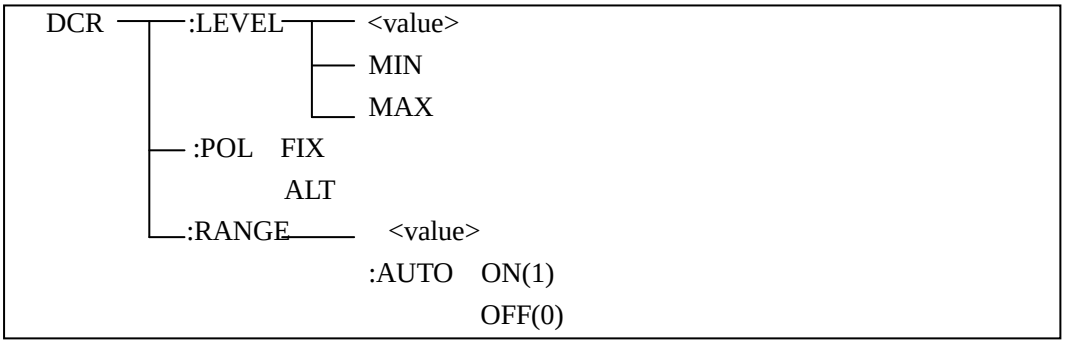
Command syntax: COMParator:BIN:COUNt:CLEar

For example: WrtCmd (“COMP:BIN:COUN:CLE”)

7.1.15 DCR subsystem commands

The DCR subsystem commands are used for setting and querying the test range, polarity and level parameters.

Command tree:



The DCR:LEVEL command is used to set the DCR level. The command DCR:LEVEL? query returns the current level.

(NOTE: Only LCR-2200 can set different DCR level values, LCR-2100 is fixed at 1V.)

Command syntax:

DCR：LEVEL { <value> | MIN | MAX }

Where,

<value> can be NR1, NR2 or NR3 data format.

<MIN> Set the DCR test level to 50mV.

<MAX> Set the DCR test level to 2V.

For example: WrtCmd("DCR:LEVEL MIN"); set the DCR test level to 50mV.

Query syntax: DCR：LEVEL?

Return format: <NR3><NL^END>

The DCR:POL command is used to set the DCR test mode. The command DCR:POL? query returns the test mode.

Command syntax:

DCR：LEVEL { ALT | FIX }

Where,

<ALT> alternative test mode of positive and negative level

<FIX> positive level test mode

For example: WrtCmd("DCR：LEVEL ALT"); set the DCR test mode to alternative positive and negative level.

Query syntax: DCR：POL?

Return format: { FIX | ALT } <NL^END>

The DCR:RANGE command is used to set the DCR range. The command DCR:RANGE? query returns the test range.

Command syntax:

DCR：RANGE <value>

Where,

<value> is the impedance value of DUT, it can be NR1, NR2 or NR3 data format, with OHM, KOHM as the suffix.

For example: WrtCmd(“DCR:RANG 1KOHM”); set the DCR test range to 1KOHM.

Command syntax: DCR:RANG?
Return format: <value><NL^END>
Where, <value> can be:

1	3	10	30
100	300	1000	3000
10000	3000	100000	

The DCR:RANGe:AUTO command is used to set the range status. DCR:RANGe:AUTO? query returns the current range status.
Command syntax:

DCR:RANG:AUTO { ON (1) / OFF (0) }

Where,

1 (decimal 49) is equal to ON.

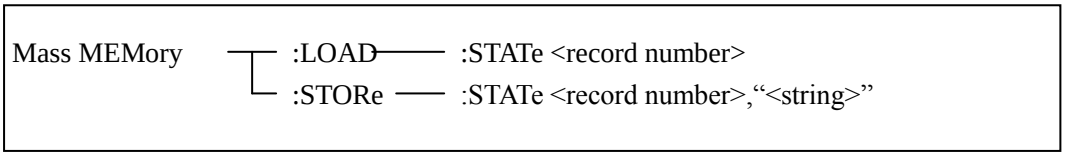
0 (decimal 48) is equal to OFF.

For example: WrtCmd (“DCR:RANG:AUTO ON”); set the range auto to ON.

Query syntax: DCR:RANG:AUTO?
Return format: <NR1><NL^END>

7.1.16 Mass MEMory subsystem commands

The Mass MEMory subsystem commands are used for file storing and load.
Command tree:



The MMEMory:LOAD:STATe command is used to load the existed file.
Command syntax: MMEMory:LOAD:STATe<value>
Where,

<value> is the file number ranging from 0 to 39 (NR1).

For example: WrtCmd (“MMEM:LOAD:STAT 1”)

The MMEMory:STORe:STATe command is used to storing the current setting to a file.
Command syntax: MMEMory:STOR:STATe<value>, “<string>”
Where,

<value> is the file number ranging from 0 to 39 (NR1).

<string> can be ASCII character string (maximum length is 16).

For example: WrtCmd (“MMEM:STOR:STAT 1, “Resistor meas””)

or WrtCmd (“MMEM:STOR:STAT 1”), IF “,”<string>”” has not been input, the default file name will be stored.

7.2 GPIB Common Commands

●*RST ●*TRG ●*IDN ●*TST
●*ESE ●*SRE ●*ESR ●*STB
●*OPC ●*CLS

- The *RST command resets the instrument.
  For example: WrtCmd (“*RST”)
- The *TRG command triggers the measurement and then sends the result to the output buffer.
  For example: WrtCmd (“*TRG”)
- The *CLS command clears the standard event status register and the service request status register.
  Command syntax: *CLS
  For example: WrtCmd (“*CLS”)
- The *IDN? query returns LCR-2100 ID.
  Query syntax: *IDN?
  Return format: <manufacturer>,<model>,<firmware><NL^END>
  Where,
  <manufacturer> Name of Manufacturer
  <model> Instrument Model
  <firmware> Firmware Version
  <HW_version> Hardware Version
  For example: WrtCmd(“*IDN?”);
- The *TST? query executes an internal self test and returns the test result as the sum of all existing errors codes. If there are no error LCR-2100 returns 0.
  Query syntax: *TST?
  Return format: 0<NL^END>
  Where,
  0 0（NR1 format）
  For example: WrtCmd(“*TST?”);
- The *ESE (standard Event Status Enable command) command sets each open bit of the standard event status register. This command returns setups of each open bit for the standard event status permission register.
  Command syntax: *ESE<value>
  Where,
  <value> NR1 format：decimal expression for each bit of operation status register.
  Descriptions for each byte of the standard event status register are shown as follows:

Bit number	Description

7	Power On(PON) Bit
6	User Request(URQ) Bit
5	Command Error(EME) Bit
4	Execution Error(EXE) Bit
3	Device Dependent Error(DDE) Bit
2	Query Error(QYE) Bit
1	Request Control(RQC) Bit
0	Operation Complete(OPC) Bit

Query syntax: *ESE?
Return format: <value><NL^END>
For example: WrtCmd ("*ESE?")

- The *SRE （Service Request Enable command）command sets each open bit of the service status byte register. This command returns the current setups for each open bit of the status byte permission register.
  Command syntax: *SRE<value>
  Where,
  <value> NR1 format: decimal expression for each permission bit of the status byte register.

  Descriptions for each byte of the status byte register are shown as follows:

Bit number	Description
7	Operation Status Register Summary Bit
6	RQS(Request Service) Bit
5	Standard Event Status Register Summary Bit
4	MAV(Message Available) Bit
3-0	Always 0(zero):

  Query syntax: *SRE?
  Return format: <value><NL^END>
  For example: WrtCmd("*SRE?");

- The *ESR? query returns the contents of the standard event status register.
  Query syntax: *ESR?
  Return format: <value><NL^END>
  Where,
  <value> NR1 format: decimal expression for contents of the standard event status register.

  Descriptions for each bit of the standard event status register

Bit number	Description
7	Power On(PON) Bit
6	User Request(URQ) Bit
5	Command Error(EME) Bit
4	Execution Error(EXE) Bit
3	Device Dependent Error(DDE) Bit
2	Query Error(QYE) Bit
1	Request Control(RQC) Bit
0	Operation Complete(OPC) Bit

For example: WrtCmd ("*ESR?")

- The *STB? query returns contents of the standard service status byte register. The execution of this command will not affect contents of the standard status byte register.

  Query syntax: *STB?

  Return format: <value><NL^END>

  Where,

  <value> NR1 format: decimal expression for contents of the standard status byte register.

  Descriptions for each bit of the standard status byte register

Bit number	Description
7	Operation Status Register Summary Bit
6	RQS(Request Service) Bit
5	Standard Event Status Register Summary Bit
4	MAV(Message Available) Bit
3-0	Always 0(zero)

  For example: WrtCmd ("*STB?")

- The *OPC command equals to set the OPC bit of the standard event status register when LCR-2100 finishes all parameter measurements. Ever since all pending operations have been completed, this command will inform the instrument to add a ASCII number "1" (decimal number: 49) into the output buffer.

  Command syntax: *OPC

  For example: OUTPUT 717; "*OPC"! Set the OPC bit of the instrument when the last command is done.

  Query syntax: *OPC?

  Return format: 1 <NL^END>

  Where,

  1 ASCII number 1（decimal number: 49）

  For example: WrtCmd("*OPC?")

Chapter 8 The description for Handler (optional)

The LCR-2100 provides the Handler interface for you. The interface is mainly used for the output of the sorted result. The interface offers the communication signal and the signal for the output of the sorted result. The separator result is corresponding to the output of BIN 10. The design for the Handler interface is very smart with the status of the output signal can be defined according to your application target.

8.1 Technical description

The following table shows the description for LCR-2100 HANDLER.

The output signal: low effective, open collector output, optoelectronic isolation Output signal judgment: BIN comparator: good, over the standard, not good List sweep comparator: IN/OUT for every sweep point and pass/fail for all the compared result. INDEX: AD Conversion ended EOC: end of one test and comparison Alarm: alarm for circuit interruption The input signal: optoelectronic isolation Keylock: lock the keys on the front panel External Trigger: pulsewidth≥1μS

Table 1 Technical description

8.2 The operation description

8.2.1 The definition for the signal line

The Handler interface has 3 signal lines: comparison output, control output and control input. The signal line's definition for the BIN comparison or list sweep comparison is below:

Comparison signal lines:

- Comparison output signal

/BIN1 - /BIN9, /AUX, /OUT, /PHI (the main parameter is higher), /PLO (the main parameter is lower), /SREJ (the secondary parameter is not good). The signal line distribution for comparison out is shown in the figure above.

- Control output signal

/INDEX (analog test finished signal), /EOM (test ended and the compared data effective), /ALARM (the circuit interruption)

- Control input signal

/EXT.TRIG (external trigger signal), /Keylock (the key lock).

The signal distribution for the pins is described in Table 2:

Pin	Signal name	Description
1 2 3 4 5 6 7 8 9 10 11	/BIN1 /BIN2 /BIN3 /BIN4 /BIN5 /BIN6 /BIN7 /BIN8 /BIN9 /OUT /AUX	BIN sorted result /BIN (BIN number) output are all open collector output.
12 13	/EXT.TRIG	External trigger: when the trigger mode is EXT.TRIG, LCR-2100 will be triggered by the positive-edge pulse signal in this pin.
14 15	EXT.DCV2	External DC voltage 2: The DC provider pin for the optoelectronic coupling signal(/EXT_TRIG, /KeyLock, /ALARM, /INDEX, /EOM)
16 17 18	+5V	The internal power +5V: to use the internal power is not recommended. If you use the internal power, please ensure that the current is lower than 0.3A and the signal line is far from the disturbance source.
19	/PHI	The main parameter is higher: the test result is greater than the high limit in BIN1 to BIN9.
20	/PLO	The main parameter is lower: the test result is less than the low limit in BIN1 to BIN9.
21	/SREJ	The secondary parameter is not good: the test result is not in the range of the high limit and the low limit.
22 23 24	NC NC NC	Not connect.
25	/KEY LOCK	When this line is effective, the keys in the front panel are locked.

27 28	EXT.DCV1	The external DC voltage 1：the pull-up DC power provider pin for optoelectronic coupling signal(/BIN-/BIN9,/AUX, /OUT,/PHI,/PLO,/SREJ).
29	/ALARM	When circuit is interrupted, /ALARM is effective.
30	/INDEX	When the analog test is finished and the UNKNOWN terminal can be connected to another DUT, /INDEX is effective. But the comparison signal is effective until /EOM is effective.
31	/EOM	End Of Measurement：when the test data and the compared result are effective, this signal is effective.
32,33	COM2	The reference ground for external power EXTV2.
34,35,36	COM1	The reference ground for external power EXTV1.

Table 2 signal distribution for the pins

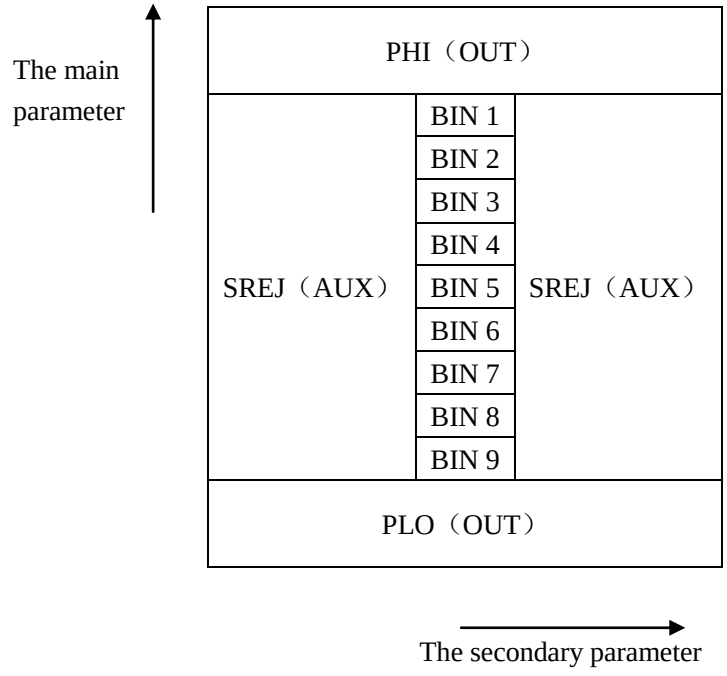
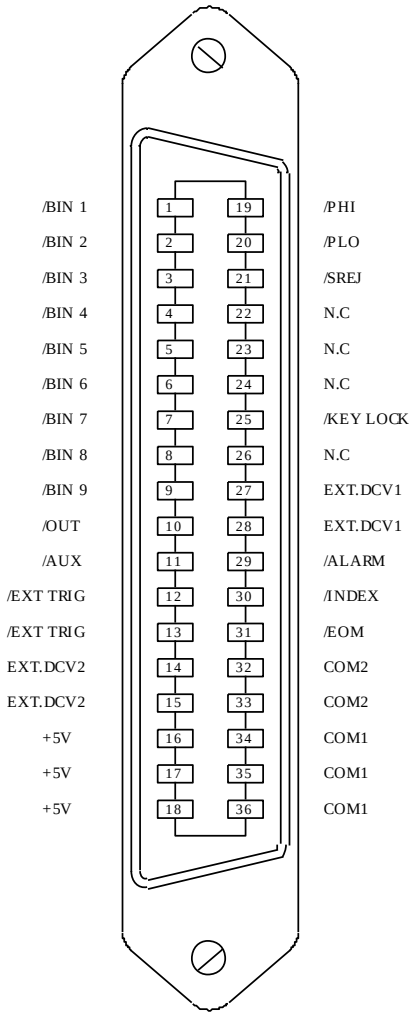
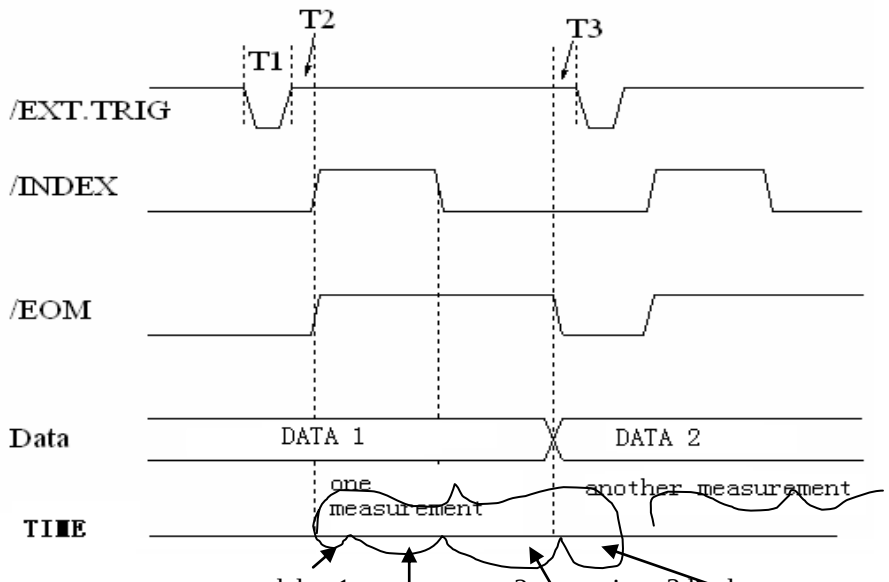


Figure 1 The /PHI, /PLO, /SREJ signal distribution for BIN comparison



Note: the signal to /BIN1 - /BIN9, /OUT, /AUX, /PHI, /PLO and /SREJ in the list sweep comparison is different from that in the BIN comparison.

Figure 2 The pin definition for HANDLER



Time	The minimum	The maximum
T1: trigger pulse-width	1us	---
T2:delay time	200us	Display time3 + 200us
T3:the trigger waiting time after /EOM output	0us	---

1. For the measurement time, please refer to the operation manual;
2. The typical comparison time is approximately 1ms;
3. The display time for every display page is below:

MEAS DISPLAY： 8ms;
BIN NO.DISPLAY：5ms;
BIN COUNT DISPLAY：0.5ms

Figure 3-The timing chart

List sweep comparison signal line

The definition for list sweep comparison is different from that for the BIN comparison.

- Comparison output signal

/BIN-/BIN9 and /OUT show the IN/OUT (good or over the standard) judgment. /AUX shows PASS/FAIL judgement.

When a sweep test is finished, these signals will be the output signal.

- Control output signal

/INDEX (analog test finished), /EOM (the test ended).

The timing is below when /INDEX and /EOM are effective：

SEQ sweep mode：

/INDEX is defined as the effective signal when the last sweep point of the analog test is finished.
/EOM is defined as the effective signal when all the test results are effective after every list sweep task is finished.

STEP sweep mode：

/INDEX is defined as the effective signal when the analog test of every sweep point is finished. /EOM is defined as the effective signal when the test and the comparison of every step are finished.

The pin distribution for list sweep is shown in table 3 and figure 2. (The pin definition for the list sweep comparison is the same to that for the BIN comparison). The timing chart is shown in figure 5.

Table 3 the pin distribute for the list sweep comparison

pin	signal	description
1	/BIN1	out of the limit of sweep point1
2	/BIN2	out of the limit of sweep point2
3	/BIN3	out of the limit of sweep point3
4	/BIN4	out of the limit of sweep point4
5	/BIN5	out of the limit of sweep point5
6	/BIN6	out of the limit of sweep point6
7	/BIN7	out of the limit of sweep point7
8	/BIN8	out of the limit of sweep point8
9	/BIN9	out of the limit of sweep point9
10	/OUT	out of the limit of sweep point10
11	/AUX	/AUX is defined as the effective signal when at least one is not good in the list.
30	/INDEX	SEQ：when the analog test of the last sweep point is finished and the UNKNOWN terminal can be connected to another DUT, /INDEX is effective. But the comparison signal is effective until /EOM is effective. STEP：when the analog test at each sweep point is finished, /INDEX is effective. But the comparison signal is effective until /EOM is effective.
31	/EOM	Test ended： SEQ：when the test is finished and the compared results are effective, this signal is effective. STEP： When the test of every sweep point is finished, /EOM is finished. the comparison result signal is effective until /EOM is effecive.
others		The definition is the same to that of the comparison.

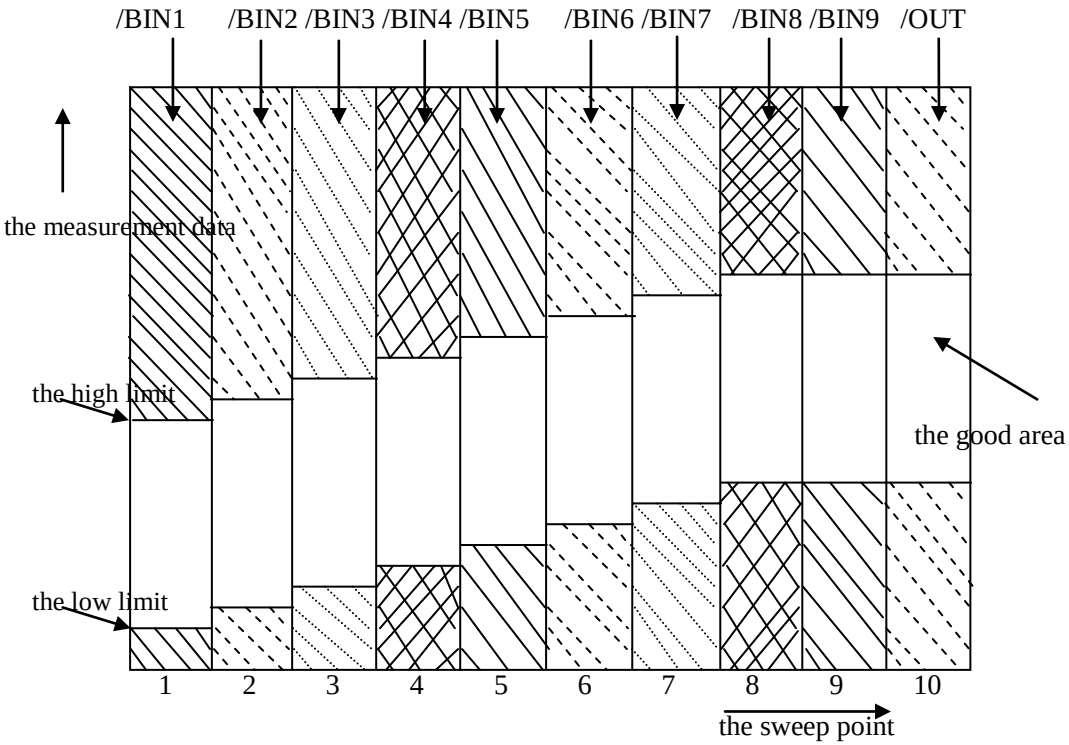
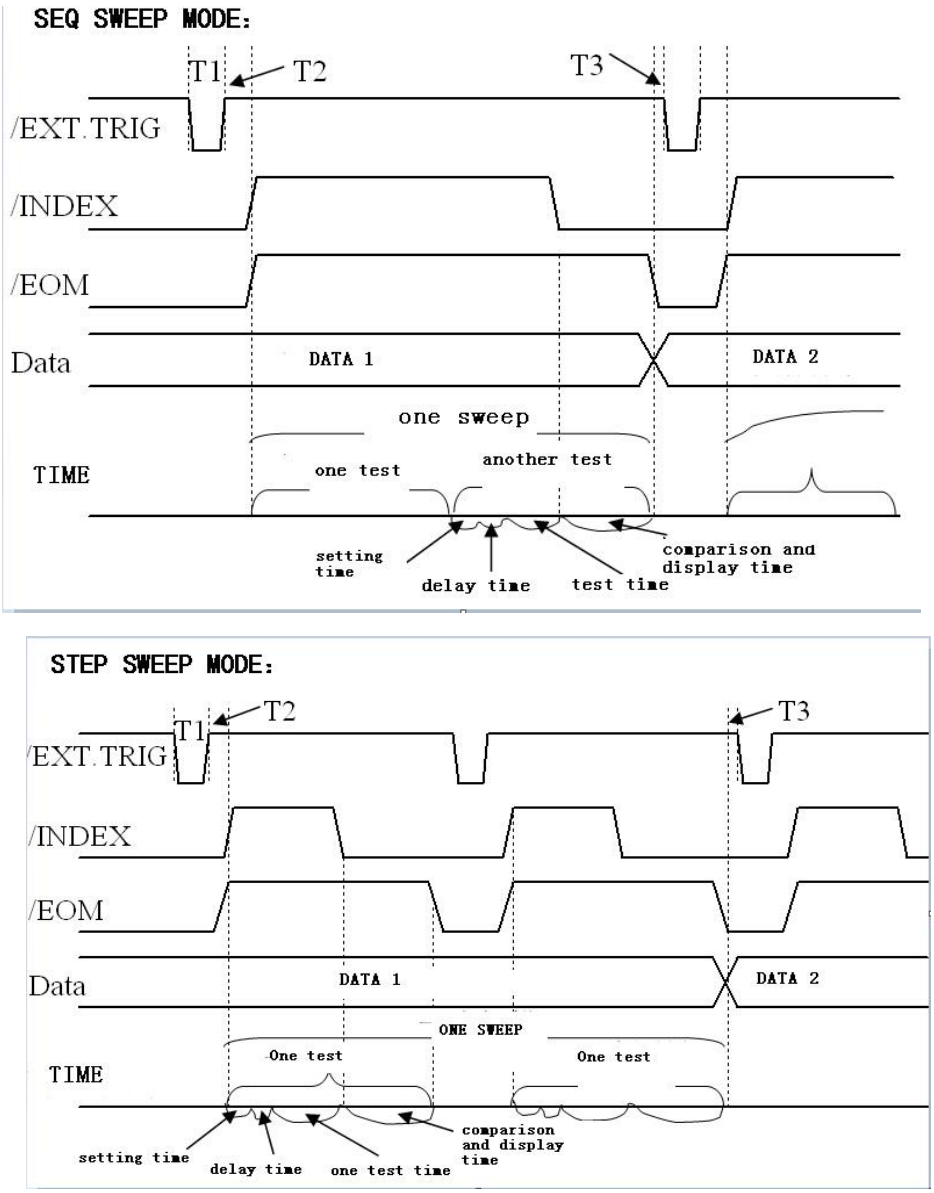


Figure 4 the signal area of the list sweep comparison



Note :(1)The setting time includes the correction ON/OFF time.

(2)The comparison and display time is 4.5ms approximately.

Figure 5 the time counting

8.2.2 Electrical feature

As it is shown above, the signal definition for the comparison and the list sweep comparison are different. But the electrical feature is same. So the description can be applied to BIN comparison and list sweep comparison.

DC isolation output: the DC isolation output (pin1 to pin16) generates the isolation by the optoelectronic coupler with the collector open. The output voltage on every line is set by the pull-up

resistance on the HANDLER interface board. The pull-up resistance is connected to the internal voltage (+5v), or the external voltage(EXTV:+5v).

The electrical feature of the DC isolation output can be divided into 2 types shown in Table 4.

Table 4 the electrical feature of the DC isolation output

the output signal	the output rated voltage		the maximum current	the reference ground for the circuit
	LOW	HIGH		
compared signal /BIN1 - /BIN9 /AUX /OUT /PHI /PLO	≤0.5V	+5V--+24V	6mA	Internal pull-up voltage: LCR-2100 GND EXTV1： COM1
control signal /INDEX /EOM /ALARM	≤0.5V	+5V--+24V	5mA	Internal pull-up voltage : LCR-2100 GND EXTV2： COM2

8.2.3 HANDLER Interface board circuit

The output circuit for the comparison result is shown in the figure 6 below.

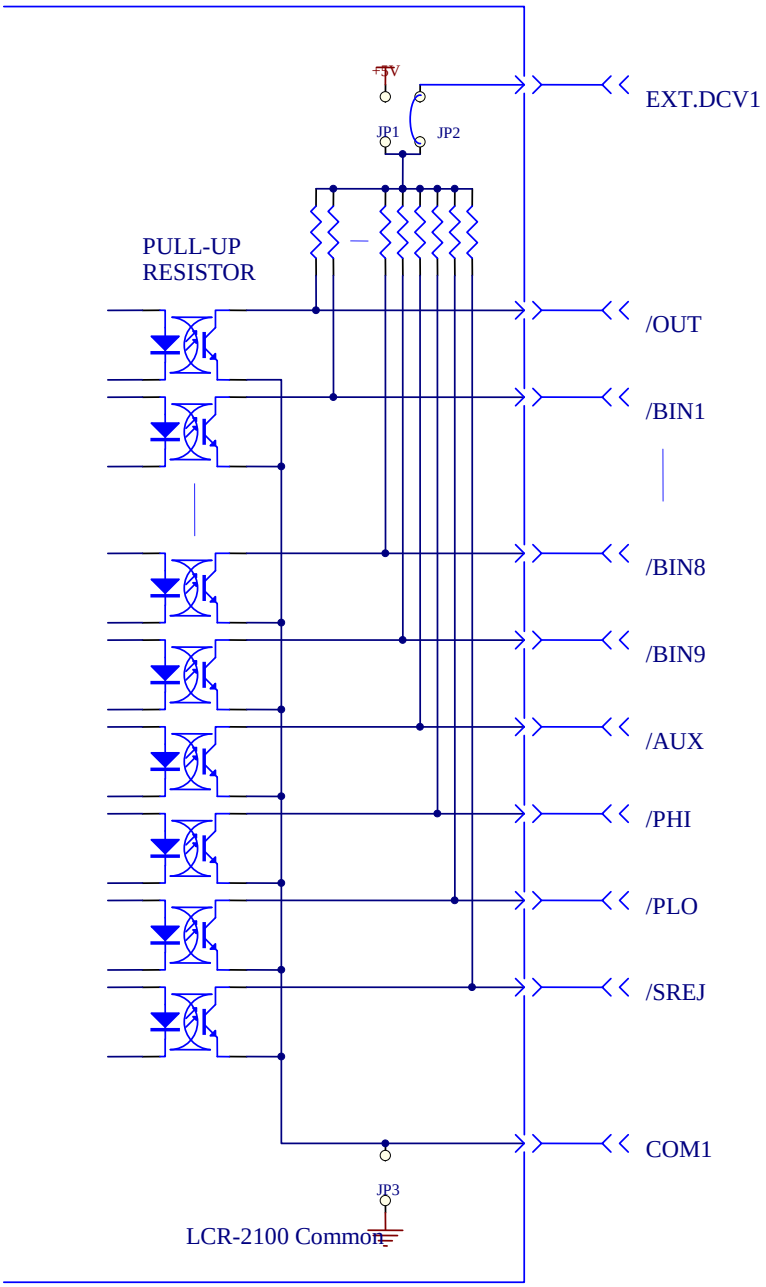


Figure 6 the output circuit for the comparison result

The output circuit for control signal is shown in the figure 7 below.

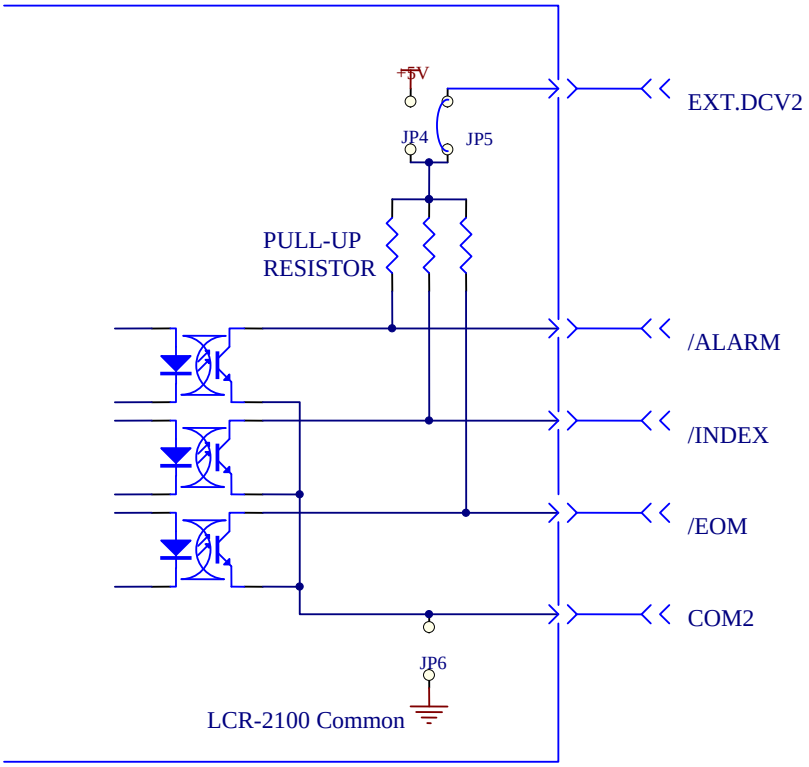


Figure 7 the output circuit for control signal

The input circuit for control signal is shown in the figure 8 below.

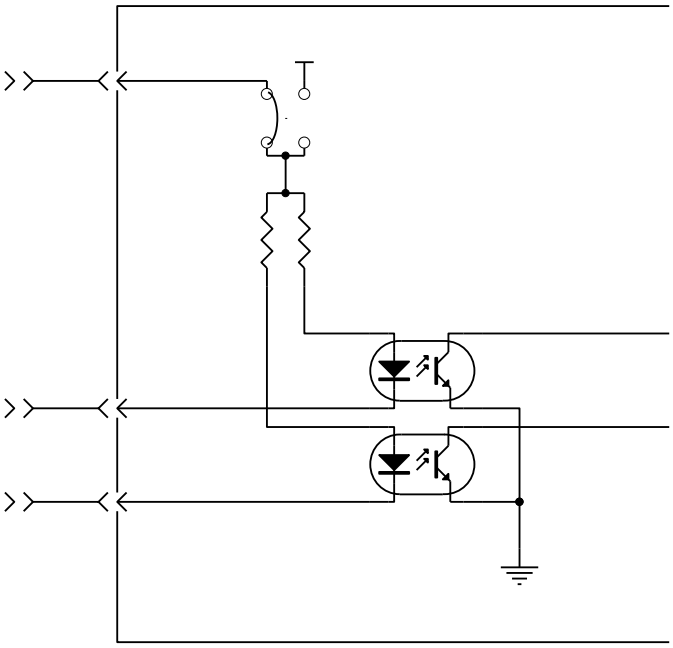


Figure 8 the input circuit for control signal

8.2.4 Operation

Before you use the HANDLER function, you should ensure that your instrument has install the HANDLER interface board.The following procedure will show you how to use the interface comparison and the list sweep comparison.

The procedure for comparison setting :

(1) Press the softkey [LIMIT TABLE]. LIMIT TABLE SETUP page will be displayed.

(2) Set the standard value and the high limit and the low limit in LIMIT TABLE SETUP. Refer to the LCR menu key description to see more details.

(3) Move the cursor to COMP field. The softkey area will display :

- ON
- OFF

(4) Press the softkey ON to enable the comparison function.

(5) Press [DISP], and then press the sotfkey BIN NO. or BIN COUNT, the DUT will be tested; at the same time, you can set the counter for the DUT and the auxiliary.

Note: COMP ON/OFF can be set in BIN COUNT page.

The procedure for list sweep comparison:

(1)Press LIST SETUP, LIST SWEEP SETUP page will be displayed.

(2)Set the sweep mode, sweep frequency point, reference value, the high limit and the low limit. Refer to the LCR menu key description to see more details.

(3)Press [LCRZ].and then press the soft key LIST SWEEP, LIST SWEEP DISP page will be displayed. Refer to the LCR menu key description to see more details.

Note: the following methods can be used to improve the speed:

(1)Set the range to the maximum that the capacitance may be, and lock this range.

(2)Set Vm: OFF and Im: OFF in the MEAS SETUP page.

(3)Test the DUT in the BIN COUNT page.