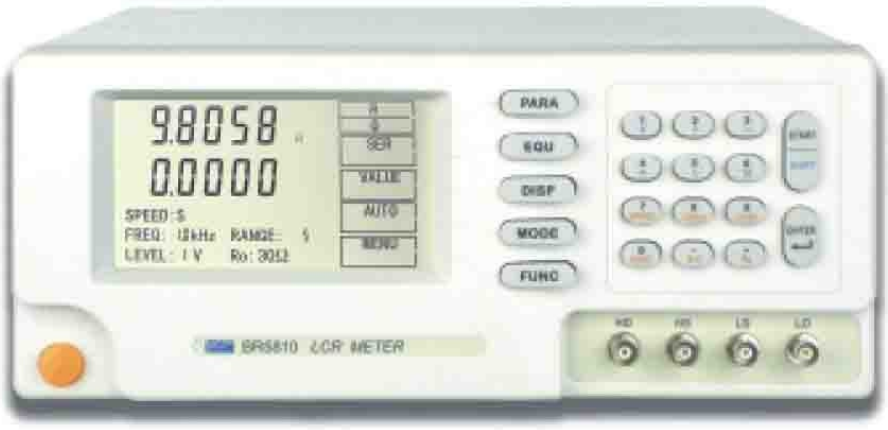
KUSAM-MECO®

An ISO 9001:2015 Company

BENCH TOP LCR METER

MODEL BR5810



OPERATION MANUAL

Caution

Keeping on turning on and off the instrument is absolutely forbidden, as this will cause the disorder of the program, which will lead to the loss of the calibrated data and the data saved by users.

Note

1. “CAL” in the setup menu should only be operated by the qualified calibration personnel, therefore, this function is password protected. Even if you know the password, you should also take high cautions when choosing to use the options. Any wrong operations may lead to the incorrect test results!
2. This instrument should be calibrated in the calibration lab.
3. Options and functions of the instrument may be advanced by our company in order to make the instrument more accurate. Any queries regarding the instrument, please feel free to contact us

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1. Overview

Thank you for your purchase and use of our products. Before your use of the apparatus, please read the instructions first.

1.1 Introduction

Model BR5810 LCR Meter is a test instrument with high price-performance ratio, newly researched and manufactured by our company. It is used automatically for testing component parameters including inductance (L), capacitance (C), resistance value (R), complex impedance (Z), phase angle (θ), quality factor (Q) and dissipation angular tangent value (D). The instrument integrates the strong function, excellent performance and simple operation. It either suits the needs of high-speed measurement on production site or meets the requirements of precision test for quality inspection, metrology and lab.

Comparing with the former general component parameter test instrument, Model BR5810 instrument has improved in the following fields.

In order to improve the immediacy and readability, a large-sized LCD display screen is designed for Model BR5810 instrument, displaying the test condition and the measured results. Model BR5810 instrument is also equipped with the man-machine interface convenient for application.

In order to meet the needs on the different sites, the instrument has two sets of sorting process with multi-digit parameter setting and high-resolution. The instrument can be connected to automatic test unit through the sorting interface, thus realizing automation test.

This instrument is equipped with RS-232 interface. It has effectively realized the communication with computer and provides the possibility of remote control and data collection.

This instrument is designed with constant signal source inherent resistance. It ensures that the voltage applied on the same measured part or the current signal does not change as the measurement range is adjusted. For this purpose, it avoids the phenomena that it is difficult for instrument to select the measurement range of the measured part located at the borderline of the measurement range.

This instrument has the key lock function and the status-holding function. It avoids the false operation and meanwhile, the instrument with customization of individual character has the default function when it is started up.

The instrument has the multiple variable measurement conditions. The typical functions are shown as follows:

- Test frequency: Four selective frequencies: 100Hz, 120Hz, 1kHz, 10kHz
- Testing signal electric level: Three selective testing signal electric levels: 0.1V, 0.3V, 1.0V
- Test speed: Fast speed, middle speed and slow speed for selection;
- Clearing zero: The instrument can carry out the zero-clearing by sweep frequency on the ends of measurement in open-circuit and short-circuit. The stray capacity remained at the test end of instrument and lead wire resistance are eliminated so that test precision may be further increased.

The instrument has three data reading modes and two sorting modes.

- Direct reading: Directly display the parameters on the measured part;
- Absolute error: Read the differential between value and nominal value;
- Relative error: Read the percentage error between value and nominal value;
- Components sorting: The test instrument provides two sorting modes: Three selectors status (sorting for three selector major parameters and one selector minor parameter); one selector status (sorting for one selector major parameter and one selector minor parameter)

The instrument provides two communication interfaces.

- Serial line interface: RS-232 interface provides the convenience for instrument and the communication between the instrument and peripheral serial communication. The instrument transmits data to peripheral equipment. The peripheral equipment shall set up functions and parameters on the instrument through the interfaces. It can be basically substituted for function of key

board.

- Handler Interface: This interface synchronizes the instrument with the component mechanical treatment equipment and does the test and sorting to the component. The selected results are outputted to mechanical treatment equipment.

1.2 Condition of Application

1.2.1 Environment Temperature and Humidity

Temperature: At 10℃～30℃ and humidity ≤ 70% RH, it meets the requirements of test accuracy;

Temperature: At 0℃～40℃ and humidity ≤ 90% RH, the instrument operates and measures.

1.2.2 Power Supply

Voltage of power supply: 220V/110V (1 ± 10%)

Frequency of power supply: 50 Hz/60 Hz（1 ± 5%）

Power: ≤ 20W

1.3 Volume and Weight

Volume: 330 x 150 x 400mm (W x H x D)

Weight: about 3.5kg

1.4 Unpacking and Turning on Power

1. After the instrument package is opened, please check the assembly according to the packing list.

2. Before operation, you should read the operation instruction and the relative attentions. Or you could do the operation with the guidance of the personnel who knows well about this instrument.

3. This instrument should use the power of 220V/50Hz or 110V/60Hz. Before switching on the power switch, please carefully check if the power is appropriate and if the power connection is normal and if the zero line N, phase line L and ground line E are correctly connected.

The ground line E connection should be correct and reliable. Otherwise, the instrument surface may cause the electric numbness and even the electric shock to endanger life. Please remember this point.

It can not share the same power socket with other big power electric appliances in order to prevent interference or electric shock not to damage the instrument.

4. The instrument should be used in the environment specified by the technical index. In particular, the test port connecting to the test components should be far from the electric magnetic field in order to prevent it from affecting the test result.

5. When the test is over or if it needs to open the shell for trouble shooting, you should turn off the power switch and pull off the power plug.

6. After the power is turned on , the pre-heating should be done for ten minutes.

2. Basic Technical Index

2.1 Test Function

2.1.1 Test Parameter

L: Inductance C: Capacitance R: Resistance value Z: impedance

D: dissipation Q: Quality factor θ: Phase angle

2.1.2 Parametric Combination

Major Parameter	Z	L	C	R
Minor Parameter	θ	Q, R	D, R	Q

2.1.3 Equivalent Mode

Series equivalent, Parallel equivalent

2.1.4 Measurement Range

Measurement range automation, Measurement range maintenance

2.1.5 Test Mode

Continuity, Single time

2.1.6 Display Mode

Direct reading, Absolute deviation, Percentage deviation

2.1.7 Test Speed

Fast speed, Middle speed and Slow speed

2.1.8 Basic Precision

0.1%

2.2 Test Signal

2.2.1 Frequency of Test Signal

Four selective test frequencies: 100Hz, 120Hz, 1kHz, 10kHz

Accuracy of frequency: 0.02%

2.2.2 Test Signal Electric Level

0.1V±10%, 0.3V±10%, 1.0V±10%

2.2.3 Output Impedance

30Ω±5% or 100Ω±5%

2.3 Introduction to Function

2.3.1 Calibration Function

Open circuit clearing "zero": Eliminate the affection of stray reactance at test end and in instrument.

Short circuit clearing "zero": Eliminate the affection of lead serial resistance and inductance.

2.3.2 Sorting Function

The test instrument has two sorting modes: After opening up the instrument, the sorting is in OFF status. After sorting is switched "ON", the initialization is 3P mode (Sorting for three selector major parameters and one selector minor parameter). 1P (Sorting for one selector major parameter and one selector minor parameter) can be selected. When the instrument is in the status of "Direct reading", "Absolute error (DELTA) and "Percentage error (DELTA%)", the sorting functions are effective and the information on P1, P2 and P3 NG and AUX is displayed on the LCD display device.

2.3.3 Keyboard Locking Function

With locking the keyboard, the function indication status in the panel can be protected. When the keyboard is locked, all keys, except "MENU" key, are under the locked status and can not be operated. For this purpose, the internal parameters shall not be affected because of false operation after the parameters are set up.

2.3.4 RS-232C Serial Interface

Uses simplified RS232 standard, and does not support hardware communication function.

Transmission baud rate：9600bps

Maximum transmission distance：15m

The communication command uses SCPI format, and all the command and data on the bus are transmitted by ASCII code.

2.3.5 HANDLER Sorting Interface

can accept the trigger signal（/TRIG）

can output comparison signal（/NG, /P1, /P2, /P3, /AUX）

can output control signal（/IDX, /EOM）

the logic low level is effective，optoelectronic isolation output.

built-in pull-up resistor，default use of outside power supply.

3. Configuration

3.1 Front Panel Description of Instrument

The pictorial diagram of the front panel is shown in Fig. 3-1.

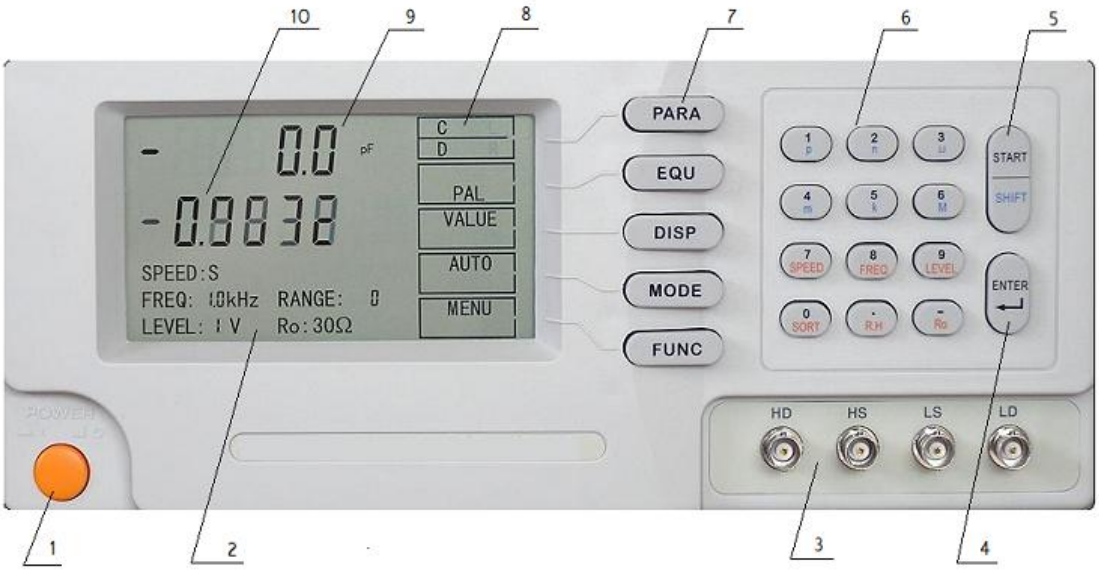


Fig. 3 – 1 Pictorial Diagram of the Front Panel

Front Panel Description: The front panel description of instrument is shown in Table 1 – 1.

Table 1 – 1

S/N	Description	Explanation of Function
1	Power switch	Switch on or off 220V/110V power. In "｜" status, switch on power. In "o" status, switch off power.
2	Measured parameter indication zone	It displays frequency, level, speed of current measurement, constant resistance and status of measurement range and sorting
3	Test port	Provide the complete four-port measurement HD - Current excitation high end: test signal is output from high end. Corresponding meter (such as voltmeter, frequency meter, oscilloscope, etc.) is used for testing voltage, frequency and wave form of test signal source on this high end. HS - Voltage sampling high end: testing the test voltage applied on measured part high end. LS - Voltage sampling low end: testing the test voltage applied on measured part low end. LD - Current excitation low end: current flowing through measured part is transmitted to current test part from the end. HD, HS is connected to a lead terminal of the measured part LD, LS is connected to another lead terminal of the measured part.
4	Enter key	Confirm inputted digit or command
5	Start/Shift key	When instrument is set up as manual mode, press this key to activate one measurement; when instrument is set up as sorting value, press this key to start up SHIFT function in digital key zone. At this time, 6 keys having

		SHIFT function are started up.
6	Keyboard and function indication	Details are shown in 4.2
7	Function key	The corresponding functions are indicated on 5 direct function keys. The current function is displayed “Function” displaying zone on the right of liquid crystal display screen.
8	Direct function display zone	Display the current function selected by 5 function keys
9	Major parameter and unit indication	Major parameter is displayed with maximum five-digit number, which is used for displaying measured results of major parameter with direct reading, absolute error Δ and relative error Δ % modes and the unit of measured results for major parameters.
10	Minor parameter and unit indication	Minor parameters is displayed with maximum five-digit number, which is used for displaying measured results of minor parameter and the unit of measured results for minor parameters.

3.2 Back Panel Description of Instrument

The schematic diagram of back panel is shown in Fig. 3-2

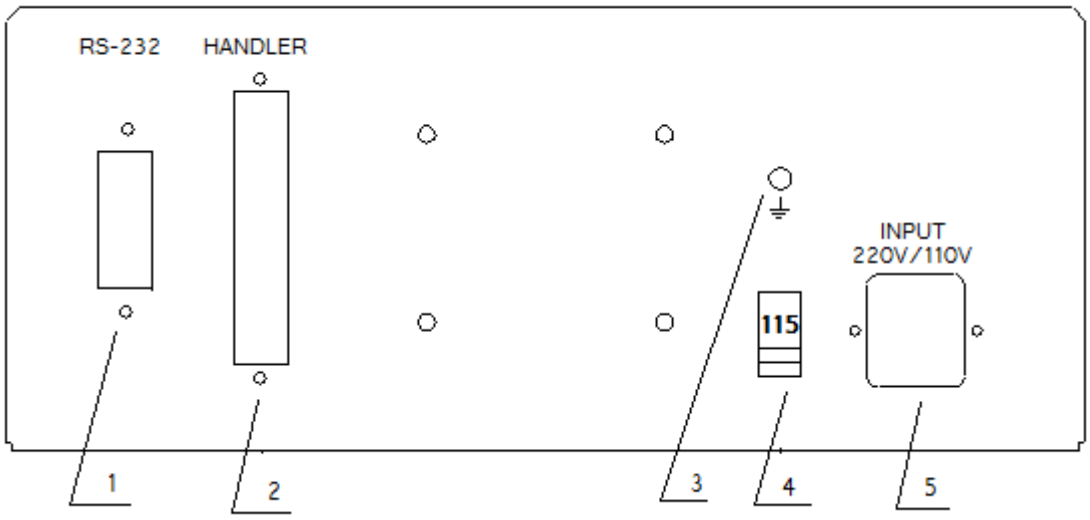


Fig 3-1 Schematic Diagram of Back Panel

Description of Back Panel: The description of back panel is shown in Table 2.

Table – 2

S/N	Description	Explanation of Function
1	RS-232C Serial interface	Provide serial communication interface between instrument and external equipment. All outputs of parameters setup, command and result shall be fulfilled by external equipment through the interface with 9-core male connectors.
2	HANDLER Interface	36-core socket
3	Ground terminal	In performance test or measurement, it is used for earth to instrument. Protective Ground to be connected a plate for preventing noise influence.

4	Line voltage selector	To select line voltage.
5	Socket of 3-wire power supply	Used for connection to AC power supply with 220V/110V. (including fuse)

4. Operation Instruction

4.1 Description of LCD Display

Description of Liquid Crystal Screen Display: Shown as Fig. 4-1.

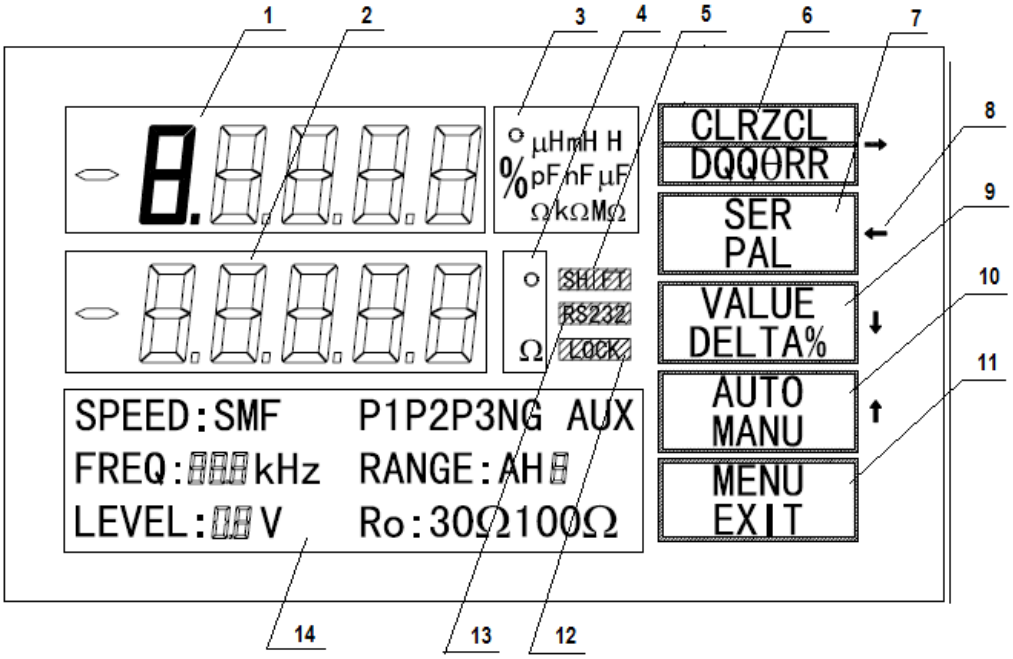


Fig. 4-1 Schematic Diagram of Display of Model BR5810 Instrument

(1) Major parameter display zone
(2) Minor parameter display zone
(3) Major parameter unit display zone
(4) Minor parameter unit display zone
(5) SHIFT Key activation symbol
(6) Current major and minor parameters names display zones including six combinations: C/D, L/Q, R/Q, Z/θ, C/R and L/R
(7) Current equivalence mode: There are two modes – serial mode (SER) and parallel mode (PAL)
(8) Directional key: It is used for indicating up, down, left and right direction. (displaying only in function menu).
(9) Current displaying mode in displaying zone: There are three displaying modes – direct reading (VALUE), error (DELTA) and percentage error (DELTA%)
(10) Current test mode in displaying zone: There are two modes – automatic continuous measurement (AUTO) and manual single time measurement (MANU)
(11) Function menu status indication: When displaying "MENU", press MENU key to enter into function menu. When displaying "EXIT", press MENU key to quit from function menu.
(12) Key-locked indicating symbol: It means the current key is in locked status. At this time only MENU key can enter into function menu.
(13) RS232 interface indicating symbol: It means RS232 serial interface activation of current instrument for two-way operation. In no display, it means the instrument is in receiving command status (one-way)

(14) Current test condition and test status zone of instrument: Respectively display test speed (SPEED), test signal frequency (FREQ), test signal electric level (LEVEL), signal source internal resistance (R0), measurement range and sorting result (P1 ~ P3, NG, AUX).

4.2 Key and Description

The instrument has English keyboard and Chinese keyboard, respectively shown in following Schematic Diagrams.

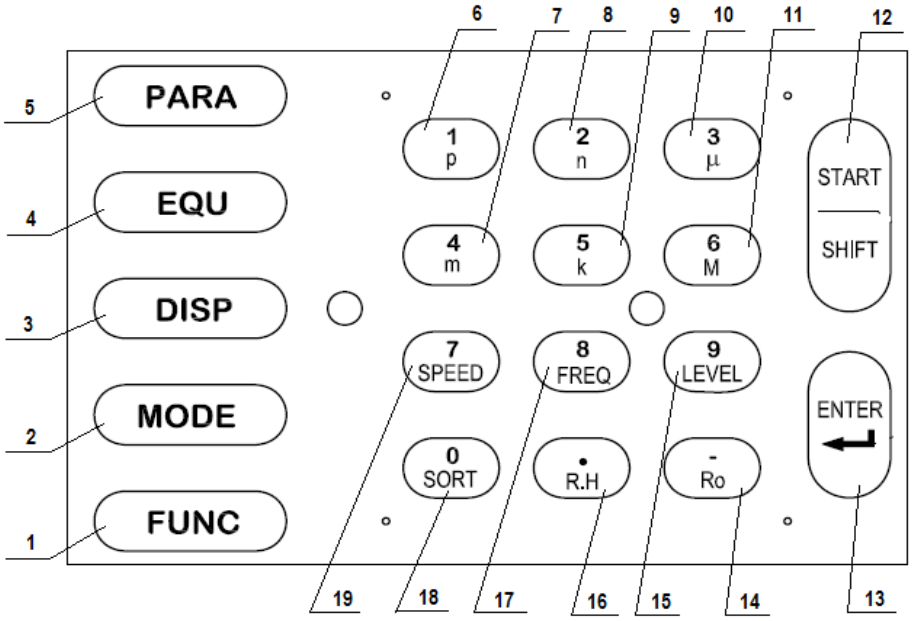


Fig. 4-2 Schematic Diagram of Model BR5810 Keyboard

Model BR5810 LCR digital bridge has 19 keys, as shown in Fig. 4-2. All functions of the instrument are implemented under the control of keyboard. The functions corresponding to five direct reading function keys including PARA, EQU, DISP, MODE, FUNC can be directly obtained. The six function KEYS in 12 digits/multiplication (0~9, -)/function combined key can be also obtained with pressing the key. The six unit multiplication keys can be obtained under the status of "SHIFT". The 12 digital keys shall be used when outputting digits. The functions shall be indicated with the following keys and in accordance with the pressing sequence.

(1) 【FUNC】Key: Function menu key – pressing this key to enter into the interface set up in function menu of instrument.

(2) 【MODE】Key: Mode key – pressing this key to select the test mode to change the test mode of instrument into manual (single time) or automation (continuous). The test mode currently selected shall be displayed in the right zone of liquid crystal screen.

(3) 【DISP】Key: Display key – pressing this key to select the display mode. The display mode currently selected shall be displayed in the right zone of liquid crystal screen.

(4) 【EQU】Key: Equivalence key – pressing this key to select the equivalent mode. The equivalent mode status currently selected shall be displayed in the right zone of liquid crystal screen.

(5) 【PARA】Key: Parameter key – pressing this key to select the test parameters. The test parameter currently selected shall be display in the right zone of liquid crystal screen.

(6) 【1/p】Key: When input digit, it is "1" and in (SHIFT) status, it is unit multiplication symbol "p".

(7) 【4/m】Key: When input digit, it is “4” and in (SHIFT) status, it is unit multiplication symbol “m”.

(8) 【2/n】Key: When input digit, it is “2” and in (SHIFT) status, it is unit multiplication symbol “n”.

(9) 【5/k】Key: When input digit, it is “5” and in (SHIFT) status, it is unit multiplication symbol “k”.

(10) 【3/μ】Key: When input digit, it is “3” and in (SHIFT) status, it is unit multiplication symbol “μ”.

(11) 【6/M】Key: When input digit, it is “6” and in (SHIFT) status, it is unit multiplication symbol “M”.

(12) 【START/SHIFT】Key: In single time mode, it is the test starting key, and when inputting sorting value unit multiplication, it is SHIF key

(13) 【ENTER】Key: Confirm the inputted digit or command

(14) 【-/R0】Key: In inputting digit “-“; when the instrument is under the status of measurement, it is the key of signal source internal resistance setup. After pressing this key, it is used for selecting signal source internal resistance.

(15) 【9/LEVEL】Key: In inputting digit it is “9”; when the instrument is under the status of measurement, it is the key of test signal electric level. After pressing this key, it is used for changing the measurement electric level of instrument.

(16) 【 /R.H】Key: In inputting digit it is “·”; when the instrument is under the status of measurement, it is the switch key of measurement range status. After pressing this key, it is used for changing the measurement range into automation or lock. The position of the current measurement range is displayed in the corresponding position.

(17) 【8/FREQ】Key: In inputting digit it is “8”; when the instrument is under the status of measurement, it is the key of test frequency. After pressing this key, it is used for changing the test frequency of instrument.

(18) 【0/SORT】Key: In inputting digit it is “0”; when the instrument is under the status of measurement, it is the key of sorting status. After pressing this key, it is used for displaying the sorting results of instrument in the corresponding position.

(19) 【7/SPEED】Key: In inputting digit it is “7”; when the instrument is under the status of measurement, it is the key of test speed. after pressing this key, it is used for changing the test speed of instrument.

4.3 Short-cut Function Use Method

After switching on the instrument, the test interface shown in Fig. 4-3 appears. With the short-cut function key, it is convenient to set up the data required for measurement. The details of setting up the instrument shall be described in accordance with the Fig. 4-3 as follows:

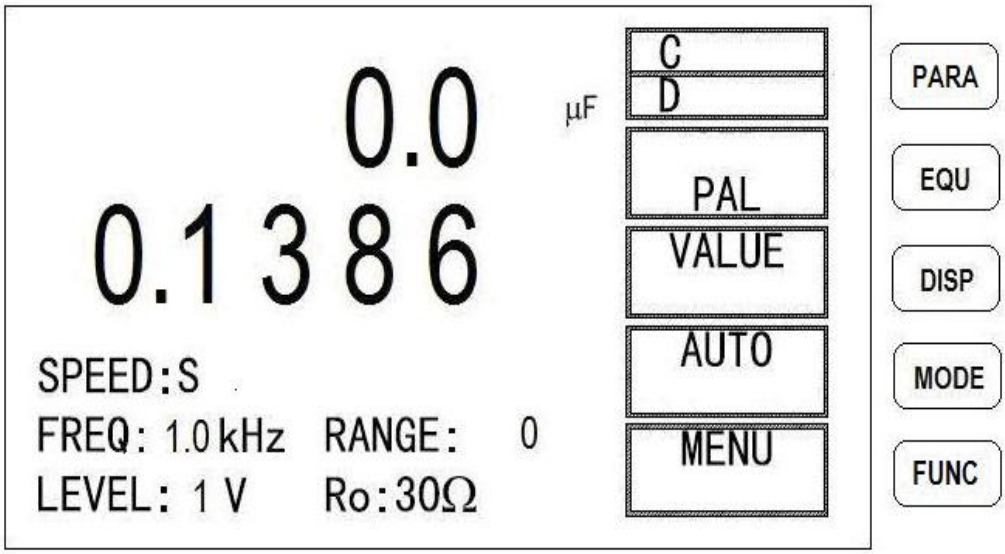


Fig. 4 – 3 Test Interface of Model BR5810

4.3.1 Selection of Test Parameters

Model BR5810 instrument has six test parameter combination - C/D, L/Q, R/Q, Z/θ, C/R and L/R. The user can select the parameters by means of PARA short-cut key. The current selected parameter combination shall be displayed in the parameter block in the right of LCD screen.

4.3.2 Selection of Serial and Parallel Equivalent Circuit

Model BR5810 instrument has two equivalent circuits – Serial (SER) and parallel (PAR) to test L, C or R. The user can select serial equivalent circuit (SER) or parallel equivalent circuit (PAR) by means of EQU short-cut key.

After starting the instrument, the initialization of instrument is in "parallel". The "serial" equivalent circuit can be selected by pressing EQU short-cut function key. Actually, the capacitance, inductance and resistance is not ideal pure resistance element or pure reactance element. In general, resistance element and reactance element exist simultaneously. An actual impedance component can be simulated by means of the ideal resistor and reactance (ideal inductance or ideal capacitance) in serial or parallel form. The model ZC2801D instrument can test the resistive element and reactive element of impedance component in the serial and parallel form.

- Selection of Equivalent Circuit

The small capacitance corresponds to the high impedance value. At this time, the affection of parallel resistance is larger than that of the serial resistance. The serial resistance is much smaller than the impedance of the capacitance. It may be neglected. Therefore, it is necessary to select the parallel equivalent mode for measurement.

On the contrary, large capacitance corresponds to the low impedance value. The parallel resistance is much larger than the impedance of the capacitance. It may be neglected. The affection of serial resistance on capacitive reactance is larger. Therefore, it is necessary to select the serial equivalent mode for measurement.

In general, the equivalent circuit can be selected in accordance with the following regulations:

When the impedance is larger than 10kΩ, the parallel mode can be selected:

When the impedance is smaller than 10Ω, the serial mode can be selected:

When the impedance is between 10kΩ and 10Ω, the suitable equivalent circuit may be adopted in accordance with the recommendation of component manufacturer or the suitable equivalent mode may be selected in accordance with the use status.

4.3.3 Selection of Display Mode

The display mode can be selected by means of 【DISP】short-cut key. There are three different display modes used for testing value, i.e. VALUE, DELTA or DELTA%

VALUE : Directly displaying the value of component to be measured.

DELTA : Displaying the error value of the measured component and inputted nominal value.

DELTA = measured value – nominal value

DELTA%: Displaying the difference of positive and negative percentage error between measured value and inputted nominal value.

$$DELTA\% = \frac{\text{Measured value - nominal value}}{\text{Nominal value}} \%$$

Note: In *DELTA or DELTA%* , *please input nominal value at first. The nominal value is inputted in reference for 4.4.6*

4.3.4 Selection of Test Mode

Model BR5810 instrument provides two test mode – automatic continuous test (displaying “AUTO”) and single time test (displaying “MANU”): Under the test status, press shut-cut key【MODE】to select ”AUTO” or ”MANU”.

Continuous Test: The instrument is continuously measuring. The measured results shall be displayed after every measurement.

Single time Test: The instrument is generally in ready status. After the keyboard or interface receives a “Beginning” signal, it shall carry out a measurement and output the result, and then is ready for next “Beginning”.

4.3.5 Selection of Test Speed

The user can select the test speed by means of【7/SPEED】combined function key.

There are three test speeds for measurement: SLOW (Slow speed), MEDIUM (Medium speed) and FAST (Fast speed). In general condition, the slower, test speed is, the more stable, the tested result is more accurate.

SLOW: 2.5 times measurement per second.

MEDIUM: 5.1 times measurement per second.

FAST: 12 times measurement per second.

4.3.6 Selection of Test Frequency

The user can select the test frequency by means of combined function key【8/FREQ】. Model BR5810 instrument has four frequency points for setup. They are respectively 100Hz, 120Hz, 1kHz and 10kHz. The frequency accuracy is 0.02%.

4.3.7 Selection of Test Electric Level

The user can select the test electric level by means of combined function key【9/LEVEL】. Model BR5810 instrument provides three types of test electric level for selection: 0.1V, 0.3V and 1.0V.

4.3.8 Selection of Measurement Range Holding

This instrument has six types of measurement ranges. The test range for each other is interlinked.

Model BR5810 instrument in 100Ω signal source internal resistance has five types of measurement range, i.e. 30Ω, 100Ω, 1kΩ, 10kΩ and 100kΩ. The effective test scope of each of measurement range is shown in Table 4-1.

Model BR5810 instrument in 30Ω signal source internal resistance has six types of measurement range, i.e. 10Ω, 30Ω, 100Ω, 1kΩ, 10kΩ and 100kΩ. The effective test scope of each of measurement range is shown in Table 4-2.

Table 4-1

S/N	Range resistance	Effective Test Scope
0	100kΩ	100kΩ～100MΩ
1	10kΩ	10kΩ～100kΩ
2	1kΩ	1kΩ～10kΩ
3	100Ω	50Ω～1kΩ
4	30Ω	0Ω～50Ω

Table 4-2

S/N	Range resistance	Effective Test Scope
0	100kΩ	100kΩ～100MΩ
1	10kΩ	10kΩ～100kΩ
2	1kΩ	1kΩ～10kΩ
3	100Ω	100Ω～1kΩ
4	30Ω	15Ω～100Ω
5	10Ω	0Ω～15Ω

The user can transfer measurement range into locked mode by means of combined function key【 /R.H】.

When the components are tested in a lot with same specs and if it is required to increase the test speed without frequently shifting measurement range of the instrument, the measurement range holding function can be used to fix the test of instrument in a measurement range. For this reason, it may save the stability time after projection and selection of measurement range. The method used for fixing measurement range is shown as follows:

A component to be tested shall be taken for testing. At first, the measurement range is set up in automatic mode, and then the combined function key【 /R.H】is pressed after the reading is stable.

If the current indication is "RANGE: X" (X is 0 ~ 5), it means that the instrument is in the measurement automation (AUTO). If the current indication is "RANGE H X" (X is 0 ~ 5), it means that the instrument is in measurement range holding (HOLD). The X value is one of six measurement ranges.

The method for selecting measurement range holding is shown as follows:

In displaying RANGE X, /R.H key is pressed to display RANGE H X. It means that the measurement range is in holding "X" status. /R.H key is pressed again to display RANGE H X. Among them, X is in flashing status. At this time, 0 ~ 5 is inputted. The input value is displayed and flashes. With pressing【ENTER】key, the input is confirmed and it stop flashing. The instrument is in the holding test status of the selected measurement range.

When RANGE: H X is displayed and the X is in flashing status, with pressing /R.H key, RANGE: X displayed, it means that the measurement range is shifted to automatic status.

Example: calculation method of measurement range position

Capacitance C=210nF, D=0.0010, test frequency f=1kHz,

$$Zx=Rx+\frac{1}{j2\pi fCx}$$

$$Zx\approx\frac{1}{2\pi fCx}=\frac{1}{2\times3.1416\times1000\times210\times10^{-9}}\approx 757.9\ \Omega$$

As indicated in the above the table, the correct measurement range of the capacitor is 3.

4.3.9 Selection of Sorting Status

In testing status, with pressing the combined function key【0/SORT】, the current sorting results are displayed at the screen. The details of set method for sorting are shown in 4.44 ~ 4.48 Setup of Sorting Index.

In Model BR5810 instrument, the tested components are divided in 5 selectors (NG, P1, P2, P3 and AUX). When the major parameter of the tested part is within the set limit scope and the minor parameter is beyond the set limit scope, the tested part is AUX auxiliary selector.

4.3.10 Selection of Constant Resistance Mode

Model BR5810 instrument provides the constant resistance mode so as to realize the accurate test. By means of combined function key【-/R0】, the output impendence at the test port is constantly selected as 30Ω or 100Ω. The status of the current constant resistance is displayed in the status zone of liquid crystal screen.

4.4 Operating Illustration of Instrument Function Menu

When the instrument is in test status, MENU key is pressed to enter into function setup menu. The function menu includes the following items in turn:

- Clearing "0" operation
- Keyboard locking setup
- RS232C interface setup
- 1 selector / 3 selector sorting setup

- Beep switch and setup
- Nominal value setup
- Minor parameters setup
- Sorting extreme value setup
- Recall Calibration setup

Note: When the function menu is displayed, with pressing ↓ key, it is selected in turn. With pressing ↑ key, it is selected in reversing direction.

When pressing MENU key to enter into function menu, at first, it enters into the first item – clearing "0" operation. The displayed interface is shown in Fig. 4-4 (In open-circuit of test port)

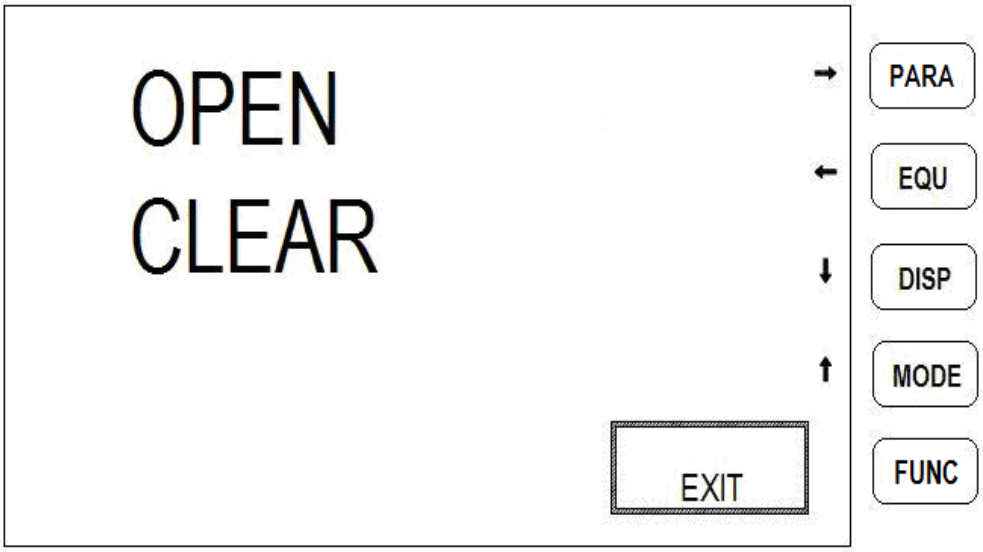


Fig. 4-4 Schematic Diagram of Function Menu First Item

"CLEAR" in the second row of menu means the item of clearing "0". That "OPEN" flashes in the first row and it means that the current zeroing mode is the open-circuit zeroing. If the testing port is shorted with pressing key, that "SHORT" flashes and it means that the current zeroing mode is the short-circuit zeroing.

In the function setup menu, four short-cut function keys in the right area of screen correspond respectively to four direction keys "→", "←","↓" and "↑" along the side of screen. Among them, "↓" and "↑ keys are used for selecting all items in function menu. The details of them are displayed correspondingly in the second row. "→" and "←" keys are used for revising the settings under the current items and are displayed correspondingly in the first row. With pressing MENU key again, it quits from function menu setup. All items in the function menu are described as follows:

Note: Since all English alphabets can not be displayed in 8-case letter, the displayed is only similar symbols, not displayed failure. In order to read conveniently, the standard English alphabet is displayed in the Operation Instruction Manual. The following drawing is the comparison table between standard alphabet and the actually-displayed alphabet

4.4.1 Operation of Clearing "0"

In order to ensure the testing accuracy of the instrument and to eliminate the influence of stray

capacitance, inductance and lead resistance in test fixture or test leading wire and inside of instruction on testing correctness, it is necessary to clear "0" in instrument. There are two zeroing process including open-circuit and short-circuit in Model BR5810 instrument.

In test interface, with pressing MENU key, enter into zeroing interface shown in Fig. 4-4. "CLEAR" in the second row of menu means the item of clearing "0". That "OPEN" flashes in the first row and it means that the current zeroing mode is the open-circuit zeroing. At this time, if the testing port is shorted, the flashing word shall be changed to "SHORT", it means that the current zeroing mode is the short-circuit zeroing.

At this time, by means of changing the open-circuit status or short-circuit status in test port, the open-circuit zeroing or short-circuit can be selected. With pressing ENTER key, start up the sweep zeroing process. After completing zeroing process, it will display PASS (pass through) or FAIL (failure).

When the tested part remains still in the test fixture, "QUIT" flashes in the first row. It means that it does not meet the normal zeroing condition. It is necessary to check test port.

With pressing MENU key, it can quit from menu. (The following is same.)

In order to ensure the reliable zeroing and calibration test, the following regulations should be carried out.

1) After completing clearing "0", it is necessary to keep the form of test leading wire same as one when clearing "0".
2) In short-circuit zeroing, it is necessary to use the gold-plated short-circuit board or low resistance lead wire supplied with shipment (bare copper wire, aluminum-plated wire or gold-plated wire) to make the test port shorted. Caution: Don't make HD, HS and LD, LS connected together. When the fixture is short-circuited, HD, HS and LD, LS are not connected together after inserting short-circuit board or low resistance leading wire.
3) After changing voltage or output impendence, it is necessary to clear "0" again.

4.4.2 Keyboard Lock Setup

In the zeroing interface shown in Fig. 4-4, with pressing "↓" key, enter into the interface of keyboard lock setup, shown in Fig. 4-5.

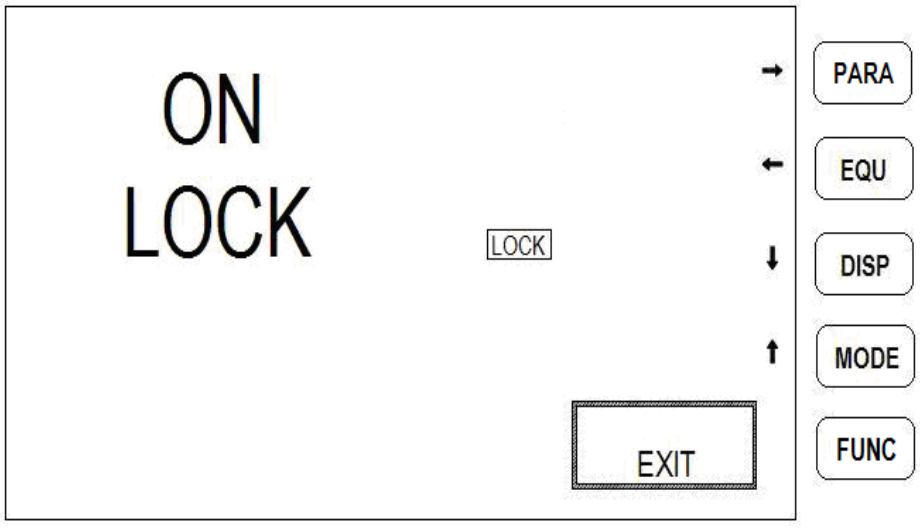


Fig. 4-5 Schematic Diagram of Function Menu Second Item

In the above diagram, “LOCK” in the second row means the keyboard lock interface. That “ON” in the first row and LOCK is flashing and it means that the current keyboard lock status is “ON”. At this time, close the keyboard lock by means of ”→”,”←” key. After closing, the flashing words are changed to “OFF” and ,LOCK mark is disappeared.

Illustration: In ON, the keyboard is locked to protect all panel function indicating status. When the keyboard is locked, all keys are in locked status and can not be used except MENU key. In this way, the parameters which are set up shall not be affected because of false operation of keyboard. In general, it is used in working mode of production line.

In OFF, the lock status is cancelled.

In the interface shown in Fig. 4-5, press ”↑” key to return to the last item as shown in Fig. 4-4. (The following is same.)

4.4.3 Setup of RS-232C Serial Interface

In keyboard lock setup status shown in Fig. 4-5, press ”↓” key to enter into RS232 interface setup shown in Fig. 4-6.

Fig. 4-6 Schematic Diagram of Function Menu Third Item

In above diagram, ”RS232” means RS232 setup interface. That “ON” and RS232 is flashing means that the current RS232 interface status is “ON”. At this time, RS232 interface can be closed with ”→” ,”←”key. After closing, the flashing word in the first row shall be changed to “OFF”, RS232 mark is disappeared.

Illustration: RS232 =”ON”, the instrument can obtain the operation command same as one shown in the panel of instrument from external equipment and transmit the tested results to external equipment (allowing to send/receive).

RS232 =”OFF”, the instrument can obtain the operation command same as one shown in the panel of instrument from external equipment (Only receiving).

4.4.4 Setup of 1 Selector/3 Selector

In RS232 interface setup interface, with pressing ”↓”key, enter into the 1 selector/3 selector sorting setup interface as shown in Fig. 4-7

Fig. 4-7 Schematic Diagram of Function Menu Fourth Item

In above diagram, ”BIN” in second row means 1 selector/3 selector sorting setup interface. When “1P” in first row is flashing, it means that the current sorting status is in 1 selector sorting. At this time, the sorting status can be changed to 3 selector (3P) with ”→”, ”←”key.

With pressing FUNC key, it directly quits from function menu.

4.4.5 Setup of Beep Mode

As shown in Fig. 4-7, in 1 selector/3 selector sorting set interface, press ”↓”key to enter in beep mode setup interface shown in Fig. 4-8.

Fig. 4-8 Schematic Diagram of Function Menu Fifth Item

In the above diagram, “BEEP” in the second row means beep setup interface. The flashing “OFF” in the first row means that the current beep status is “OFF”. At this time, by means of ”→”, ”←”key, select the setup beep switches - ”NG”, ”P1”, ”P2”, ”P3” or ”AUX”, which respectively means that the beep switch shall be opened on unaccepted (NG), 1 selector (P1), 2 selector (P2), 3 selector (P3) or auxiliary selector (AUX).

4.4.6 Setup of Nominal Value

In the beep mode setup interface shown in Fig. 4-8, press ”↓” key to enter in the nominal value set interface as shown in Fig. 4-9.

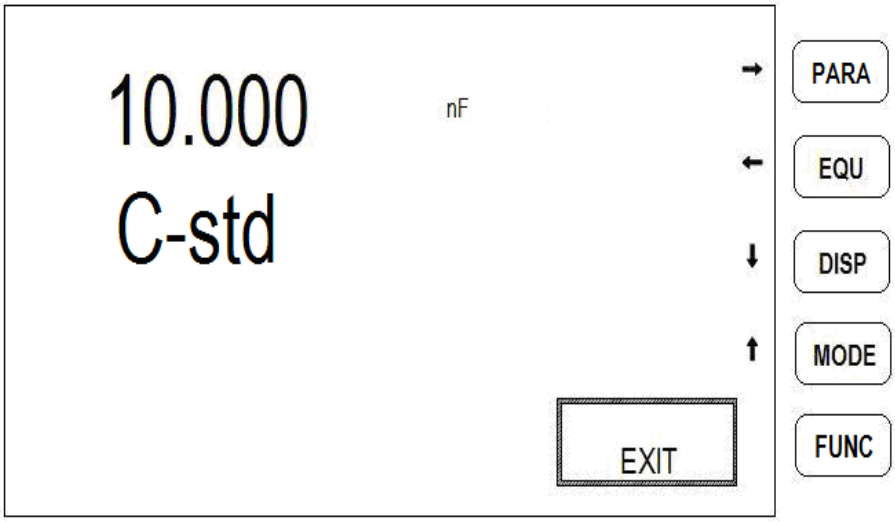


Fig. 4-9 Schematic Diagram of Function Menu Sixth Item

In above diagram, ”C-std” in the second row means the setup of the current capacitance nominal value, it is used for selection of test parameter when corresponding to test interface, respectively representing for inductance nominal value (L-std), resistance nominal value (R-std), impendence nominal value (Z-std). The number shown in the first row is the originally-set nominal values and unit. At this time, by means of ”→”,”←”key, select the value position to be changed (flashing position). The new nominal values can be inputted with 0~9 digital keys and decimal point key in the right of keyboard. The corresponding unit can be inputted with SHIFT key + digit/unit combined key. At last, confirm the input with ENTER key.

Example: When inputting nominal value 23.450nF, the operation is shown as follows:

At first, press ”←” key to locate the cursor (flashing word) in the first position, and then press the following keys in turn: 2/p + → + 3/u + ./R.H + → + 4/m + → + 5/k + → + 0/sort + SHIFT + 2/n + ENTER. The method to input inductance nominal value (L-std), resistance nominal value (R-std), impendence nominal value (Z-std) is same as one to input capacitance nominal value (C-std). It is only required to select the corresponding parameter in the test interface. The nominal values of L, C, R and Z are set up and saved respectively (The corresponding minor parameters are set up saved respectively)

4.4.7 Setup of Minor Parameters

In the nominal setup interface shown in Fig. 4 – 9, press ”↓”key to enter the nominal parameter setup interface, as shown in Fig. 4 – 10.

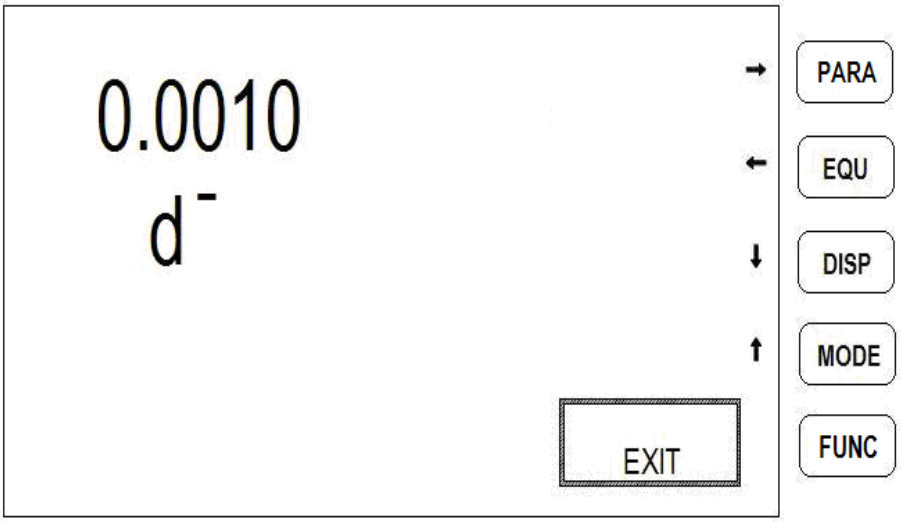


Fig. 4-10 Schematic Diagram of Function Menu Minor Parameter

In the above diagram, "d¯" in the second row means the upper limit setup of the current capacitance dissipation value. When it corresponds to test interface, the selection of test parameters may be respectively quality factor (Q–), impendence phase angle (deg) and the equivalent resistance (R) of capacitance and inductance; The number in the first row is the originally-set value and unit. At this time, by means of "→","←"key, select the value position to be changed (flashing position). The new values can be inputted with 0~9 digital keys and decimal point key in the right of keyboard. The corresponding unit can be inputted with SHIFT key + digit/unit combined key. At last, confirm the input with ENTER key. The phase angle and equivalent resistance have the upper limit and lower limit and then press "↓"key to enter in lower value setup.

Example: Input dissipation value (D): 0.0010, the operation is shown as follows:

At first, press "←" key to locate the cursor (flashing word) in the first position, and then press the following keys in turn: 0/sort + ./R.H + → + 0/sort + → + 0/sort + → + 1/p + → + 0/sort + ENTER

Note: When inputting phase angle (deg), it has positive input and negative input, refer to the Input Method shown in 4.4.8.

4.4.8 Setup of Sorting Limit Value

In the minor parameter interface d¯(Q–,deg–,R–) shown in Fig. 4-10, press "↓"key to enter sorting limit value setup interface, as shown in Fig. 4-11.

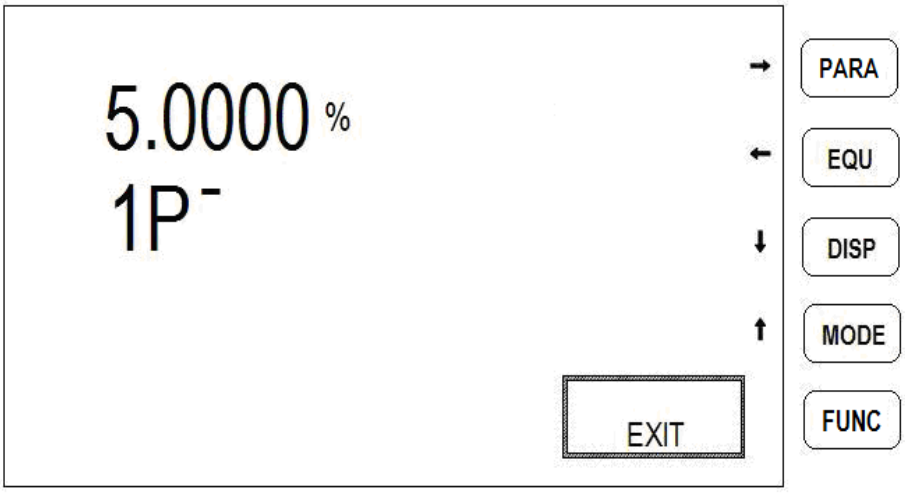


Fig. 4 – 11 Schematic Diagram of Function Menu Limit Value Setup

In above diagram, "1P" in the second row means the current display is the 1 selector sorting upper limit value setup. Press "↓"key to enter into the setup of 1 selector sorting lower limit value (1P). If 3P sorting is set up in 4.4.5, there are 6 limit values data required for setup, i.e. (1P-), (1P_), (2P-), (2P_), (3P-) and (3P_). The number in the first row is the originally-set limit value. At this time, by means of "→","←"key, select the value position to be changed (flashing position). The new limit values can be inputted with 0~9 digital keys and decimal point key in the right of keyboard. Press -/R0 key to change the positive and negative value. At last, confirm the input with ENTER key.

Example: Input – 10.000%, the operation is shown as follows:

At first, press "←" key to locate the cursor (flashing word) in the first position, and then press the following keys in turn: 1/p + → + 0/sort + ./R.H + → + 0/sort + → + 0/sort + → + 0/sort + -/R0 + ENTER.

Example: Input 10.000%, the operation is shown as follows:

At first, press "←" key to locate the cursor (flashing word) in the first position, and then press the following keys in turn: 1/p + → + 0/sort + ./R.H + → + 0/sort + → + 0/sort + → + 0/sort + ENTER.

Note: The negative sign is input at any time before pressing ENTER key. If no negative sign, press -/R0 key to display the negative sign. Contrarily, the negative sign disappears.

4.4.9 Setup of Recall Calibration

This function should only be operated by qualified calibration personnel, therefore, the function is password protected. Please contact distributor.

5. Description of Test

5.1 Connection of Test Fixture

Two test fixtures LCR001 and LCR005 equipped with instrument shall be connected to the test port of instrument for component test. If the LCR001 fixture is used for testing wire, one group of two BNC connectors on individual test fixture are connected to the corresponding sockets of high end (HD, HS) or low end (LD, LS) on the instrument panel.

5.2 Routine Test

After carefully reading the above-said Operation Instruction, you can make the routing test with the instrument. Please refer to the following steps:

With switching on power supply of instrument, the instrument shall enter into test display page frame, as shown in Fig. 5-1.

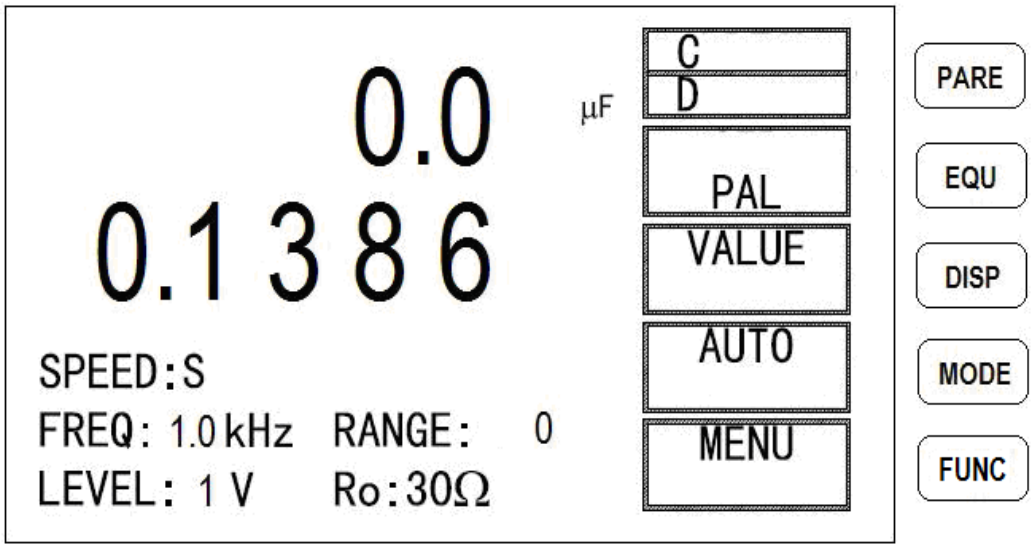


Fig. 5 -1

The test parameter, equivalent mode, display mode and test mode shall be selected in turn with【PARA】,【EQU】,【DISP】and【MODE】.

1) The frequency and electric level of the test signal shall be set up with six combined function keys -【8/FREQ】and【9/LEVEL】of 【-/R0】,【7/SPEED】、【8/FREQ】、【9/LEVEL】、【0/SORT】、【 /R.H】beneath digital keyboard as shown in 4.3. In the general test, other four keys are the initial values when the instrument is started.
2) After mounting test fixture or test wire, select the proper zeroing mode for clearing "0".
3) After connecting the tested component, the tested results should be displayed in screen.
4) Test display scope

Parameter	Frequency	Test Scope
L	100Hz、120Hz	1μH～9999H
	1kHz	0.1μH～999.9H
	10kHz	0.01μH～99.99H
C	100Hz、120Hz	1pF～19999μF
	1kHz	0.1pF～1999.9μF
	10kHz	0.01pF～19.99μF
R		0.0001Ω～99.99MΩ
D		0.0001～9.999
Q		0.0001～9999
θ		Deg -179.99°～179.999°

Note: Z constantly is positive and when others are negative, the initial indication is " – " in value zone.

5) Display Unit:

The parameters displayed in display screen basically have the unit. Model BR5810 instrument displays the tested parameters with the following units and multiplicatoin

Table – 5

C	pF（Pico-farad）	nF（Nano-Farad）	μF（Microfarad）;
L	μH（micro-Henry）	mH（Nano-Henry）	H（Henry）;
R/Z	Ω（Ohm）	kΩ（Kilo ohm）	MΩ（Meg-ohm ）;
θ	℃(degree)		
D、Q	Non unit		

5.3 Test of Error

Model BR5810 instrument makes error test with two modes, i.e. absolute error -difference with nominal value (Represented by DELTA) and percentage error -difference with nominal value (Represented by DELTA%). Since the error is calculated for a whole period in testing, the test speed may be lower.

5.3.1 Nominal Value

The nominal value shall be set up for test in DETLA or DETAL%. i.e. The error obtained is the error between actually-tested value and nominal value. The nominal value can be set up in any time. The setup of nominal value is described in 4.4.6.

5.3.2 Test Mode of Absolute Error

The test mode of absolute error is the tested value minus the nominal value and is displayed in display screen.

The test of the absolute error shall be performed by means of pressing【DISP】on the test page to select DELTA. In DELTA mode, "+/-" value shall appear.

5.3.3 Test Mode of Percentage Error

The test mode of percentage error is the error value divided by nominal value.

The test of percentage error shall be performed by means of pressing【DISP】on the test page to select DELTA%. In DELTA% mode, the displayed value always is % value .

5.4 Test of Component Sorting

In production and incoming inspection of the parts and components, a great number of parts and components with same specs should be tested so as to judge the quality in the same lot of parts and components. In this case, it is unnecessary to know the detailed values of parts and components and it is necessary to know if the parameters exist within some special scope, i.e. sorting. As for instrument, it is required for obtaining the results simply and rapidly. Model BR5810 instrument provides two sorting modes: 3P status (three sectors major parameter and one selector minor parameter sorting) and 1P status (one selector major parameter and one selector minor parameter sorting). Under the statuses of direct reading, absolute error (DELTA) and percentage error (DELTA%), the sorting function are effective.

The steps for starting sorting operation:

In order to performance the proper sorting for parts and components, the test parameters should be set up in accordance with the regulations specified in the technical requirements as far as possible or with the actual working condition of parts and components. Before sorting, the test conditions (function, frequency, electric level and speed) are set up to their optimum conditions.

1) The test conditions are set up in accordance with the tested parts, such as parameter, frequency, electric level, speed, single or continuity.
2) Set up the sorting mode (4.4.4)
3) Set up beep mode (4.4.5)
4) Set up nominal value (4.4.6)
5) Set up minor parameter limit value (4.4.7)
6) Set up selector limit (4.4.8)
7) Press 【0/SORT】key to select the display of sorting results
   Press 【0/SORT】key again to close the display of sorting results and quit from the sorting status.

5.5 Accuracy of Test

C：0.1%（1+Cx/Cmax+Cmin/Cx）(1+Dx)(1+ks+kv+kf)；

L：0.1%（1+Lx/Lmax+Lmin/Lx）(1+1/Qx)(1+ks+kv+kf)；

Z：0.1%（1+Zx/Zmax+Zmin/Zx）(1+ks+kv+kf)；

R：0.1%（1+Rx/Rmax+Rmin/Rx）(1+Qx)(1+ks+kv+kf)；

D：±0.0010（1+Zx/Zmax+Zmin/Zx）(1+Dx+Dx^2)(1+ks+kv+kf)；

Q：±0.0015（1+Zx/Zmax+Zmin/Zx）(Qx+1/Qx)(1+ks+kv+kf)；

θ：±0.010（1+Zx/Zmax+Zmin/Zx）(1+ks+kv+kf） ·180 °/π；

Note: 1. D，Q and θ is the absolute error and others are the relative error.

2. Subscript figure x is the test value of the parameter; subscript figure max is the maximum value and subscript figure min is the minimum value.

3. ks is the speed factor; kv is voltage factor; kf is frequency factor.

4. In order to ensure the test precision, when the accuracy is calibrated, the reliable open-circuit and short-circuit zeroing shall be carried out under the current test conditions and test fixture.

1 Test speed error factor, ks

Speed	Fast speed	Middle speed	Slow speed
ks	10	0	0

2 Test parameter max value and min value affecting accuracy (See Table -5

Table – 5

Parameter	Frequency			
	100Hz	120Hz	1kHz	10kHz
Cmax	800μF	667μF	80μF	8μF
Cmin	1500pF	1250pF	150pF	15pF
Lmax	1590H	1325H	159H	15.9H
Lmin	3.2mH	2.6mH	0.32mH	0.032mH
Zmax/Rmax	1MΩ			
Zmin/Rmin	1.59Ω			

3 Test electric level error factor, kv

V	0.1V	0.3V	1.0V
kv	4	1	0

4 Test frequency error factor, kf

f	100Hz	120Hz	1kHz	10kHz
kf	0	0	0	0.5

6. Direction for Use about HANDLER Interface

6.1 Brief Introduction

Model BR5810 instrument provides Handler interface. This interface is mainly used for output of sorting results. When the instrument is used in automatic component sorting test system, the interface provides the communicating signal and sorting result output signal with system, as shown in Table 6 -1. The communicating signal includes /TRIG (starting signal), /IDX (AD shifting ending), /EOM (All tests ending); the sorting result output includes the qualified selector /P1, /P2, /P3, auxiliary selector /AUX and unqualified selector/NG. With these signals, the instrument can compose the automatic

test system conveniently with system controller to perform the test of parts and components, sorting and quality control, thus increasing production efficiency.

Table 6 – 1 Illustration of Handler Interface Signal

Description	Illustration of Signal	Illustration of Circuit Characters
/P1 /P2 /P3	Qualified signal	□ Built-in pull-up resistor □ Collecting electrodes output □ Low electric level effect □ Photo-coupling isolation
/NG	Unqualified signal	
/AUX	Auxiliary selector signal	
/IDX	AD shifting ending	
/EOM	All test ending	
/TRIG	Starting signal	Pulse width ≥1μs, pulse leading edge, low electric level drive current is about 5-10mA。

6.2 Description of Operation

6.2.1 Definition of Signal Wire

Handler interface uses three kinds of signal: comparative output, control input and control output.

- Comparative output:
  /P1, /P2, /P3, /NG, /AUX. The occurrence of comparative output signal is shown in Fig. 6-1
- Control output signal:
  /IDX (AD shifting ending signal)
  /EOM (Testing ending and comparative data effective signal)
- Control input signal:
  /TRIG (External trigging signal)

Note: The slash / before signal name represents that the signal is effective in low electric level.

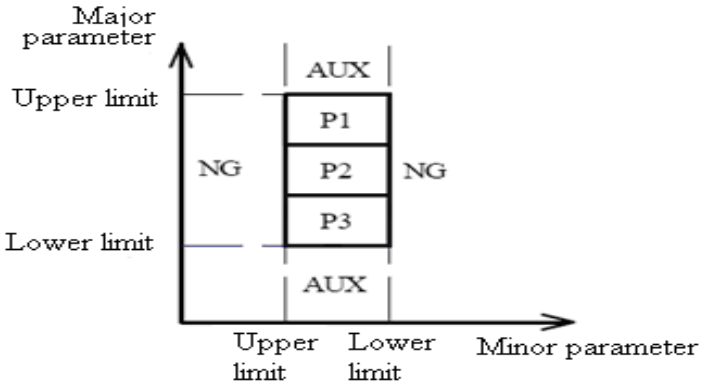


Fig. 6-1 Example of Comparative Function Area

Allocation and brief illustration of signal pins are shown in Table 6-2 and Fig. 6-2 and time sequence is shown in Fig. 6-3

Form **6-2 Definition Table of Handler Interface Pin**

Pin No.	Name of signal	Description

1 2 3 4,5,6 7,8,9 10 11	/P1 /P2 /P3 NC NC /NG /AUX	Selector sorting judging result output. All signals are built-in pull-up resistor collection electrodes output. The pull-up power supply can select internal +5V power or external power supply EXTV. Default external pull-up power before delivery of Instrument Built-in pull-up resistor resistance value is 4.7kΩ.
12,13	/TRIG	The pulse leading edge of this signal trigs instrument test.
14,15	NC	Unused
16,17,18	+5V	Internal + 5V power output: Generally, internal power is not recommended for user. If required for use, current should be less than 0.3A and signal wire should be far away from interference source.
19,20,21 22,23,24 25,26	NC	Unused
27,28	EXTV	The external power provided for sorting interface signal is connected to this port. If internal power +5V, it is necessary to change internal jumper lead.
29	NC	Unused
30	/IDX	After A/D shifting ending, /IDX is effective. After the signal is effective, it is permitted for automatic tester to move the component in next position for testing. The current tested result shall be output until /EOM is effective.
31	/EOM	End Of Measurement: The signal shall be effective when the test data and comparative results are effective.
32,33	NC	Unused
34,35,36	COM	External power EXTV reference ground When Handler interface output signal uses internal power, reference for instrument Earthed to COM

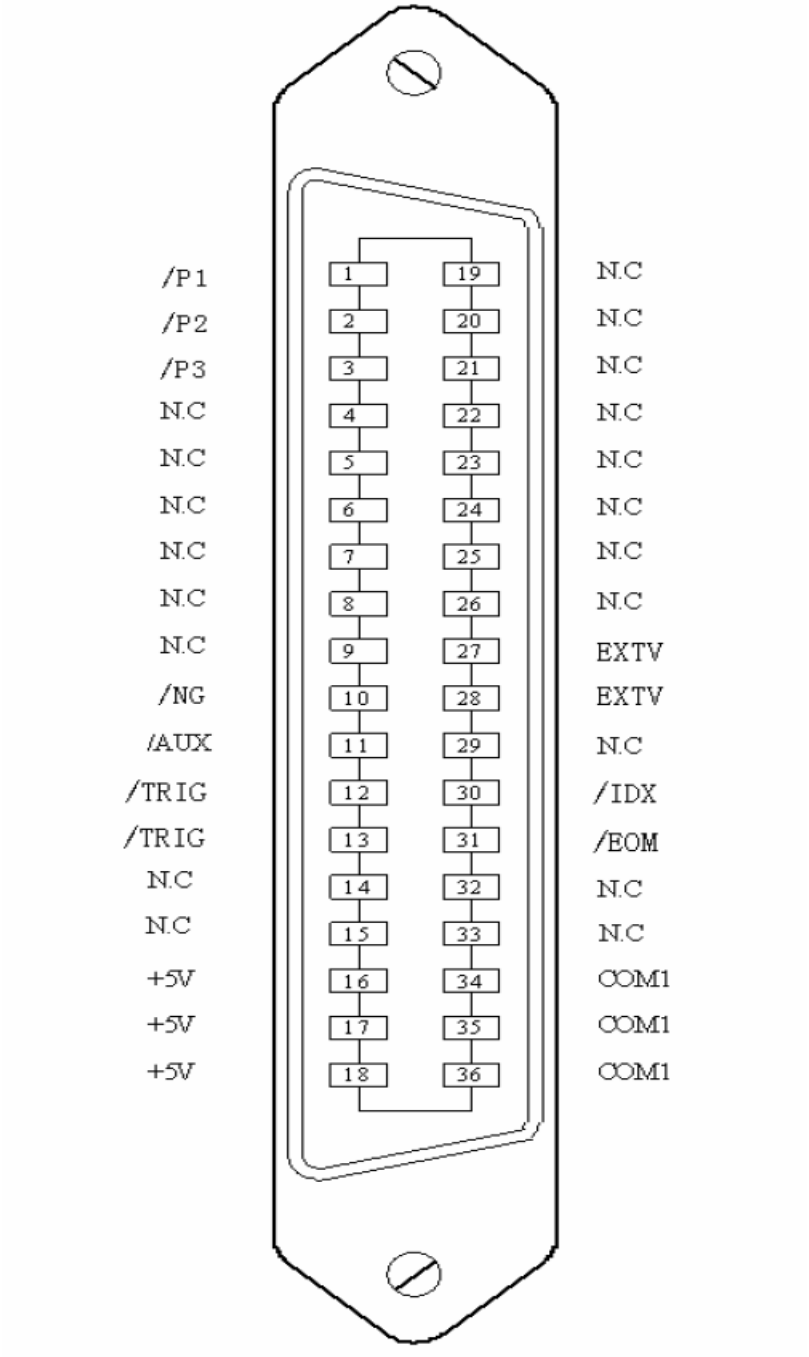
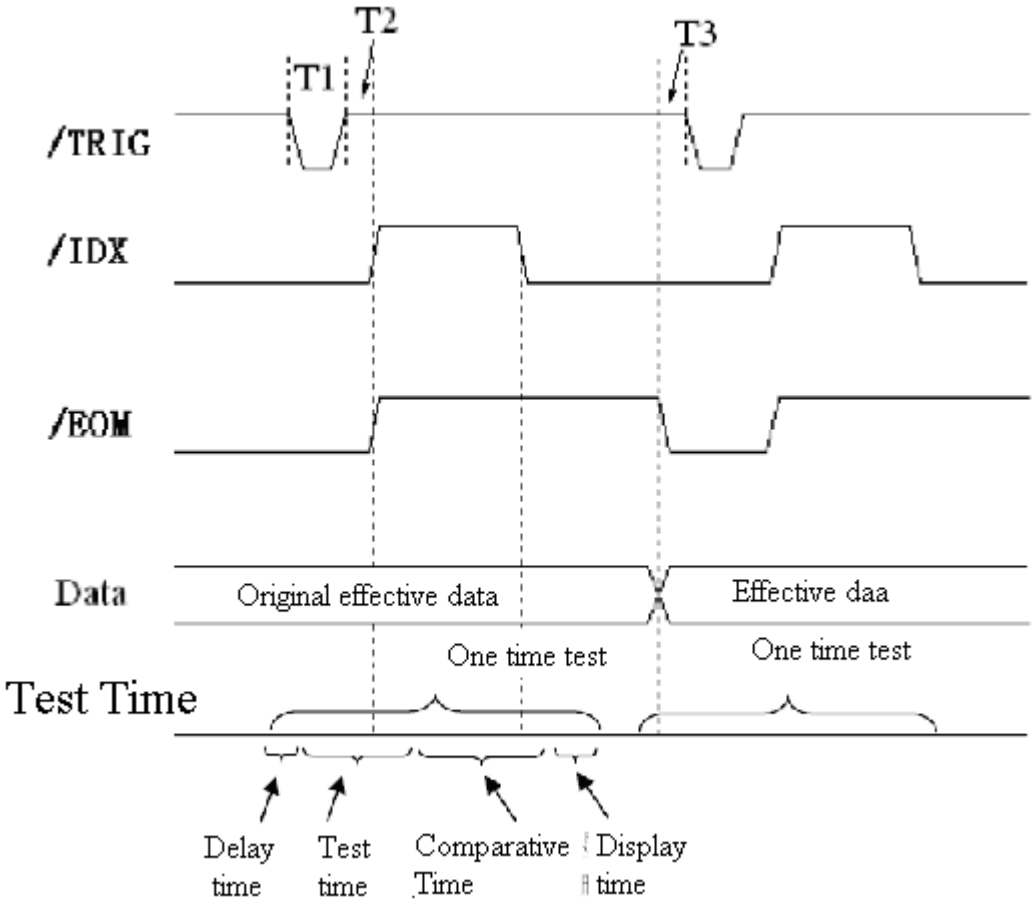


Fig. 6-2 Definition of Handler Interface Pin



Time	Min value	Max Value
T1 Trigging pulse	1 us	-----
T2 Test beginning delay time	200us	Display time + 200us
T3 After /EOM output, waiting time for trigging		-----

1. Test time refers to the operation description shown in Article 4
2. Typical comparative time is about 1ms;
3. Typical display time is about 2ms/

Fig. 6-3 Time Sequence Diagram of Handler Interface

6.2.2 Electricity Features

Each of DC output (pin 1-3, 10-13, 30, 31) is buffered through collection electrodes open-circuit photo-coupling output. The output voltage for every wire is decided by Handler interface pull-up voltage. The pull-up voltage is set up through jumper wire and provided by internal power (+5V) or by external voltage (EXTV: +5V ~ 24V)

The electricity feature of DC buffered output is shown in Table 6-3.

Table 6 – 3 Electricity Character of DC Buffered Output

Output signal	Output rated voltage		Max current	Circuit Reference Ground
	Low level	High level		
/P1 - /P3 /AUX /NG /IDX /EOM	≤0.5V	+5V~ +24V	6mA	Internal pull-up voltage: instrument ground External voltage (EXTV: COM

The simplified schematic diagram of sorting signal is shown in Fig. 6-4

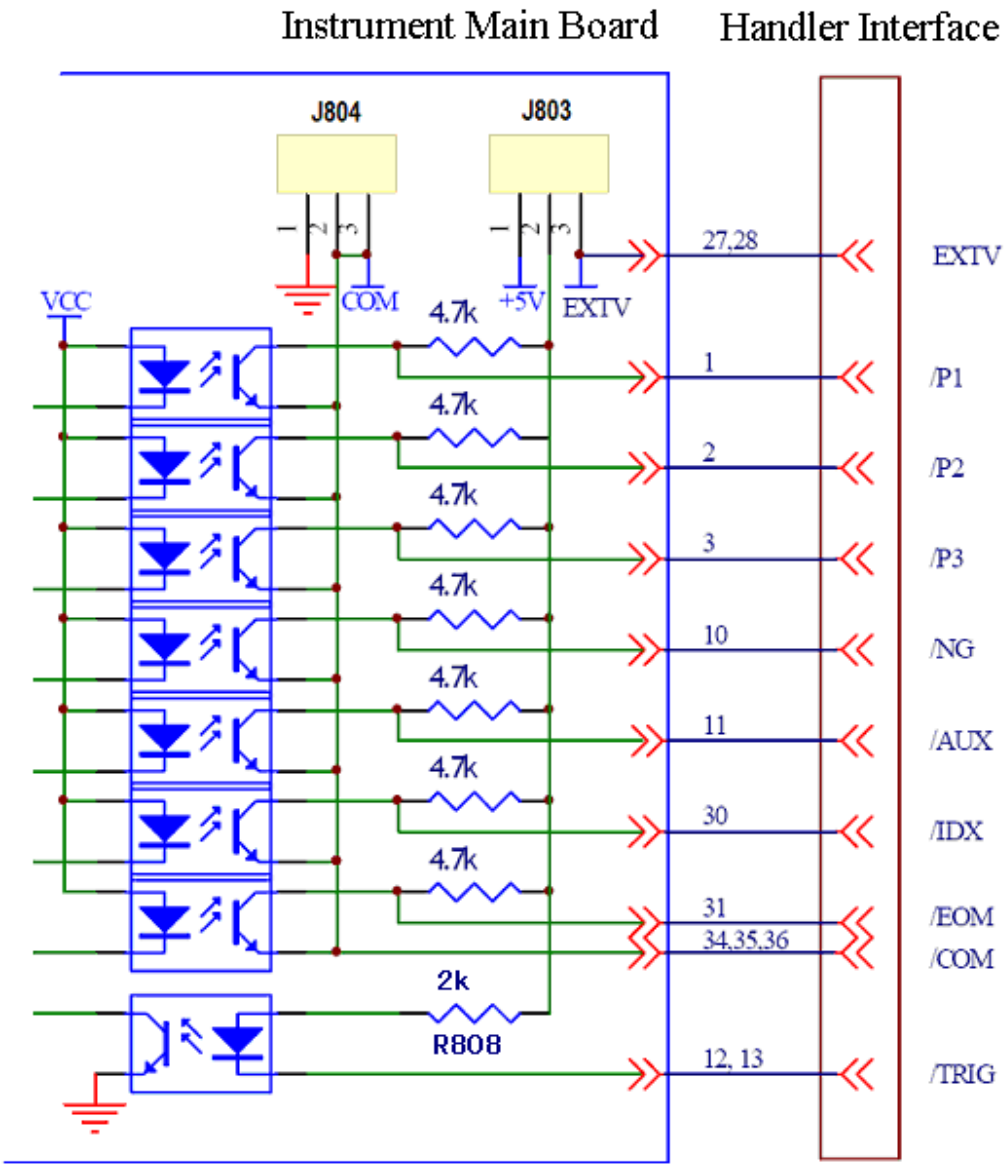


Fig. 6 – 4 Simplified Schematic Diagram of Sorting Signal

* Internal Power: Connection between 1 and 2 in J803; connection between 1 and 2 in J804

** External Power: (Default value 24V before delivery): Connection between 2 and 3 in J803; connection between 2 and 3 in J804 (When external power is 12V, R808 is changed to 1k and when external power is 5V, R808 is changed to 470Ω.

7. Illustration of RS232C Serial Interface

7.1 Introduction to RS232C Interface

At present, the serial communication standard widely applies RS-232 standard, also called as Asynchronous Serial Communication Standard. RS is the abbreviation of Recommended Standard. 232 is the standard number. This standard was formally issued by Electronic Industries Association (IEA) in 1969. It is specified that it is transmitted through one data line for every time.

The configuration for most of serial port is not strictly based on RS-232 standard. The commonly-used RS-232 signal is shown in Table 7-1

Table 7 – 1 Common-use Signal of RS-232

Signal	Abbreviation	Pin number of 9-core connector
Request to send	RTS	7
Clear to send	CTS	8
Data set ready	DSR	6
Data carrier detect	DCD	1
Data terminal ready	DTR	4
Transmit data	TXD	3
Receive data	RXD	2
Ground	GND	5

7.2 BR5810 Serial Interface

Model BR5810 instrument serial interface is not strictly based on the above-said RS-232 standard and only provides the minimum simplified subset, as shown in Table 7 -2:

Table 7 – 2: BR5810 Serial Port Signal

Signal	Abbreviation	Pin number of 9-core connector
Transmit data	TXD	**2**
Receive data	RXD	**3**
Ground	GND	**5**

RS232C connector is adopted with Model DB 9-core hole connector. The sequence of pins is shown in Fig. 7-1.

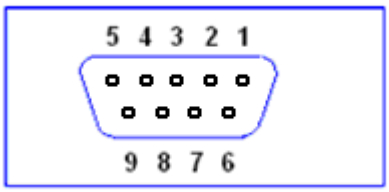


Fig. 7-1 Rear-view of RS232C

Model DB 9-core male plug can be directly connected with it.

Caution: In order to avoid electric shock, when pulling the connector, please switch off the power.

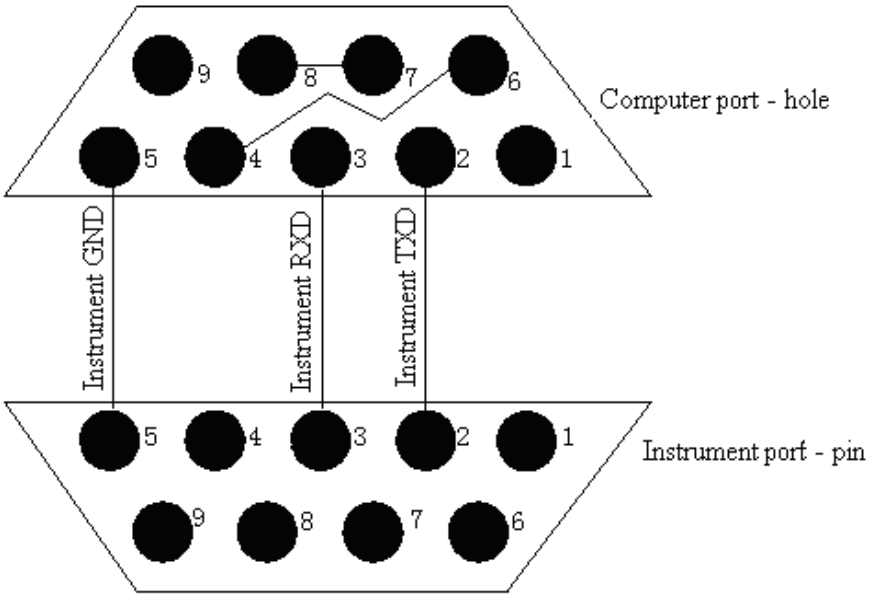
Caution: Don't short to the output end or short to housing so as to avoid damaging parts.

7.3 Connection to Computer

As shown in Fig. 7-2, the definition of BR5810 pin is different from that of 9-core connector serial interface used for computer.

User can purchase the corresponding connecting line or use double-core shield line. The three-wire

connection cable can be prepared by user in accordance with the drawing (length should be less than 1.5m). When the connection cable is prepared, the pin 4 and pin 6 should be shorted and pin 7 and pin 8 should be shorted in the side of computer.



Pin 2: transmission port Pin 3: Receive port Pin 5: Ground (GND)

Fig. 7-2 Connection Cable Drawing of RS-232C Serial Interface

When the instrument is switched on, the initialization is ON, which means that the serial interface of BR5810 instrument is in actuated status and you could transmit the command to the instrument or receive data from the instrument through RS-232.

7.4 parameters of serial interface

The parameters of serial interface of BR5810 is shown as from 7-3:

Form 7-3 parameters of serial interface

Transmission mode	full duplex asynchronous communication including the start bit and stop bit
Baud rate	9600 bps
Data bit	8 BIT
Stop bit	1 BIT
Calibration	No
End mark	NL（new-line character，ASCII code 10）
Connector	DB 9 connector

7.5 main points of programming

For BR5810 does not use the hardware communication, and RS232C serial communication is simple. So in order to reduce the possible data loss or data mistakes in communication, the below rules shall be followed for programming the computer communication software:

1)The command sent by the host is transmitted by ASCII code, and NL（i.e. new-line character, ASCII code 10）is used as the end mark. BR5810 will start to execute the command after receipt of the end mark.

2) Once BR5810 receives the inquiry command, it will immediately send the inquiry result. One command string recommended by the protocol only includes one time inquiry.
3) The inquiry result is sent out by ASCII code, with NL（i.e. new-line character, ASCII code 10）as the end mark.
4) When BR5810 sends the inquiry result, it is done continuously (1ms interval). The host shall be always in the ready-to-accept status. Otherwise, it may cause the data loss.
5) For some of the bus command which are completed for some long time such zeroing, the host shall actively wait or shall synchronize the execution of the previous command by responding and confirming the user's keyboard input in order to prevent the next command in the process of execution from being omitted or being mistaken.
6) For the communication software programmed by DOS application software, it shall be operated under the pure DOS environment which supports the serial interface and shall not be operated under the WINDOWS environment.

8. Command reference

8.1 Introduction

This section presents the detailed introduction of all the BR5810 RS232C commands. Those commands all meet SCPI standard command collection.
The introduction of each command includes the following content:
Command name：Name of SCPI command.
Command syntax：The command format includes all the necessary and optional parameters.
Inquiry syntax：The inquiry format includes all the necessary and optional parameters.
Inquiry returning：Returning data format of BR5810.

8.2 symbol rules and definition

The description of RS232C command uses the below symbol rules and definition.
< > The content in this symbol is used for the parameters of the command.
[ ] The content in this bracket symbol is optional and can be omitted.
{ } Normally the content in this bracket symbol includes several optional parameters and only one of them could be selected.
The below symbol definition will be used in command:
<NL> new-line character (decimal 10).
Space ASCII character (decimal 32).

8.3 command structure

BR5810 command has two types: public command and SCPI command. The public command is defined by IEEE standard and is applicable for all the instrument equipments. SCPI command uses the three level tree-form structure , and the top level is called the subsystem command. Only after the subsystem command is selected, the lower level command under the subsystem command will be effective. Colon（:）is used for separating the upper level command from the lower level command.

The basic rules of the tree-form command is as follows:
● To neglect the capital and small letter
For example:
LIMIT:NOMINAL <value> = limit:nominal <value> = LiMiT:NoMiNaL <value>

● Space(␣ means a space) can not be placed before or after the colon.

For example:

Wrong： **LIMIT␣:␣NOMINAL <value>**

Correct： **LIMIT:NOMINAL <value>**

● The command can be abbreviation of words and also could be the words of full spelling.

For example:

LIMIT:NOMINAL <value> = LIM:NOM <value>

● The command followed by a question mark（？）is the inquiry command of that command.

For example:

LIMIT:NOMINAL ?

The comma（,）is used for separate the different parameters of the same command line:

●For example:

<high limit>,<low limit>

8.4 command abbreviation rules

Each command and characteristic parameter at least have two types of spelling: abbreviation type and full spelling type. Sometimes, the two types are same. The abbreviation shall be done according the below rules:

- If one word has four letters or less than four letters, its abbreviation is same as the full spelling.
- If one word has more than four letters,and if the fourth letter is vowel letter, the abbreviation of this word will be the front three letters;and if the fourth letter is consonant letter, the abbreviation of this word will be the front four letters.

For example:

LIMIT can be abbreviated as LIM.

RANGE can be abbreviated as RANG.

FREQUENCY can be abbreviated as FREQ.

- If what is to be abbreviated is not a word but a phrase, its full spelling type is the first letter of the front word plus the full spelling of the last word. Based on its full spelling type, its abbreviation could be done by using the above rules to get its abbreviation.

For example:

The phrase Source RESistor's full spelling type is **SRESISTOR**， and it could be abbreviated as **SRES** according to the above rules.

8.5 command head and parameters

BR5810 control command includes the command head and the relative parameters. The command head could be full spelling type or abbreviation type. The full spelling type is easy to understand the command meaning, and the abbreviation type could improve the input efficiency. The parameters could be below two types. The space is used to separate the command and the command parameters.

- character data and character string data

  The character data is composed by ASCII letters. Its abbreviation rules are same as that of command head.
- numerical data

  Integer (NR1), Fixed-point number(NR2), or floating n number(NR3).The number range is ±9.9E37。

NR1 example：
123
+123
-123

NR2 example：
12.3
+1.234
-123.4

NR3 exmaple：
12.3E+5
123.4E-5

8.6 command reference

8.6.1 **SPEED command**

SPEED command is used to set the test speed of BR5810. SPEED? is to inquire and then return the current test speed setting.

Command syntax：

SPEED {FAST / MEDium / SLOW}

Among which，

FAST : fast speed test, about 10 times/second.

MEDium: medium speed test, about 4 times/second.

SLOW: slow speed test, about 2.5 times/second.

Inquiry syntax：

SPEED?

Inquiry returning：

{FAST / MED / SLOW} <NL>

8.6.2 **DISPlay command**

DISPlay command is used to set the display mode of the test result. DISPlay? is to inquire and then return the current test result display setting.

Command syntax:

DISPlay {DIRect / PERcent / ABSolute}

Among which，

DIRect : direct-reading display mode.

PERcent: percentage deviation display mode.

ABSolute: absolute deviation display mode.

Inquiry syntax：

DISPlay?

Inquiry returning**:**

$$\left\{\begin{matrix}\text{DIRECT}\\\text{PERCENT}\\\text{ABSOLUTE}\end{matrix}\right\}\ \text{<NL>}$$

8.6.3 **FREQuency** command

FREQuency is used to set the frequency of test source. FREQuency? is to inquire and then return the current frequency of test srouce.

Command syntax：

$$\text{FREQuency}\ \left\{\begin{matrix}100\\120\\1\text{k}\\10\text{k}\end{matrix}\right\}$$

Among which，

100 : to set the test frequency as 100 Hz.

120: to set the test frequency as 120 Hz.

1K: to set the test frequency as 1 kHz.

10K: to set the test frequency as 10 kHz.

Inquiry syntax：

FREQuency?

Inquiry returning：

$$\left\{\begin{matrix}100\\120\\1\text{k}\\10\text{k}\end{matrix}\right\}\ \text{<NL>}$$

8.6.4 **PARAmeter** command

PARAmeter command is used to set the combination of primary and secondary tested parameters. PARAmeter? is to inquire and then return the current combination of primary and secondary tested parameters.

Command syntax：

PARAmeter { CD | LQ | RQ | ZDEG | CR | LR }

Among which，

CD: to set the combination of tested parameters as C-D.

LQ : to set the combination of tested parameters as L-Q.

RQ: to set the combination of tested parameters as R-Q.

ZDEG : to set the combination of tested parameters as Z-θ.

CR: to set the combination of tested parameters as C-R.

LR : to set the combination of tested parameters as L-R.

Inquiry syntax：

PARAmeter?

Inquiry returning：

{ CD | LQ | RQ | ZDEG | CR | LR } <NL>

8.6.5 **LEVel** command

LEVel command is used to set the output voltage of test source. LEVel? is to inquire and then return the current output voltage of test source.

Command syntax：

LEVel { 1.0V | 0.3V | 0.1V }

Among which，

1.0V: to set the source's output voltage as 1.0V.

0.3V : to set the source's output voltage as 0.3V.

0.1V: to set the source's output voltage as 0.1V.

Inquiry syntax：

LEVel?

Inquiry returning：

{ 1.0V | 0.3V | 0.1V } <NL>

8.6.6 **SRESistor** command

SRESistor command is to set the source's output resistance. SRESistor? is to inquire and then return the current output resistance setting of the source.

Command syntax：

SRESistor {30 | 100}

Among which，

30: to set the source's output resistance as 30Ω.

100: to set the source's output resistance as 100Ω.

Inquiry syntax：

SRESistor?

Inquiry returning：

{30 | 100} <NL>

8.6.7 **TRIGger** command

TRIGger command is used to trigger one time test or set the trigger mode. TRIGger? is to inquire and then return the current trigger mode setting.

Command syntax：

TRIGger {INTernal | EXTernal | IMMediate}

Among which，

INTernal: to set the internal trigger mode.

EXTernal: to set the external trigger mode.

IMMediate: to immediately trigger one time test.

Inquiry syntax ：

TRIGger?

Inquiry returning：

{INTERNAL | EXTERNAL} <NL>

8.6.8 **CORRection** command

CORRection command is to execute the OPEN or SHORt zeroing operation under different test voltages and source internal resistances.

Command syntax：

CORRection {OPEN / OPEN_ALL / SHORt / SHORt_ALL}

Among which，

OPEN :to do OPEN zeroing to all the test frequencies under the current voltage and source internal resistance.

OPEN_ALL: to do OPEN zeroing to all the test voltages and frequencies under all the source internal resistances.

SHORt :to do SHORt zeroing to all the test frequencies under the current voltage and source internal resistance.

SHORt_ALL : to do SHOTt zeroing to all the test voltages and frequencies under all the source internal resistances.

After completion of zeroing, send out the information of PASS or FAIL.

8.6.9 **COMParator** command

COMParator command is used to open or close the comparison function. COMParator? is to inquire and then return the current comparison function status.

Command syntax：

COMParator {OFF / 1BIN / 3BIN}

Among which，

OFF : to close the comparator function.

1BIN : to open No.1 selector qualified comparator function.

OBIN : to open No.3 selector qualified comparator function.

Inquiry syntax：

COMParator?

Inquiry returning：

{OFF / 1BIN / 3BIN} <NL>

8.6.10 **EQUivalent** command

EQUivalent command is used to set the equivalent circuit mode of the tested part. EQUivalent？ is to inquire and then return the current equivalent circuit mode.

Command syntax：

EQUivalent {SERial / PARallel}

Among which，

SERial : to set the serial equivalent circuit mode.

PARallel: to set the parallel equivalent circuit mode.

Inquiry syntax：

EQUivalent?

Inquiry returning：

$$\left\{\begin{matrix}\text{SERIAL}\\ \text{PARALLELl}\end{matrix}\right\}\text{<NL>}$$

8.6.11 **RANGe** command

RANGe command is used to se the range selection mode or set the current test range. RANGe？ is to inquire and then return the current range and range selection mode.

Command syntax：

$$\text{RANGe}\ \left\{\begin{matrix}\text{A U T O}\\ \text{H O L D}\\ 0\\ 1\\ 2\\ 3\\ 4\\ 5\end{matrix}\right\}$$

Among which，

AUTO: to set the AUTO range mode.

HOLD: to set the HOLD range mode.

0-5 are respectively the set relative ranges.

Inquiry syntax：

RANGe?

Inquiry returning：

$$\left\{\begin{matrix}\text{AUTO-<n>}\\ \text{HOLD-<n>}\end{matrix}\right\}\text{<NL>}$$

Among which: <n> is the current range number（0-5）.

8.6.12 **ALARm** command

ALARm command is used to set the alarming status of the buzzer. ALARm？ is to inquire and then return the current alarming status of the buzzer.

Command syntax**:**

ALARm {OFF | AUX | P3 | P2 | P1 | NG}

Among which，

OFF: to close the alarming function.

AUX : the sorting result is to alarm when at AUX selector.

P3: the sorting result is to alarm when at P3 selector.

P2 : the sorting result is to alarm when at P2 selector.

P1 : the sorting result is to alarm when at P1 selector.

NG : the sorting result is to alarm when at NG selector.

Inquiry syntax:

ALARm?

Inquiry returning:

{OFF | AUX | P3 | P2 | P1 | NG} <NL>

8.6.13 **LIMit subsystem command**（only effective for the current test parameters）

LIMit:NOMinal command

LIMit:NOMinal command is used to set the nominal value, and the comparator function uses that nominal value to calculate the absolute deviation and percentage deviation. LIMit:NOMinal? is to inquire and then return the current nominal value set for calculating the deviation.

Command syntax：

LIMit:NOMinal <valuoe>

Among which，

<value> is the nominal value in forms of NR1, NR2 or NR3.

Inquiry syntax：

LIMit:NOMinal ？

Inquiry returning：

<NR3> <NL>

LIMit:BIN<n> command

LIMit:BIN <n> command is used to set the higher and lower limit value of the comparison function selectors.

LIMit:BIN <n>? is to inquire and then return the higher and lower limit values of current selectors.

Command syntax：

LIMit:BIN <n> <high limit>,<low limit>

Among which:

<n> 1 to 3 (NR1), selector numbers

<high limit> : the higher limit value in forms of NR1, NR2 or NR3.

<low limit> : the lower limit value in forms of NR1, NR2 or NR3.

Inquiry syntax：

LIMit:BIN <n>?

Inquiry returning：

<high limit> ,<low limit ><NL>

LIMit:SECondary command

LIMit:SECondary command is used to set the higher and lower limit value of comparison function secondary parameters. LIMit:SECondary? is to inquire and then return the current higher and lower limit value of secondary parameters.

Command syntax：

LIMit:SECondary <high limit>,<low limit>

Among which，

<high limit> : higher limit value in forms of NR1, NR2 or NR3.

<low limit> : lower limit value in forms of NR1, NR2 or NR3.

Inquiry syntax：

LIMit:SECondary?

Inquiry returning：

<high limit>,<low limit > <NL>

8.6.14 **FETCh?** inquiry

FETCh? is to inquire and then return the previous test result of the primary and secondary parameters.

Inquiry syntax：

FETCh?

Inquiry returning:

<primary>,<secondary> <NL>

8.6.15 public command

This instrument at present only provides the below public commands:

*RST: this command is used to reset the instrument.

Command syntax：*RST

For example: WrtCmd（“*RST”）

*IDN？: this command is used to inquire the instrument information.

Inquiry syntax：*IDN？

Inquiry returning：<product>，<version><NL^END>

Here:

<product> : BR5810 LCR Meter

<version> : software version number.

9.1 Complete assembly

A complete of instrument when it is delivered includes following components and parts

1)	Model BR5810 LCR meter	1 set
2)	LCR001 Kelvin Test Cable	1 pair
3)	LCR005 Test Fixture	1 piece
4)	Three-wire Power Wire	1 piece
5)	1A Fuse	2 pieces
6)	Operation Instruction Manual	1 copy

TEST CERTIFICATE

This Test Certificate that warranty the product has been inspected and Tested in accordance with the published specifications. The instrument has been calibrated by using equipment which has already been calibrated to standards traceable to national standards.

MODEL NO. _____

SERIAL NO. _____

DATE: _____

ISO 9001:2015 REGISTERED

QC
KUSAM-MECO
PASS

WARRANTY

Each "KUSAM-MECO" product is warranted to be free from defects in material and workmanship under normal use & service. The warranty period is one year (12 months) and begins from the date of despatch of goods. In case any defect occurs in functioning of the instrument, under proper use, within the warranty period, the same will be rectified by us free of charges, provided the to and fro freight charges are borne by you. This warranty extends only to the original buyer or end-user customer of a "KUSAM-MECO" authorized dealer. This warranty does not apply for damaged Ic's, fuses, disposable batteries, carrying case, test leads, or to any product which in "KUSAM-MECO's" opinion, has been misused, altered, neglected, contaminated or damaged by accident or abnormal conditions of operation or handling. "KUSAM-MECO" authorized dealer shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of "KUSAM-MECO". "KUSAM-MECO's" warranty obligation is limited, at option, free of charge repair, or replacement of a defective product which is returned to a "KUSAM-MECO" authorized service center within the warranty period.

KUSAM-MECO®

An ISO 9001:2015 Company

Email : sales@kusam-meco.co.in

Web: www.kusamelectrical.com