

OPERATION MANUAL

TH2851

Precision Impedance Analyzer

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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: 100~120Vac or 198~242Vac. Being related with the power setup on the rear panel.
- 2) Power-supplying frequency range: 47~63Hz.
- 3) Power-supplying power range: 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 5°C~40°C, relative humidity $\leq 75\%$, 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 -20°C and 60°C, 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 “ \perp ”.

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 $\leq 80\text{VA}$.
- 2) Dimension (W*H*D): 400mm*132mm*385mm
- 3) Weight: About 13kg.

1.8 Safe Usage

Please use the power button to switch the device on and off. It is prohibited to unplug the power cord or disconnect the power supply before the device is completely turned off, otherwise it will damage the device hardware and affect the service life of the device.

It is recommended not to install other software in the device, which may affect the working status of

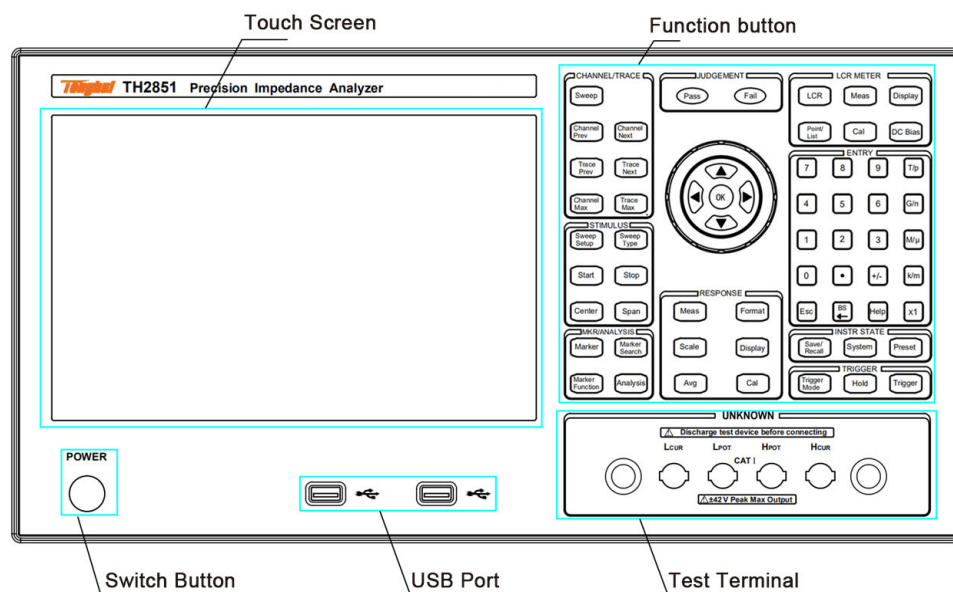
the device.

If you want to use this device to connect to the Internet, it is recommended to install your own antivirus software.

Chapter 2 Introduction

In this chapter, the basic operation features of TH2851 will be described.

2.1 Introduction to front panel



Function buttons

The keys used to implement the different functions contain the following parts:

1. CHANNEL/TRACE: switch to curve sweep function and switch channels and curves

Sweep: Switch the instrument interface to the sweep interface, and the button signal light is on.

Channel Prev: When the instrument function is trace sweep, activate to the previous channel. When this key is pressed, the active channel changes from the current channel to the channel with the channel number smaller than the current one. Only when the channel is activated, its parameters can be modified. Therefore, use this key to activate the channel before changing the channel setting.

Channel Next: When the instrument function is trace sweep, activate to the next channel. When this key is pressed, the active channel changes from the current channel to the channel with a larger channel number than the current one.

Trace Prev: When the instrument function is trace sweep, activate to the previous trace. When this key is pressed, the active trace changes from the current trace to a trace whose trace number is smaller than the current one. Only when the trace is activated, its parameters can be modified. Therefore, use this key to activate the trace before changing the trace settings.

Trace Next: When the instrument function is trace sweep, activate to the next trace. When this key is pressed, the active trace changes from the current trace to the trace with a larger trace number than the current one.

Channel Max: When the instrument function is trace sweep, the display window of the selected

channel will be switched between maximum display and normal display. When set to normal display, all set channels (whether activated or not) are displayed separately on the screen; when set to maximize display, the display window of the active channel occupies the entire display area, and the inactive channel is no longer displayed, the measurement of the inactive channel will still be performed.

Trace Max: When the instrument function is trace sweep, the display state of the active trace is switched between maximum display and normal display. When set to normal display, the traces with settings (whether activated or not) will be displayed in the channel display window; when set to maximum display, only the activated traces will be displayed in the channel window, and other districts and counties will no longer be displayed. Measurements that do not display a trace will still be performed.

2. STIMULUS : parameter setting of the trace stimulus source

Sweep Setup: When the instrument function is trace sweep, open the sweep setup menu in the menu bar, you can set the signal source parameters, sweep time, number of trace points, etc.

Sweep Type: When the instrument function is trace sweep, open the sweep mode setting menu in the menu bar to change the sweep mode of the current channel.

Start: When the instrument function is trace sweep, open the sweep range menu in the menu bar, and place the cursor in the sweep start value input area to set the start value of the sweep range.

Stop: When the instrument function is trace sweep, open the sweep range menu in the menu bar, and place the cursor in the sweep end value input area to set the end value of the sweep range.

Center: When the instrument function is trace sweep, open the sweep range menu in the menu bar, and place the cursor in the sweep center value input area to set the center value of the sweep range.

Span: When the instrument function is trace sweep, open the sweep range menu in the menu bar, and place the cursor in the span input area to set the sweep range.

3. MKR/ANALYSIS : Marker and Trace Analysis

Marker: When the function of the instrument is trace sweep, open the marker setting menu in the menu bar, you can set the marker such as the switch of the marker and the position of the marker can be changed by inputting the value of the stimulus value. You can place 10 markers on each curve.

Marker Search: When the instrument function is trace sweep, open the marker search menu in the menu bar, and the operation menu can move the marker to a specific point on the trace (maximum point, minimum value point, extreme value point and specific test value point) .

Marker Function: Open the marker function menu in the menu bar, and the operation menu can set the sweep range, switch statistical data display, etc. according to the marker position.

Analysis: When the function of the instrument is trace sweep, open the trace analysis menu in the menu bar, and the operation menu can perform the sorting settings in the scanning, as well as the analysis and simulation of the equivalent circuit.

4. RESPONSE : used to set the response for the instrument measurement data

Meas: When the instrument function is trace sweep, open the measurement setting menu in the menu bar, and the operation menu can set the measurement parameters of each trace, and switch the display of offset monitoring.

Format: When the instrument function is trace sweep, open the ordinate format menu in the menu bar, and the operation menu can change the ordinate type of each trace.

Scale: When the instrument function is trace sweep, open the coordinate axis setting menu in the menu bar, and the operation menu can set the vertical coordinate distribution and scaling (including reference position, coordinate division, etc.) of each trace.

Display: When the instrument function is trace sweep, open the display setting menu in the menu bar, you can specify the display mode of channels and traces, set the number of traces, set the value memory, etc.

Avg: When the function of the instrument is trace sweep, open the measurement speed menu in the menu bar, and you can set the trace sweep speed, the number of sliding averages, and the switch.

Cal: When the instrument function is trace sweep, open the user calibration interface in the menu bar, and user calibration can be performed.

5. LCR METER : switch the instrument function to the bridge function, and the corresponding function keys

LCR: Switch the instrument interface to the point measurement interface, and the button signal light is on.

Meas: When the instrument function is point measurement, open the measurement setting menu in the menu bar, and you can modify the measurement frequency, range, trigger mode, signal source and other parameters.

Display: When the instrument function is point measurement or list sweep, open the measurement parameter setting menu in the menu bar, and you can set all the current measurement parameters.

Point/ List : Switch between point measurement interface and list sweep interface on the screen.

Cal : switch to the user calibration interface, user calibration can be performed.

DC Bias : The switch that loads the bias voltage, and the signal light will be on and off according to the switch state.

6. ENTNR : Keys related to data entry

0, **1**, **2**... **9**: Numeric keys, used to input corresponding numbers.

+ / -: Modify the sign of the input value.

T / p, **G/n**, **M / μ** , **k / m**, **x1**: Order of magnitude keys, used to input the corresponding order of magnitude unit. When the order of magnitude key is pressed, one of the two order-of-magnitude units in the key name is automatically selected according to the entered parameter. The x1 key does not enter any units.

Esc: Cancel, which is used to cancel operations in time-consuming operations such as calibration,

and to cancel the input and restore the previous value during numerical input.

[B S ←]: Backspace key, used to backspace while typing.

[Help]: Call out the help document, which can be used to unlock the screen and front panel when they are locked.

7. INSTR STATE : the setting button of the instrument state function

[Save/Recall]: Open the save and load menu in the menu bar (bridge and sweep are different menus), you can save and load measurement parameter settings and measurement results.

[System]: Open the system settings menu in the menu bar, you can perform various system settings.

[Preset]: After the key is pressed and confirmed, the instrument will return to the initial state.

8. TRIGGER : Trigger related settings of the instrument

[Trigger Mode]: Open the trigger setting menu and set the trigger mode.

[Hold]: Set the current measurement mode to hold state.

[Trigger]: Make a trigger.

9. JUDGEMENT : Display of sorting results, non-operation keys

[Pass]: When the sorting is passed, the signal light is on.

[Fail]: When the sorting fails, the signal light is on.

10. Direction keys and dial: used to move the input cursor and adjust the input value.

Scroll wheel: When inputting numerical value, increase or decrease the input numerical value with a smaller division value.

Up and down keys: When entering numerical values, increase or decrease the entered numerical value with a larger division value.

Left and right keys: Move the input cursor left and right when entering numerical values.

Switch button

This button is used to switch the instrument on and off. The button light illuminates when the instrument is turned on.

Touch screen

TH2851 is equipped with a 10.1 -inch touch screen for displaying numerical values, traces, division values, setting values, keys, and other measurement-related information. You can operate the keys on the screen by clicking with your finger. To learn more about touchscreens, see the "Display Areas" section.

Warning: Do not use sharp objects (such as toothpicks, pen tips, screwdrivers, etc.) to press on the touch screen surface. Pressing the screen with a sharp object may damage the screen or cause dead spots on the screen .

Note: The ratio of effective dots on the touch screen should be greater than 99.998 %, and the dead dots less than 0.002 % are not considered screen damage .

Test end

The four-terminal test terminal is used to connect the four-terminal test fixture or test cable to measure the DUT.

Current excitation high side (Hcur);

Voltage sampling high-end (Hpot);

Voltage sampling low end (Lpot);

Current excitation low side (Lcur).

USB interface

USB interface can be used to connect USB devices, such as mouse, keyboard, storage device, etc.

2.2 Introduction to rear panel

Figure 2-2 shows the rear panel of TH2851.

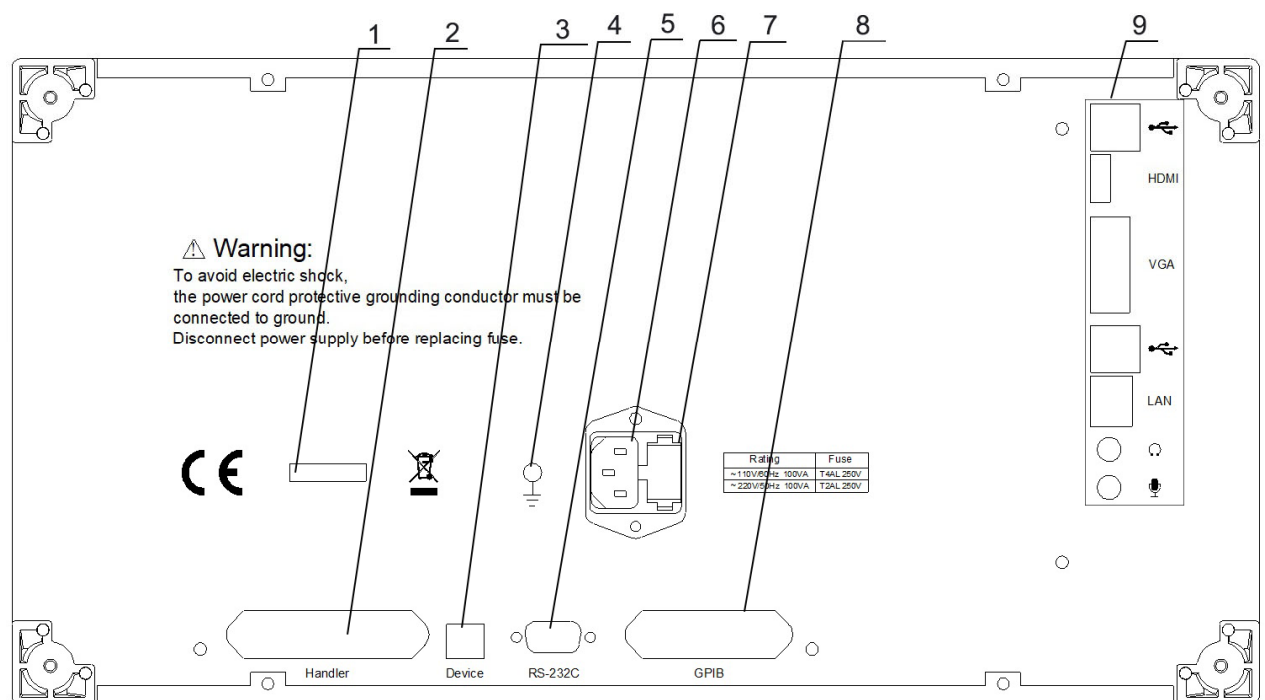


Figure 2-2 Rear panel

1. Serial label: Indicate the production date, manufacturer, instrument number and other information;
2. Handler interface: Handler signal input and output;
3. USB Device interface: USB communication interface to realize communication with other devices;
4. Ground terminal: connected to the chassis, used to protect or shield the ground connection;

5. RS232 serial interface: serial communication interface, realize communication with other equipment;
6. Power socket: used to supply AC power to the device;
7. Fuse holder: used to install fuse, protect the instrument, can switch 1 10V/220V ;
8. G PIB interface: G PIB interface realizes communication with other devices;
9. Mainboard interface: The general interface of the computer mainboard, including USB port, video output port (the screen can be put on other video output devices), audio input and output port, LAN port (network interface, realize the communication and control of network system).

2.3 Screen Area

2.3.1 Screen interface display

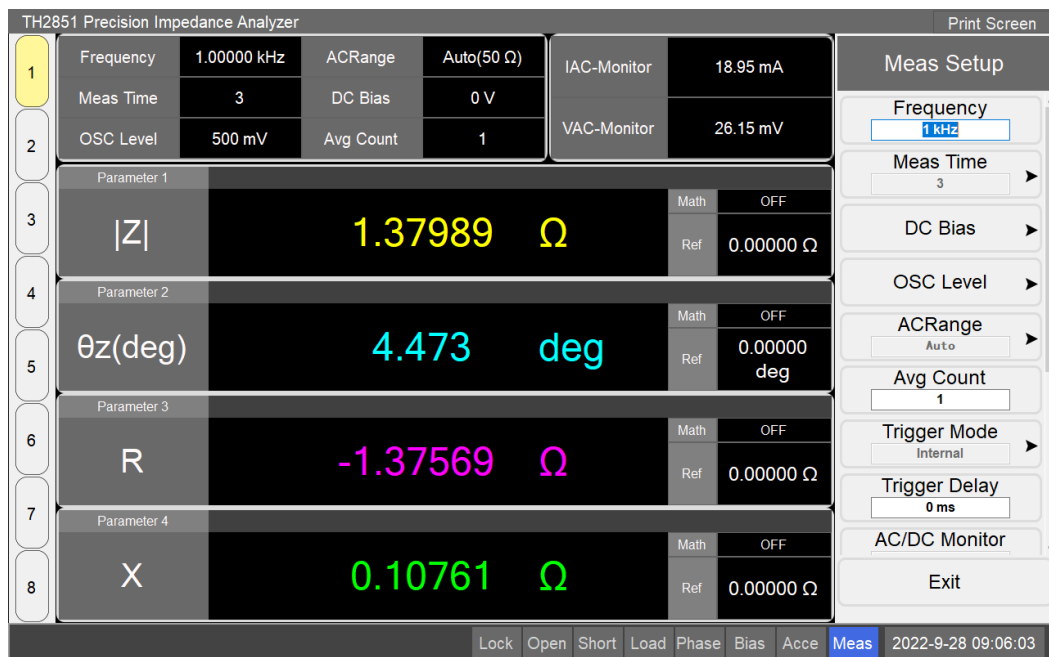
TH2851 includes a variety of measurement interface displays and setting interface displays. The main function interfaces are shown in the following table:

Display type		Function
Measurement interface	Point measurement interface	The parameters of the measured point and the measurement results are displayed in the interface
	List measurement interface	All measurement points and their measurement results are displayed in a table on the interface
	Sweep measurement interface	The curve drawn by the measurement points and their measurement results is displayed in the coordinate axes of the interface
Set interface	User Calibration Interface	All user calibration point settings and calibration values are displayed in a table in the interface
	Accessory Calibration Interface	Step prompts for user fixture calibration are displayed in the interface
	Point comparator setting interface	In the interface, the setting value of point measurement and comparator is displayed
	List setting interface	All the points to be measured and their setting parameters are displayed in the table of the interface, and all points are arranged in order in the

		table.
	List quick edit interface	Quick setup of measuring points for list sweep
	List comparator setting interface	The setting value of list sweep comparator is displayed in the interface
	Sweep comparator setting interface	The trace sweep comparator parameter settings are displayed in the table of the interface
	Sweep segment setting interface	The settings of the trace sweep segment are displayed in the table of the interface

2.3.2 Point measurement display interface

Press the LCR button on the front panel, the point measurement interface will be displayed on the screen, as shown in the figure below:



Channel number

The highlighted channel is the currently active channel. There can be 8 channels in the point measurement mode at the same time, and each channel can set different measurement conditions (frequency, level, bias, etc.) and measurement parameters. Channels can be switched by clicking the channel number button.

Measurement conditions

The measurement conditions of the current channel are displayed in the area, including measurement frequency, measurement time, OSC level, AC range, DC bias, and average count. These variables can be changed in the Measurement Setup menu. Clicking a control in this area, the menu area will open the "Measurement Settings" menu and automatically navigate to the clicked

variable.

AC and DC monitor

It displays the currently measured AC/DC current and voltage monitoring values. The monitor mode can be changed in the "Measurement Settings" menu, click on this area, the menu area will open the "Measurement Settings" menu.

Menu name

It displays the name of the current menu, displayed at the top of the menu.

Menu

It displays the currently opened menu. The menu contains different types of buttons: normal buttons, editable content buttons, selection buttons, etc. An arrow on the right side of the button means that pressing the button will open a sub-menu; a black square on the left side of the button means the button is currently selected.

Time display

It displays the current system date and time.

Device status

Various current measurement states are displayed. As shown in the table below:

Display	Definition
Open (shown in blue)	User open calibration is turned on
Short (shown in blue)	User short calibration is turned on
Load (shown in blue)	User load calibration is turned on
Phase (shown in blue)	User phase calibration is turned on
Bias (shown in red)	Bias voltage is turned on
Lock (shown in red)	Front panel and screen operations are locked
Pass (shown in green)	Comparator is passed
Fail (shown in red)	Comparator is failed
Acce (shown in blue)	User accessory calibration is turned on
Meas (shown in blue)	The current trigger mode is internal trigger (continuous measurement)
Manual (shown in blue)	The current trigger mode is manual trigger
External (shown in blue)	The current trigger mode is external trigger
Bus (shown in blue)	The current trigger mode is bus trigger

Measurement parameters and results

It displays the current measurement parameters and measurement results. TH2851 supports simultaneous display of up to 4 measurement parameters. Click this area to modify measurement parameters and display settings for measurement results (such as reference values, math operations, significant digits, etc.).

2.3.3 List measurement display interface

The list measurement display interface is shown in the following figure:

Pt	Frequency	Avg	OSC Level	ACRange	DC Bias	Z	θz(deg)	R	X
1	1 kHz	1	500 mV	Auto(50 Ω)	0 V	5.22648 Ω	35.6589 deg	-4.24652 Ω	3.04682 Ω
2	2 kHz	1	500 mV	Auto(50 Ω)	0 V	3.30619 Ω	45.7010 deg	-2.30905 Ω	2.36625 Ω
3	3 kHz	1	500 mV	Auto(50 Ω)	0 V	1.89069 Ω	27.5747 deg	-1.49864 Ω	0.78263 Ω
4	4 kHz	1	500 mV	Auto(50 Ω)	0 V	6.43247 Ω	-29.9626 deg	5.57278 Ω	-3.21280 Ω
5	5 kHz	1	500 mV	Auto(50 Ω)	0 V	6.76980 Ω	-87.3282 deg	-0.31516 Ω	-6.75345 Ω
6	6 kHz	1	500 mV	Auto(50 Ω)	0 V	5.82980 Ω	-70.2497 deg	1.97002 Ω	-5.48686 Ω
7	7 kHz	1	500 mV	Auto(50 Ω)	0 V	7.77060 Ω	-73.2166 deg	2.24379 Ω	-7.43980 Ω
8	8 kHz	1	500 mV	Auto(50 Ω)	0 V	10.4167 Ω	-81.0785 deg	1.61544 Ω	-10.2907 Ω
9	9 kHz	1	500 mV	Auto(50 Ω)	0 V	16.3280 Ω	-76.7932 deg	-3.73041 Ω	-15.8962 Ω
10	10 kHz	1	500 mV	Auto(50 Ω)	0 V	33.1482 Ω	-53.5950 deg	-19.6731 Ω	-26.6791 Ω
11	11 kHz	1	500 mV	Auto(50 Ω)	0 V	56.6865 Ω	33.4719 deg	-47.2854 Ω	-31.2642 Ω
12	12 kHz	1	500 mV	Auto(50 Ω)	0 V	11.7907 Ω	-75.1050 deg	-3.03078 Ω	-11.3945 Ω
13	13 kHz	1	500 mV	Auto(50 Ω)	0 V	9.22579 Ω	-39.1422 deg	-7.15535 Ω	-5.82376 Ω
14	14 kHz	1	500 mV	Auto(50 Ω)	0 V	7.67423 Ω	13.9615 deg	-7.44752 Ω	1.85156 Ω
15	15 kHz	1	500 mV	Auto(50 Ω)	0 V	4.74213 Ω	65.8833 deg	-1.93762 Ω	4.32821 Ω
16	16 kHz	1	500 mV	Auto(50 Ω)	0 V	2.59314 Ω	43.0399 deg	1.89527 Ω	1.76984 Ω
17	17 kHz	1	500 mV	Auto(50 Ω)	0 V	1.85053 Ω	28.7157 deg	1.44754 Ω	0.79302 Ω
18	18 kHz	1	500 mV	Auto(50 Ω)	0 V	1.44203 Ω	44.4153 deg	1.03002 Ω	-1.00921 Ω
19	19 kHz	1	500 mV	Auto(50 Ω)	0 V	1.12979 Ω	34.9265 deg	-0.92630 Ω	-0.64683 Ω
20	20 kHz	1	500 mV	Auto(50 Ω)	0 V	0.95660 Ω	65.8586 deg	-0.39124 Ω	-0.87293 Ω
21	21 kHz	1	500 mV	Auto(50 Ω)	0 V	0.11754 Ω	63.0634 deg	0.05325 Ω	-0.10479 Ω
22	22 kHz	1	500 mV	Auto(50 Ω)	0 V	1.24782 Ω	37.0604 deg	-0.99576 Ω	0.75201 Ω
23	23 kHz	1	500 mV	Auto(50 Ω)	0 V	0.56967 Ω	9.76112 deg	0.56142 Ω	0.09658 Ω
24	24 kHz	1	500 mV	Auto(50 Ω)	0 V	0.44616 Ω	-13.3106 deg	-0.43417 Ω	-0.10272 Ω
25	25 kHz	1	500 mV	Auto(50 Ω)	0 V	0.61665 Ω	-12.8438 deg	-0.60122 Ω	-0.13708 Ω
26	26 kHz	1	500 mV	Auto(50 Ω)	0 V	0.35910 Ω	28.0645 deg	0.31687 Ω	0.16894 Ω
27	27 kHz	1	500 mV	Auto(50 Ω)	0 V	0.87185 Ω	-38.8768 deg	-0.67873 Ω	-0.54721 Ω
28	28 kHz	1	500 mV	Auto(50 Ω)	0 V	0.14216 Ω	56.0678 deg	-0.07936 Ω	0.11795 Ω
29	29 kHz	1	500 mV	Auto(50 Ω)	0 V	0.74072 Ω	-22.7015 deg	-0.68334 Ω	-0.28587 Ω
30	30 kHz	1	500 mV	Auto(50 Ω)	0 V	0.70711 Ω	-9.24228 deg	-0.69793 Ω	-0.11357 Ω

Channel number

The highlighted channel is the currently active channel. There can be 8 channels in the list mode at the same time, and each channel can set different environmental variables (frequency, level, bias, etc.) and measurement parameters. Channels can be switched by clicking the channel number button.

Measured point serial number

The serial number of the measured point is displayed, which can be modified in the list setting page.

Measurement conditions

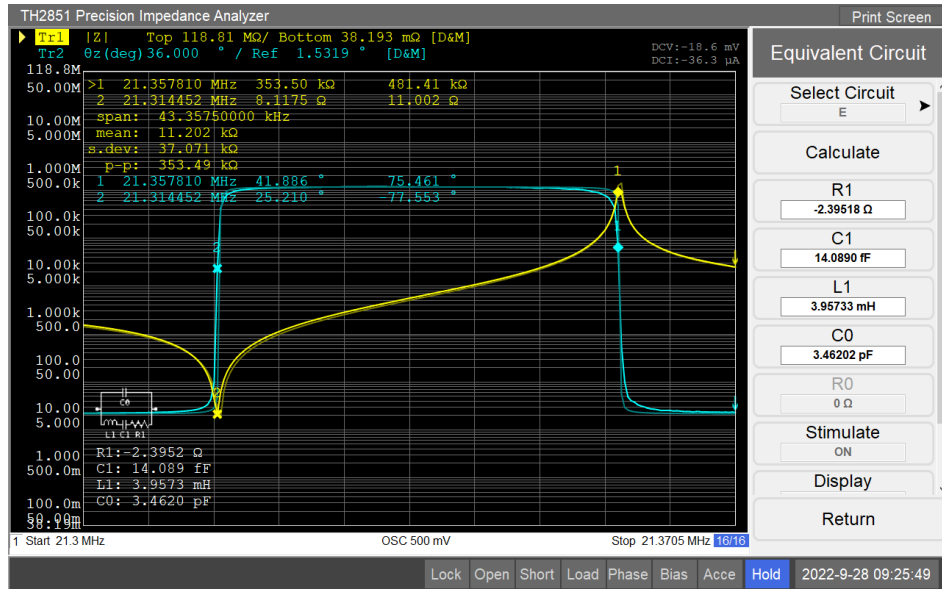
It displays the measurement conditions of the measured point, including: measurement frequency, average count, OSC level, AC range, and DC bias. These parameters can be modified in the list settings page.

Measurement parameters and measurement results

The current measurement parameters and measurement results of the measured point are displayed in sequence. The parameters to be measured can be changed in the measurement parameters menu.

2.3.4 Sweep measurement display interface

Press the **Sweep** button, and the sweep measurement interface will be displayed on the screen. The main part of the interface is the channel window, as shown in the following figure:



Moving average state

This status is only displayed when moving average is turned on. The display format is n/m, where m is the set number of moving averages, and n is the moving average count. The moving average switch and countss can be changed in the measurement speed menu.

Channel number

The serial number of the channel displayed in the current window. The active window can be switched by pressing **Channel Prev** and **Channel Next** buttons, and you can switch to the channel directly by clicking the channel window.

DC monitor

When the DC monitor is turned on, the current measured DC level and the current monitor value are displayed.

Equivalent circuit simulation results

The selected equivalent circuit model and simulated resistance, capacitance, and inductance values are shown. This graph is displayed on the channel window when the equivalent circuit result display is turned on.

Ordinate label

The tick distribution of the ordinate axis of the coordinate system is displayed. When the measured trace exists in the coordinate system, this area will display the set ordinate scale label of the currently active trace. The ordinate reference value (highlighted) can be changed in the Axis Settings menu. At the same time, you can also set the ordinate value of the selected marker as the reference value in the marker function menu. The ordinate scale distribution, ordinate reference value, etc. can also be manually changed or automatically set in the axis setting menu.

Marker

The marker is used to read measurements on the trace. Up to 10 markers can be displayed on a trace. The shape of marker 1 in the figure represents the activated marker, and the shape of marker 2 is the inactive marker. The active marker can be toggled through the marker settings menu or by clicking on the marker value field. At the same time, you can also modify the position of the marker in the

marker setting menu, and drag the screen with your finger in the coordinate system to directly drag the position of the activated marker.

Marker value

It displays the abscissa values of all current markers and the degrees of measurement values on each trace. The ">" symbol before the marker serial number indicates that the marker is the currently activated cursor. Clicking on this area will switch the active marker to the next marker.

Marker Statistics Parameters

It displays statistics (range, average, standard deviation, peak-to-peak) for all points of the current trace between marker 1 and marker 2. The display can be turned on or off in the marker function menu. When the display is turned on, if marker 1 and marker 2 are not turned on, marker 1 and marker 2 are automatically turned on .

Measurement parameters

It displays the measurement parameters of the current trace. Measurement parameters can be changed in the measurement setup menu.

Signal source voltage/DC bias/non-sweep frequency

The signal source voltage, DC bias and frequency of the sweep are displayed, which will be displayed differently in different sweep modes, as shown in the following table:

Sweep mode	Display type
Sweep frequency	Signal source voltage and bias voltage (bias voltage on)
Sweep signal source level	Non-sweep frequency and bias voltage (bias voltage on)
Sweep bias voltage	Non-sweep frequency and signal source voltage

Ordinate scaling value

It displays the current ordinate scaling value of each trace. When the vertical axis of the trace is the linear axis, the display format is "Scale/Reference"; when the vertical axis of the trace is the logarithmic axis, the display format is "Top/ Bottom ";

Span

It displays the sweep range of the current channel.

Trace number

It indicates the trace name and trace number (eg Tr1) in the current channel. The trace name is consistent with the color of the trace itself. The triangle symbol before the name indicates that the trace is the active trace, and the settings in the current channel coordinate system are based on the active trace. The activated traces can be switched via the Trace Next and Trace Prev buttons on the front panel, or by clicking on the trace number area in the screen.

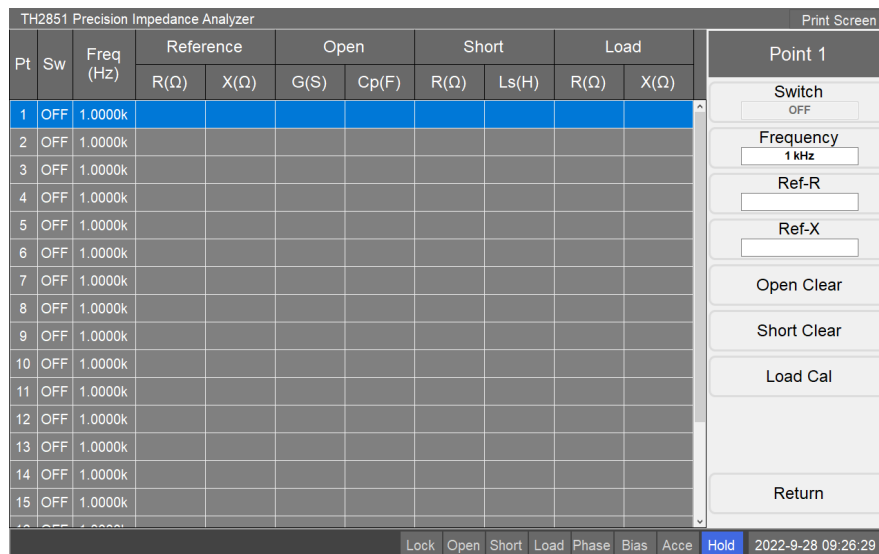
Trace state

The possible states for each trace are shown in the following table:

Classification	Status (enclosed in [])	Meaning
When the trace math operation is set to OFF , it will be distinguished according to the different display states of the trace and the stored trace.	no state	Trace display is on, the stored trace display is off
	M	Trace display is off, the stored trace display is on
	D & M	Trace display on, the stored trace display on
	off	Trace display is off, the stored trace display is off
When the trace display is on and the math operation of the trace is not OFF, it is distinguished according to the math operation of the trace. When the stored trace display is on, it is the state inside ()	D + M (D+M&M)	Math operations: Calculate data + store data
	D- M (D - M&M)	Math operations: Calculate Data - store data
	D* M (D * M&M)	Math operations: Calculate data * store data
	D/ M (D/M&M)	Math operations: Calculate data / store data

2.3.5 User Calibration Interface

The user calibration page displays the calibration settings made by the user, and the user can perform specific calibration operations and view calibration data. The specific interface is shown in the following figure:



Calibration point list

It displays the status of all user calibration points and the calibration data that has been performed. TH2851 provides a total of 20 user calibration points, each point has an independent switch and frequency settings. At the same time, the list also displays the load reference value, open circuit calibration value, short circuit calibration value and load calibration value of the calibration point. Click the row of the calibration point to open the corresponding calibration point setting menu.

Calibration point setup

The selected calibration point can be set. Settings include switching, measurement frequency, and

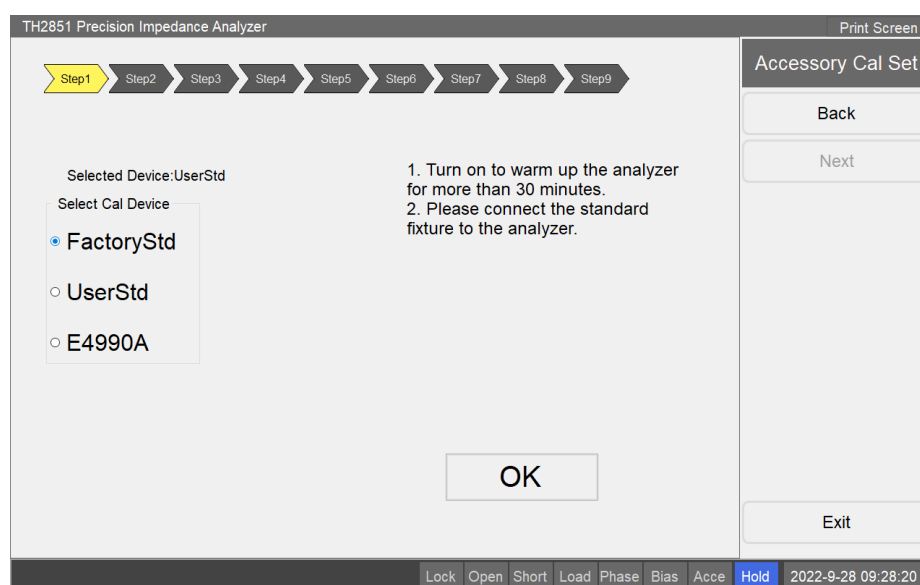
load reference. Among them, if the calibration point is turned off, then in the measurement, the calibration point will not work. The load reference parameter will depend on the load type setting.

Point calibration

Point calibration can be performed on the currently selected calibration point, including open clear, short clear, and load calibration. These calibration data will only be used in the measurement if the calibration point is turned on.

2.3.6 Accessory Calibration Interface

The main function is to guide the user to perform accessory calibration, as shown in the following figure:



Calibration steps

The overall progress of the calibration is displayed. Unfinished steps are light gray, completed steps are dark gray, and currently active steps are light yellow. You can navigate to a completed step by pressing the button in the menu bar or click the step label, and re-calibrate the step (except for some special steps).

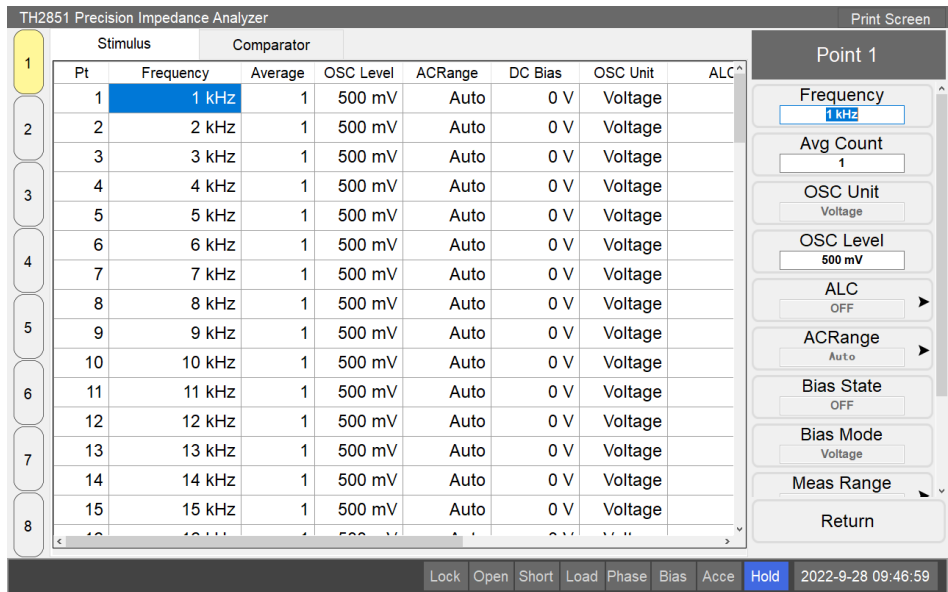
Calibration Guide

Operational guidance for the current calibration step. Follow the instructions to complete the fixture calibration.

2.3.7 Point measurement and comparator setting interface

The point measurement and comparator interface shows the conditions for point measurement and comparator, as shown in the following figure:

2.3.8 List setting interface



Desktop tab

Switch to the current setting page. You can switch to the stimulus setting interface and the comparator setting interface.

Points to be measured

It displays all the points to be measured and their measurement parameters in the current channel. Click the row of the point to be measured (except the first column), the menu bar will open the setting menu corresponding to the point to be measured, and click the first column to return to the root menu.

Point parameter setting

The measurement parameters of the current point can be changed.

2.3.9 List quick edit interface

The list quick edit page can quickly set the measurement points.

TH2851 Precision Impedance Analyzer

Print Screen

Frequency

Type: Linear

Start: 1 kHz

Stop: 100 kHz

OSC Level-Voltage

Mode: Voltage

Start: 500 mV

Stop: 500 mV

ALC: OFF

DC Bias-Voltage

State: OFF

Mode: Voltage

Start: 0 V

Stop: 0 V

Meas Range: 1mA

Average Count: 1

ACRRange: Auto

Num of Points: 100

Point Delay: 0 ms

OK

OK

Exit

Lock Open Short Load Phase Bias Acce Hold 2022-9-28 09:48:39

Quick settings area

Quickly set measurement point parameters.

Setup is complete

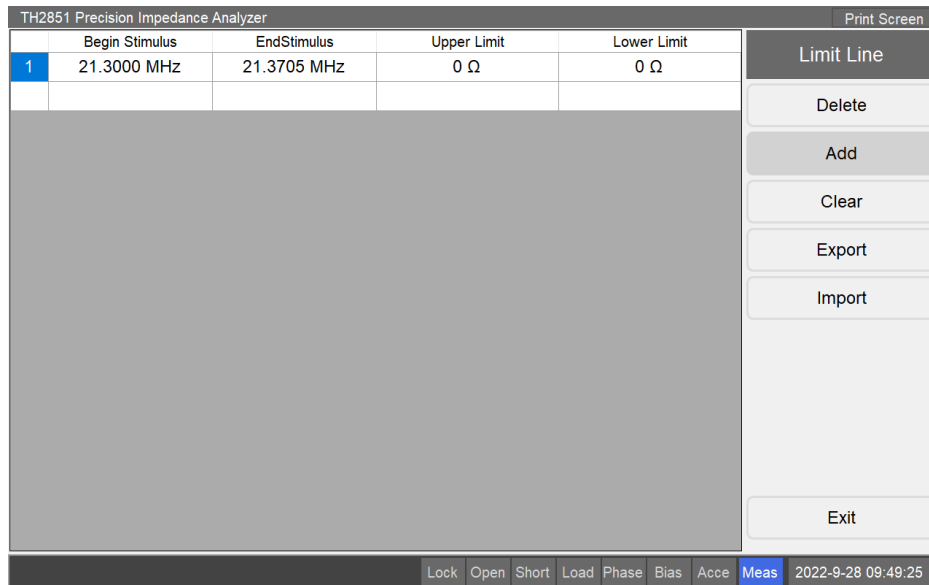
Confirm the setting of the stimulus measurement point, save the set data, exit the current interface and return to the stimulus setting interface.

2.3.10 List comparator setting interface

Please refer to the point measurement comparator setting interface.

2.3.11 Sweep comparator setting interface

Comparator condition settings for sweep test. Before entering this page, first of all, it is necessary to save the current trace to the storage data as the reference data for comparator. The sweep comparator setting page is shown as below:



Comparator condition list

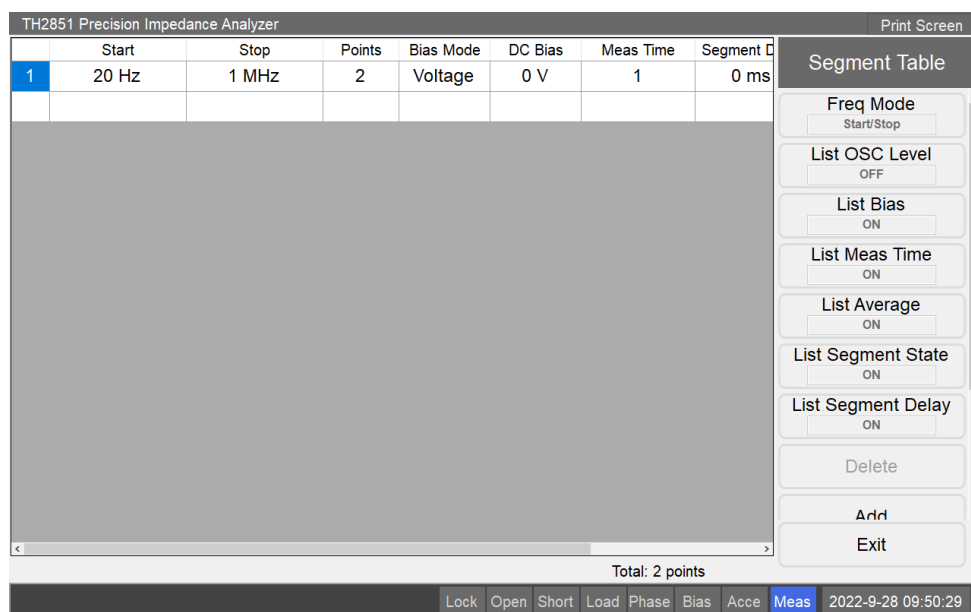
The comparator conditions that have been set are displayed. Different comparator conditions are sorted according to frequency, and the frequency range does not exceed the sweep frequency range. Click the frequency criteria (except the first column) to open the comparator settings menu, click the first column to return to the root menu.

Comparator condition setting

Set the selected comparator conditions. You can set the comparator type, begin stimulus and end stimulus, upper limit and lower limit. Among them, the setting of the comparator upper and lower limits are related to the selected comparator type. When the comparator type is numeric, set the numerical value; when the sorting type is percentage, set the percentage.

2.3.12 Sweep segment setting interface

This screen shows the settings for the sweep frequency segment. This setting only takes effect when the sweep mode is set to segmented sweep. The sweep segment interface is shown in the following figure:



Segment table

All segmentation settings are displayed. All segments are sorted by frequency, and the start frequency of the next segment is not lower than the end frequency of the previous segment, and not higher than the end frequency of the same segment. Except for frequency and number of points, the display of other parameters needs to turn on the corresponding switches in the root menu. Click the segment condition (except the first column) to open the corresponding segment setting menu, click the first column to return to the root menu.

Segment setting

The selected segment can be set, including frequency (the format includes start/stop and central/span, which can be switched in the root menu), number of points, level, bias, etc. Among them, except the frequency and the number of points, other parameters can only be set by turning on the corresponding switch in the root menu.

Points

It shows the point statistics for the current segment setting. The total number of points must not be less than 2, and at least one point is required under each segment setting.

Measurement example

This section will guide you through a measurement example to understand the basic operation of the TH2851. If you are a new user of TH2851, this part can help you get familiar with TH2851 quickly.

2.4 Equipment requirements

This section will guide you through the basic operation of the TH2851 with a single measurement example. If you are new to the TH2851, this section will help you to quickly become familiar with TH2851.

2.4.1 Equipment requirements

In order to be able to complete all the steps of this example, you need to prepare the following measurement equipment.

TH2851;

TH26005C fixture;

100 ohm resistor;

Standard open and short test pieces

Crystal resonators.

2.4.2 Measurement preparation

Complete the preparation of the TH2851 for measurement by following the steps below. This ensures that the TH2851 is properly installed and set up.

2.4.2.1 Connection fixture TH26005C

Connect the fixture TH26005C to the TH2851:

1. Align the 4 test ends of the TH26005C with the test ends on the TH2851 , and gently insert the fixture until the two test ends are fully fitted;
2. Turn the rotating operating lever on the test end of the TH26005C fixture clockwise to ensure the stability of the fixture during measurement;
3. When removing the clamp, perform the above steps in reverse order.

2.4.2.2 Turn on the power

TH2851 can be activated by pressing the switch button. After startup, the program of TH2851 will start automatically, and check whether various files are completed during startup. After everything is ready, the device first enters the point measurement interface.

Note, please do not shut down the program by directly cutting off the power supply, which may cause irreversible damage to the electronic components of the TH2851.

2.4.2.3 Initialize the instrument

Preset initialization restores the device to the factory settings, which can reset the previous measurement conditions and parameter settings to avoid the subsequent measurement being affected by the previous measurement. The initialization function can be set to restore to factory settings or user settings (user setting files are required), and the system defaults to factory settings. This setting can be changed in the system settings.

Press **Preset** on the front panel and click OK on the screen to restore the device to factory settings.

2.4.3 User measurement calibration

Perform user calibration before measurement. On the point measurement page, click **Cal** in the upper right corner of the front panel to enter the user calibration page.

Pt	Sw	Freq (Hz)	Reference		Open		Short		Load	
			R(Ω)	X(Ω)	G(S)	Cp(F)	R(Ω)	Ls(H)	R(Ω)	X(Ω)
1	OFF	1.0000k								
2	OFF	1.0000k								
3	OFF	1.0000k								
4	OFF	1.0000k								
5	OFF	1.0000k								
6	OFF	1.0000k								
7	OFF	1.0000k								
8	OFF	1.0000k								
9	OFF	1.0000k								
10	OFF	1.0000k								
11	OFF	1.0000k								
12	OFF	1.0000k								
13	OFF	1.0000k								
14	OFF	1.0000k								
15	OFF	1.0000k								

User Cal
Phase Cal
OFF
00/00/0000
Open
OFF
Short
OFF
Load
OFF
Load Type
R-X
Accessory
0m
Accessory Cal
OFF
State1
Exit

Lock Open Short Load Phase Bias Acce Meas 2022-9-28 09:51:20

2.4.3.1 User full frequency open clear

1. Click **Open** on the user calibration menu to enter the open calibration menu;
2. Install the standard open measuring piece on the TH26005C fixture, and click **All frequency clear**;
3. After the full frequency clear is completed, the data will be saved and the user open calibration will be turned on. Click **Return** to return to the user calibration menu.

2.4.3.2 User full frequency short clear

1. Click **Short** on the user calibration menu to enter the short calibration menu;
2. Install the standard short measuring piece on the TH26005C fixture, and click to **All frequency clear**;
3. After the full frequency clear is completed, the data will be saved, and the user short calibration will be turned on. Click **Return** to return to the user calibration menu.

2.4.3.3 User Phase Calibration

1. Click **Phase Cal** on the user calibration menu to enter the Phase Calibration menu;
2. Install the standard open measuring piece on the TH26005C fixture, click **Start Phase Cal**;
3. After the calibration is completed, the user phase calibration will be turned on. Click **Return** to return to the user calibration menu.

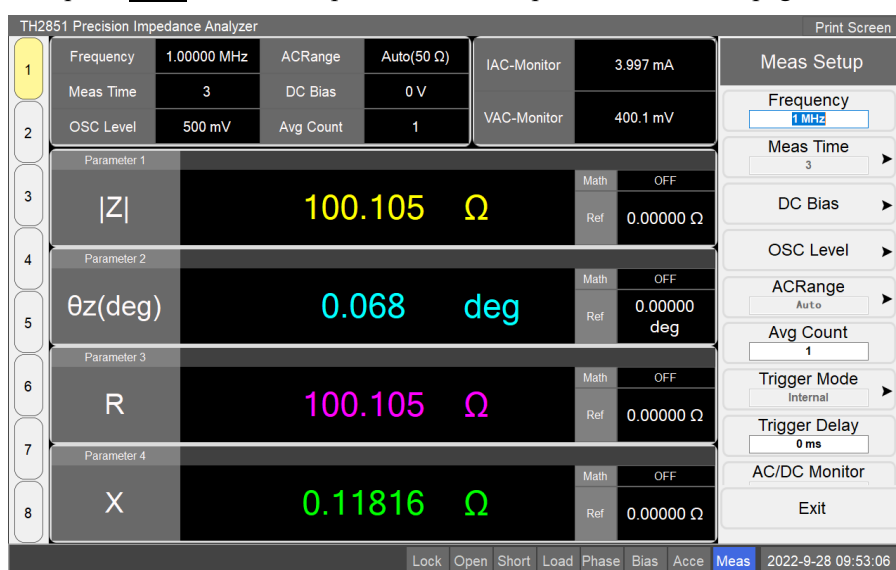
2.4.3.4 User Accessory Calibration

1. Click **Accessory Cal** on the user calibration menu to enter the accessory calibration menu;
2. Click the button to select the file location to be saved after calibration. If there is a fixture calibration file in the selected location, the file will be overwritten after the calibration is completed (if there is an * in the name of the file location button, it means an existing calibration file);
3. Click **Start Accessory Cal** to enter the accessory calibration page, and complete the calibration process according to the guidance on the page;
4. After calibration is complete, user accessory calibration will be turned on. Click **Return** to return to the user calibration menu.

Note : Because the accessory calibration includes open-short clear and phase calibration, when the user accessory calibration is turned on, the user's open calibration, short calibration, and phase calibration will be automatically closed; correspondingly, the user's open calibration, short calibration or phase calibration is turned on, the user accessory calibration will be turned off.

2.4.4 Point measurement example

This part demonstrates the point measurement function of TH2851, connect the 100Ω resistor to the accessory, and press **LCR** on the front panel to enter the point measurement page.



2.4.4.1 Set measurement conditions (frequency/average count/signal source voltage, etc.)

According to user needs, set different measurement conditions, follow the steps below:

1. Press **Meas** in the upper right corner of the front panel to enter the measurement setting menu;
2. Select **Frequency** in the measurement setting menu, and press **1** > **M /μ** on the front panel to set the measurement frequency to 1 MHz ;
3. Select **Avg Count** in the measurement setting menu, and press **5** on the front panel to set the measurement average count to 5;
4. Select **OSC Level** in the measurement setting menu, enter the measurement level menu, set the test voltage, and then press **return**;

5. Press **DC Bias** on the front panel to turn on the bias voltage switch;
6. Press **LCR** on the front panel to return to the point measurement menu.

2.4.4.2 Set measurement parameters

Set the measurement parameters required by the user and display them on the measurement interface. Follow these steps:

1. Click the parameter name on the screen to enter the test parameter setting interface;
2. Select and press the parameters to be displayed on the measurement interface;
3. Press **LCR** on the front panel to return to the point measurement menu .

2.4.5 List measurement example

This section demonstrates the list measurement function of the TH2851. On the point measurement page, press **Point / List** on the front panel to enter the list measurement interface.

2.4.5.1 List Measurement point setting

Set the points to be measured. Follow these steps:

The screenshot displays the TH2851 Precision Impedance Analyzer interface. The title bar reads "TH2851 Precision Impedance Analyzer" and "Print Screen". The interface is divided into several sections:

- Frequency:** Type (Linear), Start (100 kHz), Stop (1 MHz).
- OSC Level-Voltage:** Mode (Voltage), Start (500 mV), Stop (500 mV), ALC (OFF).
- DC Bias-Voltage:** State (OFF), Mode (Voltage), Start (0 V), Stop (0 V), Meas Range (1mA).
- Average Count:** 1
- ACRange:** Auto
- Num of Points:** 10
- Point Delay:** 0 ms

On the right side, there are two "OK" buttons. At the bottom right, there is an "Exit" button. The bottom status bar shows "Lock Open Short Load Phase Bias Acce Meas" and the date/time "2022-9-28 09:54:26".

1. Click **Stim Table** on the List Root on the screen to enter the stimulus setting interface;
2. Click **Quick Edit** on the stimulus setting menu on the screen to open the quick edit interface;
3. Set the interpolation mode to linear interpolation, the start frequency to 100 kHz, the stop frequency to 1 MHz, and the number of points to 10, click **OK** to quickly set 10 measurement points;
4. Click the row of each measurement point on the screen to enter the measurement point setting menu, you can set the measurement conditions of each point individually, and click **Return** to return to the measurement setting menu;

- Click **Exit** to return to the list measurement interface.

2.4.5.2 Set measurement parameters

Set the list measurement parameters and display them in the measurement page. Follow these steps:

- Click **Point Meas** on List Root on the screen to enter the measurement parameter menu;
- Click the parameter button that needs to be changed to enter the parameter setting menu;
- Select and click the measurement parameter to be set to return to List Root.

The screenshot shows the TH2851 Precision Impedance Analyzer interface. On the left is a vertical navigation bar with buttons 1 through 8. The main display area is divided into a table and a right-hand menu. The table contains measurement data for 10 points. The right-hand menu, titled 'List Root', includes options like Point Meas, Stim Table, Calibration, Display, List Type, List Meas Time, Trigger, Comparator, Electrode, and Thickness. At the bottom, there is a status bar with various function buttons and a timestamp.

Pt	Frequency	Avg	OSC Level	ACRange	DC Bias	Z	$\theta z(\text{deg})$	R	X
1	100 kHz	1	500 mV	Auto(50 Ω)	0 V	100.106 Ω	-0.00508 deg	100.106 Ω	-0.00887 Ω
2	200 kHz	1	500 mV	Auto(50 Ω)	0 V	100.100 Ω	-0.01344 deg	100.100 Ω	-0.02348 Ω
3	300 kHz	1	500 mV	Auto(50 Ω)	0 V	100.115 Ω	0.01121 deg	100.115 Ω	0.01958 Ω
4	400 kHz	1	500 mV	Auto(50 Ω)	0 V	100.089 Ω	0.00183 deg	100.089 Ω	0.00319 Ω
5	500 kHz	1	500 mV	Auto(50 Ω)	0 V	100.082 Ω	0.01548 deg	100.082 Ω	0.02703 Ω
6	600 kHz	1	500 mV	Auto(50 Ω)	0 V	100.091 Ω	0.04070 deg	100.091 Ω	0.07110 Ω
7	700 kHz	1	500 mV	Auto(50 Ω)	0 V	100.098 Ω	0.03763 deg	100.098 Ω	0.06575 Ω
8	800 kHz	1	500 mV	Auto(50 Ω)	0 V	100.110 Ω	0.04343 deg	100.110 Ω	0.07589 Ω
9	900 kHz	1	500 mV	Auto(50 Ω)	0 V	100.106 Ω	0.04718 deg	100.106 Ω	0.08244 Ω
10	1 MHz	1	500 mV	Auto(50 Ω)	0 V	100.100 Ω	0.06627 deg	100.100 Ω	0.11577 Ω

2.4.5.3 Set the measurement speed

Set the measurement speed of the list measurement according to the user's requirements for measurement speed and accuracy. Follow these steps:

- Click **Meas Time** on the List Root on the screen to enter the measurement speed menu;
- Select and click the desired measurement speed.

2.4.6 Sweep measurement example

This part shows the trace sweep measurement function of TH2851. Connect the crystal resonator to the fixture, press **Sweep** on the front panel to enter the trace sweep measurement interface.

2.4.6.1 Set |Z|-Theta as measurement parameter

Set the measurement parameters as follows:

- Click **Measurement** of the Sweep Root on the screen to enter the measurement setting menu, then click **Tr1 & Tr2** to enter the parameter setting menu;
- Make sure that the selected item for **Tr1 & Tr2** is **|Z|- θz** (the default state is selected), so that trace 1 reflects the absolute value of the resistance value, and trace 2 reflects the phase.

2.4.6.2 Set the center and span

1. Press **Center** on the front panel to open the sweep range menu and automatically lock at **Center** ;
2. Enter the center frequency of 8MHz , and press **8** > **M/μ** on the front panel in sequence ;
3. Press **Span** on the front panel, the sweep range menu is now automatically locked in the **Span** ;
4. Enter the value range of 30 kHz, and press the **3** > **0** > **k** **μ**m keys on the front panel in sequence.

2.4.6.3 Set sweep speed

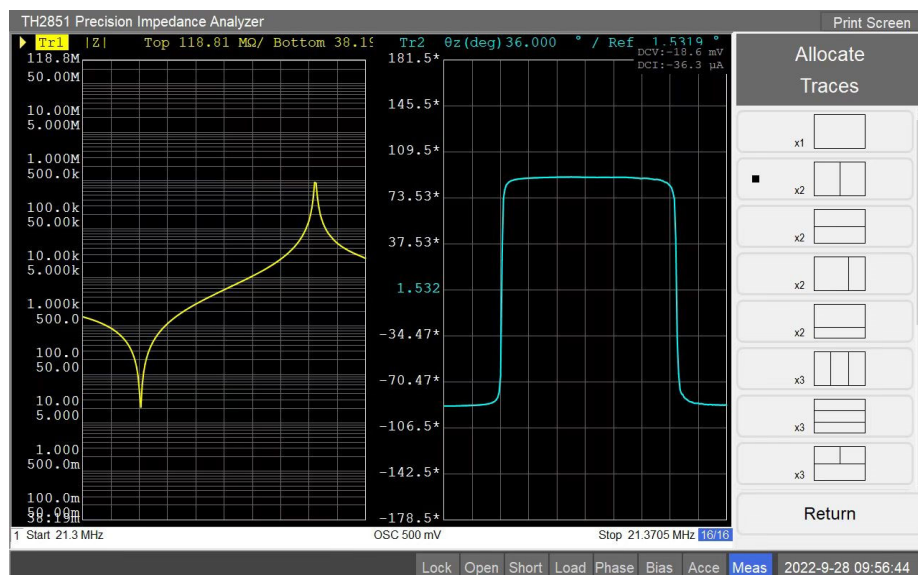
1. Press **Avg** on the front panel to enter the measurement speed menu;
2. Click **Meas Time** , then select and tap **3** as measurement Speed.

2.4.6.4 Set the ordinate of the $|Z|$ curve to the logarithmic distribution

1. Select trace 1 as the active curve (the measurement parameter of trace 1 is $|Z|$);
2. Press **Format** on the front panel to enter the ordinate format menu;
3. Click the **Vertical axis type** and select logarithmic axis.

2.4.6.5 Display traces in different coordinate systems

1. Press **Display** on the front panel to enter the display setting menu;
2. Press **Allocate Traces** to enter the trace assignment setting menu, select and click the coordinate system distribution button in the menu.

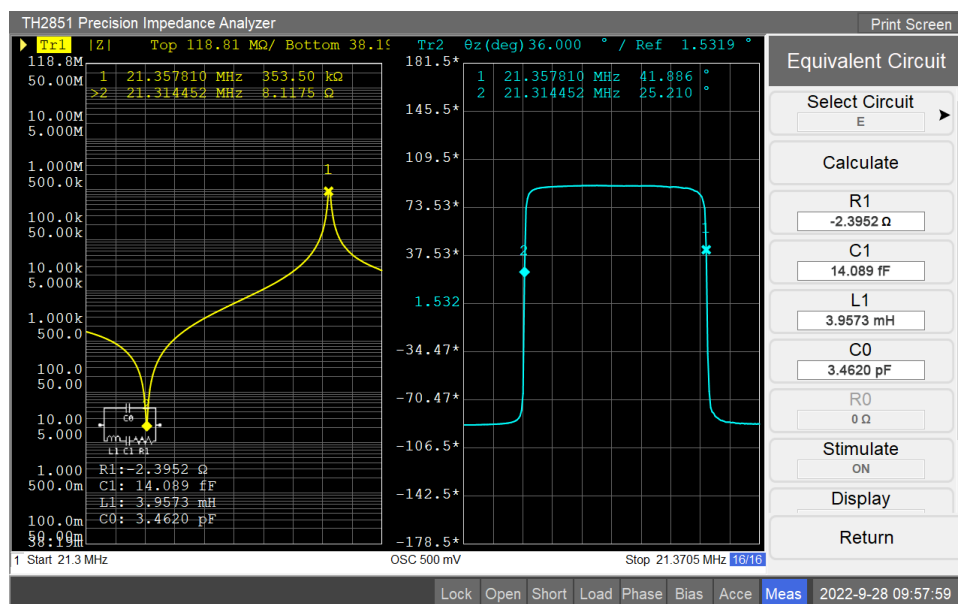


2.4.6.6 Axis auto scaling

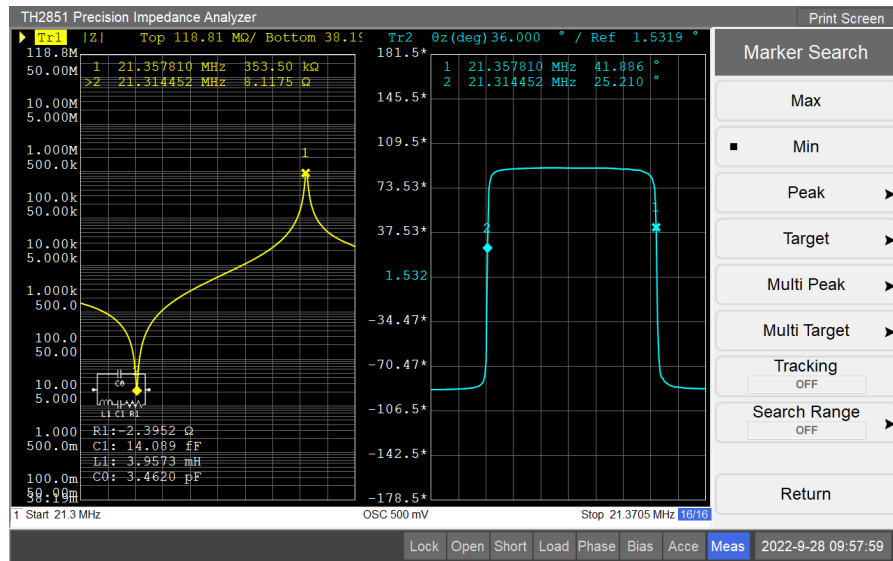
Press **Scale** on the front panel to enter the coordinate axis setting menu, and press **Auto Scale All** for all traces.

2.4.6.7 Analysis of measurement results

Perform equivalent circuit analysis on the trace to find the resonance point of the circuit, and follow the steps below:



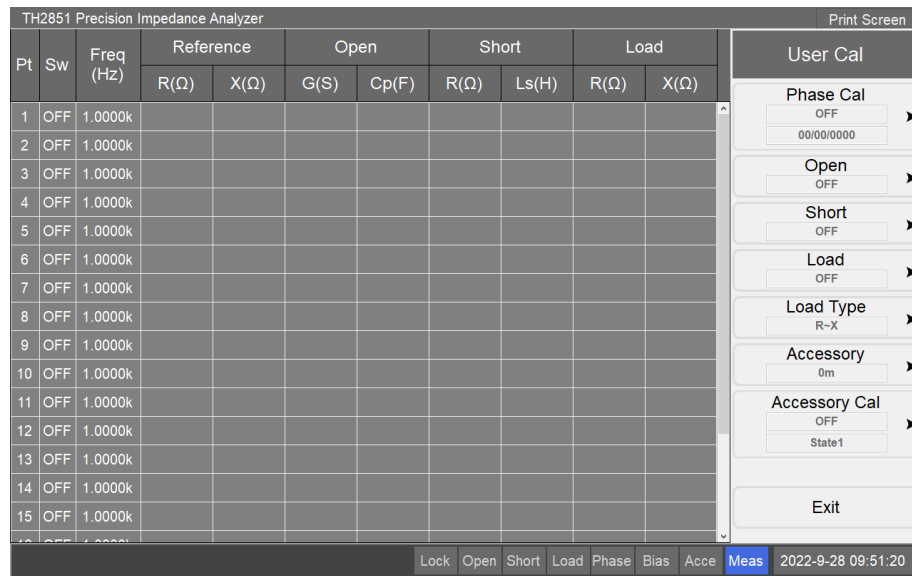
1. Press **Analysis** on the front panel to enter the trace analysis menu, and then press the **Equivalent Circuit** to enter the equivalent circuit menu;
2. Click on the screen to **Select Circuit**, select and click the Model E button;
3. Press the **Calculate** to perform an equivalent analysis on the trace, and the analog values of resistance, inductance and capacitance are displayed on the menu;
4. Turn on the **Display** button in the equivalent circuit menu, and the equivalent circuit model and simulation results will be displayed on the screen;
5. Press **Marker Search** on the front panel to enter the marker search menu;
6. Keep Tr1 as the active curve, press **Min**, the program will automatically open Tr1 and locate the minimum value of $|Z|$;
7. Click the toggle **Tacking** button to the on state. When the marker tracking is on, the program will automatically position the currently selected marker to the selected position after each sweep cycle. After one sweep period, Tr1 will be automatically positioned to the minimum value of the $|Z|$ trace;



Chapter 3 User Calibration

3.1 Overview

User calibration needs to be performed by the user before starting the measurement, which can eliminate measurement errors caused by fixtures, test pieces, etc.



Press **[Cal]** on the front panel to enter the user calibration interface. After entering, the main area on the left side of the interface is a list of calibration points. TH2851 provides 20 calibration points, whose switch, frequency, reference, etc. can be individually set; the menu area on the right side of the interface is the user calibration menu, which can perform all frequency calibration and its switch operation.

3.2 All frequency user calibration setup

3.2.1 Choose a measuring accessory

According to the currently selected measurement accessory, set the measurement accessory data in the user calibration interface. TH2851 provides several measuring accessories for selection, the default selection is 0 m. If the user uses a custom accessory to measure, or the accessory used is not in the selectable accessory options, it is recommended to set the measurement accessory to 0 m and perform accessory calibration.

Set up the measuring accessory as follows:

1. Click **Accessory** button in the user calibration menu to enter the measurement accessory menu;

-
2. Select and click the button corresponding to the selected measuring accessory.

3.2.2 User open calibration

3.2.2.1 Toggle open calibration switch

When the open-circuit calibration in the user calibration is turned off, the user-calibrated open-circuit calibration during the measurement process will be calculated using the default data of the TH2851 (the user accessory calibration is not turned on). Only the open circuit data of the calibration point is used.

Set the switch state of user open circuit calibration according to the following steps:

1. Click the **Open** button in the user calibration menu to enter the open circuit calibration menu;
2. Select and click the **ON** or **OFF** button in the Open Calibration menu to set the open state of Open Calibration.

3.2.2.2 All frequency clear for open circuit calibration

All frequency open-circuit calibration is to perform all frequency open-circuit calibration again. After completion, the user's open-circuit calibration will automatically switch to the open state. The zero-clearing data will record and overwrite the original all frequency open-circuit calibration data. If necessary, please pay attention to backup and save the original data.

Perform open-circuit all frequency clear according to the following steps:

1. Click the **Open** button in the user calibration menu to enter the open circuit calibration menu;
2. Connect the user's open-circuit standard test piece to the measuring accessory;
3. Click **All frequency clear** to start clearing, and wait for the clearing to complete. During this process, press **ESC** on the front panel to interrupt the operation.

3.2.2.3 List frequency clear for open circuit calibration

List frequency clear is to perform a one-time open-circuit calibration of the calibration points whose status is open in the current calibration point list, and the calibration results will be recorded and automatically written into the calibration point list. If no calibration point is currently open, it will simply end.

Perform open-circuit list frequency clear according to the following steps:

1. Click the **Open** button in the user calibration menu to enter the open circuit calibration menu;
2. Connect the user's open-circuit standard test piece to the measuring accessory;
3. Click the **List frequency clear** to start clearing, and wait for the clearing to complete.

3.2.3 User short calibration

3.2.3.1 Toggle short calibration switch

When the short-circuit calibration in the user calibration is turned off, the short-circuit calibration of the user-calibration in the measurement process will be calculated using the default data of the TH2851 (the user accessory calibration is not turned on). After the short-circuit calibration is turned on, the user's all frequency short calibration data and the short-circuit data for the calibration point is only used.

Set the switch state of user short-circuit calibration according to the following steps:

1. Click the **Short** button in the user calibration menu to enter the short-circuit calibration menu;
2. Select and click the **ON** or **OFF** button in the Short Calibration menu to set the on-state of the Short Calibration.

3.2.3.2 All frequency clear for short circuit calibration

All frequency clear is to perform all frequency short circuit calibration again. After the user short circuit calibration is completed, it will automatically switch to the open state. The zero-clearing data will record and overwrite the original all frequency short circuit calibration data. If necessary, please pay attention to backup and save the original data.

Perform short-circuit all frequency clear according to the following steps:

1. Click the **Short** button in the user calibration menu to enter the short-circuit calibration menu;
2. Connect the user's short-circuit standard test piece to the measuring accessory;
3. Click **All frequency clear** to start clearing, and wait for the clearing to complete. During this process, press **ESC** on the front panel to interrupt the operation.

3.2.3.3 List frequency clear for short circuit calibration

List frequency clear is to perform a one-time short-circuit calibration of the calibration points whose status is open in the current calibration point list, and the calibration results will be recorded and automatically written into the calibration point list. If no calibration point is currently open, it will simply end.

Perform short-circuit list frequency clear according to the following steps:

1. Click the **Short** button in the user calibration menu to enter the short-circuit calibration menu;
2. Connect the user's short-circuit standard test piece to the measuring accessory;
3. Click the **List frequency clear** to start clearing, and wait for the clearing to complete.

3.2.4 User load calibration

3.2.4.1 Toggle load calibration switch

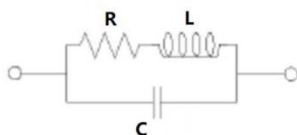
When the load calibration in the user calibration is turned off, the user-calibrated load calibration during the measurement process will be skipped. After the load calibration is turned on, the user's all frequency load calibration data and the user's calibration point load data will be used.

Set the switch state of user load calibration according to the following steps:

1. Click **Load** button in the user calibration menu to enter the load calibration menu;
2. Select and click the **ON** or **OFF** button in the Load Calibration menu to set the Load Calibration on state.

3.2.4.2 All frequency load calibration

All frequency clear is to re-calibrate the all frequency load. After completion, the user load calibration will automatically switch to the open state, and the calibration data will be recorded and overwritten with the original all frequency load calibration data. If necessary, please pay attention to backup and save the original data. For all frequency load calibration, please use the components of the following model and install them on the measurement fixture:



Perform load circuit all frequency clear according to the following steps:

1. Click **Load** button in the user calibration menu to enter the load calibration menu;
2. It is recommended to use a stable resistor or capacitor, the size of which is similar to the size of the DUT, and the impedance value is known and similar to the DUT;
3. Set the value of load resistance, load inductor and load capacitance on the load calibration menu ;
4. Click **All frequency load** to calibrate and wait for the calibration to complete. During this process, press **ESC** on the front panel to interrupt the operation.

3.2.4.3 List frequency load

List frequency load is to perform a one-time load calibration on the calibration point in the current calibration point list whose status is open, and the calibration result will be recorded and automatically written into the calibration point list. If no calibration point is currently open, it will simply end.

Perform the list frequency load as follows:

1. Click **Load** button in the user calibration menu to enter the load calibration menu;
2. Click the **List frequency load** to start the calibration and wait for the calibration to complete.

3.2.4.4 Load parameter setting

1. Click **Load** button in the user calibration menu to enter the load parameter menu;
2. Click the button corresponding to the desired load parameter combination.

3.2.5 Phase calibration

The phase calibration data is related to the measurement accessory, and when the measurement accessory is set, the phase calibration is turned off. After resetting the measurement accessory, if you need to turn on the phase calibration, it is recommended to perform the all frequency phase calibration again. In the **Phase Cal** button of the user calibration menu, the current phase calibration switch status and the date of the current all frequency phase calibration data will be displayed.

3.2.5.1 Toggle phase calibration switch state

When user phase calibration is turned off, the phase calibration during measurement will use the system phase calibration data. If you need to use user phase calibration data, turn phase calibration on.

Switch the user phase calibration state according to the following steps:

1. Click **Phase Cal** button in the user calibration menu to enter the phase parameter menu;
2. Click the **Phase Cal State** to switch the phase calibration switch state.

3.2.5.2 All frequency phase calibration

All-frequency phase calibration is to perform all-frequency phase calibration again. After completion, the user phase calibration will automatically switch to the open state, and the calibration data will be recorded and overwritten with the original user phase calibration data. If necessary, please pay attention to backup and save the original data.

Perform all frequency phase calibration as follows:

1. Click **Phase Cal** button in the user calibration menu to enter the phase parameter menu;
2. Connect the user's open-circuit standard test piece to the measuring accessory;
3. Click **All Frequency Phase Calibration** to start the calibration, wait for the calibration to complete, press **ESC** on the front panel during this process to interrupt the operation.

3.2.6 Accessory Calibration

Accessory calibration can be used to calibrate user-defined measurement accessories, which includes open calibration, short calibration, and phase calibration. If the measurement outcome selected by the user is "0m", when the accessory calibration is turned on, the user-calibrated open calibration, short calibration, load calibration, and phase calibration will be automatically turned off (accessory calibration will also be automatically turned off when the above calibration switches are turned on).

Accessory Cal button in the user calibration menu will display the name of the currently selected accessory and the state of the accessory calibration switch.

3.2.6.1 Toggle Accessory Calibration Switch Status

1. Click the **Accessory Cal** button in the user calibration menu to enter the accessory calibration menu;

-
2. Select the accessory to be loaded and click its corresponding button to select it;
 3. Click the **Accessory Cal State** button to switch the accessory calibration switch state.

Note: The name of the accessory button with the * symbol indicates that the accessory currently has a calibration file. Clicking the button will automatically load the file (if there is an error in the file, it will prompt and cancel the loading). Only when the selected accessory has a corresponding calibration file and accessory calibration can be opened only when it is loaded correctly. If there is no corresponding file or the loading is wrong, please click **Start Accessory Cal** to generate the calibration file.

3.2.6.2 Generate Accessory Calibration File

1. Click the **Accessory Cal** button in the user calibration menu to enter the accessory calibration menu;
2. Select the accessory to be loaded and click its corresponding button to select it;
3. Click **Start Accessory Cal** to enter the accessory calibration interface, follow the prompts to complete the calibration process and generate a calibration file.

Note: After completing the above steps, the calibration file corresponding to the accessory selected in step 2 will be overwritten. If necessary, make a backup in advance.

3.3 User calibration point settings

3.3.1 Toggle calibration point switch state

1. Click the calibration point to be modified in the list to enter the calibration point setting menu;
2. Click the **Switch** button to switch the ON/OFF state of the calibration point. Only when the calibration point is on, the calibration data of the calibration point will take effect during measurement.

3.3.2 Set the frequency of the calibration point

1. Click the calibration point to be modified in the list to enter the calibration point setting menu;
2. Click the **Measurement Frequency** button and enter the frequency of the calibration point.

Note: During the measurement process, the TH2851 will search for the frequencies of all open calibration points. When the searched frequency is consistent with the current measurement frequency, the measurement data of this calibration point will be used in the user calibration process.

3.3.3 Set the load reference for the calibration point

1. Click the calibration point to be modified in the list to enter the calibration point setting menu;
2. Click the Ref button and enter the reference value. Only when the reference values in both Ref buttons are set, the set value will be written to the measuring point list and recorded.

Note: The parameters corresponding to the reference values need to be set in the **Load** parameters in the user calibration menu .

3.3.4 Open clear of calibration point

1. Click the calibration point to be modified in the list to enter the calibration point setting menu;
2. Connect the user's open-circuit standard test piece to the measuring accessory;
3. Click the **Open Clear** to complete the open clear of the calibration point, and write the calculation result into the calibration point list and record it.

Note: Only when the user open calibration is turned on, the calibration point is turned on, and the frequency of the calibration point is the current measurement frequency, the open clear data of this point will be called during the measurement.

3.3.5 Short clear of calibration point

1. Click the calibration point to be modified in the list to enter the calibration point setting menu;
2. Connect the user's short-circuit standard test piece to the measuring accessory;
3. Click the **Short Clear** to complete the short clear of the calibration point, and write the calculation result into the calibration point list and record it.

Note: Only when the user short-circuit calibration is turned on, the calibration point is turned on, and the frequency of the calibration point is the current measurement frequency, the short clear data of this point will be called during the measurement.

3.3.6 Load calibration at calibration point

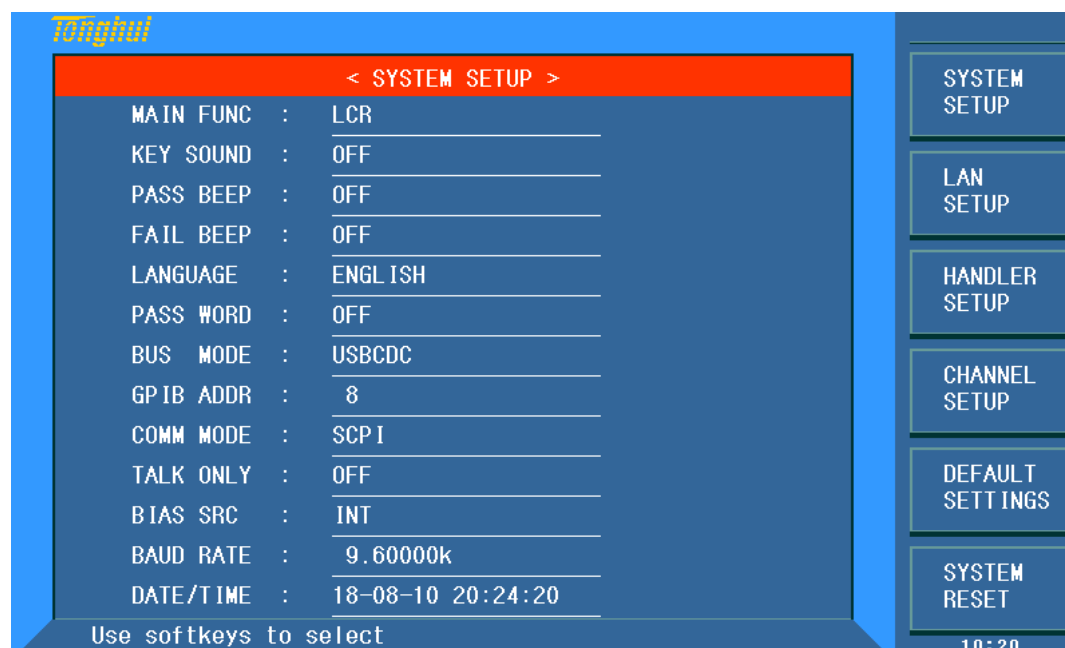
1. Click the calibration point to be modified in the list to enter the calibration point setting menu;
2. Connect the user's standard test piece to the measuring accessory;
3. Click **Load Cal** to complete the load calibration of the calibration point, and write the calculation result to the calibration point list and record it.

Note: Only when the user load calibration is turned on, the calibration point is turned on, and the calibration point frequency is the current measurement frequency, the load calibration data of this point will be called in the measurement.

Chapter 4 [SYSTEM] and <FILE MANAGE>

4.1 <SYSTEM SETUP>

Press [System] 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, key sound, PASS beeper, FAIL beeper, language, PASS word, bus mode, GPIB address, TALK only, Bias SRC, baud rate, data/time. After the parameter in system setting page is set, it is automatically saved. After the next power-on, it is the last data set before the last shutdown.

4.1.1 MAIN FUNC

The function of this zone is to control and display available instrument functions.

Only LCR function is displayed.

4.1.2 KEY SOUND

This zone is used to control the key sound.

Operation steps for selecting key sound:

- 1) Move the cursor to **KEY SOUND**, the following soft keys will be displayed.
 - **ON**
 - **OFF**
- 2) Select ON to turn on the key sound and select OFF to turn off the key sound.

4.1.3 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.

4.1.4 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.

4.1.5 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.

4.1.6 PASS WORD

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

Operation steps for setting the password

- 1) Move the cursor to Password, the following soft keys will be displayed.

- **OFF**

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

- **Hold SYSTEM**

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

- **Hold 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, a prompt information will appear on the screen to prompt you to confirm the new password. Input the new password again till the modification finishes.

- **Hold SETUP**

This soft key is used to restrict the modification operation of the setup files.

Note: The default password is 2839.

4.1.7 BUS MODE

This mode is used to select RS232C, GPIB, LAN, USBTMC or USB CDC.

Operation steps for setting bus mode

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

- **RS232C**

- **GPIB**

- **LAN**

- **USBTMC**

- **USBCDC**

- 2) Use above soft keys to select the required interface bus.

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

4.1.8 GPIB ADDR

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.

4.1.9 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, LAN, USBTMC or USB CDC. 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.

4.1.10 BIAS SRC

Bias source is used to select the DC bias power.

- INT mode

The standard DC bias voltage source is from -40V to +40V and the DC bias current source is from -100mA to 100mA.

- TH1778 mode

When the instrument adopts the external bias source to perform on-line test, TH1778 mode should be selected.

NOTE: TH1778 must be connected, then this mode can be supported.

4.1.11 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

- 1) 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.

4.1.12 DATA/TIME

When moving to the time zone, user should input the password to enter.

4.2 LCR <FILE MANAGE>

TH2839 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. The file manage function of the transformer scanning will be described in the part of transformer test setting.

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 and more than 500 can be saved in external U-disc (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
 - ☐ FUNC
 - ☐ FREQ
 - ☐ AC LEL
 - ☐ AC RNG
 - ☐ SPEED

-
- ☐ DC BIAS
 - ☐ BIAS SRC
 - ☐ TRIG
 - ☐ ALC
 - ☐ TRIG DLY
 - ☐ STEP DLY
 - ☐ AVERAGE
 - ☐ BIAS POL
 - ☐ DC RNG
 - ☐ DC LEV
 - ☐ DCI ISO
 - ☐ VDC MON
 - ☐ IDC MON
 - ☐ 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 TABLE SETUP> page
 - ☐ PARAM (swap parameter)
 - ☐ NOM
 - ☐ 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, TH2839 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.

TH2839 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) Roll the knob 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 name and then press the [ENTER] to search the target file.
- 4) Input the number and press [ENTER] to jump directly to the page.

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**
 - **SAVE**
 - **DEL**
 - **COPY TO E:**
 - **FIND**
 - **EXT**
- 3) In the file list, move the cursor to the file-saved position or input the file number directly.
- 4) Press **SAVE**, 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 “☺ : Input LCR file name: ” will displayed
- 7) Use numeric keys to input the current file name and press [ENTER]. Then TH2839 will save the control and setting parameters as a file in this name.

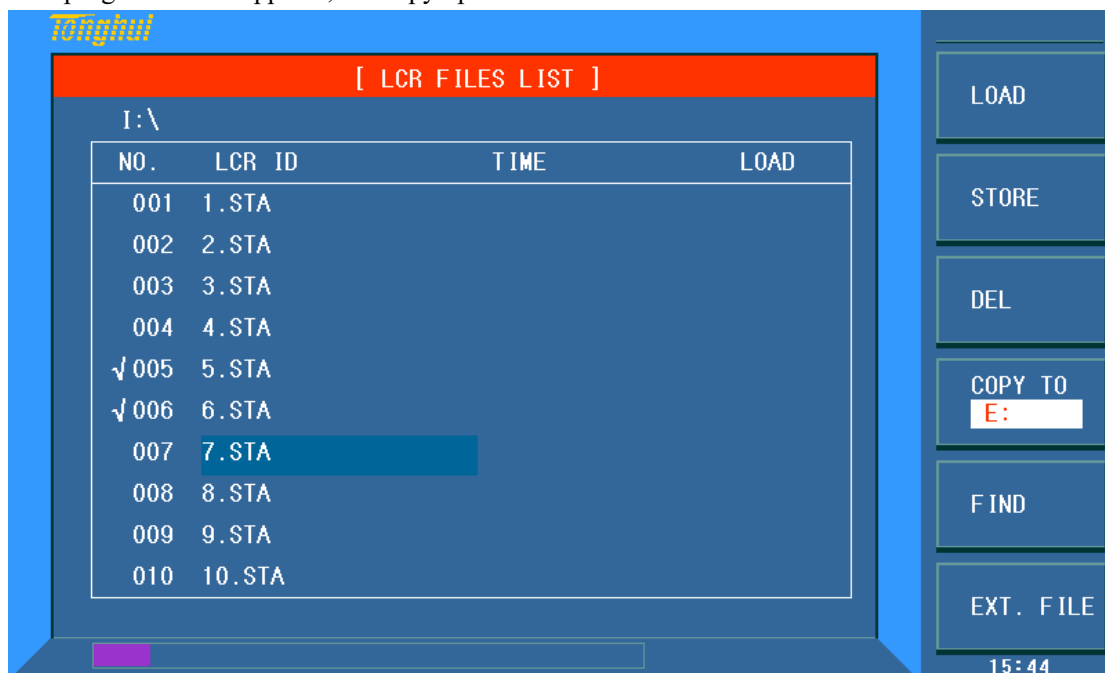
C. Load the control and setting parameters from a file by the following steps

- 1) Press File Manage, the file list and the following soft keys will be displayed.
 - **LOAD**
 - **SAVE**
 - **DEL**
 - **COPY to E:**
 - **FIND**
 - **EXT**
- 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 TH2839 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 storage.

- 2) Press **FILE MANAGE**, the file list and the following soft keys will be displayed.
 - **LOAD**
 - **SAVE**
 - **DEL**
 - **COPY to E:**
 - **FIND**
 - **EXT**
- 3) Move the cursor the file to be copied and press [ENTER] to confirm.
- 4) Press **COPY to E:** to copy the file the instrument.
- 5) When copying the files, the progress bar will prompt the replication schedule. When the progress bar disappears, the copy operation 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** and **MEAS OPEN** will be displayed in the soft key zone.
- c) Keep the test fixture be in the open status, 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 (TH26010) to the test fixture.
- f) Move the cursor to the **SHORT** zone. **ON**, **OFF** and **MEAS SHORT** 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 5.5kHz,

- 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** and **MEAS 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** and **MEAS 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 on the load correction function.
 - h) Move the cursor to the **SPOT No.** zone to select the calibration 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] [.] [5], +5.5 will be displayed in the prompt information zone 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 5.5000kHz (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 (TH26010) 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, 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

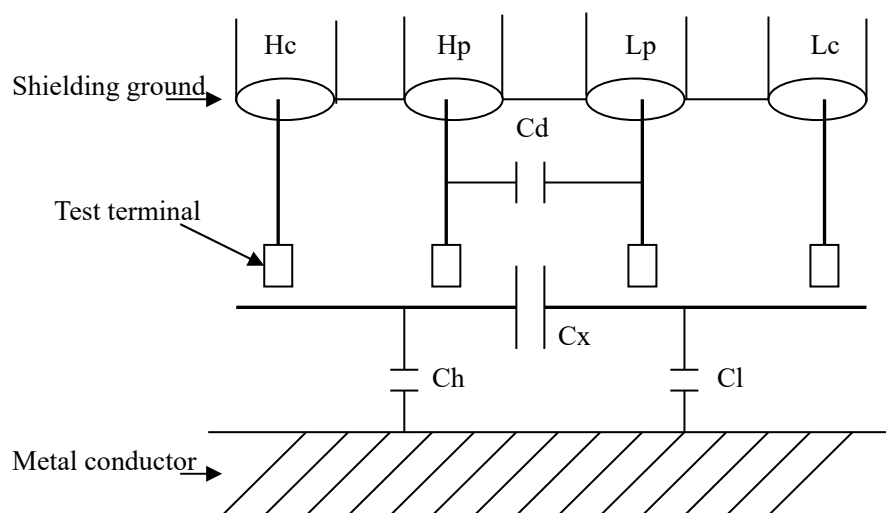


Figure 5-1 Influence of stray capacitance

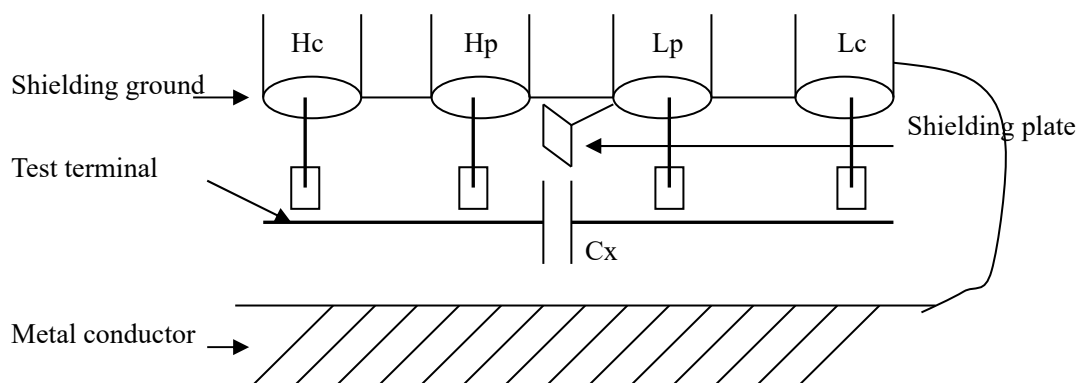


Figure 5-2 Eliminate the influence of stray capacitance

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, C_d can be reduced to Min. Meanwhile if the ground terminal is connected to the conductance plate, the influence of C_h and C_l will be eliminated.

When the DUT is low impedance (such as small inductance, large capacitance), a large current will flow through test leads H_c and L_c . 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 4 terminal-pair (4TP) connection, the currents flow through H_c and L_c are equal in value and opposite in direction with those flowing through each shielding terminals (the current reflow from H_c to shielding layer). 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 TH2839

Test Condition

Function: Ls-Q

Frequency: 5.5kHz

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) Use the knob to 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], +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 5.5000kHz.
 - 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 [ENTER], the level will be changed as 1.5V.
 - i) Press [SETUP] to enter into the <MEAS SETUP> page.
- 3) Connect the test fixture (TH26005) to the test terminals of TH2839.
- 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 (trigger the beeper: HIGH or LOW)

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 SWEEP SETUP to enter into the <SWEEP SETUP> page.
 - e) Move the cursor to the **SWEEP PARAM** zone. Then this zone will be displayed as **FREQ[Hz]**.
 - f) Use the knob to 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 1.0000k.
 - 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**. 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**. 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 [\rightarrow] 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**. Press **[ENTER]**, this zone will be changed as 100.000 μ 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**. Press **ENTER**, this zone will be changed as 300.000 μ 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 (TH26005) to the test terminals of TH2839.
- 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 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.
- 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

TH2839 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 $\text{tg}\delta < 0.15\%$.

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, 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.

Return to the MEAS DISP page after setup.

5.7 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 SETUP**, **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**.
- 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**.
- 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 **LOAD**.
- l) Press **ON** to turn on the point-frequency correction function of the **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 **SPOT No.** to select the calibration point.
- q) Move the cursor to **FREQ**. The following soft keys will be displayed: ON, OFF, MEAS OPEN, MEAS SHORT and LOAD.
- r) Hold the test fixture be in open status and keep user's hands or other interference source be far away from the test fixture. Press the soft key MEAS OPEN to execute open correction.
- s) Insert the short plate (TH26010) into the test fixture. Please ensure that the short plate and the reeds of the test fixture have good contact.
- t) Press the soft key MEAS SHORT to execute short correction.
- u) 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.
- v) Press the soft key LOAD to execute load correction.

2) Note

- a) Because of the different software editions, the soft keys and status information may be different from 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, R _S , R _P , G, R _{dc}	X	B

There is no combination for DCR.

Mathematical operation

Operation between the measurement value and the programmable nominal value: absolute deviation Δ ABS and percent deviation $\Delta\%$.

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

TH2839 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 \geq 10kHz)

Fast: about 130 times/s (7.7ms/time)

Medium: about 11 times/s (92ms/time)

Slow: about 4 times/s (230ms/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

6.2 Test signal

6.2.1 Test signal frequency

Test signal is sine wave, accuracy: 0.01%

Frequency range:

20Hz~5MHz (TH2839A)

20Hz~10MHz (TH2839)

Min. resolution: 0.01Hz

6.2.2 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.

6.2.3 Test signal level

	Mode	Range	Accuracy	Resolution
Voltage	Normal constant level	5mV _{RMS} —2V _{RMS} 10mV _{RMS} —1V _{RMS}	± (10%×preset value+2mV) ± (6%×preset value+2mV)	100μV
Current	Normal constant current	50μA _{RMS} —20mA _{RMS} 100μA _{RMS} —10mA _{RMS}	± (10%×preset value+ 10μA _{RMS}) ± (6%×preset value+ 10μA _{RMS})	1μA

6.2.4 Output impedance

100Ω ±2%

6.2.5 Monitor for test signal level

Mode	Range	Frequency	Accuracy
Voltage	5mV _{RMS} —2V _{RMS}	≤1MHz	± (5%×reading+0.5V _{rms})
	5mV _{RMS} —1V _{RMS}	>1MHz	± (10%×reading+0.5mV)
Current	50μA _{RMS} —20mA _{RMS}	≤1MHz	± (5%×reading+5μA)
	50μA _{RMS} —10mA _{RMS}	>1MHz	± (10%×reading+5μA)

6.2.6 Maximum measurement display range

Parameter	Measurement display range
L、Lk	0.00001μH ~ 99.9999kH
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

6.2.7 DC bias voltage source

0V— ± 40V Minimum resolution: 0.5mV, Accuracy: 1% x preset voltage+5mV
0mA—± 100mA Minimum resolution: 5μA, Accuracy: 5% x preset voltage+50μA

6.3 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, 2m, 4m
- 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

6.3.1 $|Z|, |Y|, L, C, R, X, G, B$ accuracies

The accuracy A_e of $|Z|, |Y|, L, C, R, X, G$ and B are expressed as:

$$A_e = \pm[A + (K_a + K_{aa} + K_b \times K_{bb} + K_c) \times 100 + K_d] \times K_e \quad [\%]$$

K_a : impedance rate factor (table A)

K_{aa} : cable length factor (table B)

K_b : impedance rate factor (table A)

K_{bb} : cable length factor (table C)

K_c : calibrated interpolating factor (table D)

K_d : cable length factor (table F)

K_e : temperature factor (table G)

Using condition of L, C, X, B accuracy A_e : D_x (test value of D) ≤ 0.1

Using condition of R, G accuracy A_e : Q_x (test value of Q) ≤ 0.1

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

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

Accuracy of G can only be used when in $G-B$ measurement combination.

6.3.2 D accuracy

The accuracy of D is given by the formula below:

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

The formula is only available when $D_x \leq 0.1$.

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

6.3.3 Q accuracy

The accuracy of Q is given by the formula below:

$$Q_e = \pm \frac{Q_x^2 \times D_e}{1 \mp Q_x \times D_e}$$

Where, Q_x is the value of the tested Q.

D_e is the accuracy of D

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

6.3.4 θ accuracy

The accuracy of θ is given by the formula below:

$$\theta_e = \frac{180}{\pi} \times \frac{A_e}{100} \quad [\text{deg}]$$

$$\theta_e = \frac{A_e}{100} \quad [\text{rad}]$$

6.3.5 G accuracy

When D_x (tested value of D) ≤ 0.1

The accuracy of G is given by the formula below:

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

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

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 above G accuracy is only used in the Cp-G and Lp-G measurement combinations.

6.3.6 R_p accuracy

when D_x (value of tested D) ≤ 0.1

The accuracy of R_p is given by the formula below:

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

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.

6.3.7 Rs accuracy

when D_x (value of tested D) ≤ 0.1

The accuracy of R_s is given by the formula below:

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

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

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.

6.3.8 Accuracy factor

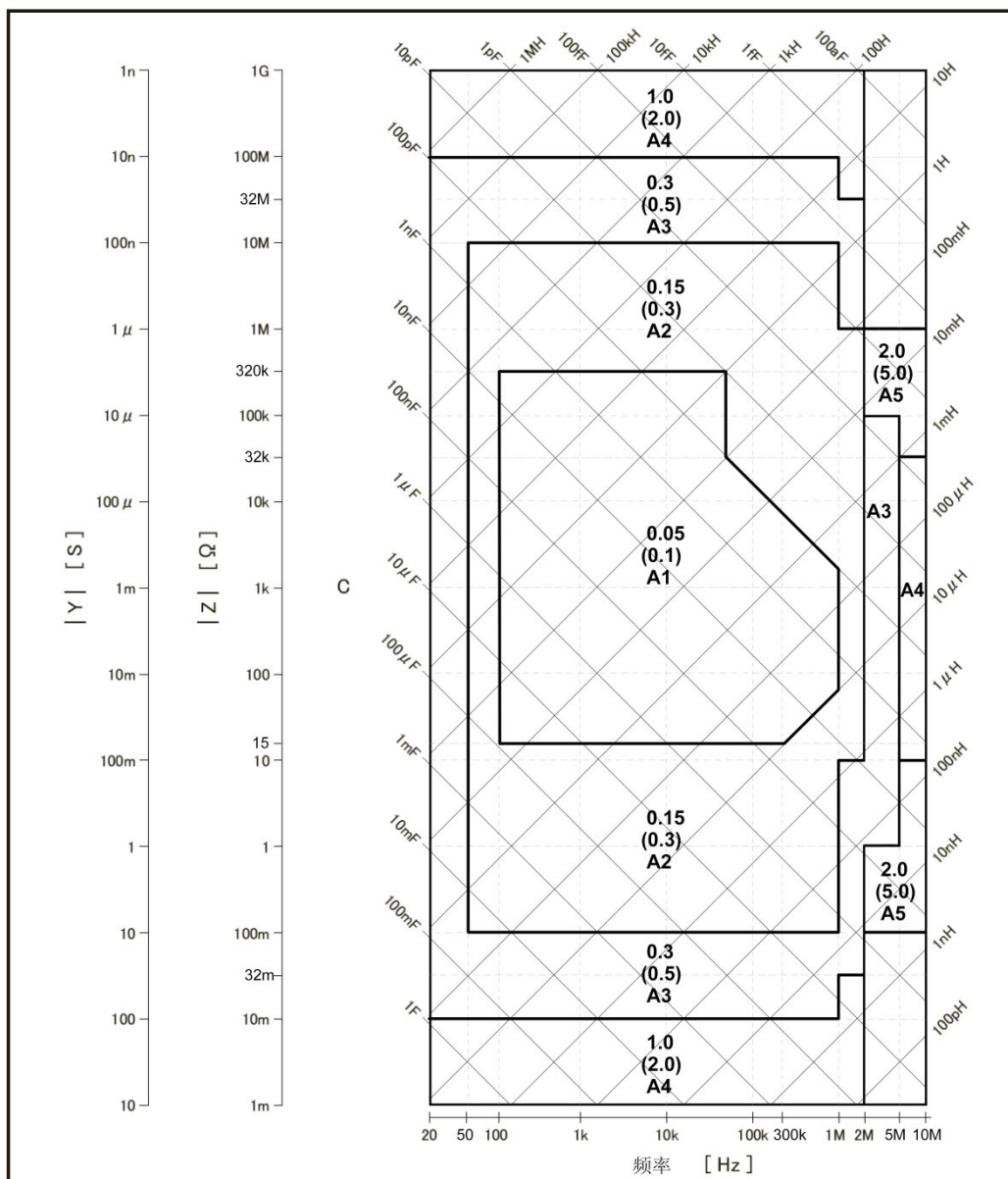


Figure 6-3 Basic accuracy A (one of two)

In figure 6-3, 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 $0.3V_{rms} \leq V_s \leq 1V_{rms}$, the test speed is the value A of medium, slow.

0.1---When $0.3V_{rms} \leq V_s \leq 1V_{rms}$, the test speed is the value A of fast.

A1---When $V_s < 0.3V_{rms}$ or $V_s > 1V_{rms}$, use the corresponding value A1, A2, A3 and A4 in figure 6-4.

Here, V_s is the test signal voltage.

The following table lists the value A for different test voltages at fast, medium and slow speeds. Use Figure 6-4 to find the value of Alt when Alt is not specified.

Test Signal Voltage						
	5m	15m	0.1	0.15	1.5	2[Vrms]
中速/ 慢速	A1=A1t A2=A1t* A3=A1t A4=2.0	A1=A1t A2=A1t* A3=0.3 A4=1.5	A1=A1t A2=0.15 A3=0.3 A4=1.0	A1=A1t A2=0.15 A3=0.3 A4=1.0	A1=A1t A2=0.15 A3=0.3 A4=1.0	A1=A1t A2=0.15 A3=0.3 A4=1.0
	A1=A1t A2=A1t A3=A1t A4=5.0	A1=A1t A2=A1t A3=0.5 A4=3.0	A1=A1t A2=0.3 A3=0.5 A4=2.0		A1=A1t A2=0.3 A3=0.5 A4=2.0	
	5m	33m	0.1	0.15		2[Vrms]

Note *: When $100\text{Hz} \leq f_m < 300\text{Hz}$, the value of A is equal to the value in the above table multiplied by 2.

When $f_m < 100\text{Hz}$, the value of A is equal to the value in the above table multiplied by 2.5.

**: A value is added to 0.15 when all the following measurement conditions are met.

Test frequency: $100\text{Hz} < f_m \leq 10\text{MHz}$

Test signal voltage: $5\text{Vrms} < V_s \leq 2\text{Vrms}$

DUT: Inductor, $|Z_m| < 200\Omega$ ($|Z_m|$: DUT Impedance)

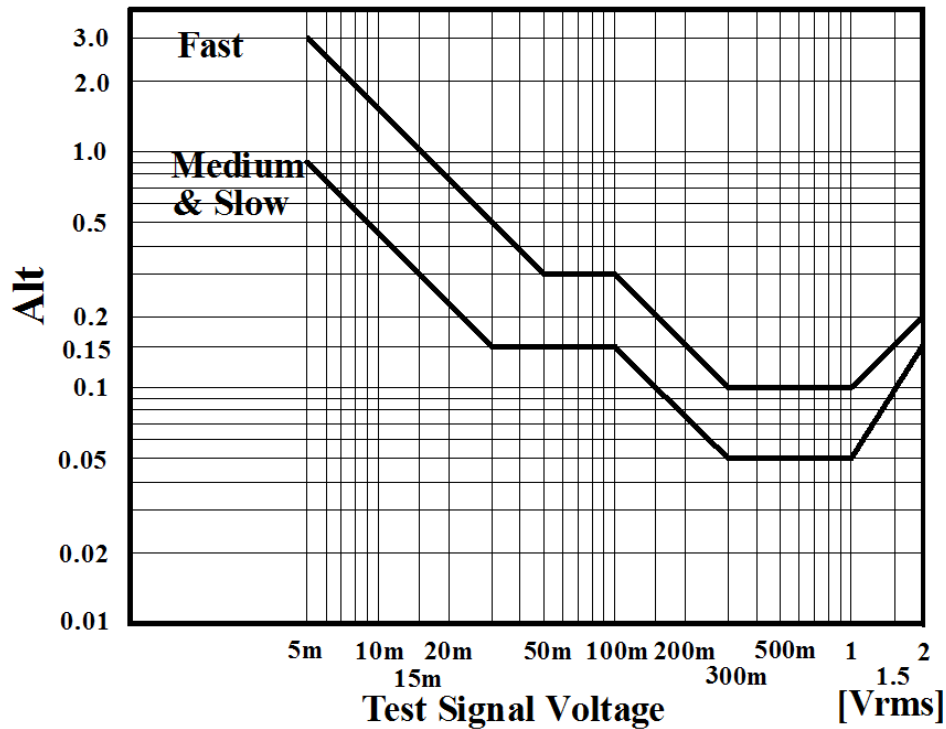


Figure 6-4 Basic accuracy of A (two of two)

K_a and K_b are respectively low impedance and high impedance increase factors. When the impedance is greater than 500Ω , K_a can be ignored; when the impedance is less than 500Ω , K_b can be ignored.

Table A Impedance rate factors: K_a , K_b

Speed	Frequency	K_a	K_b
Medium Slow	$f_m < 100\text{Hz}$	$(\frac{1 \times 10^{-3}}{ Z_m })(1 + \frac{200}{V_s})(1 + \sqrt{\frac{100}{f_m}})$	$ Z_m (1 \times 10^{-9})(1 + \frac{70}{V_s})(1 + \sqrt{\frac{100}{f_m}})$
	$100\text{Hz} \leq f_m \leq 100\text{kHz}$	$(\frac{1 \times 10^{-3}}{ Z_m })(1 + \frac{200}{V_s})$	$ Z_m (1 \times 10^{-9})(1 + \frac{70}{V_s})$
	$100\text{kHz} < f_m \leq 300\text{kHz}$	$(\frac{1 \times 10^{-3}}{ Z_m })(2 + \frac{200}{V_s})$	$ Z_m (3 \times 10^{-9})(1 + \frac{70}{V_s})$
	$300\text{kHz} < f_m \leq 10\text{MHz}$	$(\frac{1 \times 10^{-3}}{ Z_m })(3 + \frac{200}{V_s} + \frac{V_s^2}{10^8})$	$ Z_m (10 \times 10^{-9})(1 + \frac{70}{V_s})$
Fast	$f_m < 100\text{Hz}$	$(\frac{2.5 \times 10^{-3}}{ Z_m })(1 + \frac{400}{V_s})(1 + \sqrt{\frac{100}{f_m}})$	$ Z_m (2 \times 10^{-9})(1 + \frac{100}{V_s})(1 + \sqrt{\frac{100}{f_m}})$
	$100\text{Hz} \leq f_m \leq 100\text{kHz}$	$(\frac{2.5 \times 10^{-3}}{ Z_m })(1 + \frac{400}{V_s})$	$ Z_m (2 \times 10^{-9})(1 + \frac{100}{V_s})$
	$100\text{kHz} < f_m \leq 300\text{kHz}$	$(\frac{2.5 \times 10^{-3}}{ Z_m })(2 + \frac{400}{V_s})$	$ Z_m (6 \times 10^{-9})(1 + \frac{100}{V_s})$
	$300\text{kHz} < f_m \leq 10\text{MHz}$	$(\frac{2.5 \times 10^{-3}}{ Z_m })(3 + \frac{400}{V_s} + \frac{V_s^2}{10^8})$	$ Z_m (20 \times 10^{-9})(1 + \frac{100}{V_s})$
f_m : test frequency [Hz] $ Z_m $: impedance of DUT [Ω] V_s : test signal voltage [mV _{rms}]			

When the impedance is larger than 500 Ω , K_{aa} can be ignored.

Table B Cable length factor K_{aa}

Test signal voltage	Cable length			
	0m	1m	2m	4m
$\leq 2V_{rms}$	0	0	$Ka/2$	Ka
$> 2V_{rms}$	0	$\frac{2 \times 10^{-3} \times f_m^2}{ Z_m }$	$\frac{(1 + 5 \times f_m^2) \times 10^{-3}}{ Z_m }$	$\frac{(2 + 10 \times f_m^2) \times 10^{-3}}{ Z_m }$
f_m : test frequency [Hz] $ Z_m $: impedance of DUT [Ω] K_a : Impedance rate factor				

Table C Cable length factor K_{bb}

Test signal voltage	Cable length			
	0m	1m	2m	4m
$f_m \leq 100\text{kHz}$	1	$1+5 \times f_m$	$1+10 \times f_m$	$1+20 \times f_m$
$100\text{kHz} < f_m \leq 300\text{kHz}$	1	$1+2 \times f_m$	$1+4 \times f_m$	$1+8 \times f_m$
$300\text{kHz} < f_m \leq 10\text{MHz}$	1	$1+0.5 \times f_m$	$1+1 \times f_m$	$1+2 \times f_m$
f_m : test frequency [MHz]				

Table D Calibrated interpolating factor K_c

Test frequency	K_c
Direct calibrated frequency (listed in Table E)	0
Other frequency	0.0003

Table E 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	250	300	400	500	600	800	[kHz]
1	1.2	1.5	2	2.5	3	3.5	4	4.5	5	[MHz]
5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	[MHz]

There are 67 frequencies in Table E. The highest frequency of TH2839A is 5MHz (total 57 frequencies), the highest frequency of TH2839 is 10MHz(total 67 frequencies).

Table F Cable length factor K_d

Test signal level	Cable length		
	1m	2m	4m
$\leq 2V_{rms}$	$2.5 \times 10^{-4} (1+50 \times f_m)$	$5 \times 10^{-4} (1+50 \times f_m)$	$1 \times 10^{-3} (1+50 \times f_m)$
f_m : test frequency [MHz]			

Table G Temperature factor K_e

Temperature (°C)	5		8		18		28		38	
K _e	6	4	2	1	2	1	2	1	2	4

6.3.9 DCR accuracy

$$A(1+R_x/5M\Omega+16m\Omega/R_x)[\%] \pm 0.2m\Omega$$

When the instrument is in Middle and slow speed, $A=0.25$

In Fast speed, $A=0.5$

Where, R_x is the tested resistance.

6.3.10 Test time

Test time (ms) (DC BIAS is OFF)

	Test speed	Test frequency						
		20Hz	100Hz	1kHz	10kHz	100kHz	1MHz	10MHz
1	Fast	380	100	20	7.7	5.7	5.6	5.6
2	Medium	380	180	110	92	89	88	88
3	Slow	480	300	240	230	220	220	220

6.4 Safety requirement

The instrument is the I class safety instrument.

6.4.1 Insulation resistance

Under reference working condition, the insulation resistance between power terminal and instrument jacket should not be smaller than $50M\Omega$.

Under humidity condition, the insulation resistance between voltage terminal and instrument jacket should not be smaller than $2M\Omega$.

6.4.2 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.

6.4.3 Leakage current

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

6.5 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.

6.6 Performance test

6.6.1 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.

6.6.2 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

6.6.3 Function check

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

6.6.4 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.

6.6.5 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, 200kHz, 300kHz, 1MHz and 2MHz. The reading of frequency meter should meet the demand of the test signal frequency in this chapter.

6.6.6 Measurement accuracy

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

6.6.7 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, 0.1μF, 1μF 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.

6.6.8 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: 100 μ H, 1mH, 10mH, 100mH and change the frequency. The error between reading and nominal value should be in the range ruled in this chapter.

6.6.9 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: 10 Ω , 100 Ω , 1k Ω , 10k Ω , 100k Ω and change the frequency. The error between reading and nominal value should be in the range ruled in this chapter.

6.6.10 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: 0.1 Ω , 1 Ω , 10 Ω , 100 Ω , 1k Ω , 10k Ω , 100k Ω . 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 return character, integer 10

^END: EOI signal in IEEE-488

7.1 Subsystem commands for TH2839

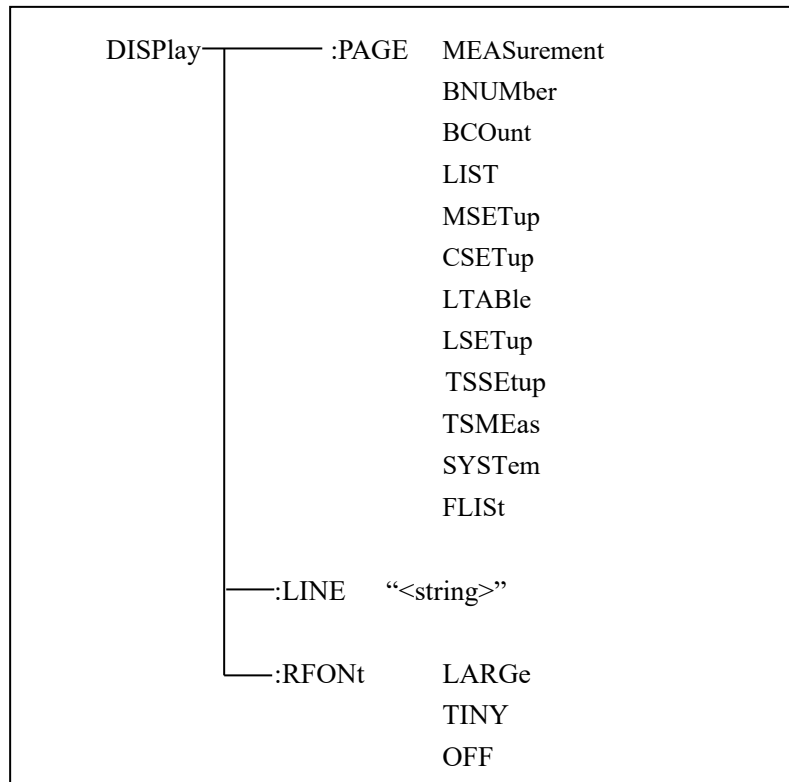
- DISPlay
- ORESister
- TRIGger
- CORRection
- FREQuency
- BIAS
- INITiate
- COMParator
- VOLTage
- FUNCTion
- FETCh?
- Mass MEMory
- CURRent
- LIST
- ABORT

7.1.1 DISPlay subsystem commands

DISPlay 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.
TSSEtup	Set the display page as the trace sweep setup.
TSMEas	Set the display page as the trace sweep display.
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 DISP>	The current page is the LCR measurement display page.
<BIN No. DISP>	The current page is the bin number display page.
<BIN COUNT DISP>	The current page is the bin count display page.
<LIST SWEEP DISP>	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.
<TRACE SWEEP SETUP>	The current page is the trace sweep setup page.
<TRACE SWEEP>	The current page is the trace sweep display 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

 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: <NL^END>

 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:

$$\text{FREQuency} \left\{ \begin{array}{l} \text{<value>} \\ \text{MIN} \\ \text{MAX} \end{array} \right.$$

Where,

<value> NR1, NR2 or NR3 data format followed by Hz, kHz, MHz.

MIN Set the measurement frequency as 20Hz.

MAX Set the measurement frequency as 10MHz (The maximum frequency of TH2839 is 10MHz, the maximum frequency of TH2839A is 5MHz)

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:

$$\text{VOLTage} \left\{ \begin{array}{l} \text{<value>} \\ \text{MIN} \\ \text{MAX} \end{array} \right.$$

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:

$$\text{CURRent} \left\{ \begin{array}{l} \text{<value>} \\ \text{MIN} \\ \text{MAX} \end{array} \right.$$

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 :AMPLitude:ALC? query returns the current status of the ALC function.

Command systax:

AMPLitude:ALC $\left\{ \begin{array}{l} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right.$

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>

7.1.6 OUTPut subsystem commands

The OUTPut subsystem commands are mainly used to set the instrument DC isolation function switch.

The OUTPut:DC:ISOLation command is used to set the DC isolation function of the 500mA/5V DC bias source as ON or OFF. The OUTPut:DC:ISOLation? query returns the current status of the DC isolation function.

Command systax:

OUTPut:DC:ISOLation $\left\{ \begin{array}{l} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right.$

Where,

Character 1 (49) is equal to ON.

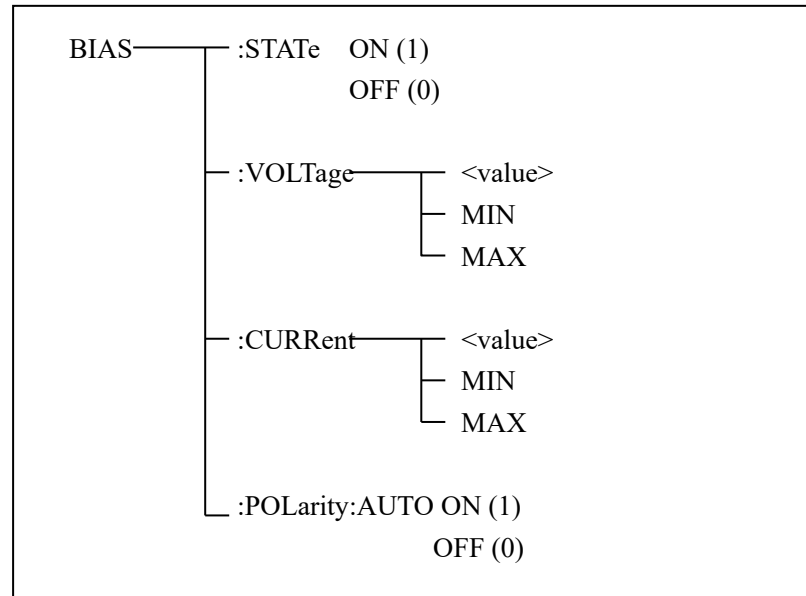
Character 0 (48) is equal to OFF.

Query syntax: OUTPut:DC:ISOLation?

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. 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 -40V.

MAX Set the bias voltage as 40V.

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.

Command syntax:

$$\text{BIAS:CURREnt} \left\{ \begin{array}{l} \text{<value>} \\ \text{MIN} \\ \text{MAX} \end{array} \right.$$

Where,

<value> NR1, NR2 or NR3 data format

MIN Set the bias current as -100mA.

MAX Set the bias current as 100mA.

For example: WrtCmd (“BIAS:CURREnt MIN”) Set the DC bias current as 0A.

Query syntax: BIAS:CURREnt?

Return format: <NR3><NL^END>

The BIAS:POLarity command is used to set the signal polarity of bias current.

Command syntax:

$$\text{BIAS:POLarity:AUTO} \left\{ \begin{array}{l} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right.$$

Where,

Character 1 (49) is equal to ON (correspond to AUTO).

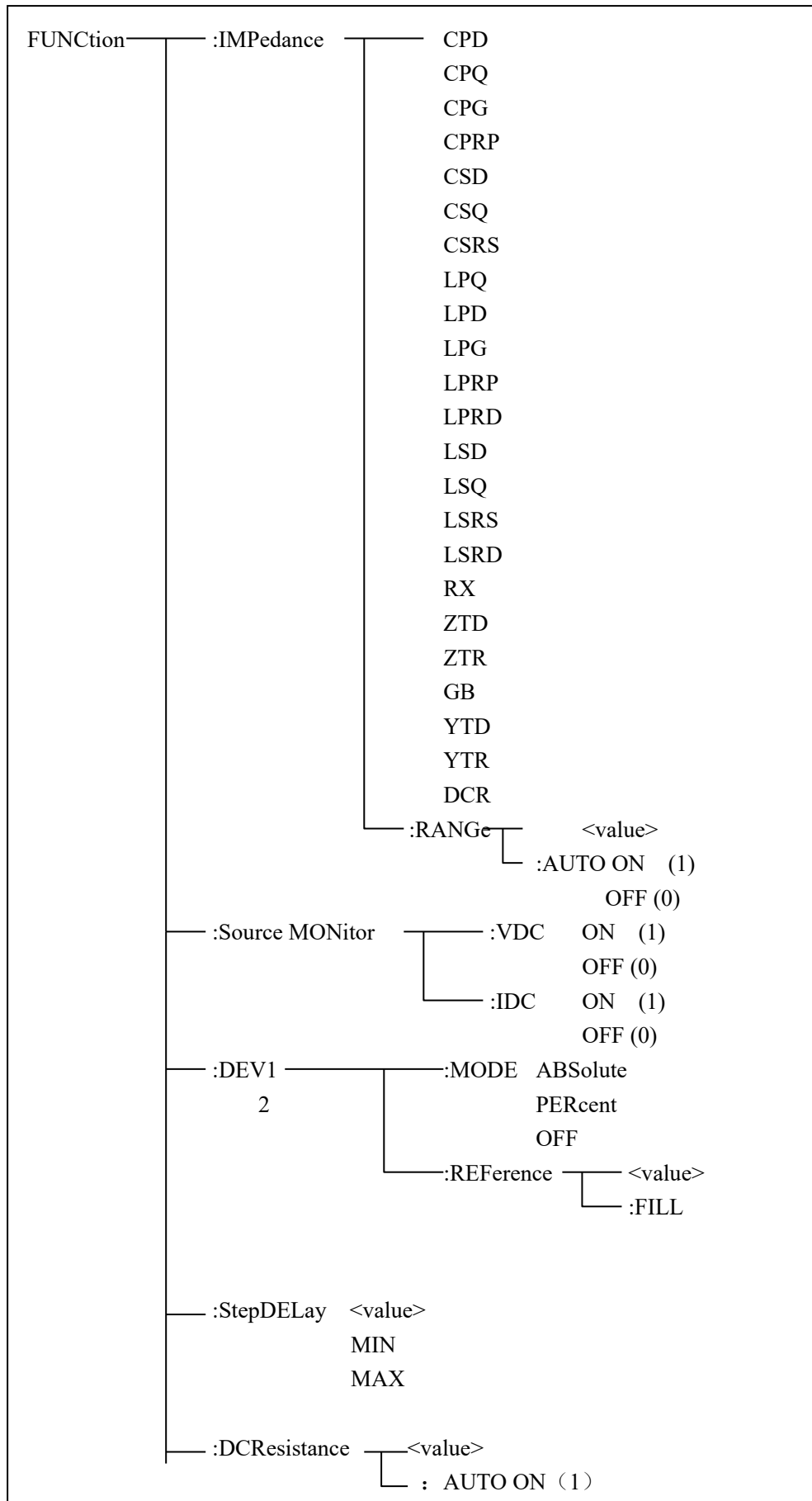
Character 0 (48) is equal to OFF (correspond to FIX).

For example: WrtCmd (“BIAS:POL:AUTO 1”) Set the DC bias polarity as AUTO.

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:



OFF (0)

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- θ_r
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- θ_r
LPRD	Set the function as Lp-Rd	RPQ	Set the function as Rp-Q
LSRD	Set the function as Lp-Rd	RSQ	Set the function as Rs-Q
DCR	Set the function as DXR		

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

0.1	1	10	20	50	100
200	500	1000	2000	5000	
10000	20000	50000	100000		

Note: TH2839 and TH2839A have the other 14 ranges that do not include 0.1. Different frequency will have different range selection.

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:DCResistance:RANGe command is used to set the range of the instrument. The FUNCTION: DCResistance:RANGe? query returns the current range parameter.

Command syntax: FUNCTION:DCResistance: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:DCR:RANG 1KOHM") Set the DCR range as 1kOHM.

Query syntax: FUNCTION:DCR:RANGe?

Return format: <value><NL^END>

Where, <value> can be

10	20	50	100	
200	500	1000	2000	5000
10000	20000	50000	100000	

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

Command syntax:

FUNCTION:DCResistance: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:DCR:RANG:AUTO ON") Set the automatic DCR range as ON.

Query syntax: FUNCTION:DCRe:RANGe:AUTO?

Return format: <NR1><NL^END>

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

FUNCTION:SMONitor:VDC $\left\{ \begin{array}{l} \text{ON (1)} \\ \text{OFF (0)} \end{array} \right.$

Where,

Character 1 (49) is equal to ON.

Character 0 (48) is equal to OFF.

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

Query syntax: FUNCTION:SMONitor:VDC?

Return format: <NR1><NL^END>

The FUNCTION:SMONitor:IAC command is used to set the current monitor as ON or OFF. The FUNCTION:SMONitor:IAC? query returns the current monitor status.

Command syntax:

FUNCTION:SMONitor:IAC $\left\{ \begin{array}{l} \text{ON (1)} \\ \text{OFF (0)} \end{array} \right.$

Where,

Character 1 (49) is equal to ON.

Character 0 (48) is equal to OFF.

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

Query syntax: FUNCTION:SMONitor:IAC?

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 $\left\{ \begin{array}{l} \text{ABSolute} \\ \text{PERCent} \\ \text{OFF} \end{array} \right.$

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 } <NL^END>
OFF }

The FUNCtion:DEV<n>:REFerence<value> command is used to set the nominal value of the deviation. The FUNCtion:DEV<n>:REFerence<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: <NR1><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>:REFerence:FILL

Where,

Character 1 (49) or haracter 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 of the instrument, The FUNCtion:StepDELay? query returns the current step delay time parameter.

Command syntax:

StepDELay { <value>
MIN
MAX

Where,

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

MIN Set the step delay parameter as 0s.

MAX Set the step delay parameter as 60s.

For example: WrtCmd("FUNC:SDEL 5S") Set the step delay parameter as 5s.

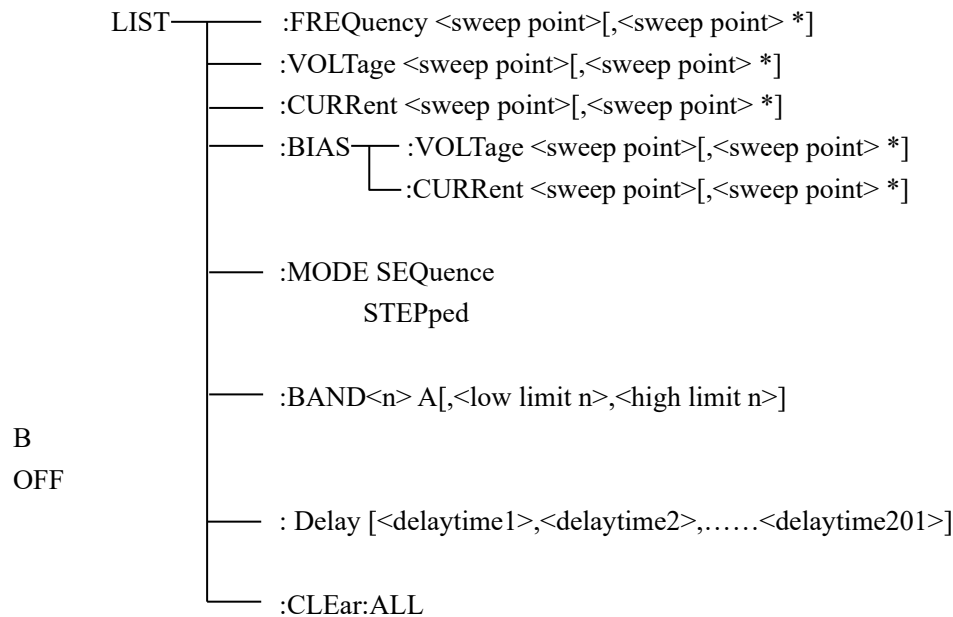
Query syntax: FUNC:SDEL?

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-5MHZ(TH2839A),

20HZ-10MHZ(TH2839),

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 (2E6 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>

<value> should be set from 5mV 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:CURREnt 100mA") Set the measurement current of the sweep point 1 as 100mA.

WrtCmd ("LIST:CURREnt 1E-2, 2E-2, 3E-3, 4E-3") 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 50μA to 100mA, 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: TH2839 instrument has installed a 40V/100mA internal DC bias current source. If 1A DC source is required, please install an external source. The instrument can be used with TH1778 DC Bias Source (providing DC current from 0 to 20A, supporting 120A at most and you can purchase from our company).

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 $\left\{ \begin{array}{l} \text{SEquence} \\ \text{STEPped} \end{array} \right\}$

Where,

SEquence means sequential mode.

STEPped means single step mode.

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

Query syntax: LIST:MODE?

Return format:

$\left\{ \begin{array}{l} \text{SEQ} \\ \text{STEP} \end{array} \right\} <NL^END>$

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:DElay command is used to set the delay time of the list sweep.

Command syntax:

LIST:Delay [<delaytime1>,<delaytime2>,...,<delaytime201>]

Where,

<delaytime n> is the delay time value of each point with unit s and ms, defaults to s when not writing.

For example: WrtCmd("LIST:DEL 1,1"); The first and second step delay time is 1s.

Query syntax: LIST:DEL?

Return Format: <delaytime1>,<delaytime2>,...,<delaytime201>

The LIST:CLear:ALL command is used to clear the setup data of all the sweeping points.

Query syntax: LIST:CLear:ALL

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 $\left\{ \begin{array}{l} \text{FAST} \\ \text{MEDium} \\ \text{SLOW} \end{array} \right\} [,<\text{value}>]$

Where,

FAST: 130 times/sec

MEDium: 11 times/sec

SLOW: 4 times/sec

<value> 1 to 255 in NR1

For example: WrtCmd (“APER MED, 55”)

Query syntax: APERture?

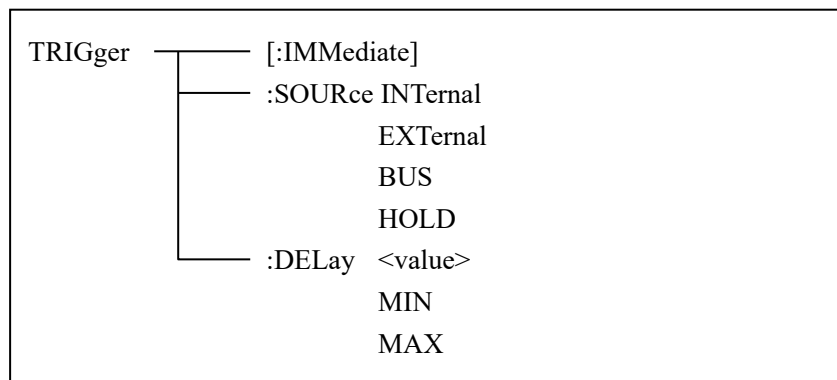
Return format:

$$\left\{ \begin{array}{c} \text{FAST} \\ \text{MED} \\ \text{SLOW} \end{array} \right\}, <\text{NR1}><\text{NL}^{\wedge}\text{END}>$$

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:

$$\text{TRIGger:SOURce} \left\{ \begin{array}{c} \text{INTernal} \\ \text{EXTternal} \\ \text{BUS} \\ \text{HOLD} \end{array} \right.$$

Where,

INTernal The default trigger mode.

EXTternal 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:

$$\left\{ \begin{array}{c} \text{INT} \\ \text{EXT} \\ \text{BUS} \\ \text{HOLD} \end{array} \right\} \langle \text{NL}^{\wedge} \text{END} \rangle$$

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

Command syntax:

$$\text{TRIGger:DELaY} \left\{ \begin{array}{c} \langle \text{value} \rangle \\ \text{MIN} \\ \text{MAX} \end{array} \right.$$

Where,

$\langle \text{value} \rangle$ 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: $\langle \text{NR3} \rangle \langle \text{NL}^{\wedge} \text{END} \rangle$

7.1.12 FETCh? subsystem commands

The FETCh? subsystem commands are mainly used to direct TH2839 to input a measurement result.

Command tree:



The FETCh[:IMP]? query directs TH2839 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?”)

TH2839 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.NNNNNNESNN	,	SN.NNNNNNESNN	,	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.NNNNNNESNN

(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 9.9E37. 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.

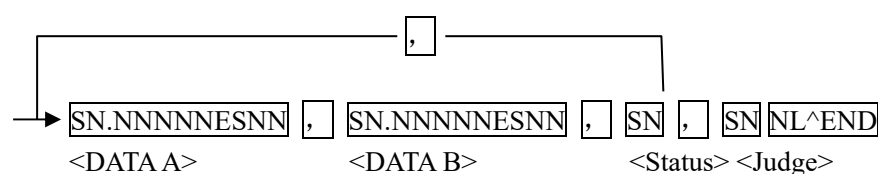


Figure 6 ASCII format 2 (list sweep)

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

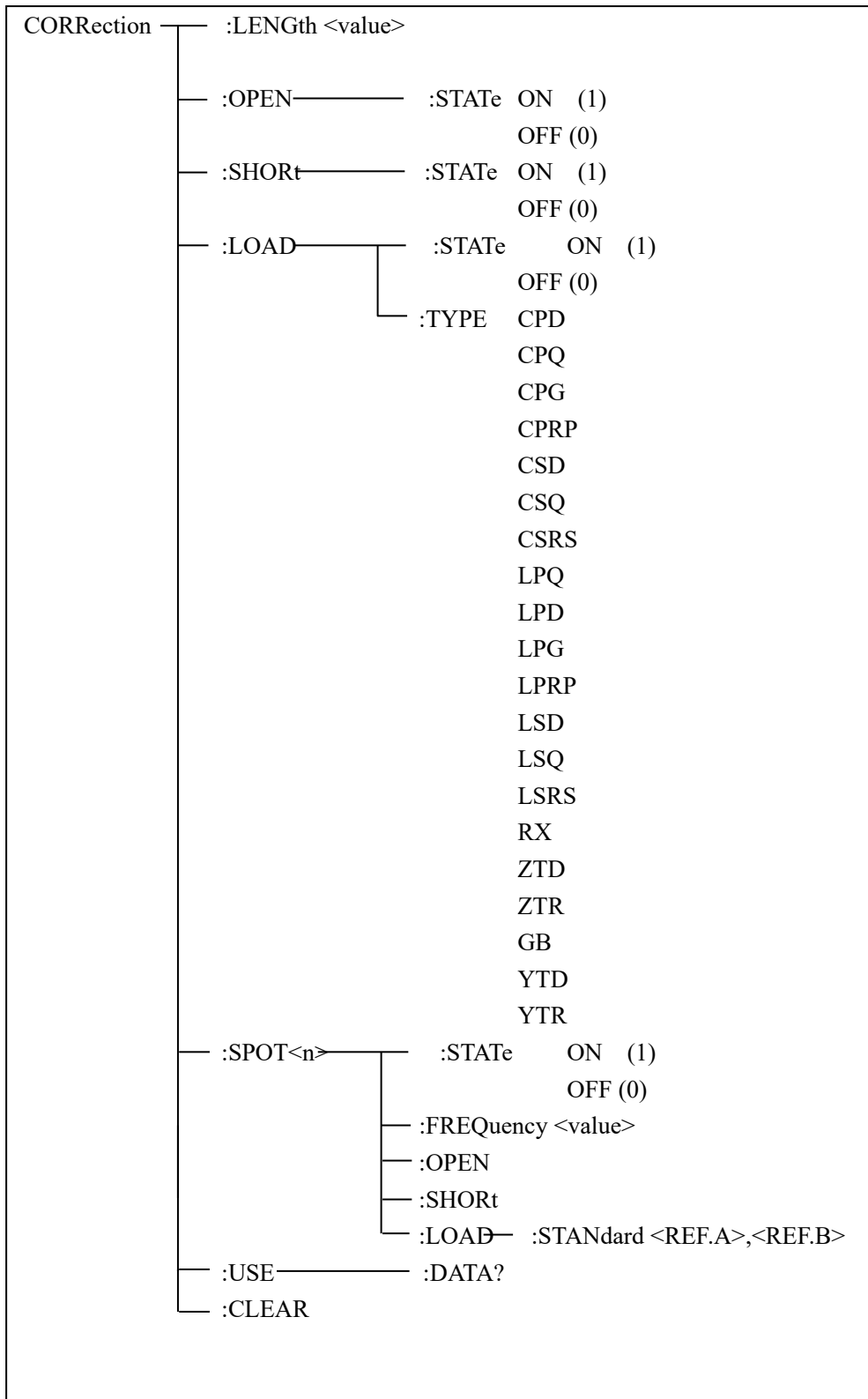
When the compare function of the list sweep measurement is turned off, the output result of <Input/Output> is 0.

<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:



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.

Query syntax: CORRection:LENGth?

Return format: <NR1><NL^END>

The CORRection:OPEN command is used to execute open correction for 51 preset test points (TH2839 has 51 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 CORRection: OPEN:STATe? query returns the current open correction status.

Command syntax:

CORRection:OPEN:STATe $\left\{ \begin{array}{c} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right\}$

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 51 preset test points (TH2839 has 51 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 $\left\{ \begin{array}{c} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right\}$

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 CORRection: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 $\left\{ \begin{array}{c} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right\}$

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

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 state of some specific frequency spots. The CORRection:SPOT<n>:STATe query returns the state of current calibration point.

Command syntax:

CORRection:SPOT<n>:STATe $\left\{ \begin{array}{c} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right\}$

Where,

1 (decimal 49) is equal to ON.

0 (decimal 48) is equal to OFF.

<n>:

Frequency spot 1~201.

For example: WrtCmd (“CORR:SPOT1:STAT ON”)

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

Return format: <NR1><NL^END>

The CORRection:SPOT<n>:FREQuency command is used to set the frequencies of frequency spots1, 2...201. The CORRection:SPOT<n> query returns the current frequency of specific frequency spot.

Command syntax: CORRection:SPOT<n>:FREQuency<value>

Where,

<value> can be NR1, NR2 or NR3 data format followed by HZ, kHz and MHz.

<n>:

Frequency spot 1~201

For example: WrtCmd (“CORR:SPOT1:FREQ 2KHZ”) Set the frequency of frequency spot 1 as 2kHz.

NOTE: <value> should be ranged from 20HZ to 10MHZ (TH2839), 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 frequency spots.

Command syntax: CORRection:SPOT<n>:OPEN

Where,

<n>:

Frequency spot 1~201

For example: WrtCmd (“CORR:SPOT1:OPEN”) Execute open correction for frequency spot 1.

The CORRection:SPOT<n>:SHORT command is used to execute short correction for specific frequency spots.

Command syntax: CORRection:SPOT<n>:SHORT

Where,

<n>:

Frequency spot 1~201

For example: WrtCmd (“CORR:SPOT1:SHOR”) Execute short correction for frequency spot 1.

The CORRection:SPOT<n>:LOAD:STANdard command is used to set the standard reference of specific frequency spots. The CORRection:SPOT<n>:LOAD:STANdard query returns the current standard reference of specific frequency spot.

Command syntax: CORRection:SPOT<n>:LOAD:STANdard <REF. A><REF. B>

Where,

<n>:

Frequency spot 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:DTAT? query returns the OPEN/SHORT/LOAD correction measurement data of specific frequency spot 1, 2 ... 201.

Command syntax: CORRection:USE:DATA?

Return format:

<open1 A>,<open1 B>,<short1 A>,<short1 B>,<load1 A>,<load1 B>,
<open2 A>,<open2 B>,<short2 A>,<short2 B>,<load2 A>,<load2 B>,
<open3 A>,<open3 B>,<short3 A>,<short3 B>,<load3 A>,<load3 B>,
.....

Where,

<open n A> is NR3 data format and the primary open correction data at frequency spot n.

<open n B> is NR3 data format and the secondary open correction data at frequency spot n.

<short n A> is NR3 data format and the primary short correction data at frequency spot n.

<short n B> is NR3 data format and the secondary short correction data at frequency spot n.

<load n A> is NR3 data format and the primary load correction data at frequency spot n.

<load n B> is NR3 data format and the secondary load correction data at frequency spot n.

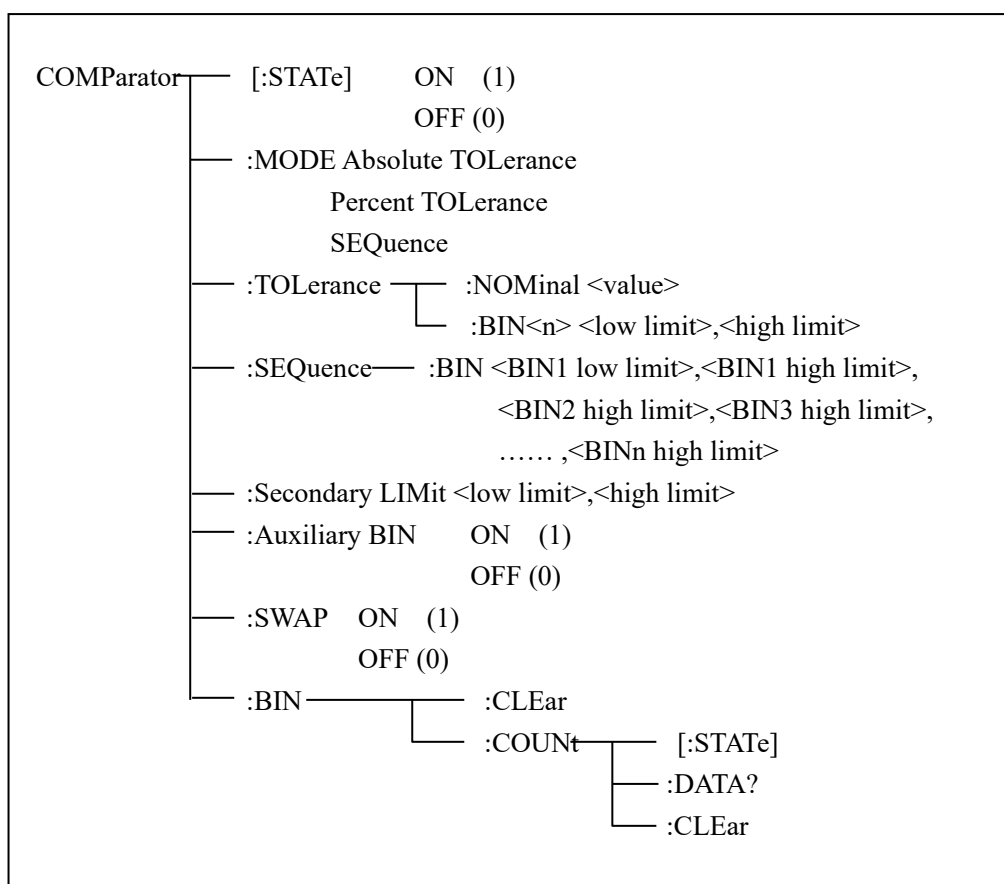
The CORRection:CLEar command is used to clear the correction data of all the correction points.

Command syntax: CORRection:CLEar

7.1.14 COMParator subsystem commands

The COMParator 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:

$$\text{COMPArator[:STATe]} \left\{ \begin{array}{c} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right\}$$

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 $\left\{ \begin{array}{l} \text{ATOLerance} \\ \text{PTOLerance} \\ \text{SEQuence} \end{array} \right\}$

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: $\left\{ \begin{array}{l} \text{ATOL} \\ \text{PTOL} \\ \text{SEQ} \end{array} \right\} \langle \text{NL}^{\wedge} \text{END} \rangle$

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:TOLerance: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 $\left\{ \begin{array}{c} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right\}$

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:

$$\text{COMParator:SWAP} \quad \left\{ \begin{array}{c} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right\}$$

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:

$$\text{COMParator:BIN:COUNt[:STATe]} \quad \left\{ \begin{array}{c} \text{ON} \\ \text{OFF} \\ 1 \\ 0 \end{array} \right\}$$

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.

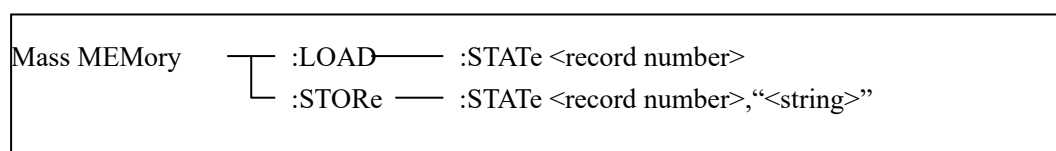
Command syntax: COMParator:BIN:COUNT:CLEar

For example: WrtCmd ("COMP:BIN:COUN:CLE")

7.1.15 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 TH2839 ID.

Query syntax: *IDN?

Return format: <manufacturer>,<model>,<firmware>,<HW_version>,<NL^END>

Where,

<manufacturer> Name of Manufacturer (Tonghui)

<model> Instrument Model (TH2839)

<firmware> Firmware Version (VER1.0.0)

<HW_version> Hardware version (Hardware Ver A5.0)

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 TH2839 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 TH2839 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 Description for Handler

TH2839 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 Technology description

Table 1 shows the description for TH2839 HANDLER.

Table 1 the HANDLER description

<p>The output signal: low effective, open collector output, optoelectronic isolation</p> <p>Output signal judgment:</p> <p>BIN comparator: good, over the standard, not good</p> <p>List sweep comparator: IN/OUT for every sweep point and pass/fail for all the compared result.</p> <p>INDEX: ADC ended</p> <p>EOC: end of one test and comparison</p> <p>Alarm: alarm for circuit interruption</p> <p>The input signal: optoelectronic isolation</p> <p>Keylock: lock the keys on the front panel</p> <p>External Trigger: pulsewidth$\geq 1\mu\text{S}$</p>

8.2 Operation description

8.2.1 Introduction

The information provided in this chapter includes the necessary descriptions of using the Handler interface signal lines and electrical features.

8.2.2 The definition for the signal line

The Handler interface has 3 signal: comparison output, control output and control input. The signal line's definition for the BIN comparison and 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 figure 1.
- 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 and figure 2.

Table 2 The signal distribution for the pins

pin	signal name	description
1	/BIN1	BIN sorted result /BIN(BIN number) output are all open collector output.
2	/BIN2	
3	/BIN3	
4	/BIN4	
5	/BIN5	
6	/BIN6	
7	/BIN7	
8	/BIN8	
9	/BIN9	
10	/OUT	
11	/AUX	
12	/EXT.TRIG	External trigger: when the trigger mode is EXT.TRIG, TH2839 will be triggered by the positive-edge in this pin.
13		
14	EXT.DCV2	External DC voltage 2: The DC provider pin for the optoelectronic coupling signal(/EXT_TRIG, /KeyLock, /ALARM, /INDEX, /EOM)
15		
16	+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.
17		
18		
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	NC	No connection.
23	NC	
24	NC	
25	/KEY LOCK	When this single 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.

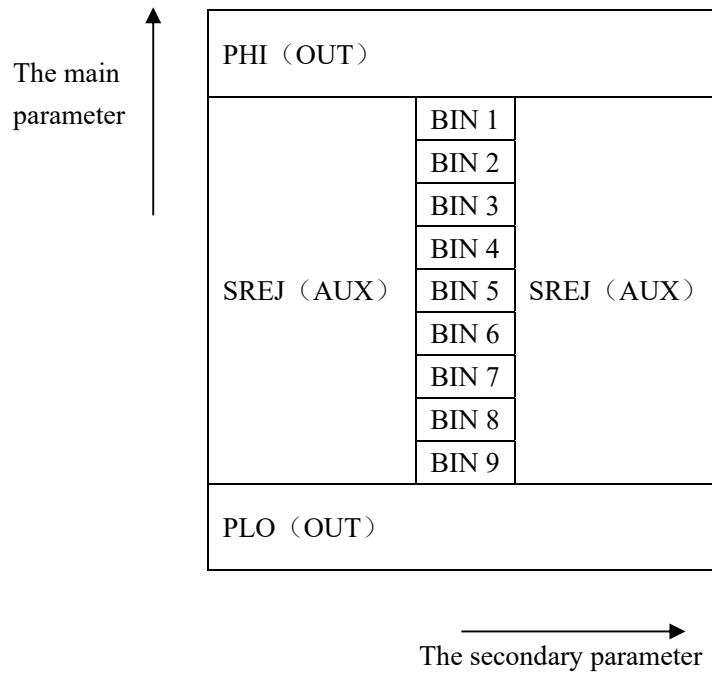
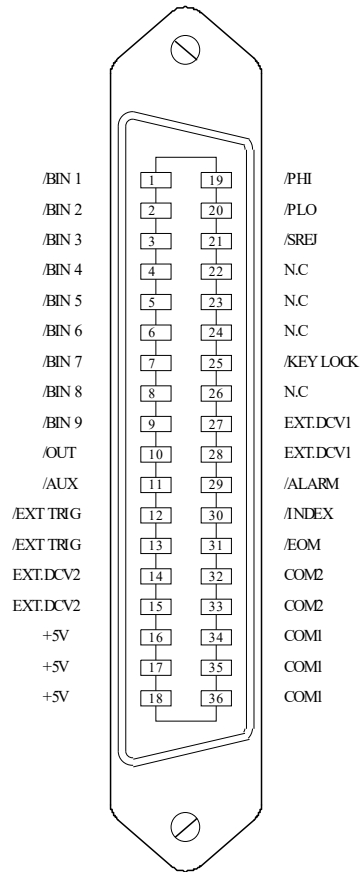


Figure 1 the /PHI, /PLO, /SREJ signal distribution for BIN comparison



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

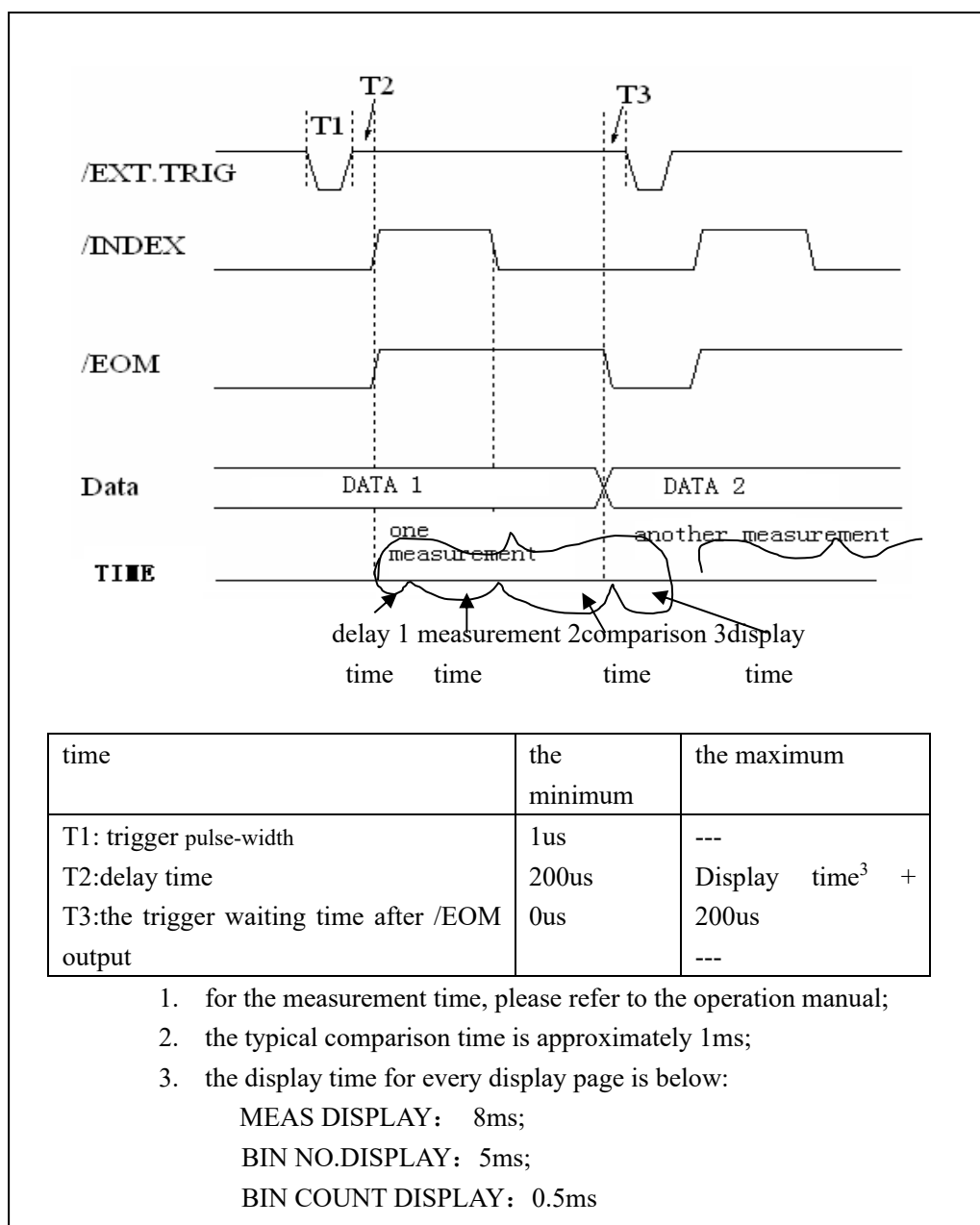


Figure 3 the timing chart

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 (figure 4).

/AUX shows PASS/FAIL judgement.

When a sweep test is finished, these signal will be the output signal.

- Control

/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 of the last 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 effective.
others		The definition is the same to that of the comparison.

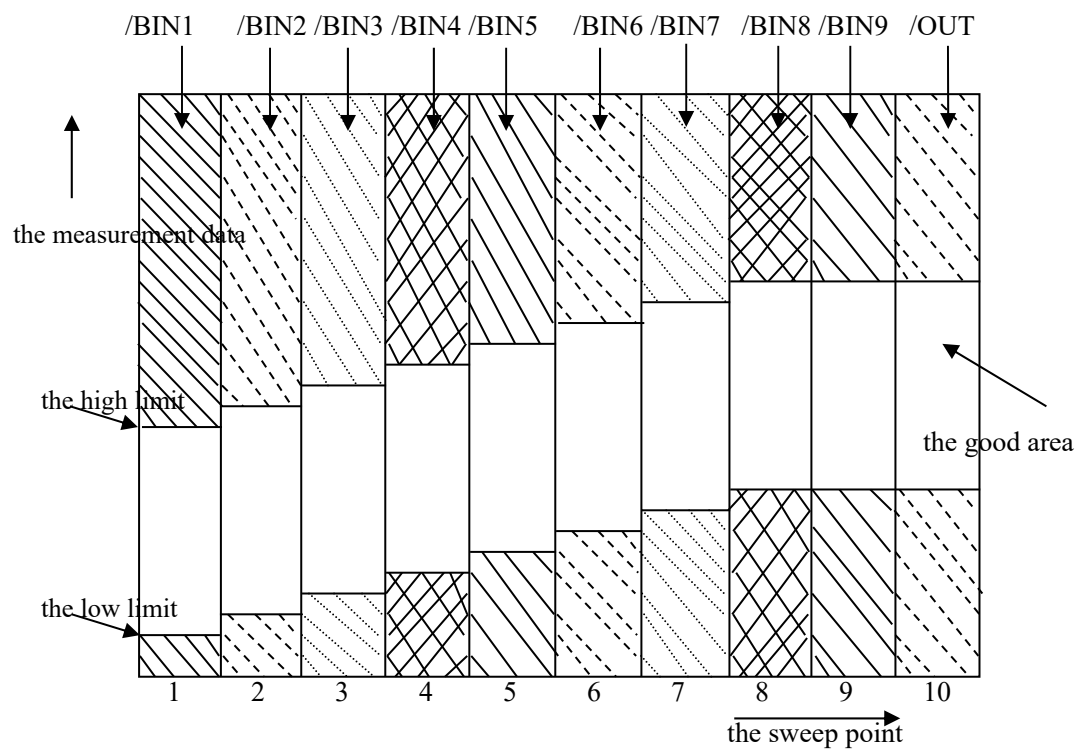


Figure 4 the signal area of the list sweep comparison

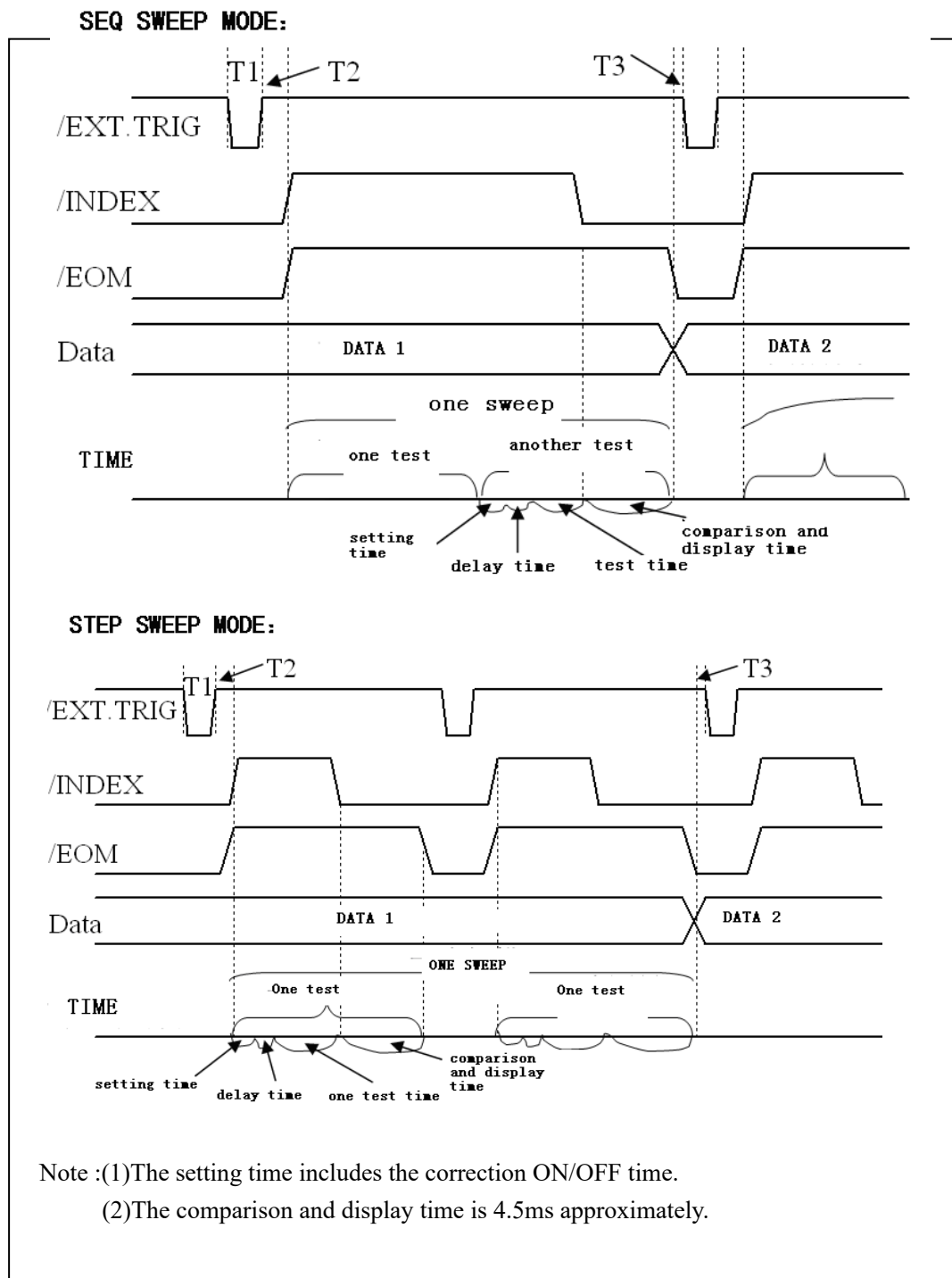


Figure 5 the time counting

8.2.3 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).

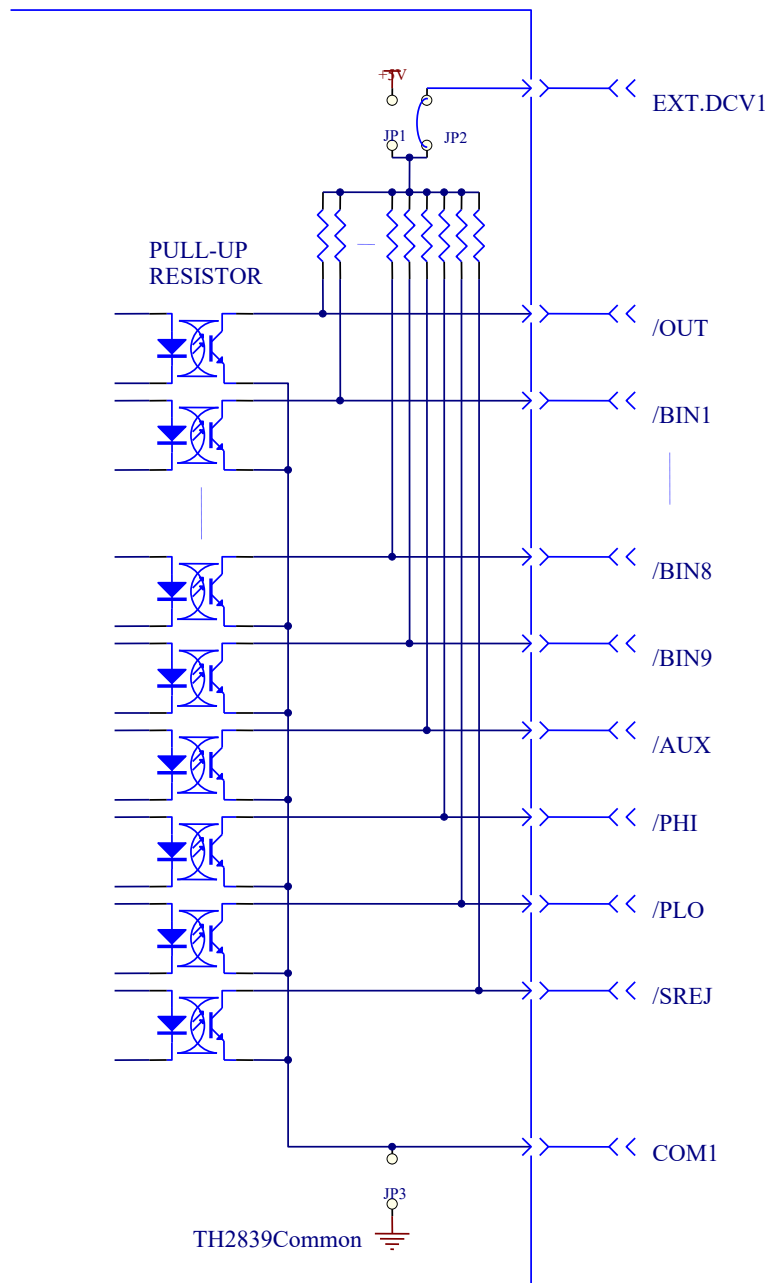
The electrical feature of the DC isolation output can be divided into 2 types shown in Table 4.

Table 4 the electrical feature of the DC isolation output

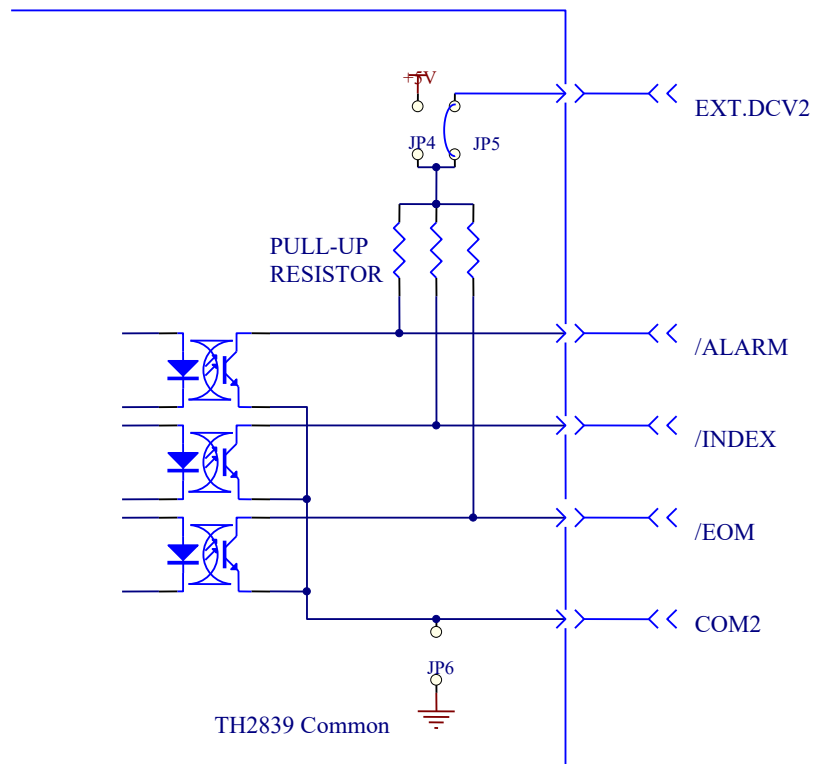
the output signal	the output rated voltage		the maximum current	the reference ground for the circuit
	LOW	HIGH		
compared signal /BIN1 - /BIN9 /AUX /OUT /PHI /PLO	$\leq 0.5V$	+5V--+24V	6mA	Internal pull-up voltage: TH2839 GND EXTV1: COM1
control signal /INDEX /EOM /ALARM	$\leq 0.5V$	+5V--+24V	5mA	Internal pull-up voltage : TH2839 GND EXTV2: COM2

8.2.4 Handler interface board circuit

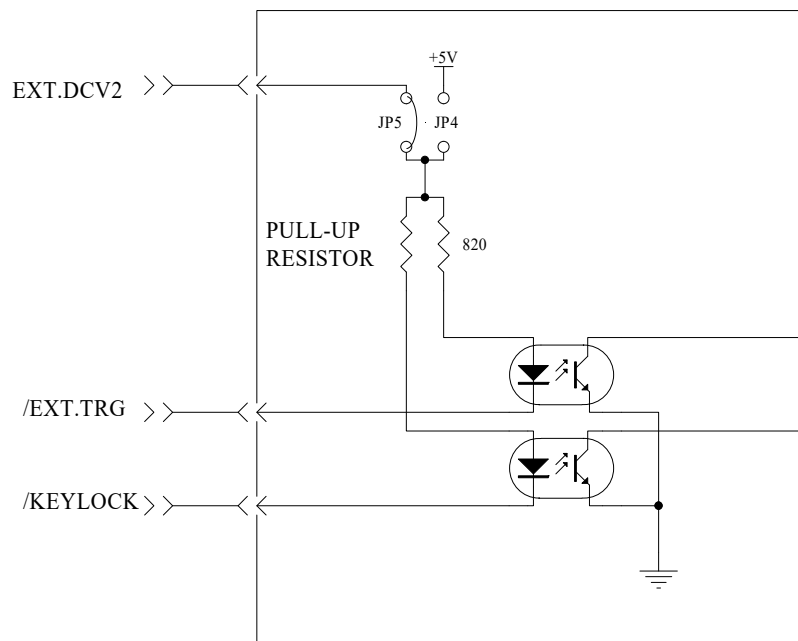
Comparison result signal output circuit



Control signal output circuit



Control signal input circuit



8.2.5 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 [DISP] key description to see more details.
- (3) Move the cursor to COMP zone. The softkey area will be displayed:
 - ON
 - OFF
- (4) Press the softkey ON to enable the comparison function.
- (5) Press [DISP], and then press the softkey 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 [DISP] key description to see more details.
- (3) Press [DISP] and then press the softkey LIST SWEEP, LIST SWEEP DISP page will be displayed. Refer to the DISP 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.