TH1773

Bias Current Source

User's Mannual

Warranty

This Tonghui instrument product is warranted against defects in material and workmanship for a period of one year from the date of shipment. During the warranty period, we will, at out option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Tonghui. Purchaser shall prepay shipping charges to Tonghui and Tonghui shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Tonghui from another country.

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

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Chapter 1　Genernal Information

1.1　　Introduction

TH1773 is a MPU-controlled DC Bias Current Source, covering a DC bias current range from -10A to 10A. TH1773 can be used with most of Tonghui's L meters and LCR meters. TH1773 provides a convenient and practical DC Bias Current Source for AC+DC overlap inductor measurement and magnetic material analysis.

TH1773 provides three types of output modes:
- **Single Out**
- **MultScan**
- **Equ Scan**

MultiScan and **Equ Scan** output modes can be performed either manually or automatically for different occasions. Loop function can be enabled for both **MutiScan** and **Equ Scan** modes.

Newly developed theory of AC+DC overlap measurement is adopted to ensure high accuracy and high frequency measurement demands.

User's data and all test conditions are stored in non-volatile memory and do not change when power has been off or after a reset. It's very easy and convenient for daily operation.

1.2　　Main Features:

- Forward and reverse current can be switched.
- Output current can be finely adjusted in **Single Out** mode.
- Loop Scan measurement can be performed automatically or manually.
- A footswitch can also be used to control the bias current output.
- Up to 5 sets of control settings can be stored to five files.

1.3　　Specifications

1.3.1　　Current

From -10A to +10A. Three different current ranges are available (200mA, 2A and 10A). TH1773 can select the correct range automatically according to the current value user set. Up to 4 slave TH1773s can be paralleled to output a maximum bias current 50A.

1.3.2　　Display

2×20 large characters LCD display.

1.3.3   Frequency Bandwidth

From 50Hz to 200kHz.

1.3.4   Maximum Driver Capacity

- Output voltage: 8Vmax
- Maximum Tolerance of unknown DCR:
  R_{max} = 7.5/I [Ω]   (I is the setting current, unit [A])
- Maximum Tolerance of unknown inductance:
  L_{max}=100/I [mH]   (I is the setting current, unit [A])
- Maximum Open-circuit time
  T_{max} = 1 [second]   (Maximum current settling time.)

1.3.5   Scan numbers

From 2 to 15 points

1.3.6   Scan Delay

From 0 to 99s

1.3.7   Interface

TH1773 provides **Slave Link** interface, **RS232C** interface (optional) and **GPIB** interface (optional).

1.3.8   Connection

TH1773 can be directly used with and controlled by some of Tonghui's L meters or LCR meters.

1.3.9   Warm-up time

Warm up the instrument for about 30 minutes

1.3.10   Working Time

TH1773 can work continuously

1.3.11   Power

Power supply: 198 to 242V AC
Line frequency: 48 to 62Hz
Power consumption: ≤200VA

1.3.12   Operation environment

Temperature: 0 to 40℃
Humidity: ≤90%RH

1.3.13   Dimensions

395(width) ×155(height) ×420(depth) mm

1.3.14   Weight

Approx. 8kg.

1.4   Basic Accuracy

1.4.1   Accuracy Test Requirements

- Within one year factory calibration
- Environment temperature: 25±5℃;
- Relative Humidity: ≤80%
- Power is regulated by a line-voltage regulator
- Warm up time: more than 30 min.

1.4.2   Current Accuracy

Range	Current	Accuracy	Resolution
200mA	0.0mA to 200.0mA		0.1mA
2A	0.201A to 2.000A	±（1%+ 3digits）	0.001A
10A	2.001A to 10.00A		0.01A

1.5   Additional Error for LCR Meter

An additional measurement error should be added to the basic error of the LCR meter, when the LCR meter is used with a bias current source. The additional measurement error is induced by attenuation of test signal source, disturbance, and non-ideal coupling, and so the reading stability will be decreased.

NOTE: There may be a resonance frequency point between the bias current source and the inductor under test. Around the resonance frequency point the measurement result will be different, so try best to avoid the very resonance frequency point.

1.5.1   Additional error calculation

Basic additional error is ±1%, and the error will be increasing with the value of impedance under test. Use the following formula to calculate the additional error.

$$Ze=\pm1\%(1+kl+kf+ki)(1+Zx/2k\Omega)$$

1) Zx   Unknown impedance of $Zx=2\pi fL$
2) ki   Bias current factor
3) kl   Unknown inductance factor
4) kf   Frequency factor

Current Factor ki

Current Range	ki
0.0mA to 2A	0
2A to 10A	1

Unknown Inductance Factor kl

Unknown Inductance	kl
0 uH to 20uH	1
20uH to 200mH	0
200mH to 2H	1
> 2H	2

Frequency Factor kf

Frequency Range	kf
50 Hz to 100Hz	1
100Hz to 1kHz	0
1kHz to 10kHz	0.5
10kHz to 50kHz	1
50kHz to 200kHz	2

1.5.2 Additional Error Specification Test Conditions

- Use the L or LCR meters manufactured by Tonghui
- Select slow or medium measurement speed for LCR meter.
- LCR's test signal voltage level more than 0.25Vrms
- Use the test cable and accessories provided with the instrument and Link the instruments according to the instruction in this manual.
- Perform SHORT correction after linking with the Bias current source.

1.6 L/LCR Meters Available

TH1773 can be used with following L meters or LCR meters.

Model	Description	Control Interface
TH2773A，TH2775B，TH2776B	Inductance　Meter	None
TH2810 Series	LCR Meter	None
TH2816A, TH2816B	Wide Frequency LCR Meter	Yes(TH2816A only)
TH2817, TH2817A	Precision LCR Meter	Yes (TH2817A only)
TH2818, TH2819A	Precision Component Analyzer	Yes

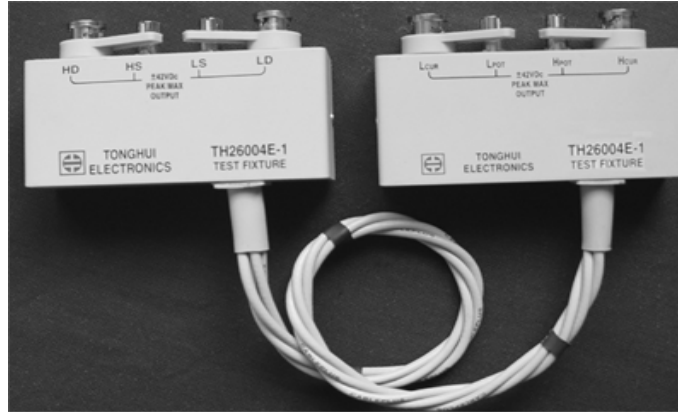**NOTE1:**   **In case of product changes and updates, please check our newest Catalog.**

NOTE2:   **LCR meters based on the four-terminal pair theory can not be used with TH1773, for example the TH2828 LCR meter series.**
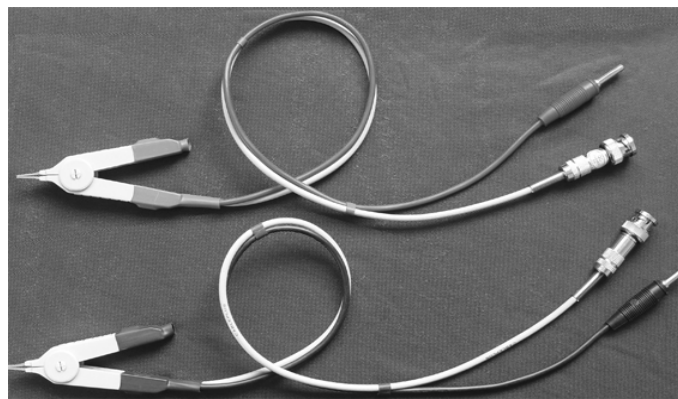
1.7   Accessories

■   **TH26004E-1 Test Fixture**

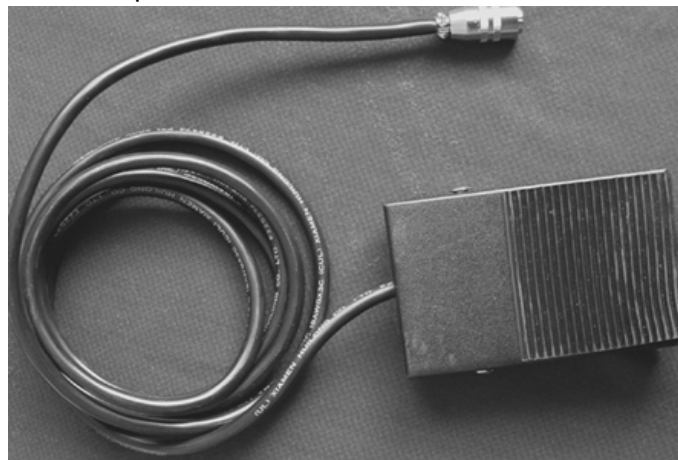TH26004E-1 Test Fixture used to connect the TH1773 with the L or LCR meter

■   **TH26013 DC Bias Test Clip Leads**

TH26013 DC Bias Test Clip Leads is used to connect the Device Under Test.

■   **TH2881-001 Footswitch**

TH2881-001 Footswitch can be efficiently used to start the bias current output instead of key operation from the front panel.

# Chapter 2　Installation and Preparation

2.1　Operation Environment

2.1.1　Temperature and Humidity

Don't use the instrument in a dusty or vibrating location. Don't expose the instrument under sunlight, or corrosive gas. Be sure that the operation temperature is between 0℃and 40℃ and that the relative humidity is below 80%.

2.1.2　Ventilation Requirments

To void internal temperature increase under large bias current output, make sure that there is adequate clearance (more than 20 cm) around the TH1773 and adequate ventilation is ensured. Never block the ventilation windows especially on both sides and below.
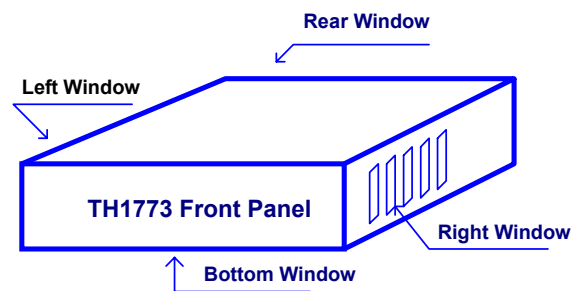

2.1.3　Line-Voltage Regulation

The instrument has been carefully designed to reduce the disturbance from the AC line input. It is recommended to be used in a low noise environment. If the noise is inevitable, please use a proper power filter or a line-voltage regulator.
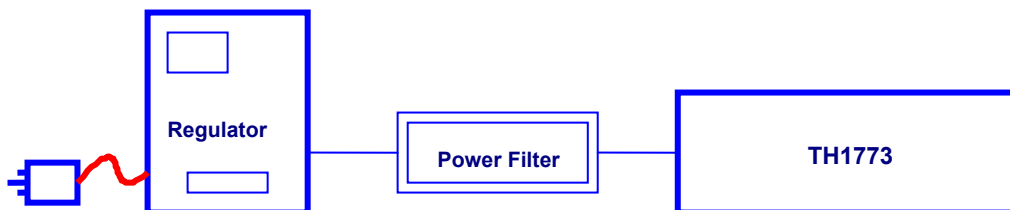
2.1.4　Storage

If the instrument will not be used for a long time, please store it in the original or similar package box and keep it from direct sunlight and humidity.

2.2 Power-Line Connection
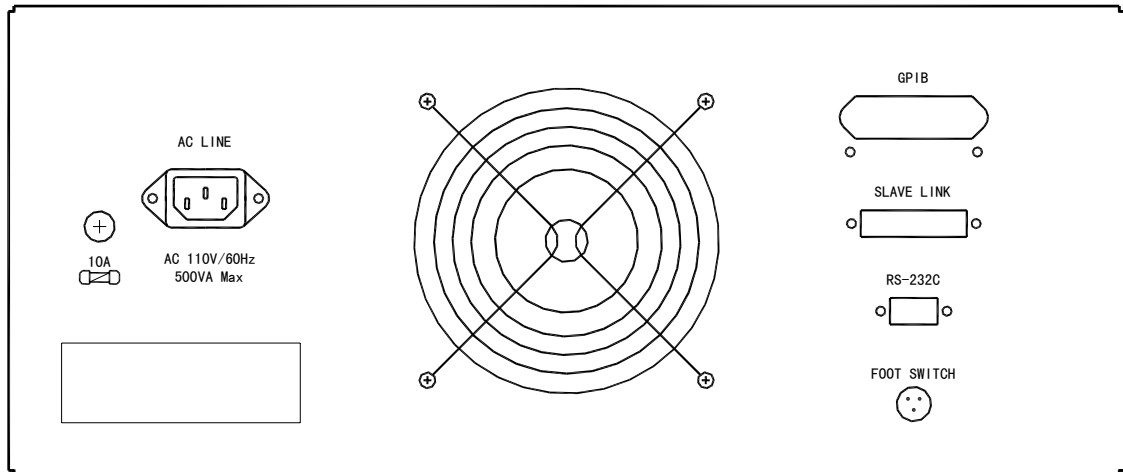
2.2.1 Fuse Selection

Use 10A Slow Blow fuse for 95V to 125V line voltage. Use only fuses with the required current rating and of the specified type as replacements. To prevent electrical shock, disconnect the TH1773 power cable from the receptacle before checking or replacing the fuse.

2.2.2 Ground the Instrument

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate ac power outlet, this cable grounds the instrument frame.

NOTE: For protection from electrical shock, the power cable ground must not be defeated. The power plug must be plugged into an outlet that provides a protective earth ground connection. The ground terminal on the front panel can also be grounded.

2.3 Footswitch Connection

Connect the foot switch when it is needed. There are two control modes for foot switch, please refer to the description late in this manual.

2.4　Turn On the Power

■ Follow the following steps to turn on the both instruments, when TH26004E-1 and TH26013 is not connected:

1) Turn on the L meter or LCR meter
2) Set up the working conditions for LCR meter.
3) Turn on the TH1773 bias current source
4) Connect the TH1773 and the LCR meter with TH26004E-1 as shown in the following figure.
5) Connect TH26013 test clip leads to the TH1773 as shown in the following Figure.

■ Some L/LCR meters will not pass the power-on self-test with a bias current source connected to their UNKNOWN terminals. Follow the following steps to turn on the instruments when TH26004E-1 and TH26013 are connected:

1) Disconnect the TH26004E-1 for one end.
2) Turn on the LCR meter and then the TH1773
3) Connect the TH26004E-1 again.
4) If you do want to turn on the instruments when they are connected, please turn on the TH1773 first, and then turn on the L/LCR meter.
5) On the contrary, if you want to turn off the instruments when they are connected, please turn off the L/LCR meter first and then turn off the TH1773.

2.5　Correction after Connection

TH1773 is a Bias current source with low additional errors. Some L/LCR meters will fail in OPEN correction because of their lower noise allowance capability. At this time, please perform the OPEN correction without connecting with the TH1773. The accuracy being affected will be within the specifications if the impedance of UNKNOWN is less than 10 kΩ.

For OPEN and SHORT correction operation, please refer to the user's manual of the LCR meter.

Open the test terminals as shown in the following figure to perform the OPEN correction for LCR meter.

Short the test terminals as shown in the following figure to perform the SHORT correction for LCR meter.

2.6 Check the Instruments Before Use

After turning on the instruments, make some simple tests to ensure that the instruments are working normally.

- It will be reseted internally, initialized and self tested when TH1773 is turned on. At first the **FWD(+)**, **REV(-)**, and the slave indicators will be turned ON, the instrument and manufacturer information will be displayed for several seconds as shown in the following figure.

- TH775 will finish its power-on operation until the **FWD(+)**, **REV(-)**, and the slave indicators are turned off. The output display page will be displayed after the information display page is cleared as shown in the following figure.

- TH1773 will be working in the **Single Out** output mode by factory default. (If the user has changed the configuration in the **OPTION** menu, then TH1773 will be working in the mode user specified, and the output current value and parameters set last time will be displayed.)
- Connect an amperometer to the UNKNOWN terminals as shown in the following figure. When output current is not enabled, there is no current outputted.


AMPEREMETER

- Press **[START]** button to enable current output, and the setup current will be outputted. Compare the measuring current value from the amperometer and the setup current value displayed on the TH1773.
- Check the measuring impedance of short circuit, open circuit, short correction, open correction, and standard samples when TH1773 is connected and without current output as shown in the following figure.

Lx

- From the measuring impedance values above you will see if the instruments are connected and working normally. In general, short circuit impedance should be as low as possible and open circuit impedance should be as large as possible. The measuring results when bias current is disabled should be consistent with the results measured directly by a L/LCR meter.

Chapter 3   Panel Description

3.1   Front Panel Description
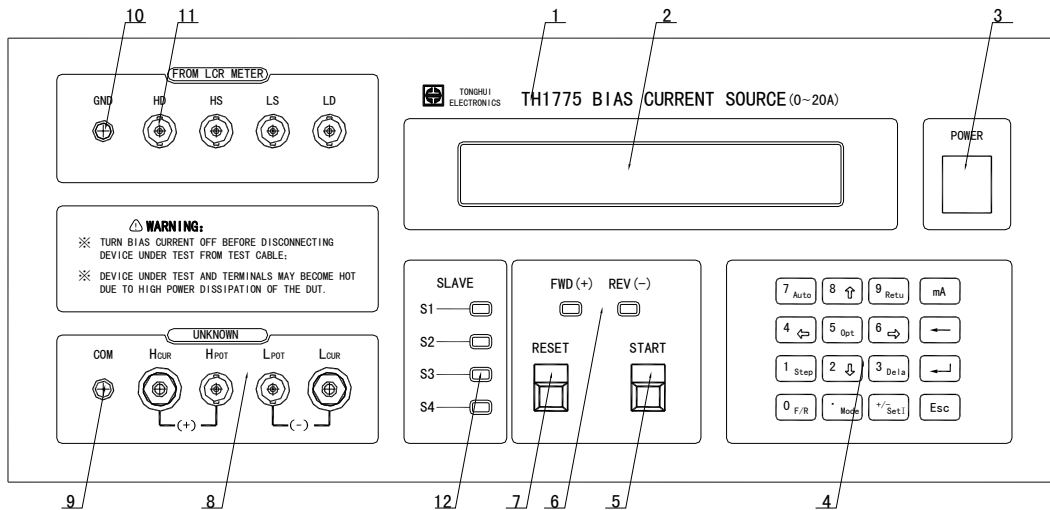
1)   **Brand and Model**

2)   **LCD Display**

2×20 character LCD display, the working conditions and setup parameters are displayed.

3)   **Power Switch**

In the "**1**" position all operating voltages are applied to the instrument. In the "**0**" position NO operating voltages are applied to the instrument.

4)   **Keyboard**

■   **[Mode]** key

Current output mode selection. There are three types of current output modes: Single point current output mode **Single Out**, Multi-point current output mode **MultScan** and Equal interval multi-point current output mode **Equ Scan**. Press the **[Mode]** key to select one of the three current output modes in turn: **Single Out → MultScan → Equ Scan**.

■   **[SetI]** key

Use the **[SetI]** key to set the output current value displayed on the LCD screen.

■   **[Auto]** key

Press **[Auto]** key to set the Automatic scan mode (**AutoScan** = 1) or Manual scan mode (**AutoScan** = 0) when **MultScan** or **Equ Scan** output mode is used.

■   **[Retu]** key

Press **[Retu]** key to enable (**Return** = 1) or disable (**Return** = 0) the loop current measurement when **MultScan** or **Equ Scan** output mode is used.

■   **[Step]** key

Press **[Step]** key to set the **Scan Numbers** from 2 to 15 when **MultScan** or **PartScan** output mode is used.

- **[Dela]** key

  Press **[Dela]** key to set up the "**Scan Delay**" time from 0 to 99 sec. When Auto scan is ON, the next current point will be outputted automatically after the "**Scan Delay**" time is expired. When Auto scan is OFF, the next current will not be outputted until the **[START]** button is pressed or the footswitch is stepped after the "**Scan Delay**" time is expired.

NOTE: **The setup parameters for [Setl], [Auto], [Retu], [Step] and [Dela] can be stored automatically and will not be lost when power has been off or after a reset.**

- **[Option]** key

  Press ⏎ key to save the parameters modified in the **Option** Menu to the current **FileNum** file.

  Press ⎋ key to cancel the parameters modified in the **Option** Menu.

- **[F/R]** key

  [F/R] is the current forward and reverse switching key. This key is valid only when **Single Out** mode is selected and the bias current output is started.

NOTE: **All above key operations except [F/M] key is available only when the bias current output is not started.**

- ⏎ key

  Press ⏎ key to confirm the modification with the parameters.

- ⎋

  Press ⎋ key to cancel or exit the parameter setup.

- **[←]** key

  Press **[←]** key to delete one last character of the input value. This key can only be used when output current, **Scan Numbers** or **Scan Delay** time is to be inputted.

- Numeric Keys: 0 , 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9

  The numeric keys are used to input a data. For example, when bias current, **Scan Numbers** or **Scan Delay** time is to be inputted.

- Cursor Keys: ↓ , ↑ , → , ←

  The cursor keys are only available when corresponding symbols (◀, ▶, ▲, ▼) are displayed on the LCD screen. The cursor keys can be used to select a scan current point which you want to modify. The cursor keys can also be used to adjust the **Single Out** current value finely. Finally the cursor keys can be used in **Option** menu to switch between option menus and to set the parameters for each menu.

5) [START] button

Start a current output or change to the next scan output current point.

6) Current output indicators

FWD(+) indicates that a forward current is being outputted.

REV(-) indicates that a reverse current is being outputted

7) [RESET] button

Press **[RESET]** button to interrupt a bias current output immediately.

8) UNKNOWN terminals

UNKNOWN terminals are used to connect a device under test.

Hcur：High terminal of current drive

Hpot：High terminal of potential sense

Lpot：Low terminal of potential sense

Lcur：Low terminal of current drive

Hcur and **Hpot** terminals are connected to a red clip.

Lcur and **Lpot** terminals are connected to another black clip.

9) COMMON terminal

This is the **COMMON** terminal which is tied to the instrument's chassis and which can be used for measurements that require guarding.

10) GND

This is the GND terminal which is tied to the instrument's chassis and which can be connected to a protective earth ground to protect from electrical shock.

11) LCR terminals

Connect these LCR terminals to the Unknown terminals of a LCR meter using the TH26004E-1 accessory.

Make sure that every terminal is connected to its corresponding terminal.

HD of TH1773 is connected to **Hcur** (**HD**) of a LCR meter.

HS of TH1773 is connected to **Hpot** (**HS**) of a LCR meter.
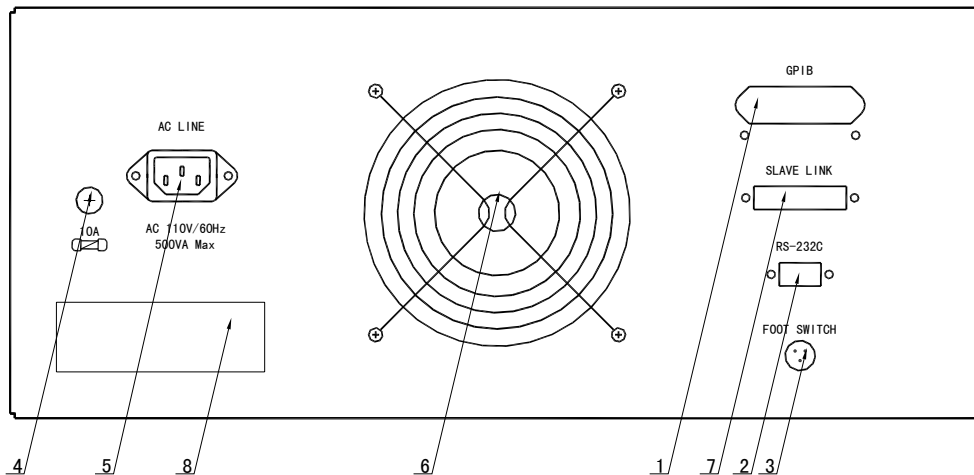
LS of TH1773 is connected to **Lpot** (**LS**) of a LCR meter

LD of TH1773 is connected to **Lcur** (**LD**) of a LCR meter

12) Slave Indication

Indicate that a slave instrument is connected successfully.

3.2   Rear Panel Description

1) **GPIB interface (optional)**
   This optional interface provides a way to communicate with a computer and other instruments which are also equipped with GPIB interfaces.

2) **RS232C Interface (optional)**
   The RS232C interface is also an optional interface which can be used to communicate with a computer and with some of our L/LCR meters which can be programmed to control a bias current source.

3) **Footswitch**
   A foot switch can be used to trigger the TH1773. Several control modes of the footswitch can be selected from the Option menu "**FootMode**".

4) **Fuse**
   Use a 10A slow blow fuse for this instrument. Press the fuse holder and turn anti-clockwise at the same time to loose the fuse holder. Press the fuse holder and turn clockwise at the same time until the fuse holder is locked.

> **Warning!**
> **Disconnect the power cable before replacing the fuse！**

5) **Line Receptacle**
   Use the standard three-wire power cable provided with the instrument.

6) **Cooling Fan**
   TH1773 uses two cooling fans. Make sure that sufficient space must be kept around the TH1773 to avoid obstructing the air flow of the cooling fans.

7) **Slave Link**
   Up to 4 slave bias current sources can be paralleled to provide a maximum 100 A bias current.

8) **Name Plate**
   Provide the information of Serial number and name of manufacture.

Chapter 4 Basic Operation

The foregoing chapters have introduced the basic of using this instrument. This chapter will tell you how to set the functions and parameters through the keyboard to meet different measurement requirements.

When all functions and parameters have been finished, operation will become very simple. Just press the **[START]** or **[RESET]** buttons to perform the measurement, sometimes only a footswitch is needed.

NOTE: Functions and parameters can only be set when bias current is OFF.

4.1 Option Menu

Not all items in the **Option** menu are necessary for TH1773, but the setups will make your measurement more convenient and efficient. For example you can select the footswitch control mode as you like, and set the proper **Scan Delay** time you want.

Press **[OPt]** key to enter the display page of **<Set Options>** in the **Option** menu as shown in the following figure.
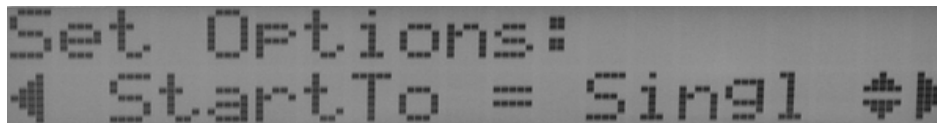

- ■ "**Set Options**" in the first line indicates current display page.
- ■ The item displayed on the left of "**=**" is the current menu item to be modified.
- ■ The value or option of current item is displayed on the right of "**=**".
- ■ The arrow marks displayed on the bottom right screen remind you to select a menu item using the ⬅ or ➡ key and to change the value of the current menu item using the ⬆ or ⬇ key.

4.1.1 StartTo

Perform the following steps to set the default output current mode when TH1773 is turned on.

1) Press **[Opt]** key from the output display page to enter the **<Set Option>** display page as shown in the following figure.
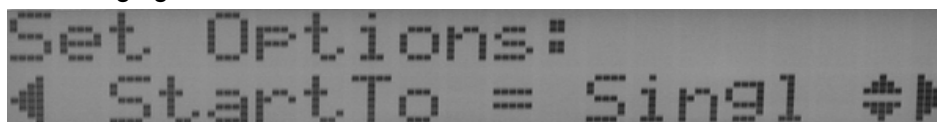
2) Press ⬆ or ⬇ key to set "**StartTo**" to **Singl**, **Mult** or **Equal**.

- ■ **StartTo = Singl**   Set the **Single Out** mode as the default current output mode.
- ■ **StartTo = Mult**   Set the **MultScan** mode as the default current output mode.
- ■ **StartTo = Equal**   Set the **Equ Scan** mode as the default current output mode.

3) Press ⏎ key to confirm and save the change of **StartTo** and return back to the current output

page. When TH1773 is turned on, the specified "**StartTo**" mode you have just set will be displayed.

4) Press ⌷ key to cancel the change of **StartTo** and return back to the current output page.

5) Whatever default current mode you have selected, you still can switch the output mode by pressing the **[Mode]** key directly. However the default mode of **StartTo** will not be changed by pressing the **[Mode]** key.

4.1.2   FootMode
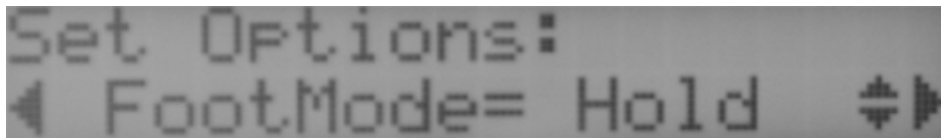
Perform the following procedures to set up the footswitch control mode.

1) Press **[Opt]** key from the output display page to enter the **<Set Option>** display page.

2) Press ⌷ key to select the "**FootMode**" menu item. The current control mode will be displayed as shown in the following figure.

3) Press ⌷ or ⌷ key to select **Trig**, **Hold** or **OFF** control mode.

- ■ **FootMode = OFF**
  Footswitch is disabled.
- ■ **FootMode = Trig**
  Trig Operation: Step on the footswitch and then loose your foot to accomplish a trigger action.

  For **Single Out** mode, the first footswitch trigger action (same as **[START]** button pressing) will start the bias current output and the second footswitch trigger action (same as **[RESET]** button pressing) will interrupt the bias current output immediately.

  For **MultScan** or **Equ Scan** mode and **AutoScan** is set to **Auto** mode, the footswitch can only be used to start the current output. If you want to interrupt the current output, you have to press the **[RESET]** button on the front panel.

  For **MultScan** or **Equ Scan** mode and **AutoScan** is set to **Manual** mode, the first footswitch trigger action will start the bias current output and each following footswitch trigger action will change the output current to the next scan current point until all setup current points have been finished.
- ■ **FootMode = Hold**
  Hold mode is available only when **Single Out** mode is used.
  Step on the footswitch and hold on to enable bias current output, and the bias current will be interrupted as soon as you loose the footswitch.
  Footswitch operation for **MultScan** or **Equ Scan** is the same as when **Footmode** is set to **Trig** mode.
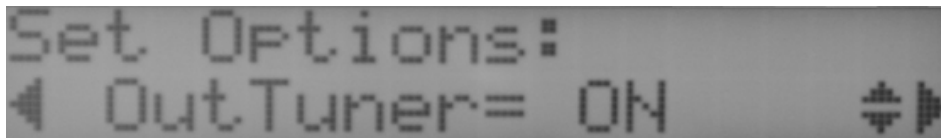
4) Press ⏎ key to confirm and save the change of **FootMode** and return back to the current output page.

5) Press ⎋ key to cancel the change of **FootMode** and return back to the current output page.

4.1.3   OutTuner

This function is only available when **Single Out** mode is used, which can be used to finely adjust the current output value using the cursor keys. It's very useful for product experiment, product research and development, characteristic analysis.

Perform the following procedures to turn on/off the **OutTuner** function.
1) Press **[Opt]** key from the output display page to enter the **<Set Option>** display page.

2) Press ⬅ or ➡ key to switch to the "**OutTuner**" menu item. The current setup will be displayed as shown in the following figure.

3) Press ⬆ or ⬇ key to turn on or off the **OutTuner** function.
   ■ **OutTuner = OFF**
   Turn off the **OutTuner** Function.
   ■ **OutTuner = ON**
   Turn on the **OutTuner** function.

4) Press ⏎ key to confirm and save the change of **OutTuner** and return back to the current output page.

5) Press ⎋ key to cancel the change of **OutTuner** and return back to the current output page.

4.1.4   BusMode

Perform the following procedures to set up the **BusMode**.
1) Press **[Opt]** key from the output display page to enter the **<Set Option>** display page.

2) Press ⬅ or ➡ key to switch to the "**BusMode**" menu item. The current setup will be displayed as shown in the following figure.
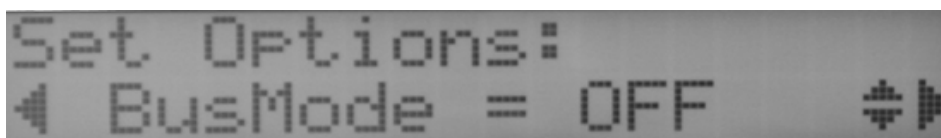
3) Press ⬆ or ⬇ key to set the **BusMode** to **LCR**, **GPIB**, **RS232** or **OFF** mode.

■ **BusMode=LCR**

When **BusMode** is set to **LCR**, TH1773 is connected by a LCR meter through the RS232 interface and the bias current output can be set and controlled through the LCR meter.

Note: **When BusMode is set to LCR mode, the <Set Options> display page will be displayed instead of output display page after Power is on. You can set the BusMode to other modes from the <Set Options> page. When BusMode is selected, the keyboard will be forbidden on the output display page. If you want to change the BusMode, just turn off the instrument and turn on the instrument again, and then change the BusMode from the <Set Options> display page.**

■ **BusMode=GPIB**

When **BusMode** is set to **GPIB**, TH1773 will be controlled through the GPIB interface which is an option. Another computer fixed with a GPIB interface card is required to control the TH1773. Operation manual for GPIB interface will be provided together with the GPIB option.

■ **BusMode=RS232**

When **BusMode** is set to **RS232**, TH1773 will be connected and controlled by a computer.

■ **BusMode=OFF**

When **BusMode** is set to **OFF**, TH1773 can only be operated from the front panel.

4) Press ⏎ key to confirm and save the change of **BusMode** and return back to the current output page.

5) Press Esc key to cancel the change of **BusMode** and return back to the current output page.

4.1.5   GPIB Address

Set the GPIB address for this TH1773 from 1 to 31.

Perform the following procedures to set the GPIB **Address**.

1) Press **[Opt]** key from the output display page to enter the **<Set Option>** display page.

2) Press ⬅ or ➡ key to switch to the "**Address**" menu item. The current setup will be displayed as shown in the following figure.
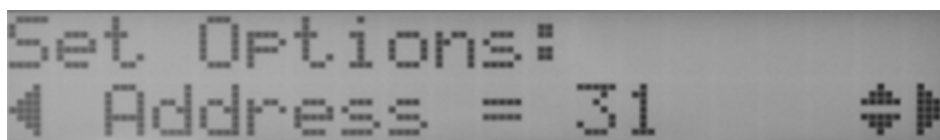

3) Press ⬆ or ⬇ key to set the GPIB **Address** from 1 to 31 for TH1773.

4) Press ⏎ key to confirm and save the GPIB **Address** and return back to the current output page.

5) Press Esc key to cancel the change of GPIB **Adddress** and return back to the current output

page.

4.1.6   FileNum

Select the current File number for storing and reloading the parameters and configurations. Up to 5 sets of configurations can be saved in **FileNum** 1 to 5. User can save the different sets of scan point values to different file for later use.

Following parameters and states are stored in the file:
1) The default **StartTo** mode when TH1773 is powered on.
2) Parameters set in the "**Option menu**"
3) Output current value "**Io**" for **Single Out** mode.
4) Current point values for **MultScan** mode
5) Current value of I_s and I_e for **Equ Scan** mode.
6) **Scan Delay** time (0 to 99s)
7) **AutoScan** mode (Manual/Auto)
8) **Return** mode (Not/Return)
9) **Scan Numbers** (2 to 15)

Note: All parameters are saved automatically in the current FileNum when they are modified.

Perform the following procedures to select a **FileNum** and reload the configurations.
1) Press **[Opt]** key from the output display page to enter the **<Set Option>** display page.
2) Press ⬅ or ➡ key to switch to the "**FileNum**" menu item. The current **FileNum** will be displayed as shown in the following figure.
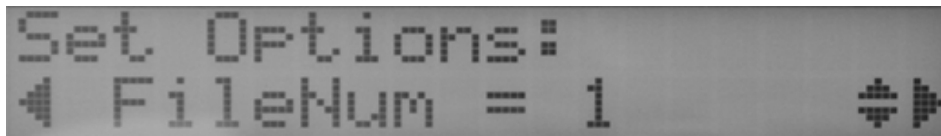
3) Press ⬆ or ⬇ key to select a **FileNum** to reload from 1 to 5.

4) Press ⏎ key to confirm the **FileNum** selection and reload the configurations. TH1773 will return back to the current output page.

5) Press Esc key to cancel the **FileNum** selection and the configurations will not be loaded. TH1773 will return back to the current output page

4.1.7   Calibration

Calibration function is not available for common users, which can only be used by qualified personals in the calibration laboratory of Tonghui.
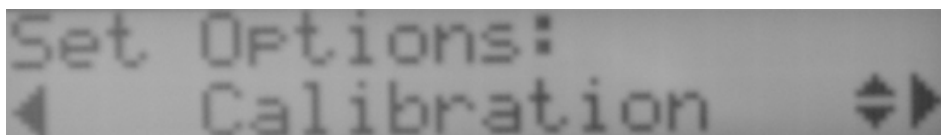
4.2 Single Out Mode

Single Out mode is the most commonly used output mode. A single current is outputted after the TH1773 is started. If you want more than one current, please select the **MultScan** or **Equ Scan** mode.

Perform the following steps to measure a DUT using **Single Out** mode:

1) Use the **[Mode]** key to select the **Single Out** mode as shown in the following figure. "**Stop**" at the bottom right means that the bias current has not been started. **Io** is the present output current value.

```
Single Out:
Io = 2.000 A      Stop
```
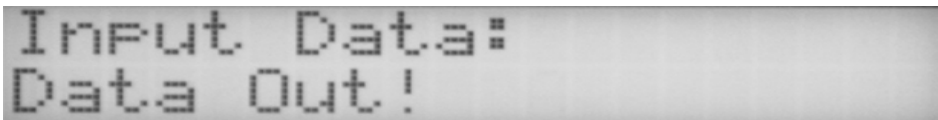
2) Press **[SetI]** key to set the output current value. The **<Input Data>** display page will be displayed as shown in the following figure.

```
Input Data:
Io =           A
```

3) Use the entry keys ([0],[1],[2],[3],[4],[5],[6],[7],[8],[9],[.],[-],**[mA]**) to set up the current value from -100A to 100A.

4) Press ⏎ key to confirm the **I$_o$** value and return back to the current output page. If a current value out of the maximum value is inputted, "**Data Out**" error message will be displayed for a while. TH1773 will return back to the **<Input Data>** page in step 2. Try to enter a correct current value again.

```
Input Data:
Data Out!
```

5) Press [Esc] key to cancel the **Io** value and return back to the current output page.

6) Connect the device under test to the **UNKNOWN** terminals of TH1773.

7) Press **[START]** button to start the bias current output.
    Trig the footswitch once to start the bias current output. (**FootMode= Trig**)
    Step on the footswitch and hold on to enable the bias current output. (**FootMode = Hold**)

    If the **Io** value is more than 20A, and the slave instrument is not connected, "**Slave1 NotReady**" will be displayed as shown in the following figure.

```
   Slave1 NotReady
Please RESET...
```

A forward current is outputted when LED **FWD(+)** is ON. Message "**Run**" will be displayed at the bottom right corner of the LCD indicating that the bias current is ON as shown in the following figure.

8) Press **[F/R]** key to change the current direction between **FWD(+)** and **REV(-)**. When a reverse current is outputted, LED **REV(-)** will be lighted as shown in the following figure.
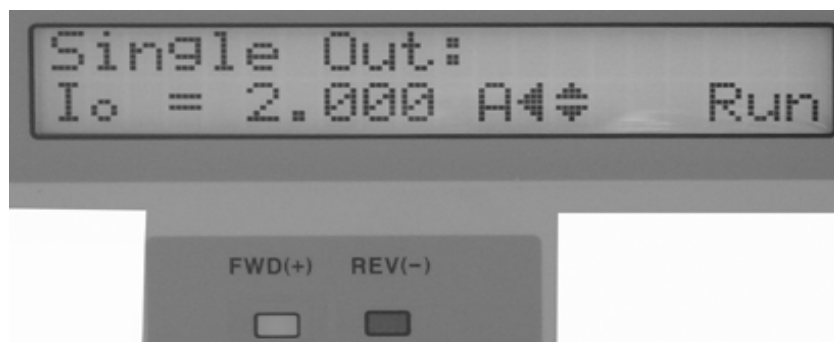
9) The indications of arrow keys will be displayed on the right of the current output value, if the **OutTuner** function is on. Use the ⬅ or ➡ key to select one of the last two digits to be changed, and a cursor will be blinking under the digit to be changed. Once a digit has been selected, press ⬆ or ⬇ key to increase or decrease the current output value.

10) Read the measuring results from the LCR meter.

11) Press [**RESET**] button to interrupt the bias current output.
    Trig the footswitch once again to interrupt the bias current output. (**FootMode= Trig**)
    Loose the footswitch to interrupt the bias current output. (**FootMode = Hold**)

12) Disconnect the device under test.

13) Repeat step 6 to 12 to measure other devices.

Warning
Device under test, terminals and adjacent area may become hot due to high power dissipation of the DUT. Be careful when exchanging devices

---

4.3 Setup for MultScan and Equ Scan

Working parameters and modes (such as **AutoScan**, **Return**, **Scan Numbers** and **Scan Delay**) have to be set before using the **MultScan** or **Equ Scan** mode.

4.3.1 Auto

There are two scan operation modes for **MultScan** and **Equ Scan**:

■ **AutoScan** = 0 (**Manual**)

$$[START] \rightarrow I_1 \rightarrow [START] \rightarrow I_2 \rightarrow \dots \rightarrow [START] \rightarrow I_n \rightarrow [START] \rightarrow Scan\ Over$$

■ **AutoScan** = 1 (**Auto**)

$$[START] \rightarrow I_1 \rightarrow Delay \rightarrow I_2 \rightarrow Delay \rightarrow \dots \rightarrow I_n \rightarrow Delay \rightarrow Scan\ Over$$

Perform following steps to set **AutoScan** mode:

1) Press **[Mode]** key to select the **MultScan** or **Equ Scan** mode.

2) Press **[Auto]** key to to enter the **<SetAutoScan>** display page as shown in the following figure.
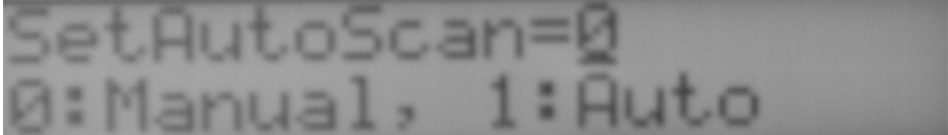
3) Press ⬜1 to select the **Auto** mode or press ⬜0 to select the **Manual** mode.

4) Press ⏎ key to confirm the **AutoScan** mode and return back to the current output page.

5) Press [Esc] key to cancel the **AutoScan** mode and return back to the current output page.

6) If **Auto** mode is selected, "**A**" will be displayed on the top right corner of the LCD as shown in the following figure.

4.3.2   Step

Scan Numbers is the maximum current points you want to output.

Perform following steps to set **Scan Numbers**:
1) Press **[Mode]** key to select the **MultScan** or **Equ Scan** mode.
2) Press **[Step]** key to to enter the **<Input Date>** display page as shown in the following figure.

```
Input Data(2-15):
Scan Numbers=
```
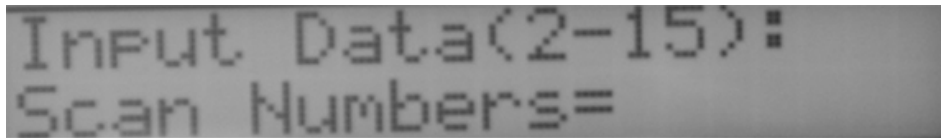
3) Use the numeric keys to input the **Scan Numbers** from 2 to 15. Press **[←]** (Backspace) key to delete the digit before the cursor.

4) Press ⏎ key to confirm the input and return back to the former display page. If the input number is out of the range from 2 to 15, TH1773 will clear the wrong scan number and require you to input again.

5) Press ⎋ key to cancel the input and return back to the former display page.

4.3.3   SetI

Set the output current values for **Single Out**, **MultScan** and **Equ Scan** modes.

Perform the following steps to set the I_O current for Single Out mode.

1) Press **[Mode]** key to select the **Single Out** mode.

2) Press **[SetI]** key to enter the I_O **<Input Data>** display page as shown in the following figure.

```
Input Data:
Io =          A
```

3) Use the entry keys ([0], [1], [2], [3], [4], [5], [6], [7], [8], [9], [.], [-], **[mA]**) to set up the current value from -100A to 100A.

4) Press ⏎ key to confirm the I_O value and return back to the current output page. If a current value out of the maximum value is inputted, "**Data Out**" error message will be displayed. TH1773 will return back to the **<Input Data>** page in step 2. Try to enter the right current value again.

```
Input Data:
Data Out!
```
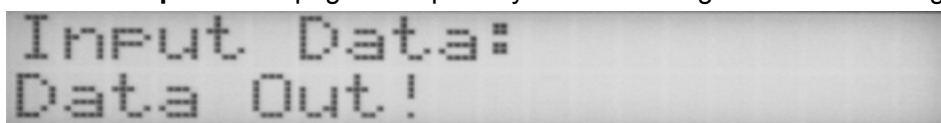
5) Press ⎋ key to cancel the I_O value and return back to the current output page.

Perform the following steps to input the current values from I$_1$ to I$_n$ for MultScan mode.

1) Press **[Mode]** key to select the **MultScan** mode.

2) Set the **Scan Number** for **MultScan** mode first.

3) Use ⬆ or ⬇ key to select a current point from I$_1$ to I$_n$.

4) Press **[SetI]** key to enter the **<Input Data>** display page as shown in the following figure.
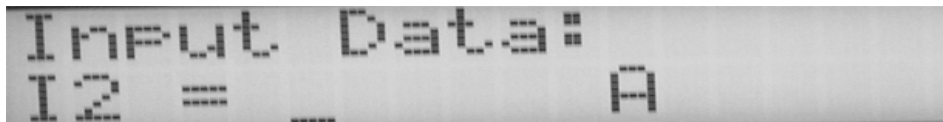

```
Input Data:
I2 = _          A
```

5) Use the entry keys (⓪, ①, ②, ③, ④, ⑤, ⑥, ⑦, ⑧, ⑨, ⋅, ⁻, **[mA]**) to set up the current value from -100A to 100A.

6) Press ⏎ key to confirm the input value and return back to the current output page. If a current value out of the maximum value is inputted, "**Data Out**" error message will be displayed. TH1773 will return back to the **<Input Data>** page in step 5. Try to enter the right current value again.

```
Input Data:
Data Out!
```

7) Press **Esc** key to cancel the input value and return back to the current output page.

8) Use ⬆ or ⬇ key to select another current point from I$_1$ to I$_n$.

9) Repeat step 3 to step 8 to input other current points.

Perform the following steps to set the I$_s$ and I$_e$ currents for EQU Scan mode.

1) Press **[Mode]** key to select the **Equ Scan** mode.

2) Set the **Scan Number** for **Equ Scan** mode first.

3) Use ⬆ or ⬇ key to select the start current I$_s$.

4) Press **[SetI]** key to enter the **<Input Data>** display page as shown in the following figure.

```
Input Data:
Is = _          A
```

```
Input Data:
Ie = _          A
```

5) Use the entry keys ($\boxed{0}$, $\boxed{1}$, $\boxed{2}$, $\boxed{3}$, $\boxed{4}$, $\boxed{5}$, $\boxed{6}$, $\boxed{7}$, $\boxed{8}$, $\boxed{9}$, $\boxed{.}$, $\boxed{-}$, **[mA]**) to set up the current value from -100A to 100A.

6) Press $\boxed{\hookleftarrow}$ key to confirm the I_s value and return back to the current output page. If a current value out of the maximum value is inputted, "**Data Out**" error message will be displayed. TH1773 will return back to the **<Input Data>** page in step 5. Try to enter the right current value again.

```
Input Data:
Data Out!
```
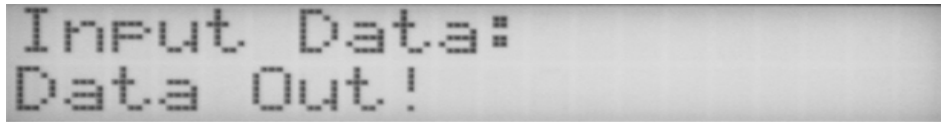
7) Press $\boxed{\text{Esc}}$ key to cancel the input value and return back to the current output page.

8) Use $\boxed{\uparrow}$ or $\boxed{\downarrow}$ key to select the end current I_e.

9) Repeat step 4 to step 7 to input the end current I_e.

4.3.4   Dela

Set the **Scan Delay** for **MultScan** or **Equ Scan** mode, when **AutoScan** is set to **Auto** mode.

Perform the following steps to set the **Scan Delay** time:
1) Press **[Mode]** key to select the **MultScan** or **Equ Scan** mode.

2) Press **[Dela]** key to enter the **<Input Data>** display page as shown in the following figure.
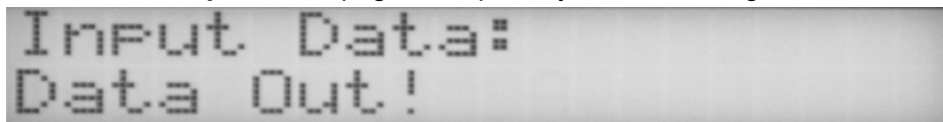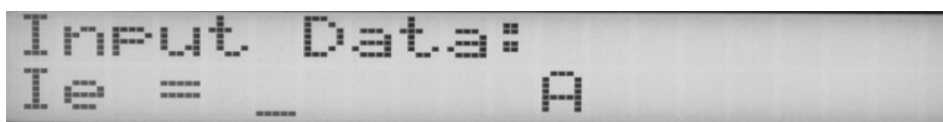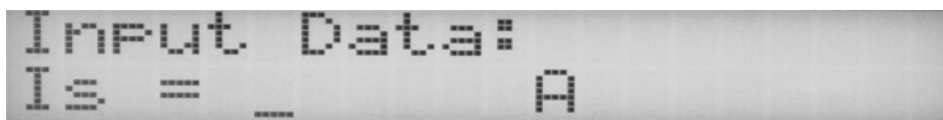
```
Input Data(0-99s):
Scan Delay=_  s
```
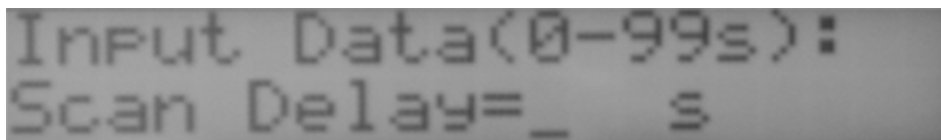
3) Use the numeric keys ($\boxed{0}$, $\boxed{1}$, $\boxed{2}$, $\boxed{3}$, $\boxed{4}$, $\boxed{5}$, $\boxed{6}$, $\boxed{7}$, $\boxed{8}$, $\boxed{9}$) to input the delay time from 0 to 99s.

4) Press $\boxed{\hookleftarrow}$ key to confirm the input value and return back to the current output page.

5) Press $\boxed{\text{Esc}}$ key to cancel the input value and return back to the current output page.

4.3.5   Retu

Loop function can be enabled to analyze the characteristics of magnetic materials. When loop function is on (**Return** = 1), the multi-current will be outputted like this:

Start $\rightarrow I_1 \rightarrow I_2 \rightarrow \ldots \rightarrow I_{n-1} \rightarrow I_n \rightarrow I_{n-1} \rightarrow \ldots \rightarrow I_2 \rightarrow I_1 \rightarrow$ **End**

Perform the following steps to turn on/off the loop function:
1) Press **[Mode]** key to select the **MultScan** or **Equ Scan** mode.

2)   Press **[Retu]** key to enter the **<Set Return>** display page as shown in the following figure.

```
Set Return=0
0:Not, 1:Return
```

3)   Press ⌨1 to select the **Return** mode or press ⌨0 to select the **Not** mode.

4)   Press ⏎ key to confirm the setup and return back to the current output page.

5)   Press ⎋Esc key to cancel the setup and return back to the current output page.

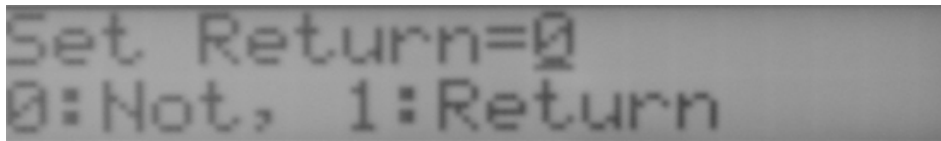6)   If **Return** mode is selected, "**R**" will be displayed on the top right of the LCD as shown in the following figure.

```
MultScan(N= 6):    R A
I1 = 1.000 A▾    5sec
```

4.4   MultScan Mode

TH1773's **MultScan** Mode permits user to measure the device over different DC bias current points. It's very useful if you want to analyze the characteristics of some kind of magnetic materials.

From 2 to 15 different bias currents can be set. TH1773 will output the bias currents in the order $I_1, I_2, \ldots ,$ I_n with a delay time from 0 to 99 seconds between different current points (**Auto** mode). For some special measurement needs, loop current function can be used.

Perform following steps to measure a device in **MultScan** and **Auto** mode:
1) Press **[Mode]** key to select the **MultScan** mode.
2) Press **[Auto]** key to select the **Auto** scan mode, referring to paragraph 4.3.1.
3) Press **[Step]** key to set the **Scan Numbers**, referring to paragraph 4.3.2.
4) Press **[SetI]** key to set the current value for each point, referring to paragraph 4.3.3.
5) Press **[Dela]** key to set the **Scan Delay** time, referring to paragraph 4.3.4.
6) Press **[Retu]** key to set the loop function, referring to paragraph 4.3.5.
7) Set the footswitch mode to **Trig** mode.
8) The setups are listed below, and the following display page will be displayed.
    - ■ **Auto** operation mode
    - ■ **Scan Numbers** = 6
    - ■ **Scan Delay** = 5 sec
    - ■ Loop function enabled
    - ■ **FootMode** = Trig

    ```
    MultScan(N= 6):     R  A
    I1 = 1.000 A▾      5sec
    ```
9) Connect the device to the **UNKNOWN** terminals.
10) Press **[START]** or trigger the footswitch to start the bias current output. The current points will be outputted automatically in the following order:
    [START] → I_1 → **Delay** → I_2 → **Delay** → … → I_6 → **Delay** → I_5 → **Delay** → … → I_2 → **Delay** → I_1 → **Delay** → **Over**
11) **[START]** button or footswitch can both be used to skip the delay time and switch to the next point directly.
12) Read the measurement results from the LCR meter.
13) Press **[RESET]** button to end the measurement at any time.
14) Disconnect the device under test.
15) Repeat step 9 to step 14 to test other devices.

Perform following steps to measure a device in **MultScan** and **Manual** mode:
1) Press **[Mode]** key to select the **MultScan** mode.
2) Press **[Auto]** key to select the **Manual** scan mode, referring to paragraph 4.3.1.
3) Press **[Step]** key to set the **Scan Numbers**, referring to paragraph 4.3.2.
4) Press **[SetI]** key to set the current value for each point, referring to paragraph 4.3.3.
5) Press **[Retu]** key to set the loop function, referring to paragraph 4.3.5.

6) Set the footswitch mode to **Trig** mode.

7) The setups are listed below, and the following display page will be displayed.
   - **Manual** operation mode
   - **Scan Numbers** = 6
   - Loop function disabled
   - **FootMode** = **Trig**

```
MultScan(N= 6):
I1 = 1.000 A▾    Stop
```

8) Connect the device to the **UNKNOWN** terminals.

9) Press **[START]** or trigger the footswitch to start the bias current output.

10) Read the measurement result from the LCR meter.

11) Press **[START]** or trigger the footswitch to the next current point.

12) Repeat step 10 and 11, until all current points are finished.

13) Press **[RESET]** button to end the measurement at any time.

14) Disconnect the device under test.

15) Repeat step 8 to step 14 to test other devices.

4.5   Equ Scan Mode

For **Equ Scan** mode, you don't have to input the values for all current points. Only I_s and I_e are required be inputted. The TH1773 will automatically calculate the value for each point according to equal current interval rule.

For example: if Scan Numbers is N, start current is I_s, and end current is I_e. We can calculate the current values for each point:

$I_1 = I_s$;

$I_2 = I_s + (I_e - I_s)/(N-1)$

...

$I_n = I_s + (n-1)(I_e - I_s)/(N-1)$

...

$I_N = I_s + (N-1)(I_e - I_s)/(N-1) = I_e$

From 2 to 15 different bias currents can be set. TH1773 will output the bias currents in the order I_1 (I_s), I_2, ..., I_n (I_e) with a delay time from 0 to 99 seconds between different current points (**Auto** mode). For some special measurement need, loop current function can be used.

Perform following steps to measure a device in **Equ Scan** and **Auto** mode:

1)   Press **[Mode]** key to select the **Equ Scan** mode.
2)   Press **[Auto]** key to select the **Auto** scan mode, referring to paragraph 4.3.1.
3)   Press **[Step]** key to set the **Scan Numbers**, referring to paragraph 4.3.2.
4)   Press **[SetI]** key to set the current value for I_s and I_e, referring to paragraph 4.3.3.
5)   Press **[Dela]** key to set the **Scan Delay** time, referring to paragraph 4.3.4.
6)   Press **[Retu]** key to set the loop function, referring to paragraph 4.3.5.
7)   Set the footswitch mode to **Trig** mode.
8)   The setups are listed below, and the following display page will be displayed.
- ■   **Auto** operation mode
- ■   **Scan Numbers** = 6
- ■   **Scan Delay** = 5 sec
- ■   Loop function enabled
- ■   **FootMode** = Trig

```
Equ Scan(N= 6):    R A
Is = 1.000 A▾    5sec
```

9)   Connect the device to the **UNKNOWN** terminals.
10)   Press **[START]** or trigger the footswitch to start the bias current output. The current points will be outputted automatically in the following order:

$[START] \rightarrow I_1 \rightarrow Delay \rightarrow I_2 \rightarrow Delay \rightarrow ... \rightarrow I_6 \rightarrow Delay \rightarrow I_5 \rightarrow Delay \rightarrow ... \rightarrow I_2 \rightarrow Delay \rightarrow I_1 \rightarrow Delay \rightarrow Over.$

11)   **[START]** button or footswitch can both be used to skip the delay time and switch to the next point directly.
12)   Read the measurement results from the LCR meter.

13) Press **[RESET]** button to end the measurement at any time.
14) Disconnect the device under test.
15) Repeat step 9 to step 14 to test other devices.

Perform following steps to measure a device in **Equ Scan** and **Manual** mode:
1) Press **[Mode]** key to select the **Equ Scan** mode.
2) Press **[Auto]** key to select the **Manual** scan mode, referring to paragraph 4.3.1.
3) Press **[Step]** key to set the **Scan Numbers**, referring to paragraph 4.3.2.
4) Press **[SetI]** key to set the current value for I_s and I_e, referring to paragraph 4.3.3.
5) Press **[Retu]** key to set the loop function, referring to paragraph 4.3.5.
6) Set the footswitch mode to **Trig** mode.
7) The setups are listed below, and the following display page will be displayed.
   - **Manual** operation mode
   - **Scan Numbers** = 6
   - Loop function disabled
   - **FootMode** = Trig

```
Equ Scan(N= 6):
Is = 1.000 A▾     Stop
```

8) Connect the device to the **UNKNOWN** terminals.
9) Press **[START]** or trigger the footswitch to start the bias current output.
10) Read the measurement result from the LCR meter.
11) Press **[START]** or trigger the footswitch to the next current point.
12) Repeat step 10 and 11, until all current points are finished.
13) Press **[RESET]** button to end the measurement at any time.
14) Disconnect the device under test.
15) Repeat step 8 to step 14 to test other devices.

4.6 Messages displayed during operation

Two kinds of error messages may be displayed during operation.

4.6.1 OverLoad

If TH1773 and the slave current sources fail to provide the preset bias current value within 1 second, TH1773 will no longer attempt to output the bias current, and **Overload** message will be displayed as shown in the following figure.


The possible reasons for overload:

✧ The **UNKNOWN** terminals are open circuit, when TH1773 is started to output a bias current.

✧ The resistance of DUT is too large to be tested. The voltage (V=IR) exceeds the maximum output voltage of TH1773.

✧ The output bias current does not reach the required current value within 1 second, when a large inductance is tested under a large bias current.

✧ TH1773 may be broken down and needs to be repaired.

If the overload error message is disappeared after the **UNKNOWN** terminals are shorted directly, which means TH1773 is working normally. The reason for overload must be among the first three reasons listed above. The current device under test can not be measured under this bias current value. Try to measure it under a lower bias current.

4.6.2 Unbal

TH1773 adopts a special balancing technology to meet the need of 4-terminal test theory of a L/LCR meter. Once error message "**Master Unbal**" is displayed, this means that TH1773 fails to accomplish overlap current measurement and bias current output will be disabled as shown in the following figure.
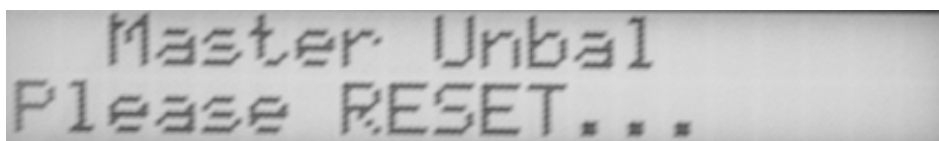
Press **[RESET]** key to clear the error message first. Check the connection with the LCR meter and short the **UNKNOWN** terminals directly. Try to start the bias current again.

If the "**Master Unbal**" error message is displayed again, there may be something wrong inside the TH1773. Please connect our company or service center for help.