DC Bias Current Source
SM6027A

User Manual

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Chapter 1 General Information

1.1 Introduction

SM6027A DC Bias Current Source adopts high-performance MPU and can provide a constant current range from 0A to 20A. The maximum current output can reach 0-120A by connecting the slave. SM6027A can be used with Scientific LCR meters. It is suitable for the AC/DC superposition test of magnetic inductors and provides the convenient and practical magnetization current source for the characteristic analysis of magnetic materials.

The instrument can accept real-time modified current at work and respond immediately.

It adopts a new generation of AC-DC superimposed test principle to adapt to high-precision and high-frequency test needs.

The instrument has a new design-friendly graphical operation interface and offers a variety of control modes: manual key control, foot switch control and remote command control.

1.2 Specification

1.2.1 Current Accuracy

The main machine: 0.000mA~20.0A 1A/5A/20A three current gears;

Up to 5 slaves can be connected, the output current range is 0.000mA ~ 120.0A.

1.2.2 Display

480 × 800 16: 9 24bit true color TFT LCD

1.2.3 Control

Physical keys: START / STOP button to control the start or close of the current output;

Foot switch: two kinds of foot mode to control the start or close of the current output;

RS232: remote control can be performed by commands.

1.2.4 Frequency response

0Hz ~ 2MHz

1.2.5 Driver

Output voltage: 7.5Vmax

The maximum allowable DC resistance of the DUT: Rmax= $\frac{Vmax}{I}$ (Ω);

The maximum allowable inductance of DUT: Lmax= $\frac{Vmax}{di/dt}$ (mH)

The maximum allowable time of open circuit, overload, overheating or unbalance: automatic protection <1ms;

The smallest step of sweep:

I ≦ 1A: 5mA

I ≦ 5A: 25mA

I ≦ 120A: 100mA

1.2.6 Interface

SM6027A is equipped with SlaverLink interface, RS232C interface and USB Device interface.

SM6027A can be connected directly with the Company's L-Meter or LCR Bridge and can be controlled by some L-Meter or LCR Bridge. It can be controlled by all upper computers with serial port (the control instruction set must follow the SCPI instruction set provided by this manual).

1.3 Main Functions

- Only capable of forward current output. If directional current is needed, please change the connection direction between DUT and the output end.
- Display the real-time working state of the main machine and the slaver.
- With two foot-control mode, strong adaptability.
- Provide SCPI command
- With user-friendly graphical interface, can quickly indicate the working status of the instrument, convenient and efficient control.
- Provide English and Chinese operation interface.

1.4 Others

1.4.1 Warm-up

Please warm-up the machine minimum for 30 minutes before using it.

1.4.2 Working Time

It is better not to load large current continuously for a long time.

1.4.3 Power Supply

Voltage: AC220/110V (1±10%)

Frequency: 50/60Hz (1±5%)

Range: ≤600VA

1.4.4 Environment

Temperature:

- Normal Working: 0~55℃
- Reference Working: 23±5℃
- Storage Environment: 0~55℃

Humidity:

- Normal Working: <90%RH
- Reference Working: <80%RH
- Storage Environment: ≤93RH

1.4.5 Precautions for Usage

- Please do not use the tester in dusty, vibrating, direct sunlight and corrosive gases and other adverse environments.
- When the instrument is not used for a long time, please put it in the original box or similar box and stored in a ventilated room with temperature of 5℃~40℃ and relative humidity less than 85% RH. Do not store the tester in a corrosive atmosphere containing harmful impurities and should avoid direct sunlight.
- The instrument has been carefully designed to reduce clutter due to AC power input. However, it should still be used under low noise conditions. If that is inevitable, please install the power filter.

1.4.6 Dimension

W*H*D: 430×185×473 (mm3)

1.4.7 Weight

18kg

1.4.8 Safety

This tester is a Class I safe equipment.

1.4.8.1 Insulation resistance

In the reference working conditions, the insulation resistance between the power

terminals and the shell is not less than 50M.

In hot and humid transport conditions, the insulation resistance between the power terminals and the shell is not less than 2M .

1.4.8.2 Dielectric strength

In the reference working conditions, the power terminal and the shell can withstand for one minute with no breakdown and flashover phenomenon of 1.5kV rated voltage and 50Hz frequency of AC voltage.

1.4.8.3 Leakage current

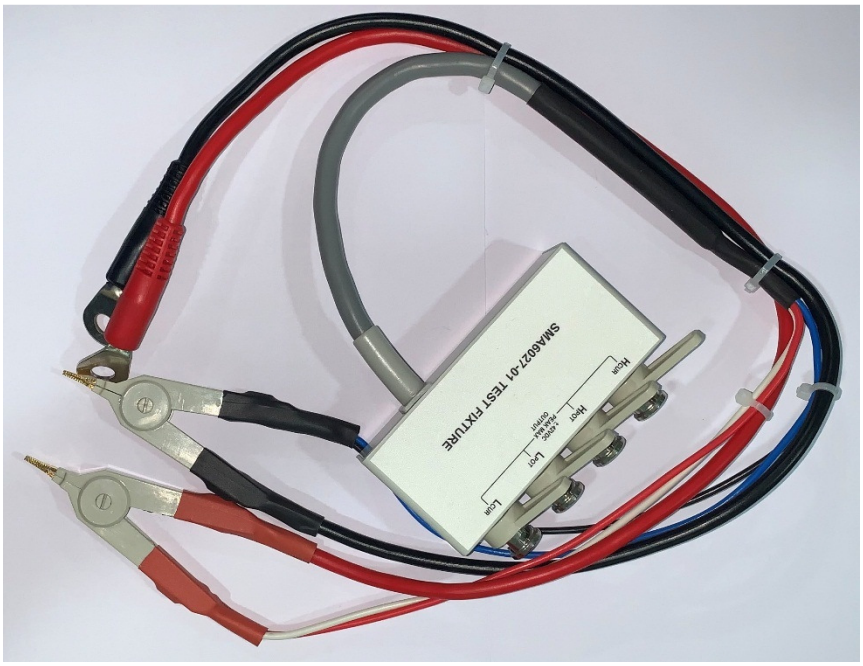
The leakage current is not greater than 3.5mA.

Chapter 2 Installation

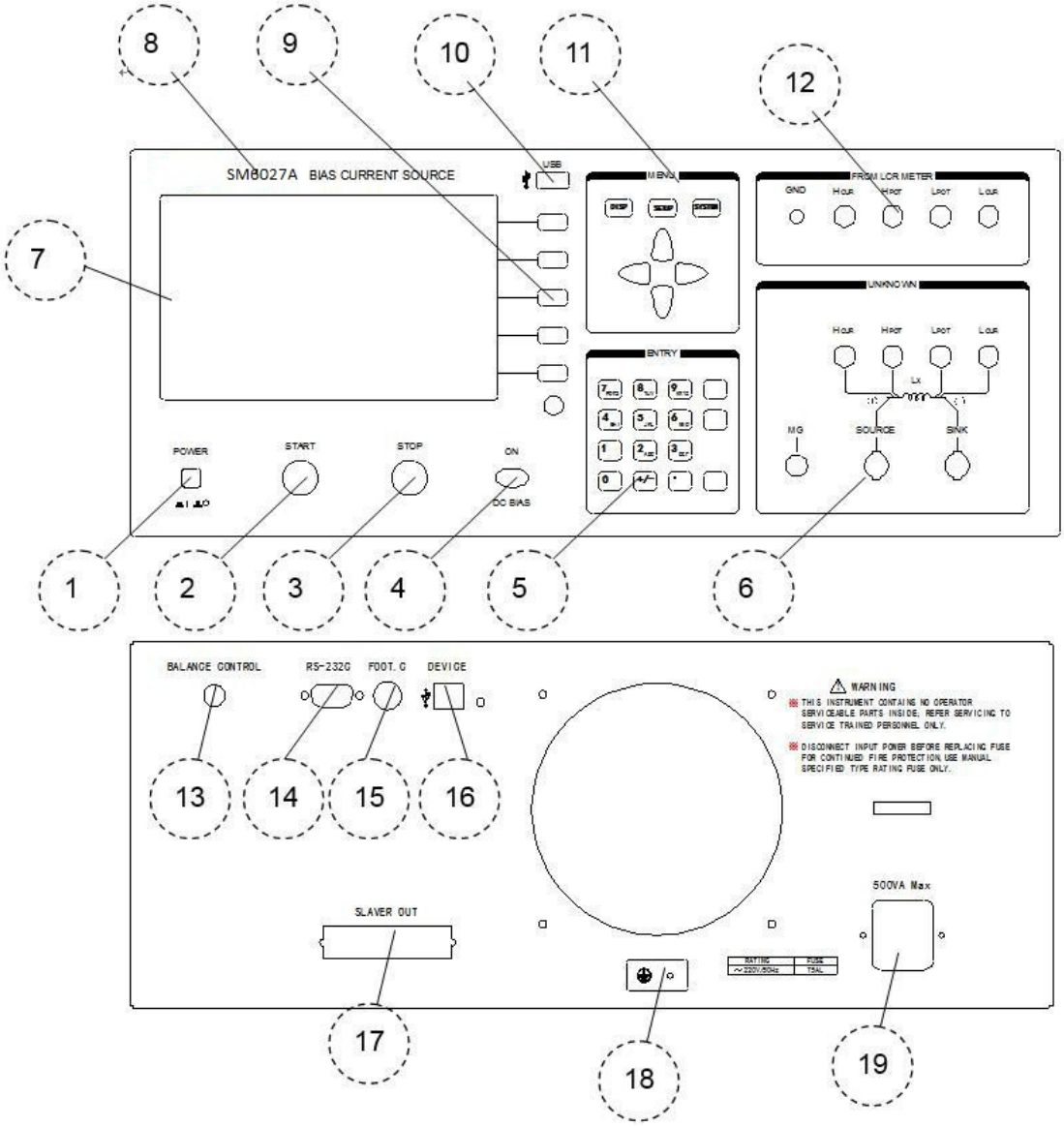
2.1 Accessories

2.1.1 Test Fixture

The standard test fixture is SMA6027-01



2.2 Front Panel Description



1) Power Switch

   Press down to power on, push out to power off.

2) Start Button To start output

3) Stop Button To stop output

4) DC Bias LED

   When the instrument starts to output, the output indicator lights up.

5) Number Keys

   Used to input numbers

6) Output Port

   Current is output from this port.

7) LED Screen
   Used to display operation interface

8) Brand and Model
   The brand and model of the instrument

9) Menu Button
   For menu manipulation

10) USB Interface
    Used for software upgrade

11) Module Keys and Direction Keys
    Used for switching modules and moving the cursor

12) Test Input
    Used to connent LCR or L meters, making the test signal and DUT produce the test access through AC coupling.

13) Balance
    -

14) Serial Port (RS232)
    The output of the bias source and its parameters can be controlled through the serial port according to the SCPI instruction of the manual.

15) Foot input
    Foot switch input port

16) USB Interface
    The output of the bias source and its parameters can be controlled through the USB interface according to the SCPI instruction of the manual.

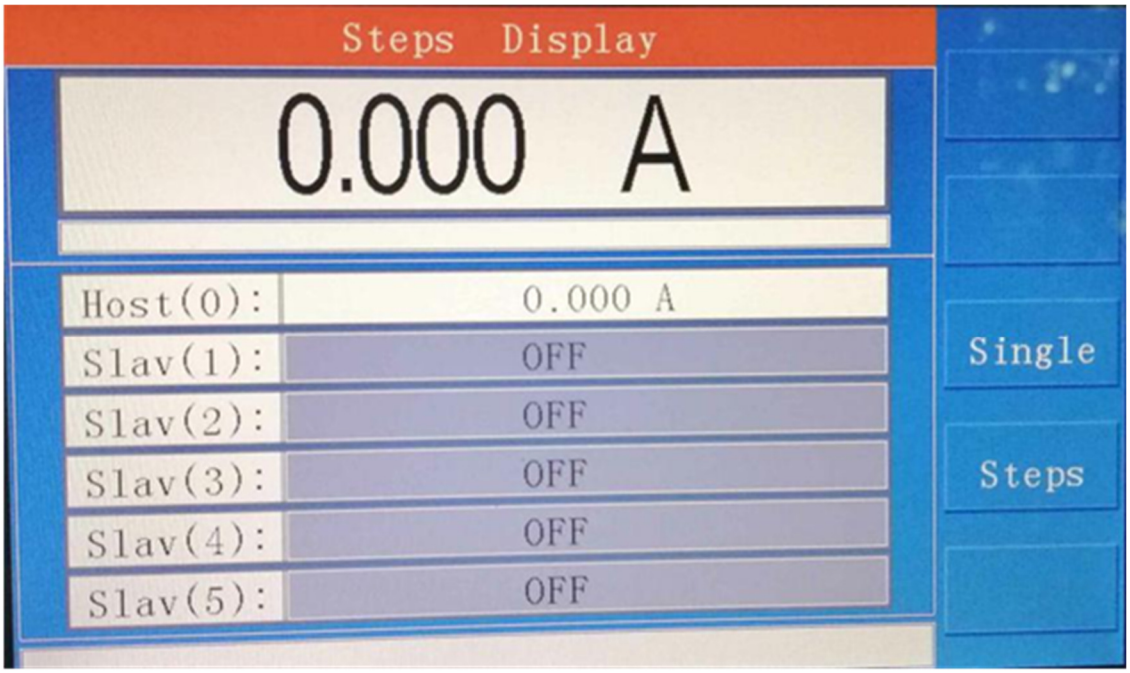
17) Slaver Out Interface Master/slave dedicated interface.

18) GND
    If the power cord is not grounded, please connect the grounding cord here!

19) Power Socket
    Used to input the AC power. Be sure to use a three-core power supply with grounding!

Chapter 3 Basic Operation

3.1 Instruction of main interface



3.1.1 Current Display

The total output current can be set on the setting interface or on the main interface. Using the numeric keypad, you can set the current value. The default unit is A.

The setting range of current value is listed below:

Slaver Amount	Set Lower Limit (A)	Set Upper Limit (A)
0	0	20
1	0	40
2	0	60
3	0	80
4	0	100

3.1.2 Current Climbing Progress Bar

When the instrument starts to output current, there is a climbing process. The higher the current is, the slower the climbing will be. Therefore, in order to visually display the current climbing process, there is a current climbing progress bar. When the progress bar is full, it means the current climbing is finished and the setting value is reached.

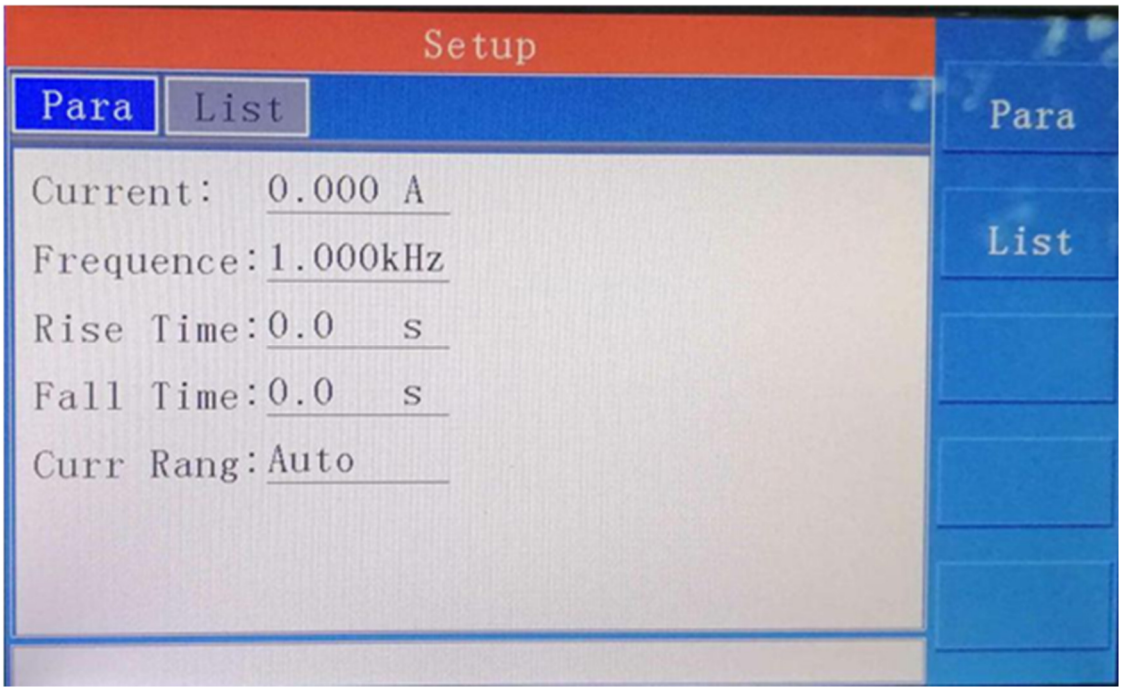
3.1.3 Host and Slave Current Display

After setting the total current, the system will automatically allocate the current to the host and each slave and display in the table.

In addition to displaying the respective current, it can also display the status of each slave and the host.

Status	Meaning
Off	Indicates that the slave power is off or not connected to the host or does not exist.
Not Output	White background indicates the instrument is currently not output current.
Output	Green background indicates the instrument is currently output current.
Overload	Indicates the instrument is currently in an abnormal state of overload
Overheat	Indicates the instrument is currently in an abnormal state of overheating.
Unbalance	Indicates the instrument is currently in an abnormal state of unbalance.

3.2 Instruction of Setting Interface



As shown in the figure above, the setting interface includes parameter setting and list setting.

3.2.1 Parameter Setting

3.2.1.1 Current Output

Make use of the numeric keyboard to set the total current output value, the default unit is A.

The current setting range is listed below:

Slaver Amount	Set Lower Limit (A)	Set Upper Limit (A)
0	0	20
1	0	40
2	0	60
3	0	80
4	0	100
5	0	120

3.2.1.2 Response Frequency

Make use of the numeric keyboard to set the response frequency, the default unit is Hz. The response frequency setting range is 0~2MHz.

3.2.1.3 Rise Time

Make use of the numeric keyboard to set the current rise time, the default unit is s.

3.2.1.4 Fall Time

Make use of the numeric keyboard to set the current fall time, the default unit is s.

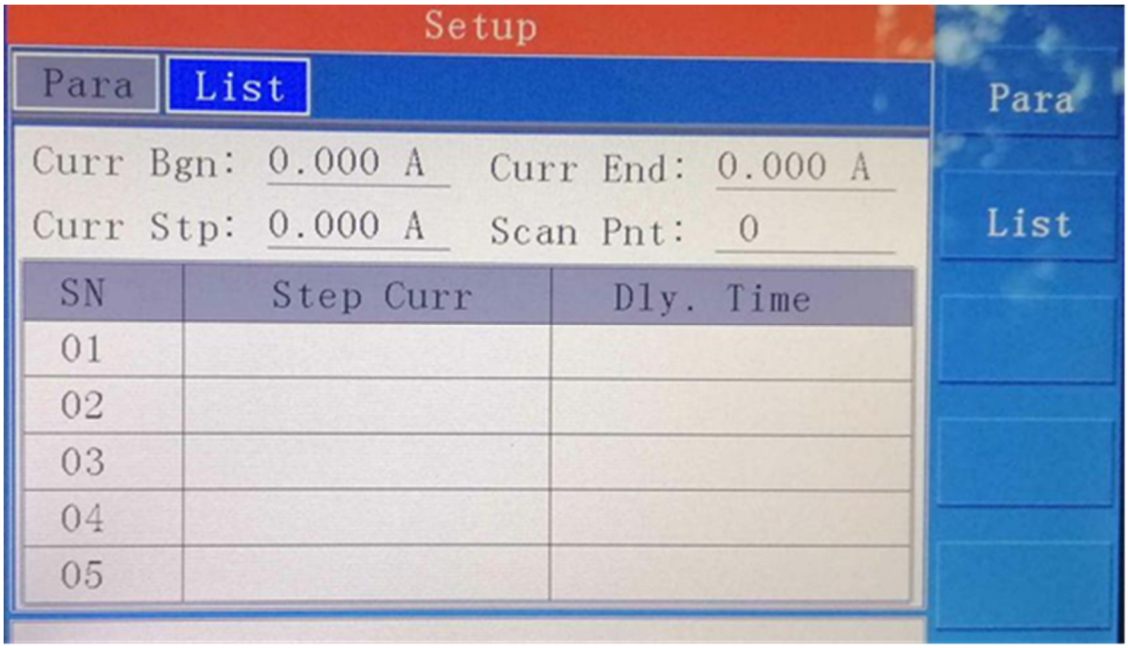
3.2.1.5 Current Range

The instrument is designed to have three current ranges which are listed below:

Range	Current Range
1	0A~1A
2	1A~5A
3	5A~20A

The default is automatic range which means the instrument will automatically set to the appropriate range based on the current setting value.

3.2.2 List Setting



3.2.2.1 Current Begin

Make use of the numeric keyboard to set the current begin value, the default unit is A, the setting range is 0~120A.

3.2.2.2 Current End

Make use of the numeric keyboard to set the current end value, the default unit is A, the setting range is 0~120A.

3.2.2.3 Current Step

Make use of the numeric keyboard to set the current step value, the default unit is A, the setting range is 0~120A.

3.2.2.4 Scan Point

Make use of the numeric keyboard to set the scan point amount, the setting range is 0~50.

3.2.2.5 List Setting

There are three methods to set the current list:

1) According to the three parameters of current begin, current end and current step to generate the list automatically.

If current begin is Ib, current end is Ie, current step is Is. Then the current list can be shown as Ib, Ib+ Is, Ib+ Is*2, ……, Ie.

2) According to the three parameters of current begin, current end and scan point to generate the list automatically.

   If current begin is Ib, current end is Ie, scan point is n, then the current step can be represented as Is=(Ie-Ib) /(n-1). The current list can be shown as Ib, Ib+ Is, Ib+ Is*2, ……, Ie.

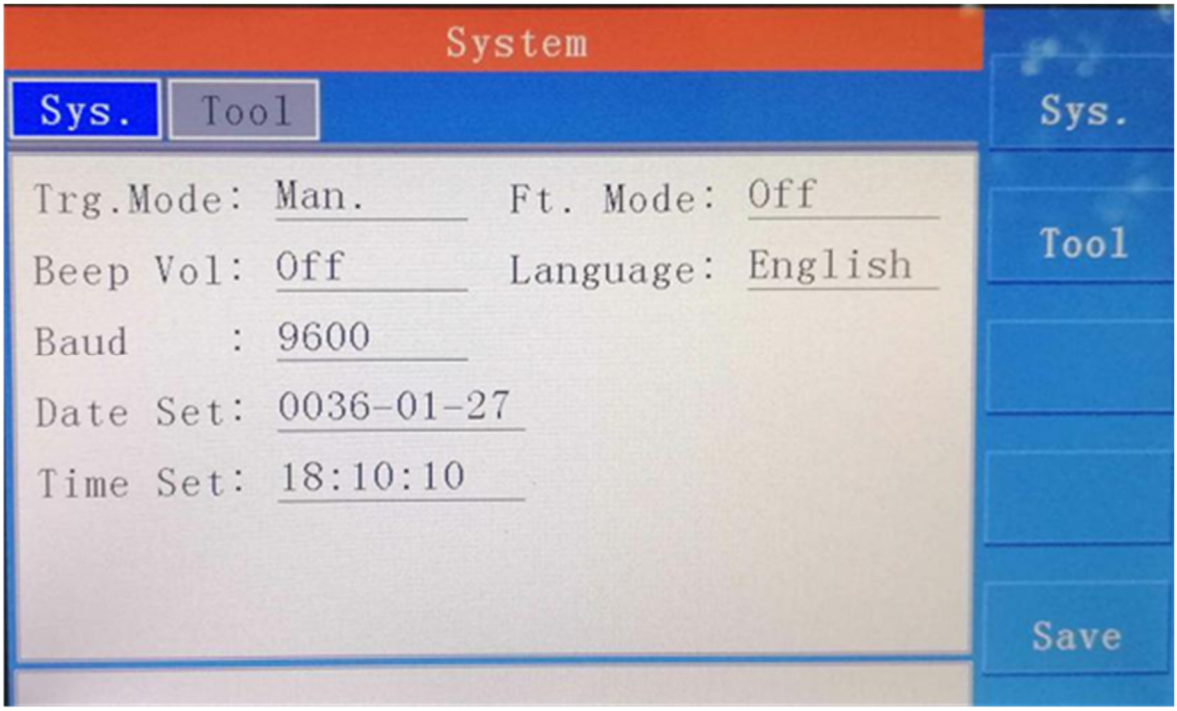
3) Move the cursor to the desired place and make use of the numeric keyboard to input each value. There are two methods to set the delay time:

   1 Move the cursor to the desired place and make use of the numeric keyboard to input each value.

   2 Move the cursor to the place where the delay time has been set already, and make use of the copy function to copy the value to all the blanks.

3.3 System and Tool Settings

3.3.1 System Setting



3.3.1.1 Trig Mode

There are three trigger modes which are listed below:

- Man: Make use of the start button on the front panel to start output current.
- Ext: Make use of the pedal switch on the rear panel to start output current.
- Bus: Make use of the RS232 interface on the rear panel to start output current.

3.3.1.2 Foot Mode

There are two foot modes which are listed below:

- Trig Mode: Step one time to start outputting, step one time again to stop outputing.
- Hold Mode: Step and hold on the switch to start outputting, loosen the switch to stop outputting.

3.3.1.3 Beep Volume

To set the speaker to ON/OFF.

3.3.1.4 System Language

The system language includes Chinese and English two options.

3.3.1.5 Baud Rate

The baud rate includes 9600, 19200, 38400, and 115200.

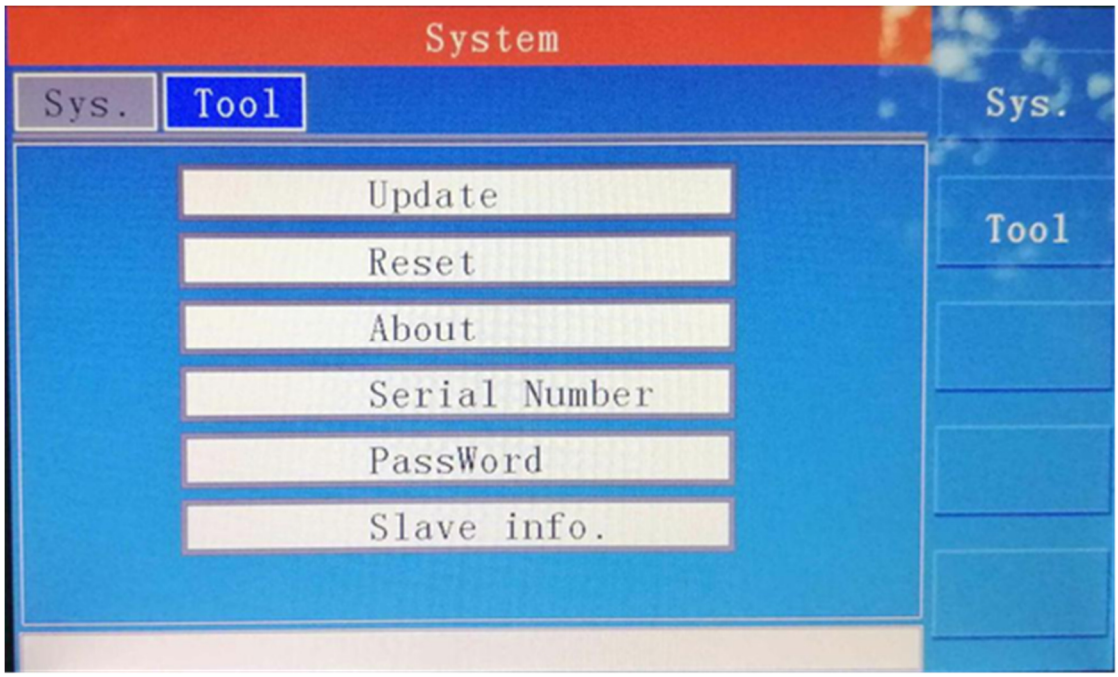
3.3.1.6 Date Setting

To set year, month and date.

3.3.1.7 Time Setting

To set hour, minute, and second.

3.3.2 System Tool



3.3.2.1 Software Update

- Copy the upgrade program file (SM6027A.sec) to the USB root directory
- Insert the USB disk to the USB interface on the front panel
- Select Update to upgrade the software, and there will be a progress bar to indicate the progress
- The instrument will restart automatically while the upgrade is completed

3.3.2.2 Restore Factory Setting

Select Rest to restore factory setting.

3.3.2.3 Instrument Information

The provided information are listed below:

- Model number and name of the instrument
- Software version
- Statement of software copyright

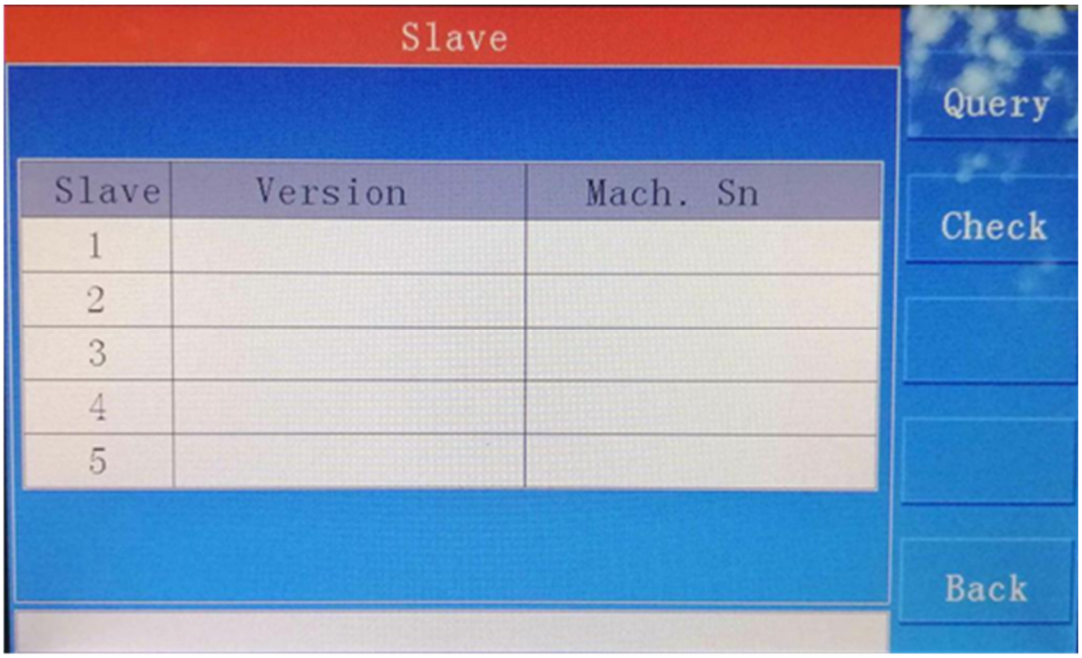
3.3.2.4 Serial Number

Serial Number of the instrument is provided.

3.3.2.5 Password

Users are able to set a new password, or change the password.

3.3.2.6 Slave Information



You can use this feature to view the slave index and its software version.

3.4 Instruction of Instrument Output

3.4.1 Current Output

There are three methods to start outputting current which are listed below:

3.4.1.1 Start Button

Press the start button to start outputting current.

3.4.1.2 Foot Switch

In Trig mode, step and release the foot switch, the instrument starts to outputting current.

In Hold mode, step and hold the foot switch to output current.

3.4.1.3 Command

While receive the command WORK:START the instrument starts to output current.

3.4.2 Stop Current Output

3.4.2.1 Stop Button

Press the stop button to stop outputting current.

3.4.2.2 Foot Switch

In Trig mode, step and release the foot switch, the instrument will stop outputting current.

In Hold mode, release the foot switch to stop outputting current.

3.4.2.3 Command

While receive the command WORK:STOP the instrument will stop outputting current immediately.

3.4.3 Single and Steps Output

On the display interface, users can choose Single/Steps output.

Single Output: Output a single current value.

Steps Output: In accordance with the set list, and output current in order.

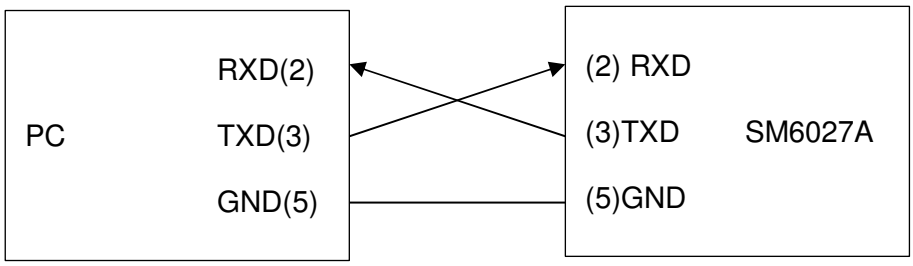
Chapter 4 Command

4.1 SM6027A RS232 Instruction

As the most serial ports, TH1778 is not based on RS-232 strictly, only a min. subset. As figure：

Signal	Abbr.	Pin No.
Send data	TXD	3
Receive data	RXD	2
Ground	GND	5

The connection between instrument and PC：



As can be seen from the figure above, the serial port connecting line needs to be crossed, so please be aware of it when purchasing it. Users can also buy the serial port cable from Tonghui.

4.2 SCPI Command

Note that all the following command are sent and received as strings. Each command must be followed by a terminator, or the instrument will remain in a waiting state and not process the command. The ending character is a newline character which is LF. It's ASC code is 10 in decimal or 0A in hexadecimal. When there is data return, each data is terminated with LF.

4.2.1 General command set

***IDN?**

Function: Check the model, and edition.

Command Format: *IDN?

Command Example:

Input Command: *IDN?

Returned Info: TH1778A, Ver 1.00

***STA**

Function: Turn on the instrument and output current

Command Format: *STA

Command Example:

Input Command: *STA

Instrument starts to output current

***STO**

Function: Stop outputting current

Command Format: *STO

Command Example:

Input Command: *STO

If the instrument is outputting current, then stop outputting current

4.2.2 Parameter Sub-System Command

The parameter sub-system command is used to remotely set parameters.

:PARA:CURR

Function: Set or query the current current

Command Format:

Set Format: :PARA:CURR <data>

Query Format: :PARA:CURR?

Data:

Data Type: Float, 4 bytes

Data Range：0~120

Data Accuracy: 0.1

Data Unit: A

Set Example: To set the current to 1A, enter the command: :PARA:CURR 1

Query Example: If you enter the command: :PARA:CURR?, the returned content is ：1, indicating the current current is 1A.

:PARA:FREQ

Function: Set or query the current frequency

Command Format:

Set Format: :PARA:FREQ <data>

Query Format: :PARA:FREQ?

Data:

Data Type: Float, 4 bytes

Data Range：0~2000000

Data Accuracy: 1

Data Unit: Hz

Set Example: To set the frequency to 100kHz, enter the command: :PARA:FREQ 100000

Query Example: If you enter the command: :PARA:FREQ?, the returned content is: 100000, indicating the current frequency is 100kHz.

:PARA:FOOT

Function: Set or query the current working state of the foot switch

Command Format:

Set Format: :PARA:FOOT <data>

Query Format: :PARA:FOOT?

Data:

Data Type: Enumeration, 1 byte

Data Range：TRIG, HOLD

Data Accuracy: -

Data Unit: -

Set Example: To set the foot switch to rising edge trigger, enter the command: :PARA:FOOT TRIG

Query Example: If you enter the command: :PARA:FOOT?, the returned content is: TRIG, indicating the current foot switch is rising edge triger.

4.2.3 State Sub-System Command

:STAT:HOST

Function: Query the current state of the host.

Command Format:

Query Format: :STAT:HOST?

Returned Info:

Data type: Unsigned integer, 1 byte

Data Range: 0~31(0x1F)

Meaning:

Bit0: On or Off

Bit1: Running or not

Bit2: Over-heat or not

Bit3: Overload or not

Bit4: Unbalanced or not

Query Example: If you enter the command: :STAT:HOST?, the returned content is: 1 has the following meaning:

Bit0: 1 The host has been turned on

Bit1: 0 Not running

Bit2: 0 Not overheat

Bit3: 0 Not overload

Bit4: 0 Not unbalanced

:STAT:SLAV

Function: Query the current state of the slave.

Command Format:

Query Format: :STAT:SLAV?

Returned Info:

Data type: Unsigned integer, 1 byte

Data Range: 0~31(0x1F)

Meaning:

Bit0: On or Off

Bit1: Running or not

Bit2: Over-heat or not

Bit3: Overload or not

Bit4: Unbalanced or not

Query Example: If you enter the command: :STAT:SLAV?, the returned content is: 1 has the following meaning:

Bit0: 1 The slave has been turned on

Bit1: 0 Not running

Bit2: 0 Not overheat

Bit3: 0 Not overload

Bit4: 0 Not unbalanced

:STAT:WORK

Function: Query the current working state of the slave.

Command Format:

Query Format: :STAT:WORK?

Returned Info:

Data type: String

Data Range: running, preparing

Meaning:

Running: The instrument is outputting current

Preparing: The instrument is in the state of preparing

Query Example: If you enter the command: :STAT:WORK?, the returned content is: running, indicating the instrument is outputting current.

4.2.4 System Sub-System Command

System Sub-System Command is used to remotely set the system of the instrument.

:SYST:BAUD

Function: Set or query the baud rate

Command Format:

Set Format: :SYST:BAUD <data>

Query Format: :SYST:BAUD?

Data:

Data Type: Enumeration, 4 byte

Data Range：9600,19200,38400,115200

Data Accuracy: -

Data Unit: -

Set Example: To set the baud rate to 9600, enter the command: :SYST:BAUD 9600

Query Example: If you enter the command: :SYST:BAUD?, the returned content is: 9600, indicating the current baud rate is 9600.

:SYST:BEEP

Function: Set or query the beep is on or off

Command Format:

Set Format: :SYST:BEEP <data>

Query Format: :SYST:BEEP?

Data:

Data Type: Enumeration, 1 byte

Data Range：ON, OFF

Data Accuracy: -

Data Unit: -

Set Example: To set the beep to ON, enter the command: :SYST:BEEP ON

Query Example: If you enter the command: :SYST:BEEP?, the returned content is: ON, indicating the beep is on.

:SYST:LANG

Function: Set or query the system language

Command Format:

Set Format: :SYST:LANG <data>

Query Format: :SYST:LANG?

Data:

Data Type: Enumeration, 1 byte

Data Range： ENG

Data Accuracy: -

Data Unit: -

Set Example: To set the system language to English, enter the command: :SYST:LANG ENG

Query Example: If you enter the command: :SYST:LANG?, the returned content is: ENG, indicating the current system language is English.

:SYST:TRIG

Function: Set or query the trigger mode

Command Format:

Set Format: :SYST:TRIG <data>

Query Format: :SYST:TRIG?

Data:

Data Type: Enumeration, 1 byte

Data Range：MAN, EXT, BUS

Data Accuracy: -

Data Unit: -

Set Example: To set the trigger mode to manually, enter the command: :SYST:TRIG

Query Example: If you enter the command: :SYST:TRIG?, the returned content is: MAN, indicating the current trigger mode is manually.

:SYST:FOOT

Function: Set or query the current working mode of the foot switch

Command Format:

Set Format: :SYST:FOOT <data>

Query Format: :SYST:FOOT?

Data:

Data Type: Enumeration, 1 byte

Data Range：EDGD, EDGU, HOLD, LOCK, VOLT

Data Accuracy: -

Data Unit: -

Set Example: To set the foot switch to rising edge trigger, enter the command: :SYST:FOOT EDGU

Query Example: If you enter the command: :SYST:FOOT?, the returned content is: EDGU, indicating the current foot switch is rising edge trigger.

4.2.5 Working Sub-System Command

Working Sub-System Command is used control the current output or stop current output.

:WORK:START

Function: Start current output

Command Format: :WORK:START

Example: To start current output, enter the command: :WORK:START

:WORK:STOP

Function: Stop current output

Command Format: :WORK:STOP

Example: To stop current output, enter the command: :WORK:STOP

4.2.6 Other Command

:REMO:LOCK

Function: Key lock, disable all the buttons on the front panel, except the STOP button.

Command Format: :REMO:LOCK

Example: To lock keys, enter the command: :REMO:LOCK

:REMO:ULOC

Function: Key unlock.

Command Format: :REMO:ULOC

Example: To unlock keys, enter the command: :REMO:ULOC

:DEVI:MODE

Function: Set working mode, Tonghui mode or Common mode

Command Format: :DEVI:MODE <data>

Data:

Data Type: Enumeration, 1 byte

Data Range: COMM, TH

Data Accuracy: -

Data Unit: -

Set Example: To set to Tonghui mode, enter the command: :DEVI:MODE TH, the returned content will be 1778.

Chapter 5 Service & Maintenance

Maintenance

There are no user serviceable parts inside the unit. Your DC Current Bias unit is thoughtfully engineered for ease of use, accuracy and reliability. The instrument is carefully tested and calibrated using standards traceable to National Laboratories. Take care of your instrument by cleaning the exterior of the instrument regularly with a dusting brush. Dirt which is difficult to remove on the casing & plastic parts, can be removed with a moist cloth (99% water, 1% mild detergent) spirit or washing benzene(petroleum ether) can be used to remove greasy dirt. The display may be cleaned with water or washing benzene (but not with spirit- alcohol solvents), it must then be wiped with a dry clean lint-free cloth. Under no circumstances the cleaning fluid should get into the instrument. The use of cleaning agents can attack the plastic & paint surfaces.

Dispatch Procedure for Service

No user serviceable parts are inside the instrument, should it become necessary to send back the instrument to factory for service, please observe the following procedure:

1. Before dispatching the instrument please write to us giving full details of the model number, serial number, fault noticed and contact details of concerned person.
2. After receipt of your communication, our service department will advise you whether it is necessary to send the instrument back to us for repairs or the adjustment is possible in your premises.
3. Dispatch the instrument (only on the receipt of our advice) securely packed in original packing duly insured and freight paid along with accessories and a copy of the faults details noticed at our Service Center listed on last page of this manual, nearest to you.

Chapter 6 Warranty

Scientific warrants all its Instruments to be free from defects in material and workmanship when used under normal operating conditions in accordance with the instructions given in the manual for a period of 12 (Twelve) months from date of purchase from Scientific or its authorized dealers.

The service during the warranty period will be rendered on return to factory / service center basis.

1. Its obligation under this warranty is limited to repairing or replacing at its own discretion. This warranty shall not apply to any defect, failure or damage caused by accident, negligence, mis-application, alteration or attempt to repair, service or modify in any way.
2. This warranty does not include display, fuses, batteries or accessories. This warranty is only valid with the original purchaser who must have properly registered the product within 15days from date of purchase. No other warranty is expressed or implied.
3. When it becomes necessary to return the instrument to our Factory facility, kindly pack it carefully in the original carton or equivalent and ship it duly insured, transportation charges prepaid.
4. Your Scientific instrument is a complex electronic device and deserves the best service available by technicians thoroughly familiar with its service and calibration procedures.