

SOURCETRONIC – Quality electronics for service, lab and production

User Manual

0-20A DC BIAS Source ST1778



Edition history:

The manual will be continually revised.

In case of errors or omissions, revision of device functions, as well as technological and software upgrades, there will be corresponding adjustments and modifications of the manual.

February, 2014.....ver1.0

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Chapter 1 General Information

1.1 Introduction

ST1778 DC Bias Current Source adopts high-performance MPU and can provide a constant current ranging from 0A to 20A. The maximum current output can reach 0-120A by connecting up to five slaves. ST1778 can be used with most of Sourcetric's L meters and LCR meters. ST1778 provides a convenient and practical DC Bias Current Source for AC+DC overlap inductor measurement and magnetic material analysis.

1.2 Basic Accuracy

1.2.1 Accuracy Test Requirements

- Within two year since factory calibration;
- Environment temperature: $25\pm 5^{\circ}\text{C}$;
- Relative Humidity: $\leq 80\%$;
- Power supply is regulated by a line-voltage regulator;
- Warm up time: more than 15 mins.

1.2.2 Current Accuracy

Range (A)	Resolution (mA)	Accuracy
0.000~1.000	5	$\pm(1\%+5\text{mA})$
1.025~5.000	25	$\pm 2\%$
5.1A~20.0*n (n=1~6)	100	$\pm 3\%$

1.3 Accessories

■ Current output clip

The standard test clip and output line is ET-07-2 and ET-54. (Note: when the current is greater than 40A, please do not use it as the current output.)

■ Footswitch

The standard footswitch is ST1801-001.

■ Link line

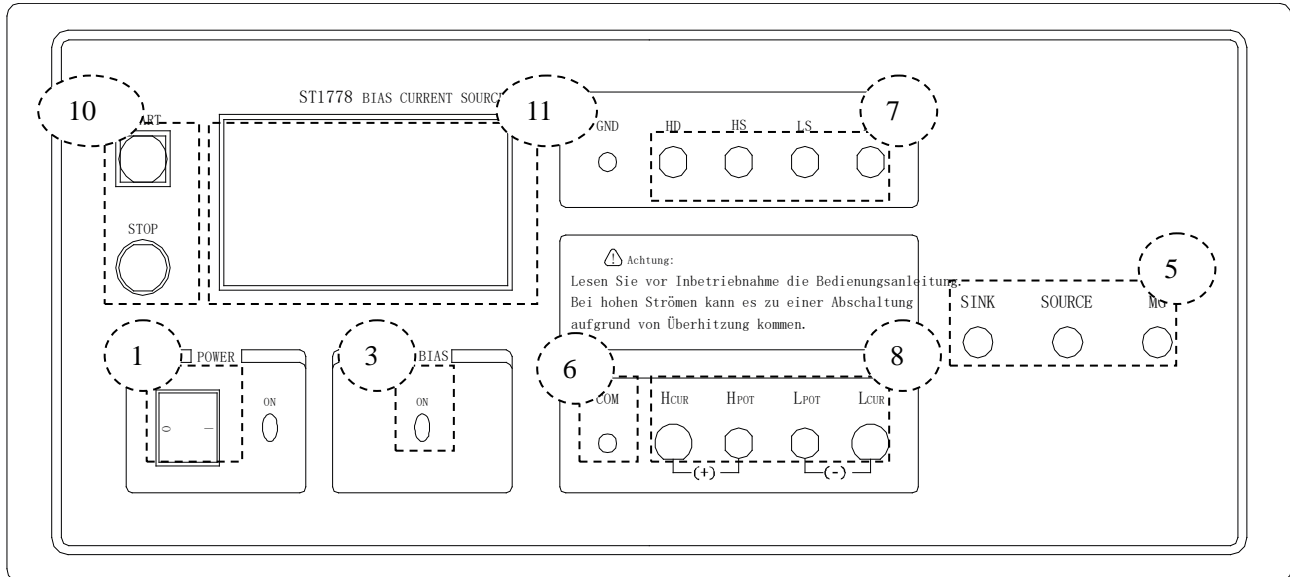
Each ST1778S slave is equipped with a SlaverLink.

■ Test Fixture

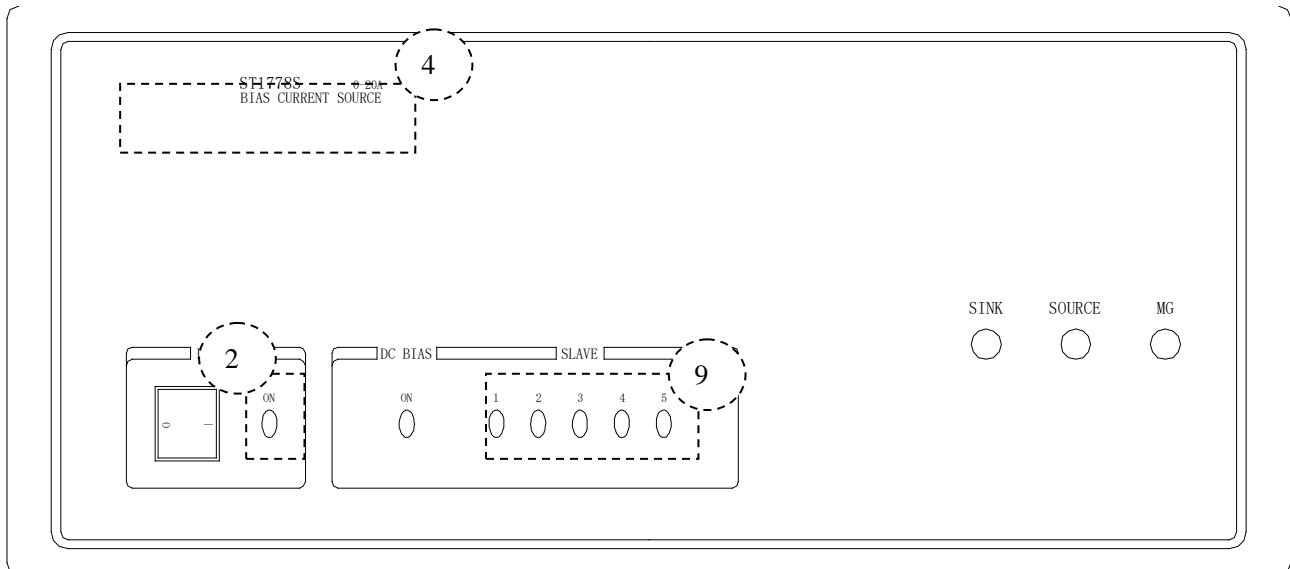
The standard high frequency test fixture is ST26004E-1.

Chapter 2 Panel Description

2.1 Front Panel Description



Front panel of host machine



Front panel of slave

1) Power Switch

When the switch is in the "I" position, all operating voltages are applied to the instrument. In the "0" position, no operating voltages are applied to the instrument.

2) POWER LED

The power led is lightening after power on.

3) OUTPUT LED

When the instrument starts outputting, the output led of the main machine lights up; when the

output current of the slave reaches 20A, the output led of the slave lights up.

4) LOGO/MODEL

Logo and Model

5) OUTPUT PORT

6) GND

The GND terminal is tied to the instrument's chassis. If using a three-phase socket, this GND terminal is connected to the ground directly. If a large current fixture is used, this GND terminal can be connected to that fixture in order to provide protection.

7) TEST INPUT

This port is used for connecting LCR or L meters, supplying the test signal and returning the test access from the DUT through AC coupling.

8) TEST OUTPUT

This port is used for connecting the DUT, combining the signal load from the upper input port and the bias current through the DUT.

9) SLAVE NO. LED

This led indicates the number of slave.

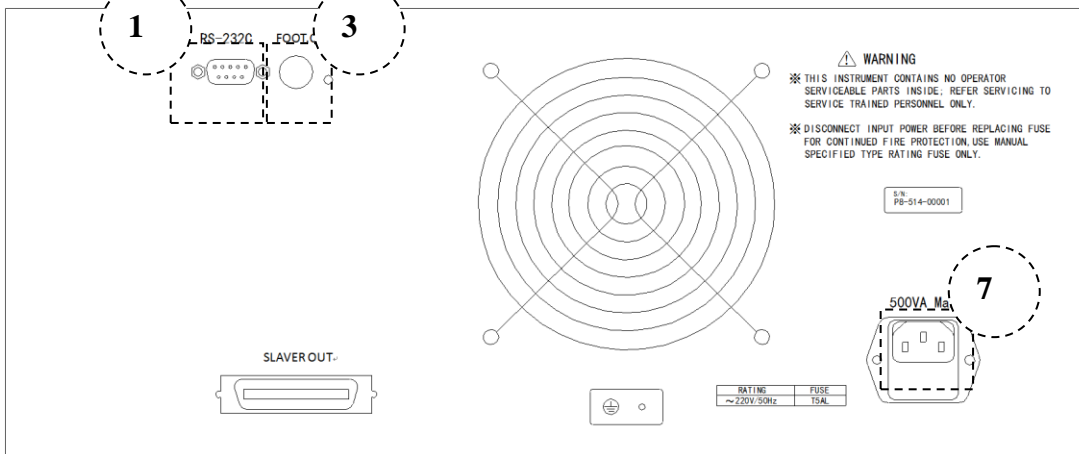
10) BUTTON

This button is used for controlling the start and stop of the current output manually.

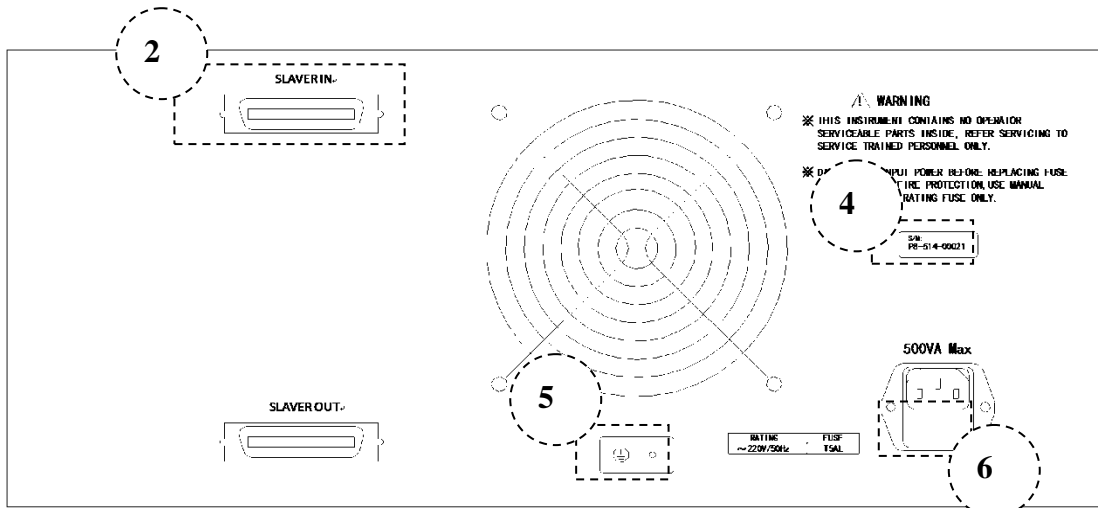
11) SCREEN

This screen indicates the working condition of the instrument and it includes all the operation functions via touch screen.

2.2 Rear Panel Description



Rear panel of host machine



Rear panel of slave

1) SERIAL PORT

Following the SCPI instruction set to control the output of the bias current and set its parameters.

2) LINK PORT

The special link port for daisy-chaining slave devices.

3) FOOT CONTROL INPUT

Foot control input interface.

4) DATA PLATE

Provides the information of Serial number and name of manufacturer.

5) GND

Connect the ground lead.

6) FUSE SOCKET

Used for installing the power fuse to protect the instrument.

This instrument uses a 220V/5A fuse. If using foreign power, please replace the fuse to 110V/8A and change the internal electric source jumper.

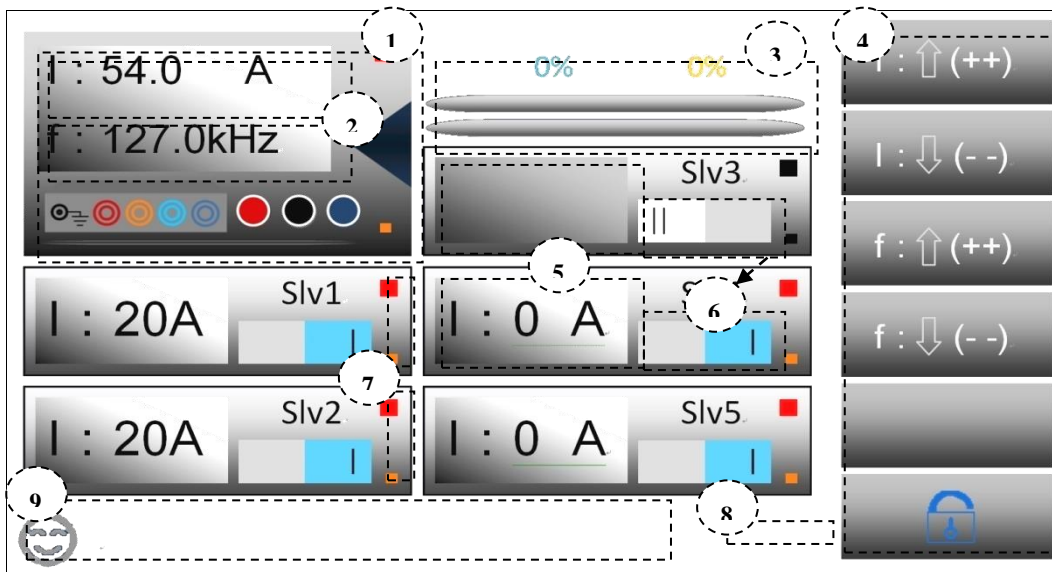
7) POWER SOCKET

It is used for inputting the AC current. Please use the three-phase socket.

Chapter 3 Basic Operation

3.1 Instruction of main interface

3.1.1 Diagram and instruction



1. In this zone, tap to enter the management windows, the detailed description follows in next part.

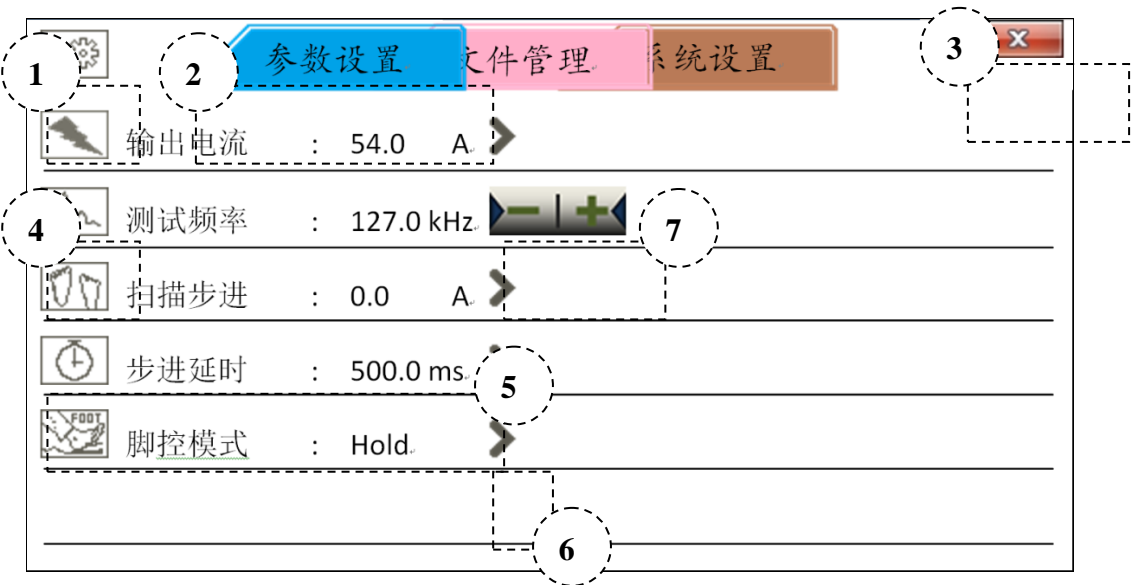
2. The primary and secondary parameters are displayed in this zone (Total current and frequency), tap it to enter the current and frequency setting (The keyboard has calculating function, and supports dual display and input-protection, which means double-confirm of input parameter). The detailed description is in the next part.

3. Indication of output adjusting progress, after step-scanning, the light yellow percentage indicator which is the first progress bar from the top will display the percentage of each adjustment, when the instrument is operating, the first progress bar is used with light yellow color. When step scanning is off, the bar will keep the default status, and the percentage will also keep 0%. The water blue indicator which is the second progress bar from the top will display the percentage of total adjustment. When instrument is operating, the second progress bar is used with water blue color. In either operating mode, even if the output is started, the indicator will work.

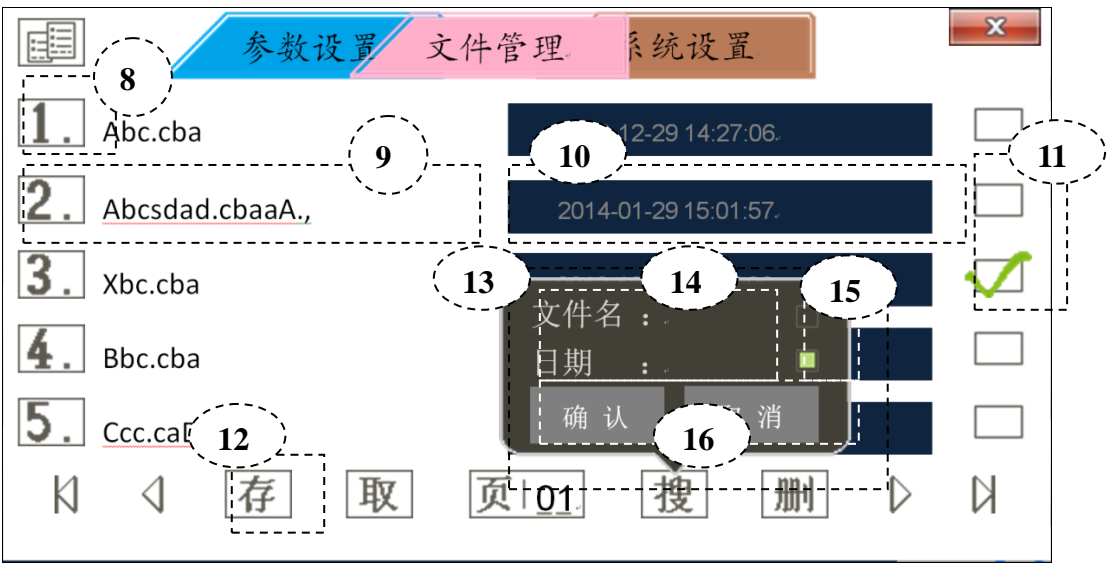
4. Virtual keyboard, there are 5 functions from top to down: current increase, current decrease; frequency increase, frequency decrease; blank ; lock and unlock touchscreen. In the page, if touch is unlocked, all 5 keys can be used to 1 2 3 4 6 5 7 8 9 operate the tester, in any condition, Key 6 can be used to lock and unlock the touch function

5. Sub-frame parameter display, when the slave is not powered or connected or not started up, the zone is blank; when it is powered and connected, and user starts it up, the zone is lighted, also the value of output current is displayed. Generally, the current is distributed automatically, if the slave is assigned as one of the output drivers, then it displays 20A, if not, it is 0A.
6. Virtual switch, click the zone to switch on and off, if sky blue “I” is displayed, it means user has set the slave as active, and when it is connected and powered, the display is as No. 5 above and LED indication is as No 7 zone, then it will be included in the driver distribution; if gray “II” is displayed, it means the user has deactivated this slave and it is not available for current distribution.
7. Virtual display LED displays the status of power supply and running state. The bigger LED indicates the STATE, the smaller LED indicates the connection and POWER status; if the slave is not connected or powered, then all LEDs are black; if the slave is connected and powered, but not activated by the user, then only POWER is lighted; if there is no problem, user can use it as one of the distributed drivers; if all is finished, then the display is like No.5. and the STATE LED is lighted; if this slave is not distributed or system is not in output status, the LED is red; if the slave outputs current, the LED is green.
8. Real time clock display (RTC)
9. The zone display real time message; currently only 2 messages are supported to display now, if user needs, we can add more.

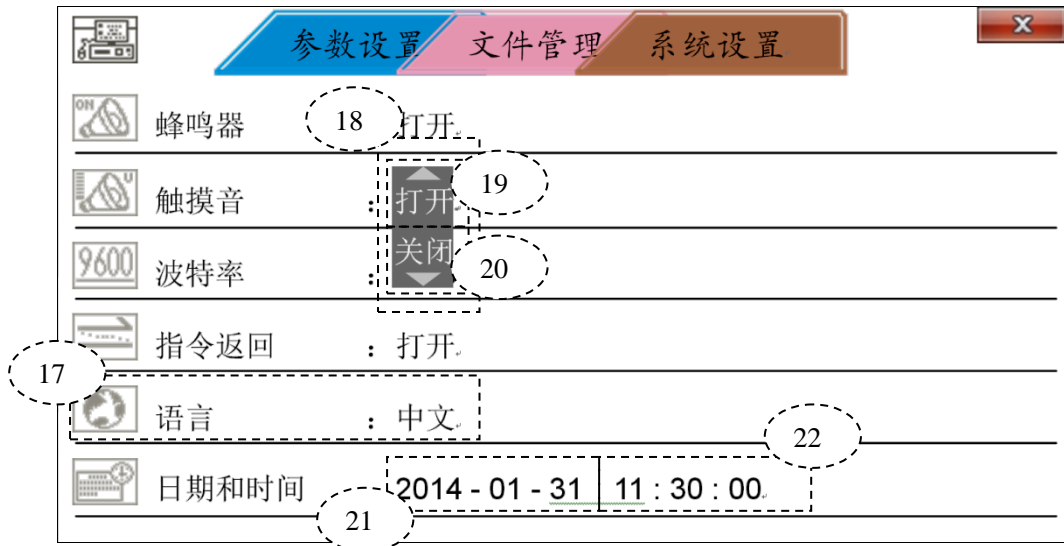
3.1.2 Tab diagram and function instruction



Tab—parameter setting



Tab—file management

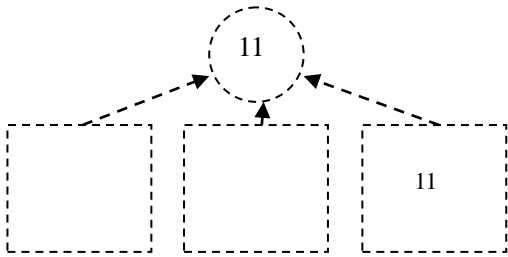
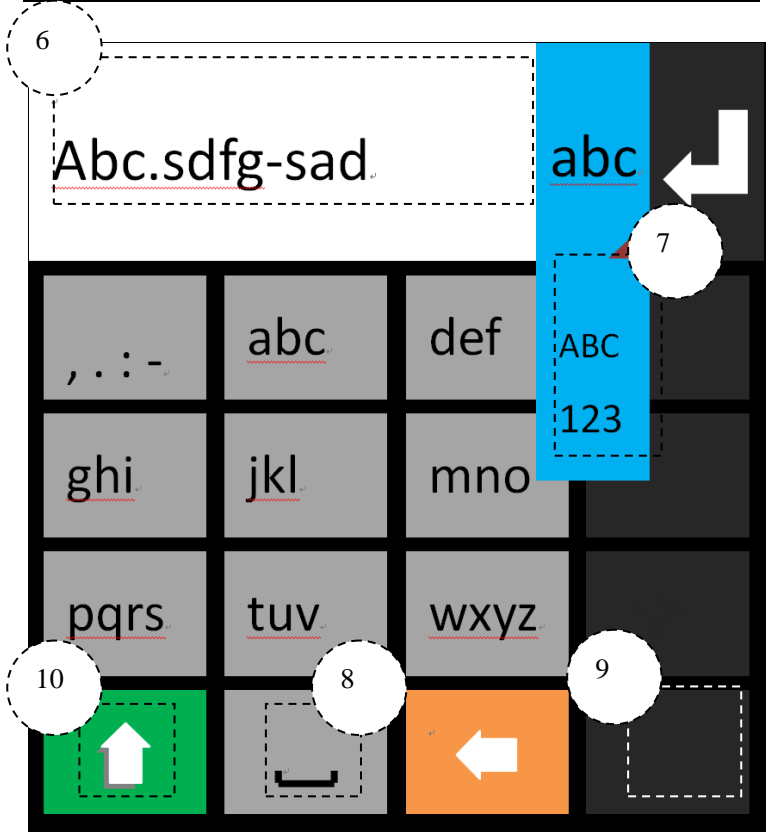
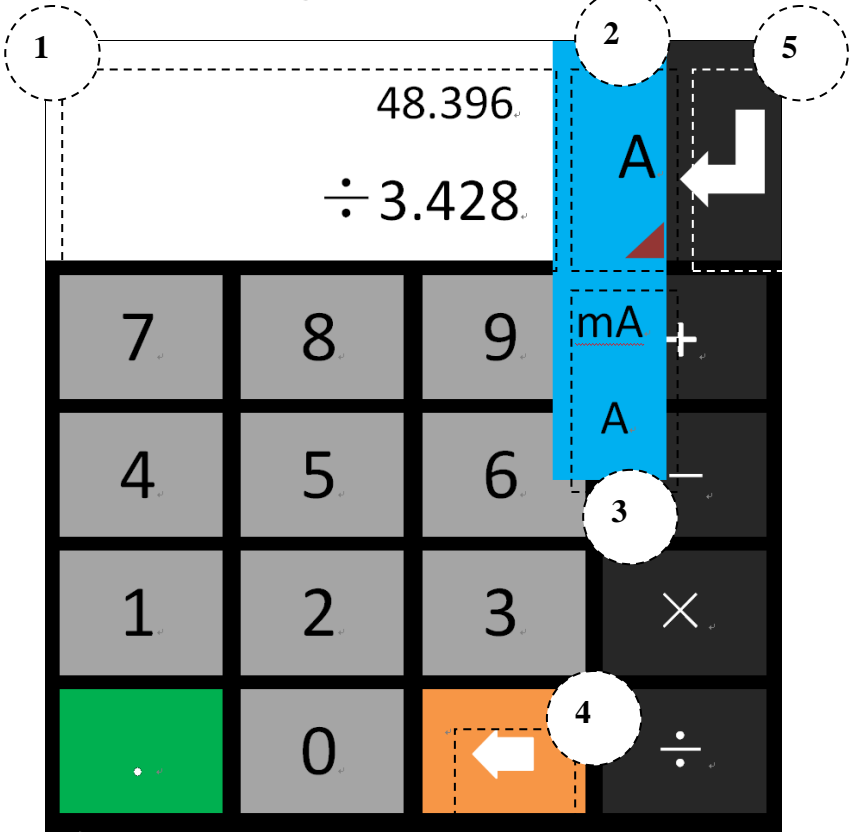


Tab—system setting

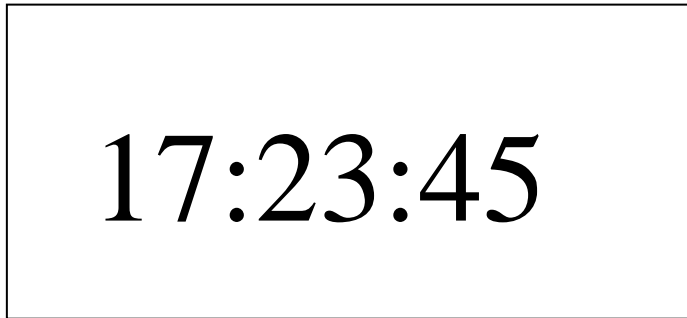
1. Label function, used to indicate the current label function.
2. Label, used to distinguish the current label and indicate the name, the current label is always on top, if you want to switch, just click the naked zone to switch.
3. Close button, click to close the tab.
4. Functional icon for the current line, only for indication and click is allowed, after clicking, there is some menu, like small keyboard or options .etc.
5. Parameter and content in current line, click is allowed, then there is an entity which can fit the description in Zone No.4, foot control mode is not fit for the current description, so there is no any menu or options.
6. External control button, the virtual button is only included in the parameter setting in figure 3.1.2.1, all lines in this page include the buttons, and click any of it to get an external controlled options, the options is fit as the description in Zone No.7.
7. Virtual external control key, only included in the parameter setting in figure 3.1.2.1, which is used to control the increase and decrease of the parameter or switch, long press is allowed to fast increase and decrease or switch.
8. File No. noted box, which can show the file No.
9. File name display, the file name can be revised in this zone.
10. File stored date and time display.
11. File noted box, when click, if there is file in this serial no. then you can make a note, otherwise, can't. Then there is a green tick in the noted file.

12. In this zone, there are virtual options and keys, the arrow key is used to turn the page or turn to the front or end page. Other 5 options can be clicked to get the menu or functions. From left to right, there are file storage, 18 17 19 20 22 21 file load, page no. and page switch, file search and delete functions.
13. Function menu, which will be pointed out in Zone No. 14.,15.,16.
14. In this zone, there is small input keyboard, which is used to obtain the file name, date, file no. After the input is over, there is some notes whose description will be shown in zone No.15.
15. Click is available here, which contains the information input by user. If the box is green, it means user has input information, if click this zone, then user's information will be deleted.
16. The zone is virtual key, which is used to confirm or give up the inputted information.
17. Click is available in this zone, which is used to display the system setting and its status, after click, there is optional menu, which is fit as Zone No. 18.
18. System setting menu, if click the zone out of the menu, it means user confirm the updated setting.
19. If click this zone, the switch is finished, the zone means virtual page up zone.
20. If click this zone, the switch is finished, the zone means virtual page-down zone.
21. Click there, it will show the date, if click, there is data setting keyboard.
22. Click there, it will show the time, if click, there is time setting keyboard.

3.1.3 Keyboard diagram and function



Keyboard—character



Keyboard—calendar setting

3.2 The output command

3.2.1 Start

1. Use START to control the output, long press can generate long pulse beeper.
2. Use foot switch to control the output, there are 5 modes, the mode can be revised in parameter setting
 - Edge_U: Rising edge trigger
 - Edge_D: Falling edge trigger
 - Level: Level trigger
 - Hold: Hold the switch, it means output

3.2.2 Stop

1. Use STOP to control the output, long press to generate the long pulse beeper. When instrument is in output status, press STOP to stop the output, and when the STOP key is pressed, instrument will cut the internal relay to cut off the current path.
2. Use foot switch to stop the output.
 - Edge_U: Rising edge cut
 - Edge_D: Falling edge cut
 - Level: Level cut
 - Hold: Hold the switch, it means cut

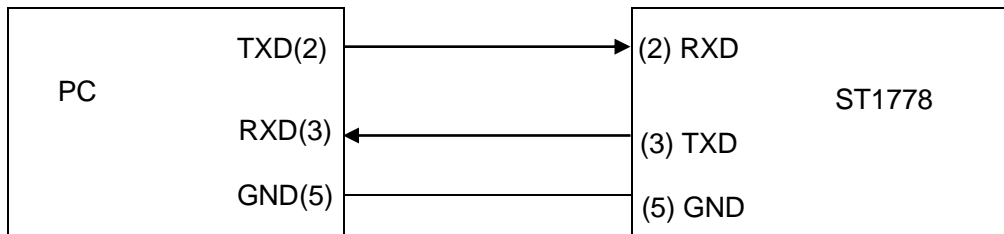
Chapter 4 Command interface

4.1 ST1778 RS232C

As the most serial ports, ST1778 is not strictly based on RS-232, and uses only a minimal subset of the 9 pins. Only three wires are actually used:

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

The connection of instrument and PC:



As seen in the figure above, the pin definition of ST1778 is different from the 9-pin configuration in IBM AT. Connection has to be 1:1, no crossover of Tx/Rx. Users can order a serial port cable from Sourcetronic.

4.2 SCPI commands

<NR1> :Integer, as: 123。

<NR2> :fixed-point, as: 12.3。

<NR3> :floating point, as: 12.345.....。

<LF> :Command terminator (Enter), which is 0x0A as a hexadecimal number or 10 in decimal. The terminator should be added after all commands, otherwise, the instrument stays in waiting status. When there is data returned, each data is terminated as <LF>.

4.2.1 General command set

*IDN?

Check the manufacturer, model, edition and firmware revision date. The returned format is as below:

"Sourcetronic,ST1778,V1.0.6,@2013.12"

*STA

Start the output.

*STO

Stop the output

4.2.2 ST1778 sub-system commands

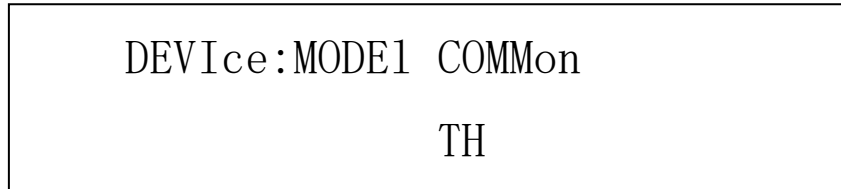
The following is the root command set for the SCPI sub- system

●DEVlce ●MEMORy ●PARAMeter ●REMOte ●STATe ●SWITCh ●SYSTem ●WORKing

1. DEVIce sub system command set

DEVIce is used to inform if ST1778 follows Sourcetronic standard with the communicated instrument. Different settings will cause different system action: If Sourcetronic standard is used (TH), there is no return if a parameter is changed; if switch to common mode (COMMOn), all activity will be reported back to the controller (default is common).

Command tree:



:MODE1 control SCPI command

Command: DEVIce:MODE1 <SCPI mode><LF>

<SCPI mode>:

COMMOn set SCPI system as common mode, any activity from instrument will return parameters, it is a default mode.

TH set SCPI system as Sourcetronic mode.

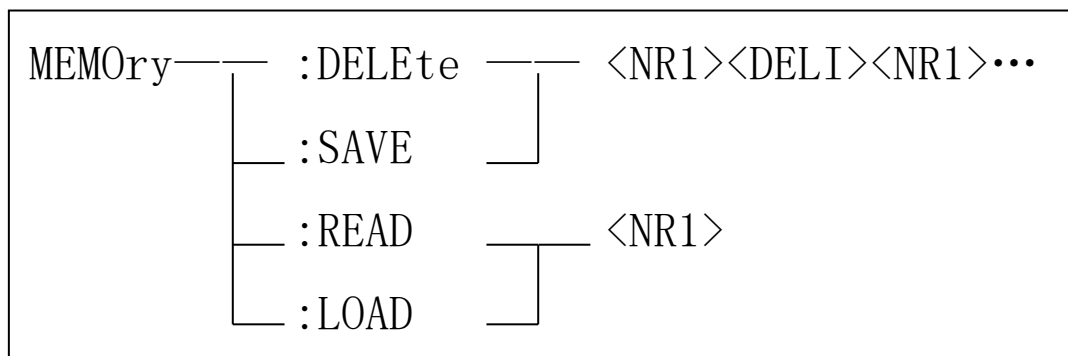
E.g :Send_Command("DEVI:MODE TH"); set instrument to enter Sourcetronic mode

Return command: "1778"

2. MEMORy sub system command set:

MEMORy sub system command set can realize the remote operation to local file system. The separator can be any of “,.-”, it will be expressed as <DELI> in the command tree, please note to change it to one of the above allowed delimiters in real operation. In command tree, <NR1> should be in the range of 1~99

Command tree:



:DELEte delete the file

Command: MEMORy:DELEte <number string><LF>

<number string>:

<NR1> 1~99

<DELI> separator“,-.”

E.g.:Send_Command ("MEMO:DELE 1,5.16,21:34,75,94-97"); delete the file of No.1, 5, 16, 75, 16 to 21 and 94 to 97.

:SAVE save the current setting

Command: MEMORy:SAVE <number string><LF>

<number string>:

<NR1> 1~99

<DELI> separator“,:-”

E.g.:Send_Command ("MEMO:SAVE 1,5.16,21:34,75,94-97"); save the file of No.1, 5, 16, 75, 16 to 21 and 94 to 97.

:READ read file

Command: MEMOry:READ <number><LF>

<number>:

<NR1> 1~99

E.g.:Send_Command ("MEMO:READ 5"); read the No.5 file, the description is as:

File head			
Description	Format	Content	byte
Valid flag (dirty)	WORD	0 invalid/'D'valid	2
Serial No. (No.)	WORD	1~99	2
(name)	STRING	'0'~'9'/'A'~'Z'/'a'~'z'	16
(time)	TIME	'0'~'9'&'-'&'.'	20
(addr)	DWORD	number	4
Total			44

File body			
Description	Format	Content	(byte)
Current setting	MULTIPLE	ASCII	44
Frequency setting	MULTIPLE	ASCII	44
Step setting	MULTIPLE	ASCII	44
Delay setting	MULTIPLE	ASCII	44
Foot control setting	MULTIPLE	ASCII	44
Total			220

The details of each setting:

Single setting			
Description	Format	Content	(byte)
Data	FLOAT	NUMBER	4
Name	STRING	'A'~'Z'/'a'~'z'	16
Character string	STRING	'0'~'9'/'A'~'Z'/'a'~'z'	20
Chinese character addr.	MULTIPLE	ASCII	4
Total			44

:LOAD used to load the existed file

Command: MEMOry:LOAD <number><LF>

<number>:

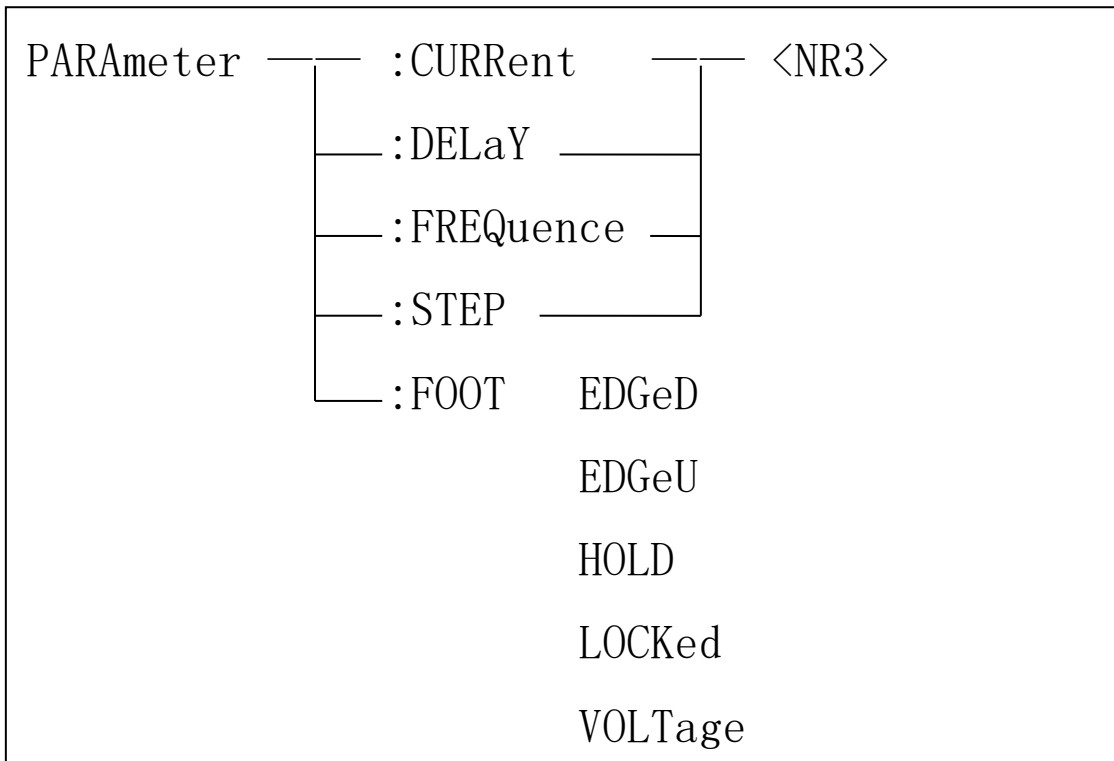
<NR1> 1~99

E.g.:Send_Command("MEMO:LOAD 5"); load No.5 file.

3. PARAMeter sub system command set

PARAMeter sub system command set is used to remote adjust the parameter.

Command tree:



:CURRent set the output current (unit:A), "?" can inquire the current.

Command: PARAMeter:CURRent <number><LF>

<number>:

<NR3> 0.0~20.0*(n+1)(n means the quantity of slaves) floating number.

E.g.:Send_Command("PARA:CURR 17.6"); set the current as 17.6A.

:DELAY set the time interval of scanning step(unit:ms), "?" can inquire the delay

Command: PARAMeter:DELAY <number><LF>

<number>:

<NR3> 0.0~3600000.0

E.g.:Send_Command("PARA:DELY 100"); set the time interval of scanning step as 100ms。

:FREQuence set the frequency(unit:kHz), "?" can inquire the frequency

Command: PARAMeter:FREQuence <number><LF>

<number>:

<NR3> 0.0~2000.0

E.g.:Send_Command("PARA:FREQ 300"); set the frequency as 300kHz.

:STEP set the step adjustment(unit:A), "?" can inquire the step

Command: PARAMeter:STEP <number><LF>

<number>:

<NR3> 0.0~20.0*(n+1)(n means the quantity of slaves) floating number.

E.g.:Send_Command("PARA:STEP 2.1"); set the step as 2.1A。

:FOOT set the foot control mode(there are 5 modes), "?" can inquire the mode

Command: PARAMeter:STEP <string><LF>

<string>:

EDGEd set the valid mode as down edge

EDGEu set the valid mode as up edge

HOLD set the valid mode as hold

LOCKed set the mode as lock, it means turn off

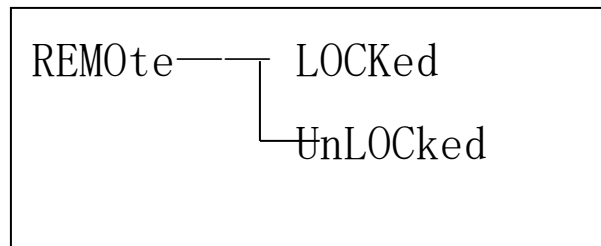
VOLTage set the mode as level

E.g.:Send_Command("PARA:FOOT EDGD"); set the mode as down edge trigger

4. REMOte sub system command set

REMOte sub system command set is used to remote control the lock and unlock of system

Command tree:



Command: REMOte <string>

<string>:

LOCKed

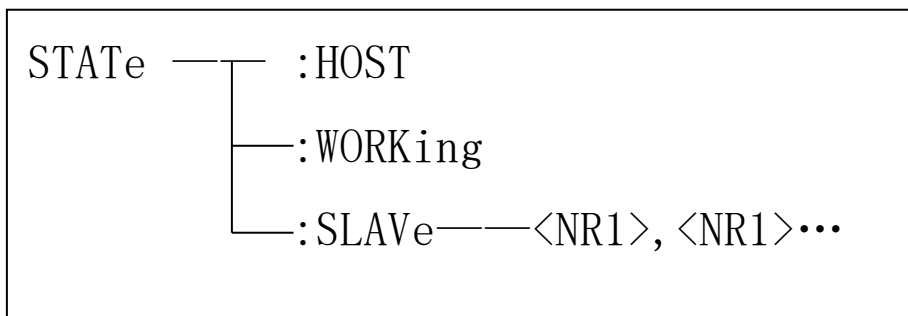
UnLOCKed

E.g.:Send_Command(" REMO ULOC"); unlock the system

5. STATE sub system command set

STATE sub system command set is used to remote inquire the state of host and system.

Command tree:



:HOST inquire the state of host, add"?" at the end.

Command: STATE:HOST?<LF>

E.g.:Send_Command("STAT:HOST?"); obtain the state of host.

Definition of returned data **(include a byte)**:

When the following bit is 1, it means the state is on or valid

Bit1: if charge

Bit2: if working

Bit3: if over heat

Bit4: if over load

Bit5: if unbalance

Bit6: if set this set

:WORKing obtain the working state, add "?" at the end.

Command: STATe:WORKing?<LF>

E.g.:Send_Command("STAT:WORK?"); obtain the working state.

Definition of returned data:

"preparing": the system is in prepare

"stop": the system is in stop, waiting for trigger or other thing happen

"running": system is in output state

:SLAVe obtain the state of slave, add "?" at the end.

Command: STATe:SLAVe <string>?<LF>

<string>:

<NR1> 1~5

"," ID character

E.g.:Send_Command("STAT:SLAV 1,2,5?"); obtain the state of slave no.1, 2, 5.

Definition of returned data **(each slave includes 2 bytes)**:

When the following bit is 1, it means the state is on or valid **(each byte should deduct ASCII character '0', then can get the real data)**

Bit1: if charge

Bit2: if working

Bit3: if over hear

Bit4: if over load

Bit5: if unbalance

Bit6: if setup the set

6. SWITChsub system command set

SWITChsub system command set is used to check if user has started the setting of slave

Command tree:

SWITCh——:SLAVe——:TurNOFF——<NR1>, <NR1>...
 :TurNON

:SLAVe control the state of slave

Command: SWITCh:SLAVe <string>

<string>:

:TurNOFF turn off the slave

Command: SWITCh:SLAVe:TurNOFF <string>

<string>

NR1 1~5

"," ID Interval

E.g.:Send_Command("SWIT:SLAV:TNOF 1,2,5?"); turn off the slaves No. 1, 2, 5.

:TurNON turn on the slave

Command: SWITCh:SLAVe:TurNON <string>

<string>:

NR1 1~5

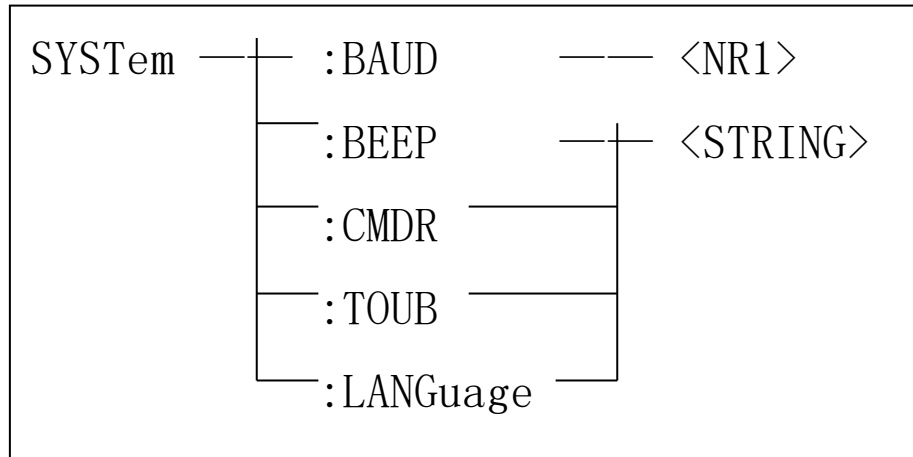
“,” ID interval

E.g.:Send_Command("SWIT:SLAV:TNON 1,2,5?"); turn on the slaves No,1, 2, 5

7. SYSTem sub system command set

SYSTem sub system command set is used to adjust the system settings

Command tree:



:BAUD adjust the baud

Command: SYSTem:BAUD <number>

<number>:

9600, 19200, 38400, 57600, 115200, 128000

E.g.:Send_Command("SYST:BAUD 128000"); set the baud of serial port as 128000, then host computer should readjust the baud with instrument.

:BEEP set the beeper on or off

Command: SYSTem:BEEP <string>

<string>:

OFF

ON

E.g.:Send_Command("SYST:BEEP ON"); turn on the beeper

:CMDR turn on or off the command return function. If turned on, when SCPI command works in common mode, any manual revision to current, frequency or other setting will have the revised parameter return to the current parameter, otherwise, there is no return

Command: SYSTem:CMDR <string>

<string>:

OFF

ON

E.g.:Send_Command("SYST:CMDR ON"); turn on the command return function

:TOUB turn on or off the touch beep

Command: SYSTem:TOUB <string>

<string>:

OFF

ON

E.g.:Send_Command("SYST:TOUB ON"); turn on the touch beep
:LANGuage

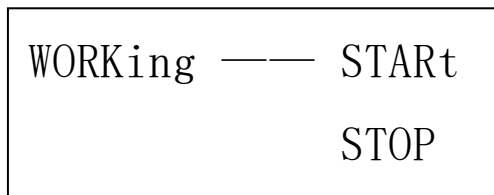
Command: SYSTem:LANGuage <string>
<string>:
CHInese simplified Chinese
ENGLISH English

E.g.:Send_Command("SYST:LANG ENG"); change the system language to English

8. WORKing sub system command set

WORKing sub system command set is used to control the output of device.

Command tree:



Command: WORKing <string>
<string>:
START
STOP

E.g.:Send_Command("WORK STAR"); start the output.