User Manual

SPD3000 Series

Programmable DC Power Supply

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General Safety Summary

Please review the following safety precautions carefully to avoid personal injury or damage to this product or any product connected to it. To prevent potential danger, please use the instrument as specified.

Use proper power cord
Only the power cord designed for the instrument and authorized by local country could be used.

Power supply
AC Input Voltages: 100V/110V/220V/230V ±10%, 50/60Hz.

Use proper fuse
The fuse types: 100V/110V: T6.3A/250V; 220V/230V: T3.15A/250V;
Make sure to use the correct type of fuse before turning on the instrument.
Do not connect the power cord before replacing the fuse.
Find out the reason why the fuse burned out before replacing the fuse.

Ground the instrument
The instrument is grounded through the protective terra conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to the earth. Make sure that the instrument is properly grounded before any inputs or outputs.

Observe all terminal ratings
To avoid fire or electric shock, please observe all ratings and symbols on the instrument. Read this guide carefully to know more details about the ratings before connection.

Keep proper ventilation
Inadequate ventilation may cause an increase of temperature,, which will lead to further damage. Please keep proper ventilation and check the fan and air-vents regularly when using the instrument.

Operate condition
Location: indoor, no strong light, almost no Interfering pollution;
Comparative humidity: <80%
Altitude: <2000m
Temperature: 0℃ to 40℃

Do not operate in an explosive atmosphere

To avoid personal injury or damage to instrument, please do not operate in an explosive atmosphere.

Keep surface of the product clean and dry

To avoid dust or moisture in the air influence the performance of the instrument , please keep surface of the product clean and dry.

Safety Terms and Symbols

Terms may appear on the product:

DANGER: Indicates direct injury or hazard that may happen.

WARNING: Indicates potential injury or hazard that may happen.

CAUTION: Indicates potential damage to the instrument or other property that

may happen.

Symbols may appear on the product:

Hazardous	Protective	Warning	Earth	Power
Vlotage	Earth Ground		Ground	Switch

SPD3000 Series Brief Introduction

SPD3000 series Programmable DC Power Supply is convenient, flexible and multi-function. It has three independent outputs, two sets of adjustable voltage value and a fixed set of selectable voltage value of 2.5V, 3.3V, and 5V ,and it also provides output short circuit and overload protection at the same time.

Main features of SPD3000 Series

4.3" TFT color LCD display with content of 16M;

Three independent outputs, two of which are adjustable, and the total power up to 195W;

Four kinds of input voltage values includes 100V, 110V, 220V and 230V to satisfy different requirements;

Function of storage and call setting parameters;

Function of timing output ;

Function of waveform display, Real-time display of voltage or current waveforms with digital display of voltage, current and power values

Start up screen protective procedure every fixed interval(30 minutes)

Perfect PC software to realize the real-time control through USBTMC..

Content

Chapter 1 Start Guide

In this chapter, we mainly introduce the panel and Display Interface of SPD3000, and also the notes about how to check and operate it at the first use. You can quickly understand how to operate it after reading the following steps.

Please check the instrument according to the following steps.

1. The machine and packing inspection

If the packing or cushioning material is seriously damaged, please retained them for follow-up inspection.

If the instrument is damaged during shipment, the compensation will be provided by consigner or carrier, and **SIGLENT** will not undertake free repair or replacement.

If there is a mechanical damage or loss please contact with your sales representative.

2.Accessory examination

Information about the accessories is introduced in detail at the end of the manual, you can refer to this description to check whether the accessories are completed t.

If there are accessories damaged or lacked, please contact with your **SIGLENT** sales representative.

The front panel
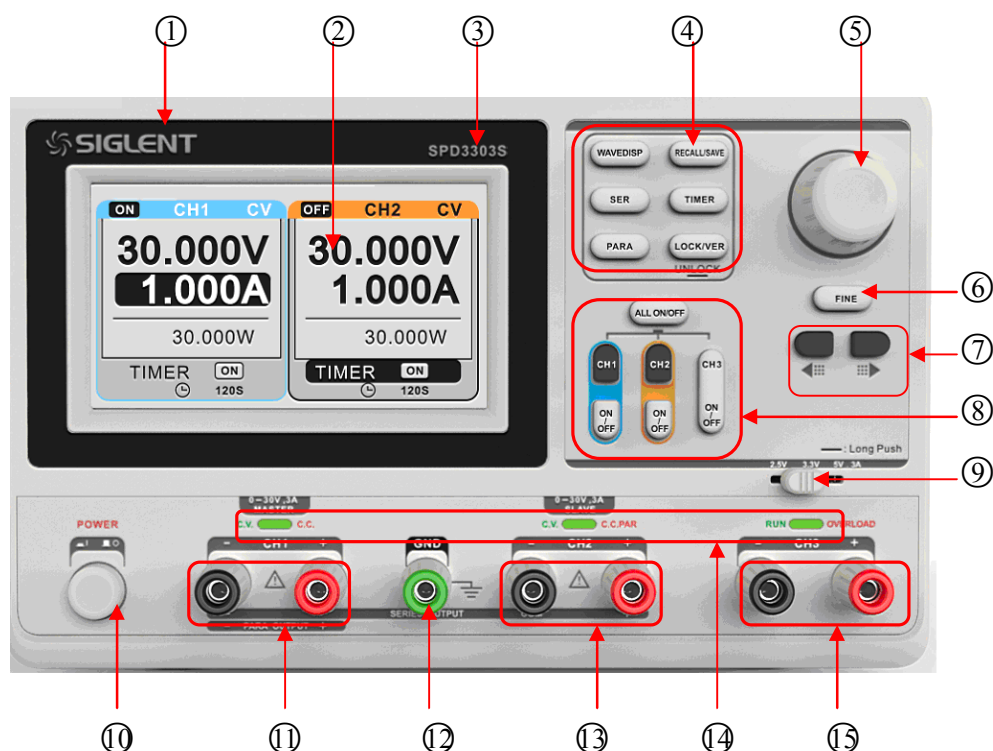
NO.	Description	NO.	Description
1	Logo	9	CH3 DIP Switch
2	Display Area	10	Power Switch
3	Model	11	CH1 Output Terminal
4	System parameter configuration button	12	Ground Terminal
5	Multi-function knob	13	CH2 Output Terminal
6	Fine Adjust button	14	CV/CC indicator light
7	Right/Left Direction button	15	CH3 Output Terminal
8	Channel Control button		

Instruction for buttons

Buttons for setting parameters

WAVEDISP : Press the button to turn on/off the waveform display interface;

SER : Press the button to set series mode of CH1/CH2, and the logo

" ‾‿‾ " displays at the same time;

PARA : Press the butten to set parallel mode of CH1/CH2, and the logo

" ▬▬▬ " displays at the same time;

RECALL/SAVE : Press the butten to enter the storage function interface

TIMER : Press the butten to enter timer setting interface

LOCK/VER : Press the button longer to lock it and shorter to turn to system information interface.

Buttons for controlling the channel

ALL ON/OFF : Press the button to turn on/off all the channels;

CH1 : Press the button to select CH1 as the current channel;

CH2 : Press the button to select CH2 as the current channel;

ON/OFF : Press the button to turn on/off the CH1 output;

CH3 ON/OFF : Press the button to turn on/off the CH3 output.

Other buttons

FINE : Press the button to open the fine tuning function and change the parameters with the minimum step;
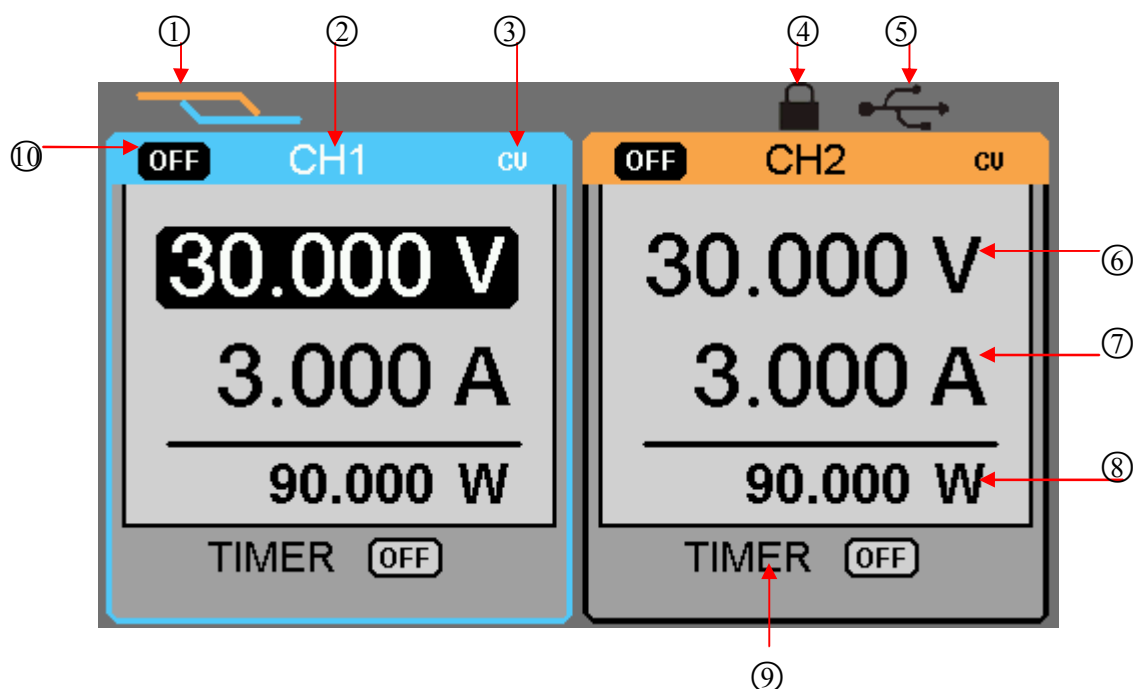
▮ ▮ : To move the cursor around.

The output terminal on front panel

The output terminals of CH1、CH2 and CH3 include positive terminal and negative terminal, and a common ground for CH1 and CH2 additional. Each channel has its own logo. The operation details are introduced in the follow-up " control panel operation".

User interface

① Parallel/Series logo: The logo will be displayed when the corresponding

mode is on

② Channel logo;

③ Operating mode logo: The corresponding logo will display when working in

CV or CC mode;

④ LOCK logo: It will display when the LOCK is turned on

⑤ USB logo: It will display when there is a USB connection;

⑥ Voltage value;

⑦ Current value;

⑧ Power value;

⑨ Timer ID: Timer state identification

⑩ Channel on/off logo;

The rear panel
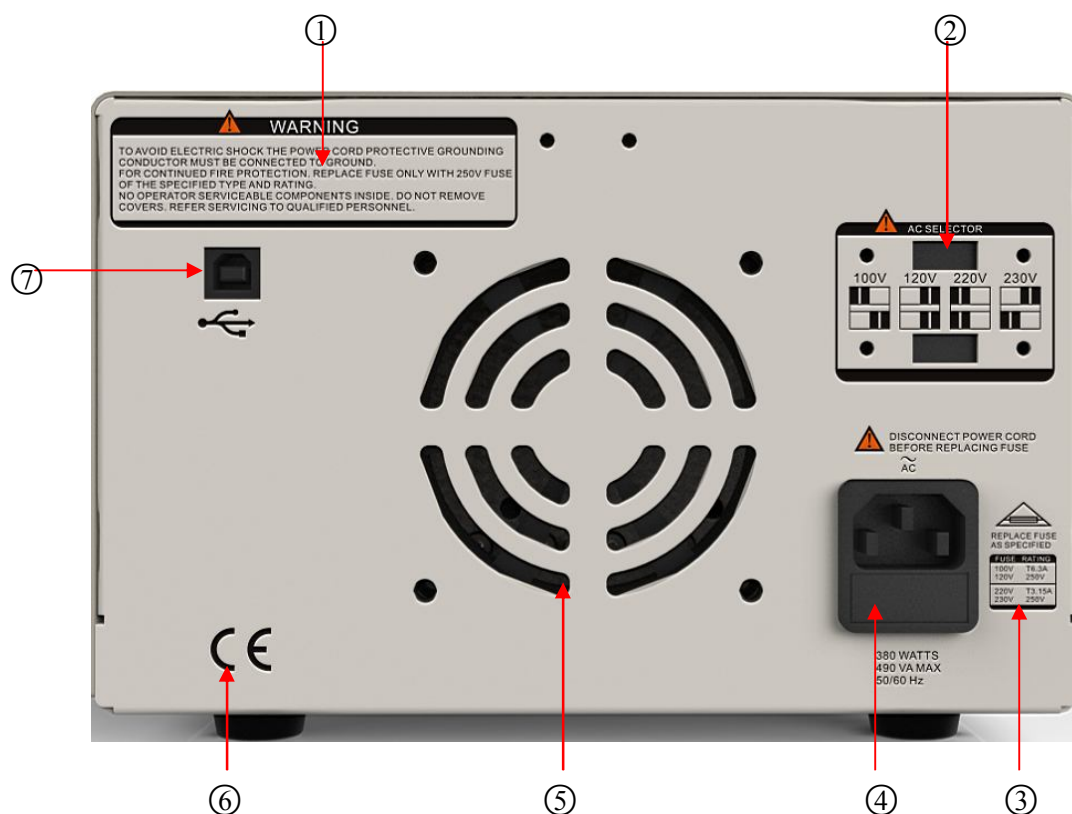
Description:

① warning message

② The DIP switch of the AC power and its identification .

③ The description of the AC input voltage

④ AC power socket

⑤ The fan air vents

⑥ CE certification mark

⑦ USB interface and identification

Notice in first use of SPD3000 Series

To ensure that the instrument can work normally,, you need to undertake the necessary inspection before using the SPD3000.

Input power requirement

The SPD3000 series allows two kinds of frequency that are 50hz and 60hz, four kinds of AC power that are 100v、110v、220v and 230v. You can choose the different input power with the "DIP switch "at the rear panel according to your actual requirement.

⚠ **Warning**
Pease disconnect the power cords at first and then dial the code to the corresponding gear if you want to change a new power supply.

Electrical check

Please use power cord provided as accessories and connect the instrument to AC power first, and then starting power check according to the following steps.

1. Connect the power supply

⚠ **Warning**
To avoid electrical shock, please make sure that the instrument has been properly earthing.

2. Turn on the power switch

   Press the button "POWER" to enter boot interface, and the default setup will show automatically after a while.

Output check

The output check includes voltage check in condition of all channels   with no load and current check in condition of short circuit so as to make sure that the instrument correctly responds to operation of the front panel.

1. Voltage output check

(1) Within no load, turn on the power, and make sure the setting current values of all channels are not zero;

(2) Check the voltage output of CH1/CH2

Turn on CH1/CH2 and the instrument work in CV mode. Check whether the voltage value could be changed from 0V to 32V.

2. Current output check

(1) Turn on the power.

(2) Check the current output of CH1/CH2

Use an insulated wire to connect the positive and negative terminal of CH1/CH2;

Turn off CH1 and CH2;

Revolve the knob to set the voltage value to 32V;

Revolve the knob to set the current value to 0A;

Adjust the current parameters to check whether the current value can be changed from 0A to 3.2A.

Chapter 2 Control panel operation

In this chapter，the function and operation of SPD3000 series control panel will be introduced in detail to giving you an all-around understanding of it, which will eventually lead to easier work.

Brief introduction:

Output summary

CH1/CH2 independent output

CH3 independent output

Parallel output

Series output

Waveform display

Timer

Save and recall

2.1 Output summary

Summary

SPD3000 series have three independent outputs, two of which are adjustable in voltage value and the other one includes selectable 2.5V, 3.3V or 5.0V

Independent/Parallel/Series

SPD3000 series have three output modes: independent、parallel and series, which can be selected through the track switch on the front panel. In the independent mode, the output current and voltage are controlled respectively. In the parallel mode, the current value is twice that of the single channel. In the series mode, the voltage value is twice that of the single channel.

Constant voltage/current

In the constant current mode (independent or tracking mode), the current value is rated and controlled through the front panel. The indicator light displays red and the voltage value is under rating. It will return to constant voltage mode when the current value is under dating.

In the constant voltage mode, the current value is less than the setting value, and the voltage value is controlled through the front panel. The indicator light displays green and the current value is maintained at the set value. It will return to constant current mode when the voltage value is under dating.

2.2 CH1/CH2 Independent Output

Instruction CH1 and CH2 are working in the independent mode, at the same time，they are insulated from the ground.


Output rating   0~30V/0~3A   (max:32V, 3.2A)

Operation steps

1. Make sure that parallel/series mode is off.
2. Connect load to the positive and negative terminals of CH1/CH2.
3. Set voltage and current value of CH1/CH2: Firstly, move the cursor to select the wanted parameter(voltage,current), and then revolve the multi-function knob to change the corresponding parameter(you can press "FINE" to make accurate adjusting).

   Coarse adjusting: 0.1V or 0.1A each step.

   Fine adjusting: the least precision each step.
4. Open output ：Press "ON/OFF" button to turn on the output, the corresponding indicator light gets lighted immediately and "CC" or "CV" is showed on the current interface.
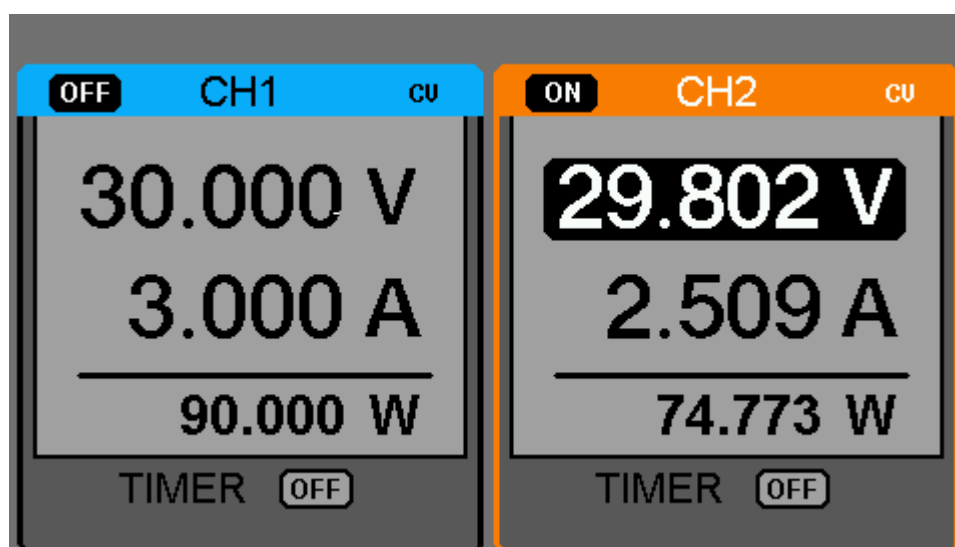
2.3 CH3 Independent mode

Instruction

CH3 is independent from CH1 and CH2, and it works neither in parallel mode nor in series mode. Its voltage and current ratings are respectively 2.5V,3.3V, 5V and 3A.

Output ratings   2.5V/3.3V/5V, 3A

Operation steps:

1. Connect the load to the positive and negative terminals of CH3 on the front panel.
2. Select the wanted voltage value by moving CH3 "DIP switch".
3. Open output ：Press "ON/OFF" button to turn on the output, the corresponding indicator light gets lighted immediately.

CV → CC

When the current value is higher than 3A, the overload indicator light turns red and the working mode turns to CC from CV

Note: "overload" does not mean abnormal operation.

2.4 CH1/CH2 Series mode

Instruction

In the series mode, CH1 and CH2 are linked internally into one channel which is controlled by CH1, and the output voltage value is twice compared with that of single channel.
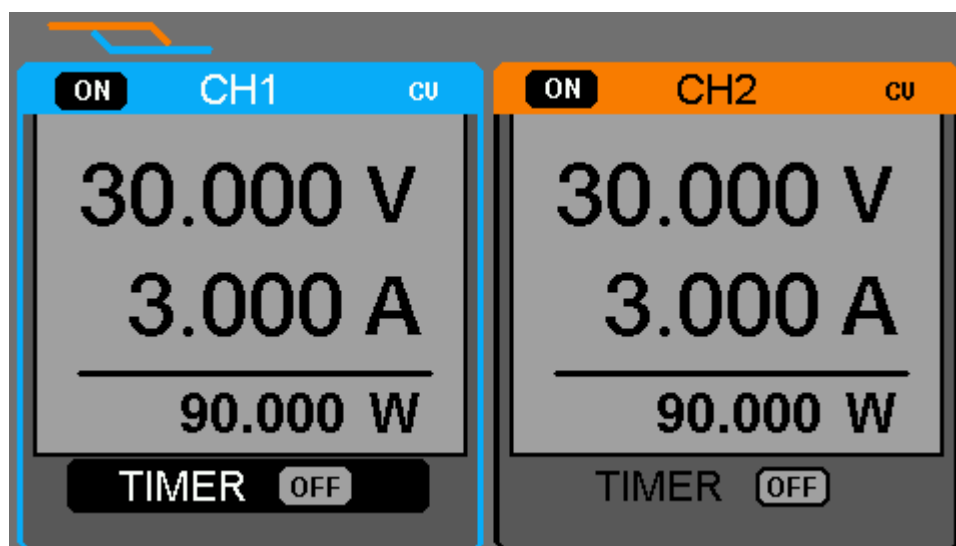

Output rating   0~60V/0~3A   (max: 64V,3.2A)

Operation steps：

1. Press the "SER" button to start the Series mode, and the indicator light turns bright immediately;

2. Connect the load to the positive terminal of CH2 and the negative terminal of CH1;

3. Turn on CH2, and then adjust its current value by revolving the multi-function button to 3A. In the default setup, the instrument works in "Coarse", you can turn to "Fine" by pressing "FINE" button;
   Coarse: 0.1V or 0.1A each step;
   Fine: the least precision each step;

4. Turn on CH1, and then set the output voltage/current value by revolving the multi-function knob;

5. Press "ON/OFF" button to open the output.

Note: You can identify   the current working state "CC" or "CV" by referring to indicator light of CH1/CH2.(red means CV, green means CC).

2.5 CH1/CH2 Parallel mode

Instruction In the parallel mode, CH1 and CH2 are linked internally into one channel which is controlled by CH1. Its output current value is twice as much as the single channel.


Output rating   0~30V/0~6A

Operation steps:

1. Press the "PAR" button to start Parallel mode, and the indicator light turns bright immediately；
2. Connect the load to the positive and negative terminal of CH1；
3. Turn on CH1, and then set the output voltage/current value by revolving the multi-function knob；
4. Press "ON/OFF" button to open the output.

Note: You can identity the current working state "CC" or "CV" by referring to indicator light of CH1/CH2.(red means CV, green means CC)；
In parallel mode, CH2 only works in CC mode.
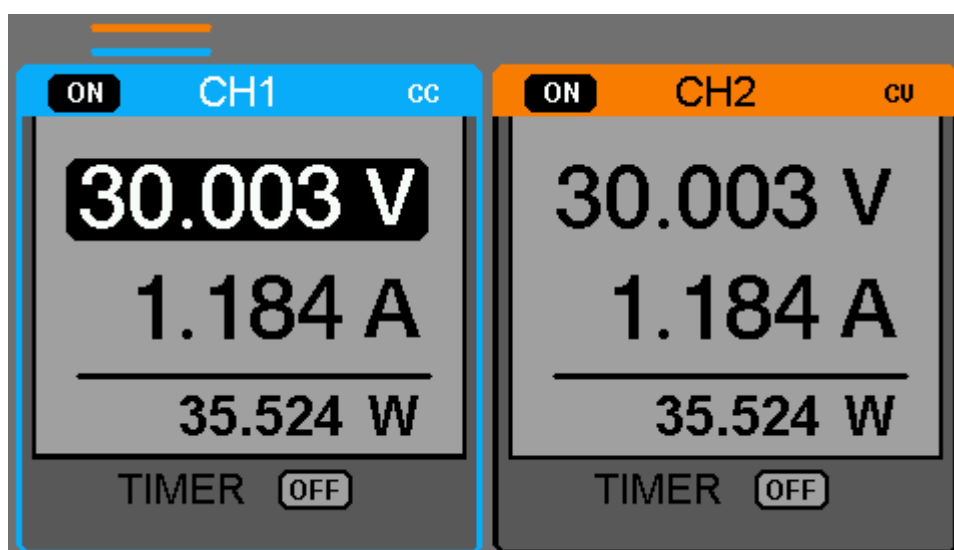
2.6 Save and Recall

Save setup

Five group setups can be saved in memory. The contents of the setup file including:

Independent/series/parallel mode

Output voltage/current value

Timer setup

Operation steps

1. Set the state that you wanted;

2. Press "STORE" to enter Save/Recall interface;

3. Select "FILE CHOICE" by revolving the multi-function knob;

4. Select "OPEN CHOICE" by moving the cursor;

5. Move the cursor to "STORE", and then press it to save the current setup.

Recall setup

Operation steps:

1. Press "STORE" to enter Save/Recall interface;

2. Select "FILE CHOICE" by revolving the multi-function knob;

3. Select "OPEN CHOICE" by moving the cursor;

4. Move the cursor to "RECALL", and then press it to read the saved setup.

Note: if you want to delete the file that has been saved, please go on with step 3 above, select "DELETE" and then press it.

2.7 Timer

The timer works in the Independent mode, and can save five timing setups, each of which is independent from each other. You can set any voltage/current value within the range as you want. The timer supports consecutive output, and the longest time of each group is 10000s.

Setup steps:

1. Press CH1/CH2 to select the wanted channel;
2. Press "TIMER" to enter the Timer Setup interface, and the indicator light turns bright immediately;
3. Move the cursor to select the wanted parameter(voltage/current/time) by pressing the direction button;
4. Revolve the multi-function knob to set the corresponding value and then press it.
5. Press "Timer" again to exit current interface.
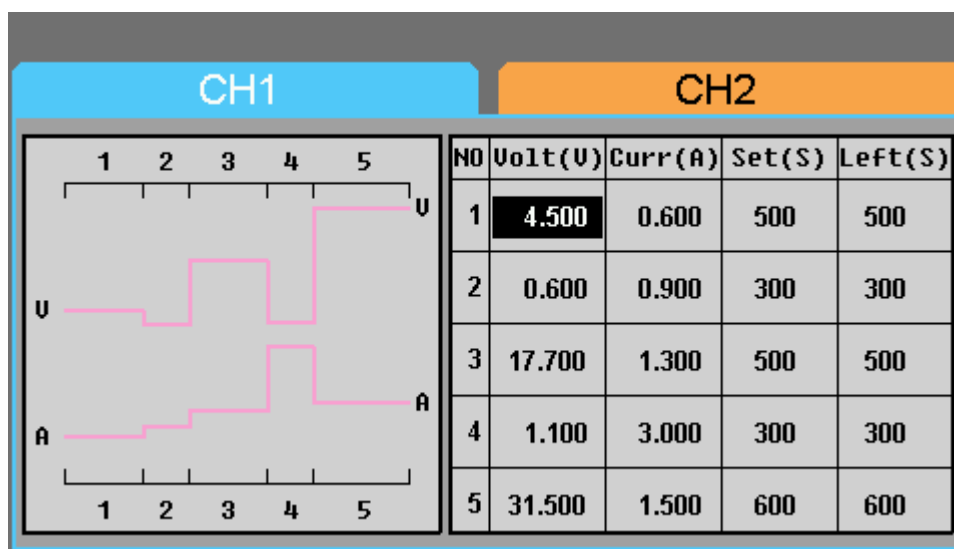
Start the Timer

1. Move cursor to "TIMER" menu by pressing the direction button;

2. Revolve the multi-function knob to make theTimer state to "ON";

3. Press the knob to start theTimer.
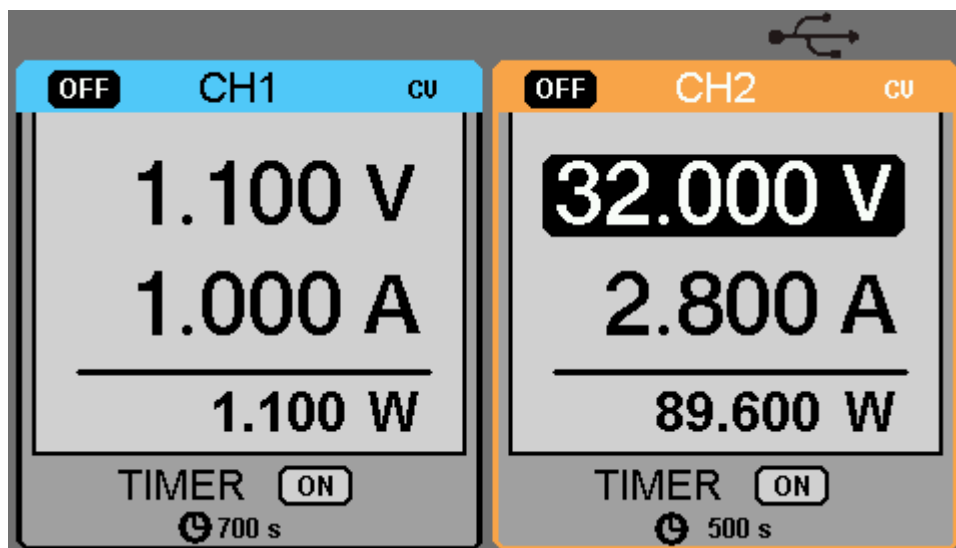
Note: If press the "TIMER" button when the timer is running, then you can observe the decreasing of the time ,and the changes of the curve .The Timer will automatically turn off when the time reduces to 0.

2.8 Waveform display

Display the changing of current voltage and current in the form of curve.

Operation steps:

1. Select CH1/CH2, and then set voltage/current parameter;

2. Press "WAVE" button to enter Waveform Display interface, and the indicator light turns bright immediately.

3. Press CH1/CH2 "ON/OFF" button to turn on CH1/CH2 channel, the corresponding indicator light turns bright immediately and you can observe the real-time changing of current voltage/current.

Waveform interface:
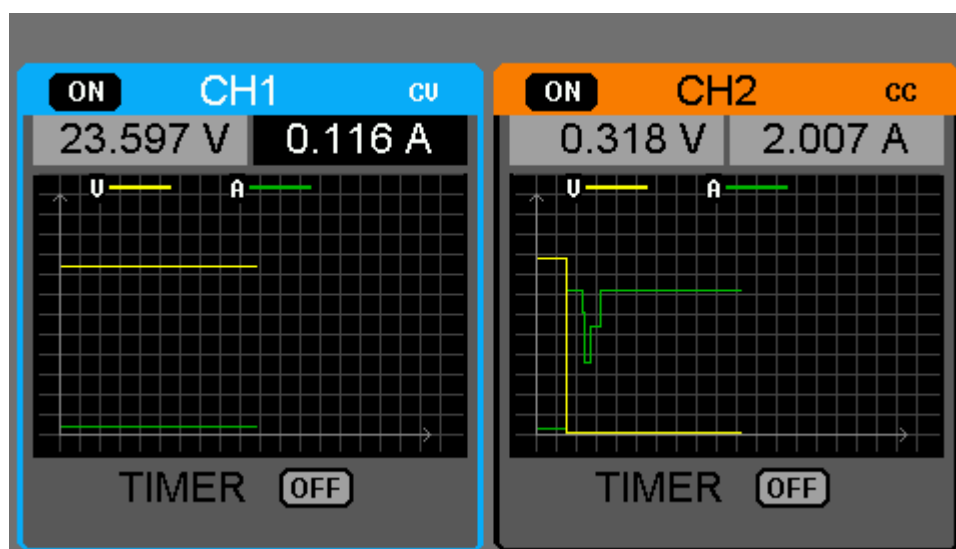
Note: Yellow line means voltage, green line means current, and axis of ordinate means voltage or current value (0~30V/0~3A).

2.9 Version information

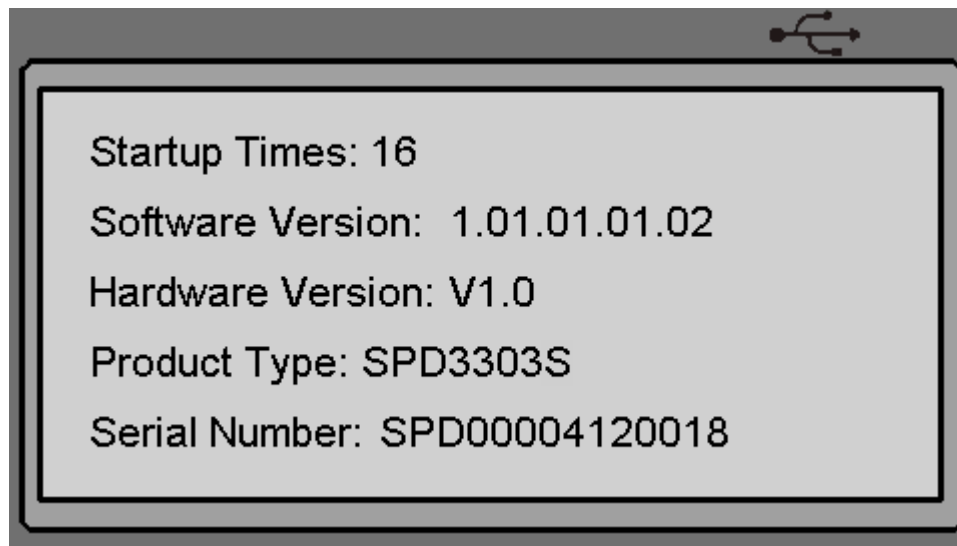Press "LOCK" button quickly to enter Version Information interface, which is shown below:

Startup Times: 16

Software Version: 1.01.01.01.02

Hardware Version: V1.0

Product Type: SPD3303S

Serial Number: SPD00004120018

2.10 Upgrade firmware

The software of the instrument is upgraded with a fixed name file via PC management software with USBTMC. The upgrade method is below:

Upgrade in normal Interface

1. Open the EsayPower software after USB line having been connected perfectly, and make sure the instrument is connected with the software correctly.

2. Click Version and then choose Upgrade in the drop-down menu to enter the USB firmware upgrade dialogue. See figure 1:
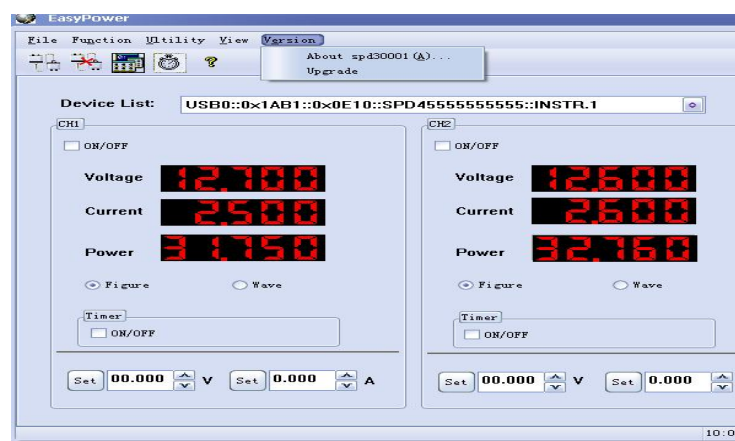
Figure 1

3. Figure 2 shows the firmware upgrade dialogue. Click file choosing icon, and then select the file to be upgraded which must have a postfix ugf.
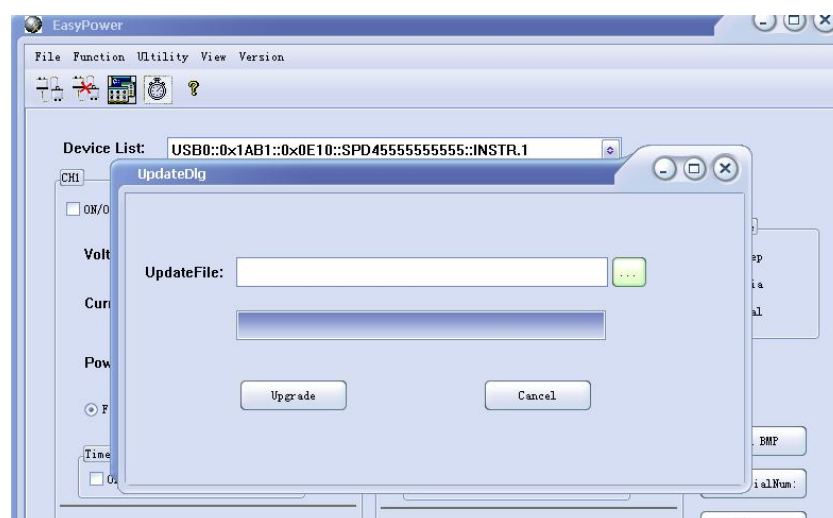
Figure 2
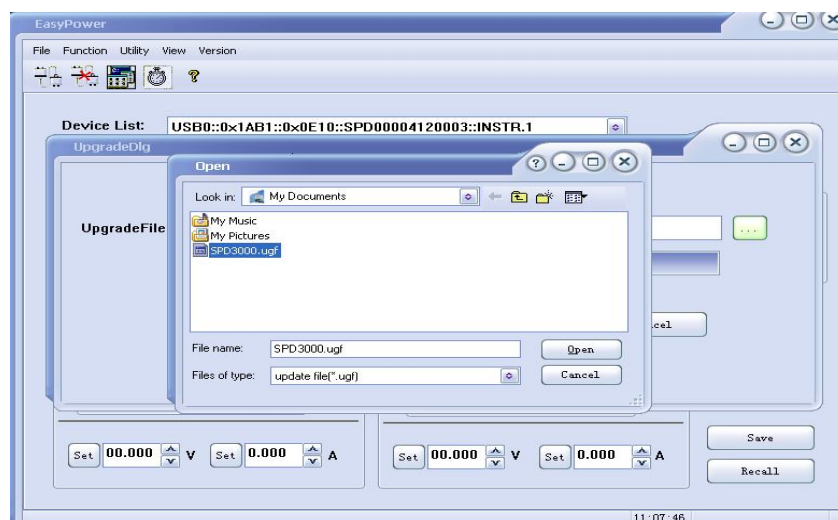
Figure 3

4. As it shows in figure 4, click Upgrade button to start upgrading. The upgrade is finished when the progress bar complete and the instrument will run the version after upgrade.

Figure 4

Upgrade Via Guide Procedure

Upgrade via guide procedure also can be used if the method above is failed. Specific steps are below:

1. Press the knob before powering on the instrument, and the turn on the instrument and it will enter the guide procedure mode.

2. After enter the guide procedure mode, the upgrade method is the same as the first one.

Chapter 3 Remote control

The SCPI Commands are used to perform remote control through USBTMC.

Connect the USB device on the rear panel to computer which has been installed with EasyPower software or NI（Measurement＆Automation）.

3.1 Command list

1. *IDN?

2. *SAV

3. *RCL

4. INSTrument {CH1|CH2}

5. INSTrument ?

6. MEASure:CURRent?

7. MEAsure:VOLTage?

8. MEASure:POWEr?

9. [SOURce:]CURRent <current>

10. [SOURce:]CURRent ?

11. [SOURce:]VOLTage <volt>

12. [SOURce:] VOLTage?

13. OUTPut

14. OUTPut:TRACk

15. OUTPut:WAVE

16. TIMEr:SET

17. TIMEr:SET?

18. TIMEr

19. SYSTem:ERRor?

20. SYSTem:VERSion?

21. SYSTem: STATus?

3.2 Command description

1.*IDN?

Command format   *IDN?

Description   Query the manufacturer, product type, series NO. and software version.

Return Info   Manufacturer, product type, series NO., software version.

Example   Siglent, SPD3303S, SPD00001130025, 1.01.01.02.

2.*SAV

Command format   *SAV <name>

Description   Save current state in nonvolatile memory with the specified name.

Example   *SAV 1

3.*RCL

Command format   *RCL <name>

Description   Recall state that had been saved from nonvolatile memory.

Example   *RCL 1

4.INSTrument

Command format   INSTrument <CH1|CH2>

Description   Select the channel that will be operated.

Example   INSTrument CH1

Command format   INSTrument?

Description   Query the current operating channel

Example   INSTrument?

Return Info   CH1

5.MEASure

Command format   MEASure: CURRent? < CH1|CH2>

Description   Query current value for specified channel, if there is no specified channel, query the current channel.

Example   MEASure: CURRent? CH1

Return Info   3.000

Command format   MEASure: VOLTage? < CH1|CH2>

Description   Query voltage value for specified channel, if there is no specified channel, query the current channel.

Example   MEASure: VOLTage? CH1

Return Info   30.000

Command format   MEASure: POWEr? < CH1|CH2>

Description   Query power value for specified channel, if there is no specified channel, query the current channel.

Example   MEASure: POWEr? CH1

Return Info   90.000

6.SOURce

Command format	\<SOURce:>CURRent \<value>
	\<SOURce>:={CH1 | CH2}
Description	Set current value of the selected channel
Example	CH1:CURRent 0.5

Command format	\<SOURce>: CURRent?
	\<SOURce>:={CH1 | CH2}
Description	Query the current value of the selected channel.
Example	CH1: CURRent?
Return Info	0.500

Command format	\<SOURce>: VOLTage \<value>
	\<SOURce>:={CH1 | CH2}
Description	Set voltage value of the selected channel
Example	CH1: VOLTage 25

Command format	\<SOURce>:CURRent?
	\<SOURce>:={CH1 | CH2}
Description	Query the voltage value of the selected channel.
Example	CH1: VOLTage?
Return Info	25.000

7.OUTPut

Command format   OUTPut <SOURce>, <state>

<SOURce>:={CH1 | CH2}; <state>:={ON | OFF}

Description   Turn on/off the specified channel.

Example   OUTPut CH1, ON

Command format   OUTPut: TRACK <NR1>

<NR1>:={**0**[Independent] | **1**[Series] | **2**[Parallel]}

Description   Select operation mode

Example   OUTPut: TRACK 0

Command format   OUTPut: WAVE<SOURce>, <state>

<SOURce>:={CH1 | CH2}; <state>:={ON | OFF}

Description   Turn on/off the Waveform Display function of specified channel.

Example   OUTPut: WAVE CH1, ON

8.TIMEr

Command format   TIMEr: SET <SOURce>, <secnum>, <volt>, <curr>, <time>

<SOURce>:={CH1 | CH2}; < secnum >;=1 to 5;

Description   Set timing parameters of specified channel

Example   TIMEr: SET CH1, 2, 3, 0.5, 2

Command format   TIMEr: SET? <SOURce>, <secnum>

<SOURce>:={CH1 | CH2}; < secnum >;=1 to 5;

Description   Query the voltage/current/time parameters of specified group of specified channel.

Example   TIMEr: SET? CH1, 2

Return Info   3, 0.5, 2

Command format   TIMEr <SOURce>, <state>

<SOURce>:={CH1 | CH2}; < state >;={ON | OFF};

Description   Turn on/off Timer function of specified channel

Instruction   The command works effectivly only when <secnum> starts from 1.

Example   TIMEr CH1, ON

9.SYSTem

Command format   SYSTem: ERRor?

Description   Query the error code and the information of the equipment.

Command format   SYSTem: VERSion?

Description   Query the software version of the equipment.

Example   SYSTem: VERSion?

Return Info   1.01.01.02

Command format   SYSTem: STATus?

Description   Query the current working state of the equipment.

Instruction   The return info is Hexadecimal format, but the actual state is binary , so you must change the return info into a binary. The state correspondence relationship is as follow.

Example   SYSTem: STATus?

Return info   0x0224

Bit NO.	Corresponding state
0	0: CH1 CV mode; 1: CH1 CC mode
1	0: CH2 CV mode; 1: CH2 CC mode
2,3	01: Independent mode; 10: Parallel mode 11: Series mode
4	0: CH1 OFF 1: CH1 ON
5	0: CH2 OFF 1: CH2 ON
6	0: TIMER1 OFF 1: TIMER1 ON
7	0: TIMER2 OFF 1: TIMER2 ON
8	0: CH1 digital display; 1: CH1 waveform diplay
9	0: CH2 digital display; 1: CH2 waveform diplay

Chapter 4 Specification

Test condition:Heat for 30minitus, temperature between +20℃~+30℃.

Output rating	CH1/CH2 independent	0～30V , 0～3A
	CH1/CH2 series	0～60V , 0～3A
	CH1/CH2 parallel	0～30V , 0～6A
	CH3	2.5V/3.3V/5.0V , 0～3A
Constant Voltage Mode	Voltage coefficient	≤0.01%+3mV
	Load coefficient	≤0.01%+3mV(rating current ≤ 3A) ≤0.02%+5mV(rating current ＞ 3A)
	Ripple and noise	≤2mVrms（5Hz ～ 1MHz）
	Recover time	≤100μs(50% load change ,minimum load 0.5A)
	Temperature coefficient	≤300ppm/℃
Constant Current Mode	Power coefficient	≤0.2%+3mA
	Load coefficient	≤0.2%+3mA
	Ripple and noise	≤3mArms
CH3	Power coefficient	≤5mV
	Load coefficient	≤15mV
	Ripple and noise	≤2mVrms（5Hz ～ 1MHz）
Tracking operation	Track error	≤0.5%+10mV of Master(No Load)
	Parallel coefficient	Line：≤0.01%+3mV Load： ≤0.01%+3mV(rating current≤3A) ≤0.02%+5mV(rating current＞3A)
	Series coefficient	Line：≤ 0.01%+5mV Load：≤ 300mV
Resolution	Voltage	Voltage: 1mV
	Current	Current: 1mA
Precision	Ammeter	3.2A full scale, 4 digits 0.4" LED display
	Voltmeter	32V full scale, 5 digits 0.4" LED display
	Set precision	Voltage：±（0.03% of reading + 10mV） Current：± (0.3% of reading + 10mA)
	Read precision	Voltage：±（0.03% of reading + 10mV） Current：± (0.3% of reading + 10mA)
Insulation	Between base and terminal	20MΩor above （DC 500V)
	Between base and AC power cord	30MΩor above （DC 500V)

Operating environment	Indoor	
	Altitude	≤2000 m
	Environment temperature	0 ~ 40℃
	Comparative humidity	80%
	Installation level	Ⅱ
	Pollution level	2
Storage environment	Environment temperature	-10 ~ 70℃
	Comparative humidity	≤ 70%
Power supply	AC 100V/120V/220V/230V±10%, 50/60HZ	
Volume	275mm x 225mm x 136mm	
Weight	8kg	

Chapter 5 Troubleshooting

Question 1: what to do if there occurs a short circuit on output terminal?

Answer1: There are over current protection and short circuit protection inside the power, so current will be controlled in safety range.

Question 2: Is it abnormal that the CH3 overload indicator is lit ?

Answer 2: No, that only means the current value reaches 3A, which is the maximum value within its range, and now power supply can be used continuously with the suggestion that decrease the output load.

Question 3: Is it normal that in the series mode, voltage and current value of a channel is respective   0V and not 0A, while that of another channel is   both not 0?

Answer 3: Yes, because when current output load is higher than the limited current value, the working mode turns to CC from CV.

Question 4: How to deal with the upgrade failed?

Answer 4: please do it again.

Question 5: why the practical value is not the same with the   set value (over performance standard) and even changs slowly on startup?

Answer 5: It's normal. On startup, components inside the instrument are in the process of getting stable, readings will be stable about 30 minutes later.

Chapter 6 Service and Support

Maintain summary

SIGLENT warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of three years from the date of shipment from an authorized **SIGLENT** distributor. If a product or CRT proves defective within the respective period, **SIGLENT** will provide repair or replacement as described in the complete warranty statement.

To arrange for service or obtain a copy of the complete warranty statement, please contact your nearest **SIGLENT** sales and service office.

Except as provided in this summary or the applicable warranty Statement, **SIGLENT** makes no warranty of any kind, express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. In no Event shall **SIGLENT** be liable for indirect, special or Consequential damages

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Appendix A: Accessories

SPD3000 Series Programmable DC Power Supply Accessories:

Standard Accessories:

- A User Manual
- A Certification
- A Guaranty Card
- A CD(including EasyPower computer software system)
- A Power Cord that fits the standard of destination country
- A USB Cable