DC Power Supply

SPS-1230/1820/3610/2415/606

USER MANUAL

GW INSTEK PART NO. 82PS-36100MJ1

ISO-9001 CERTIFIED MANUFACTURER GW INSTEK

The information in this manual was correct at the time of printing. However, Good Will continues to improve products and reserves the rights to change specification, equipment, and maintenance procedures at any time without notice.

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Table of Contents

SAFETY INSTRUCTION

This chapter contains important safety instructions that you must follow when operating the SPS power supply and when keeping it in storage. Read the following before any operation to insure your safety and to keep the power supply in the best possible condition.

Safety Symbols

These safety symbols may appear in this manual or on the SPS.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the power supply or to other objects or property.
	DANGER High Voltage
	Attention: Refer to the Manual
	Protective Conductor Terminal
	Earth (Ground) Terminal

Do not dispose electronic equipment as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased.

Safety Guidelines

General Guideline

CAUTION

- Do not place heavy objects on the power supply.
- Avoid severe impact or rough handling that may damage the power supply.
- Avoid discharges of static electricity on or near the power supply.
- Use only mating connectors, not bare wires, for the terminals.
- Do not block the cooling fan vent.
- The power supply should only be disassembled by a qualified technician.

(Measurement categories) EN 61010-1:2001 specifies the measurement categories and their requirements as follows. The SPS falls under category II.

- Measurement category IV is for measurement performed at the source of a low-voltage installation.
- Measurement category III is for measurement performed in a building installation.
- Measurement category II is for measurement performed on circuits directly connected to a low voltage installation.
- Measurement category I is for measurements performed on circuits not directly connected to Mains.

Power Supply

WARNING

- AC Input voltage: 115V / 230V ±15%
- 47 ~ 63Hz
- Connect the protective grounding conductor of the AC power cord to an earth ground

Fuse ⚠ WARNING	• Fuse type: 115V input: T 10A 250V; 230V input: T 6.3A 250V • To ensure fire protection, replace the fuse only with the specified type and rating. • Disconnect the power cord before replacing the fuse. • Make sure the cause of fuse blowout is fixed before replacing the fuse.
Cleaning the power supply	• Disconnect the power cord before cleaning the power supply. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid into the power supply. • Do not use chemicals containing harsh products such as benzene, toluene, xylene, and acetone.
Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) • Relative Humidity: < 80% • Altitude: < 2000m • Temperature: 0°C to 40°C

(Pollution Degree) EN 61010-1:2001 specifies pollution degrees and their requirements as follows. The power supply falls under degree 2.

Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity".

- Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.
- Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

Storage environment	• Location: Indoor • Relative Humidity: < 70% • Temperature: -10°C to 70°C
Disposal 	Do not dispose this instrument as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

Power cord for the United Kingdom

When using the SPS in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead/appliance must only be wired by competent persons

⚠WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colours of the wires in main leads may not correspond with the colours marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol ⏚ or coloured Green or Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

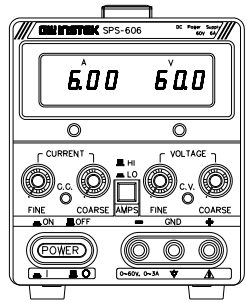
This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of 0.75mm² should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any moulded mains connector that requires removal /replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if a engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

OVERVIEW

This chapter describes the SPS series of power supplies, including their main features and front / rear panel introduction. After going through the overview, follow the Setup chapter (page 17) to properly power up and set operation environment.

For initial inspection, refer to the Performance adjustment chapter (page27).



Main Features

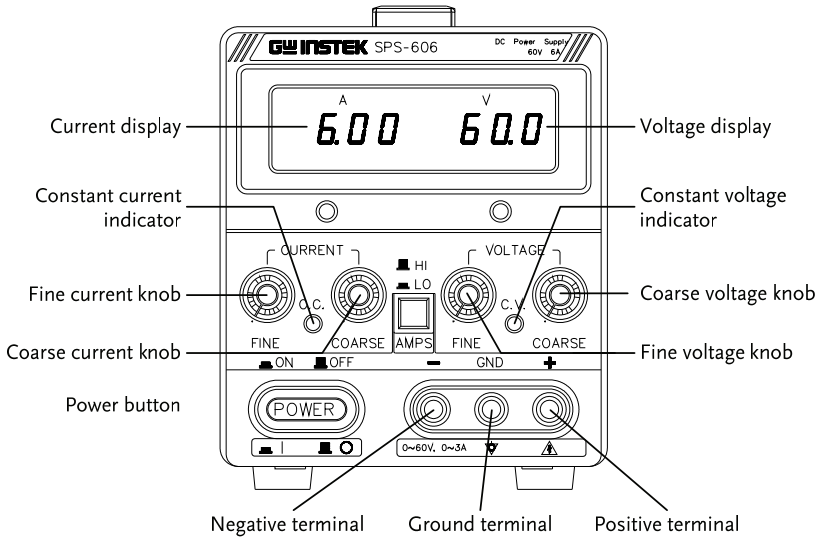
Features

- Broad input power range: For 115V (97~133V), for 230V (195V~265V)
- High frequency switching power
- High power Density
- High efficiency (70%)
- Constant voltage and constant current operation
- Remote output control (on/off)

Model Differences

Model name	Voltage	Current	Input Ratting Watts	Input Ratting VA
SPS-1230	12V	30A	500	900
SPS-1820	18V	20A	500	900
SPS-2415	24V	15A	500	900
SPS-3610	36V	10A	500	900
SPS-606	60V	6A	500	900

Front Panel Overview



Constant voltage indicator

C.V.

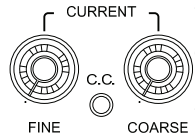
The constant voltage indicator lights up when the power supply is in constant voltage mode.

Constant current indicator

C.C.

The constant current indicator lights up when the power supply is in constant current mode.

Fine current knob

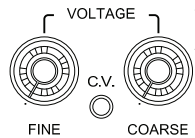


Used for fine adjustment of the current output.

Course current knob

Used for coarse adjustment of the current output.

Fine voltage knob

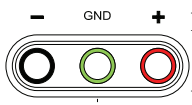


Used for fine adjustment of the voltage output.

Course voltage knob

Used for coarse adjustment of the voltage output.

Positive output terminal



Positive polarity terminal

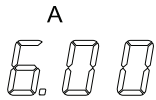
Negative output terminal

Negative polarity terminal

Ground terminal

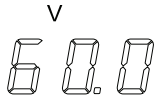
Ground terminal

Current Display



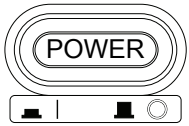
Displays the current output

Voltage display

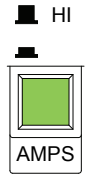


Displays the voltage output

Power switch

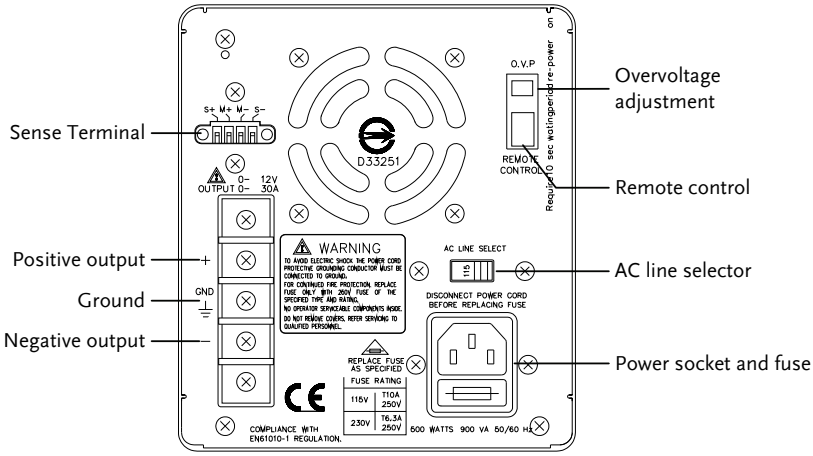


Range selector



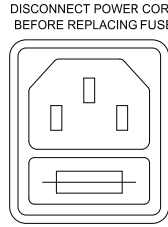
Selects high or low current range.

Rear Panel Overview



Fuse holder

Power Socket



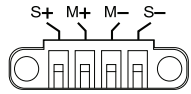
115V input: T 10A 250V; 230V input: T 6.3A 250V

AC line select

115V / 230V AC line select

Fan

Voltage –sense terminal

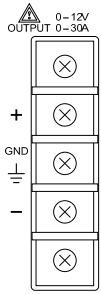


Sense S+, S-
Meter M+, M-

Ground

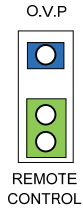
Positive output terminal

Negative output terminal



OVP adjuster

Overvoltage protection adjustment



Remote control terminal

Remote control jumper.

Open = Remote output off
Short = remote output on

CV/CC Crossover Characteristics

Background

SPS power supplies automatically switch between constant voltage mode (CV) and constant current mode (CC), according to the load conditions.

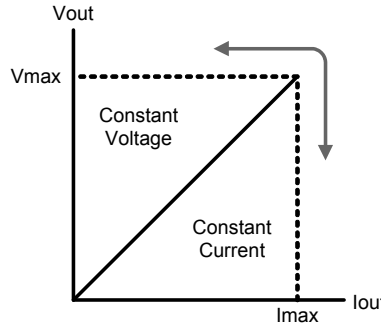
When **the current level is smaller than the output setting**, SPS operates in **Constant Voltage mode**. The C.V. indicator on the front panel turns green. The Voltage level is kept at the setting and the Current level fluctuates according to the load condition until it reaches the output current setting.

C.V.

When **the current level reaches the output setting**, SPS starts operating in **Constant Current mode**. The indicator on the front panel turns red (C.C.) The Current level is kept at the setting but the Voltage level becomes lower than the setting, in order to suppress the output power level from overload. When the current level becomes lower than the setting, SPS goes back to the Constant Voltage mode.

C.C.

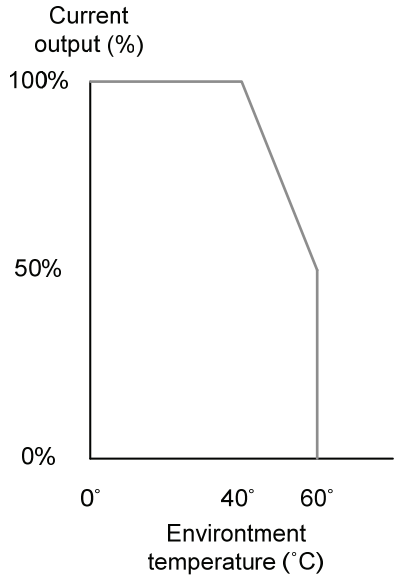
Diagram



Output Current/Temperature Characteristics

Background The chart below shows the current output characteristics versus temperature.

Diagram



SETUP

This chapter describes how to properly power up and configure SPS before operation. For checking the functionality, refer to the Performance verification chapter, page27.

Installation Location

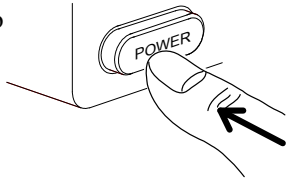
Ventilation and cooling fan clearance

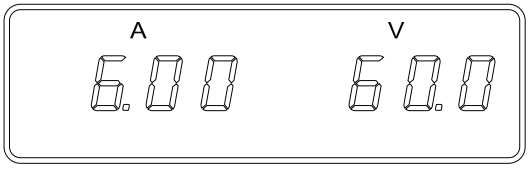
Please ensure there is adequate ventilation and that the cooling fan has enough clearance to allow adequate airflow.

Power Up

Power On

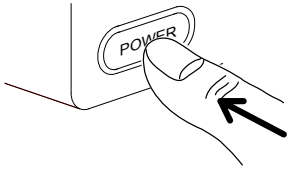
Press the Power switch to turn on the power. The current and voltage display will light up.





Power Off

Press the Power switch again to turn off the power. After two seconds, the meters and indicators turn off.

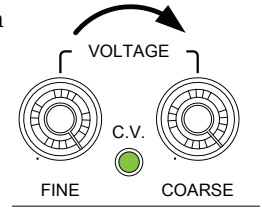


Over Voltage Protection Set Up

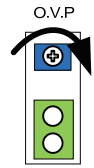
OVP setup Background

Over Voltage Protection (OVP) protects SPS and DUT from excessive output Voltage. The user sets the maximum output voltage limit before operation. When the output voltage exceeds this limit, the output is shut off immediately.

1. With the machine off, turn the voltage output to maximum.

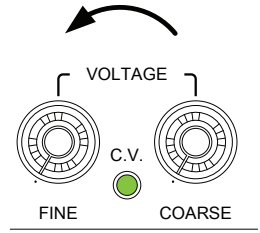


2. Turn the OVP adjuster to maximum (fully clockwise)

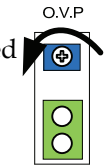


3. Turn on the SPS.

4. Adjust the voltage output to slightly above the desired OVP level.



5. Turn the OVP adjuster until the voltage displayed on the meter starts to drop. This sets the OVP level.



Setting range	5% rating to rating +5.5%.

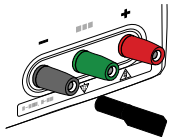
Note

Over voltage protection is always on and cannot be disabled. The OVP voltage however, can be set to the rating voltage +5.5%.

Load Cable Connection

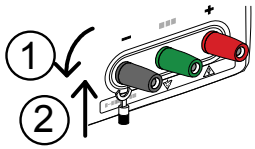
Standard accessory

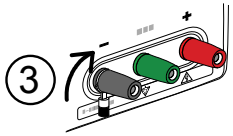
Insert the plug into the socket.



Test lead

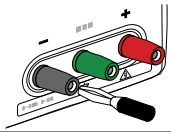
1. Turn the terminal counterclockwise and loose the screw.
2. Insert the cable terminal.
3. Turn the terminal clockwise and tighten the screw.





Banana plug

Insert the plug into the socket.



Wire type

When using load cables other than the attached, make sure they have enough current capacity for minimizing cable loss and load line impedance. Use the table below to choose an adequate test lead for a given application.

UL (CSA) Model	1015 TEW Twisted wire							
AWG	24	22	20	18	16	14	12	10
Component pc/mm	11/0.16	17/0.16	21/0.18	34/0.18	26/0.254	41/0.254	65/0.254	65/0.32
Cross sectional area (mm^2)	0.22	0.34	0.53	0.87	1.32	2.08	3.29	5.23
Outer diameter	0.64	0.78	0.95	1.21	1.53	2.03	2.35	3.00
Maximum conductive resistance	88.6	62.5	39.5	24.4	15.6	9.90	6.24	3.90
Permissible current (A)	7.64	10.0	13.1	17.2	22.6	30.4	40.6	55.3

Note

The ambient temperature of "Permissible Current" is at 40˚C. The withstanding temperature of a conductor is at 105˚C according to the condition of the distributed single wire.

The permissible current listed as above is recommended to be used at under 70%.

If sense wires are needed, any wire gauge above UL(CSA) AWG 20 is permissible (18~10). When using a capacitive load, please twist the +output test lead with the (S+) sense wire. Similarly, twist the – output wire with the –S sense wire.

If the current value exceeds those shown above, wires can be used in parallel to increase the permissible current draw.

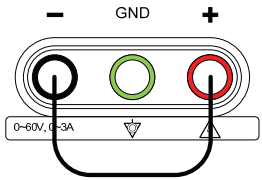
Setting the Current Level

The current level must be set each time a new current level is needed.

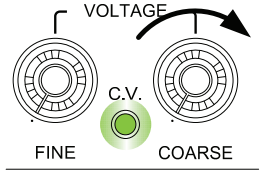
Panel operation

1. Determine the maximum safe current for the EUT.

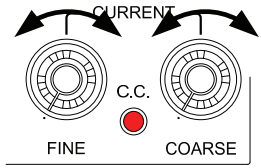
2. Short the positive (+) and negative (-) terminals.



3. Turn the coarse voltage knob away from the zero position until the C.C. knob becomes lit.

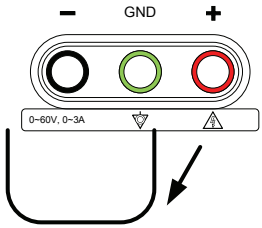


4. Adjust the current knobs to the desired current limit. The current will be shown in the ammeter display.



5. The current limit has now been preset. Do not change the current values.

6. Remove the short from the terminals.



7. The power supply is now ready for constant voltage operation.

Setting the Remote Control

Background	The SPS output can be controlled remotely using the remote control pins on the rear panel.
Output Off	Remote control pins open.
Output On	Remote control pins shorted.

OPERATION

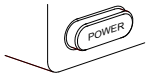
Constant Voltage Mode

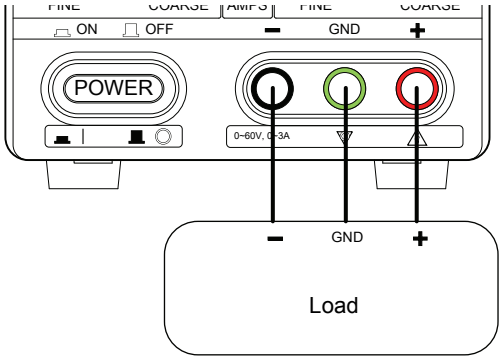
Background

Before voltage can be output, please see page 22 to set the current level.

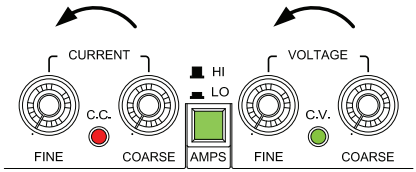
Setting step

1. Connect the test leads to the EUT with the power off.

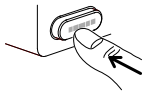




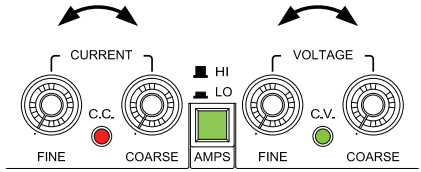
2. Set the current and voltage knobs to the left most position (0A, 0V).



3. Turn the instrument power on.



4. Adjust the current and voltage knobs to the desired values.



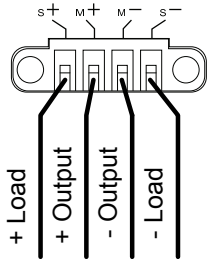
Using the Sense Terminals

Background

The sense terminals are used to compensate for the voltage drop seen across the test leads during quick changes in current output.

M+, M-

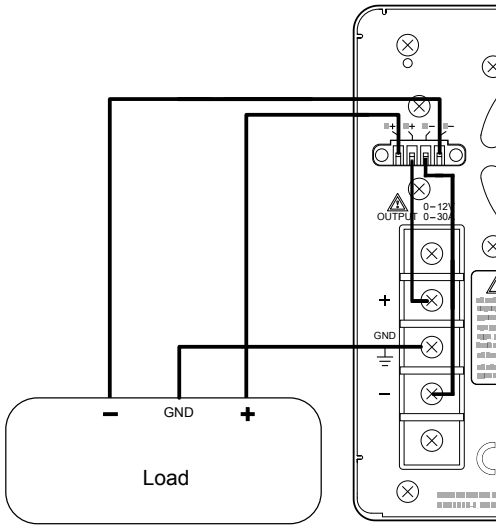
Meter side sense terminals. Connect the M+ terminal to the + positive output terminal of the power supply. Connect the M- terminal to the – negative terminal of the power supply output.



S+, S-

Sense terminals. Connect the S+ terminal to the + positive terminal of the load. Connect the S- terminal to the – negative terminal of the load.

Connection



PERFORMANCE ADJUSTMENT

Overview

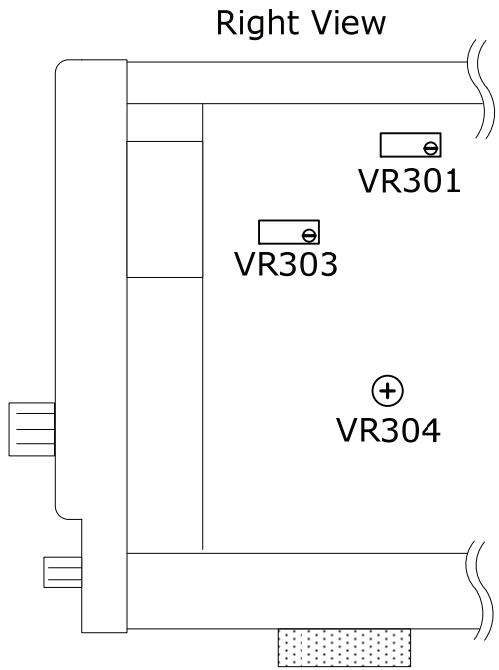
Background	Performance adjustment checks that the SPS power supply is performing at the correct specification level.
Verification item	• Rating Voltage • Voltage coarse/fine level • Rating Current • Current coarse/fine level

Equipment

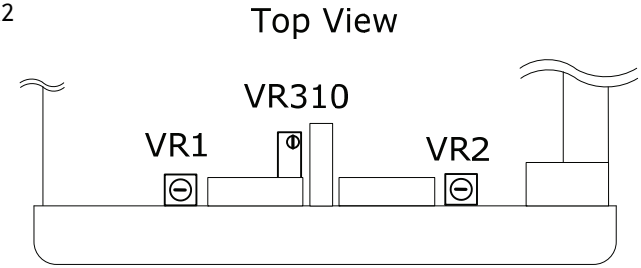
Digital Multimeter	• DCV Accuracy < 0.1% • DCA Accuracy < 0.1% • DCA range: 32A • Recommended model: GDM-8145
Philips screw driver	• < 3mm for adjustment points

Adjustment Points

VR301, VR303, VR304

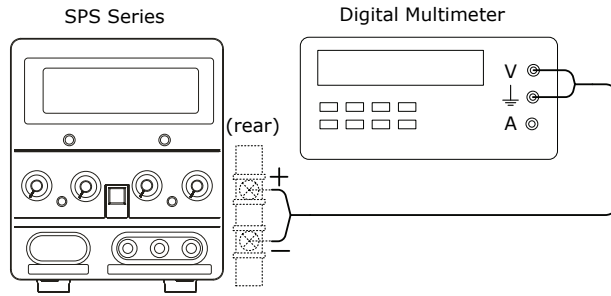


VR1, VR310, VR2



Rating Voltage Adjustment

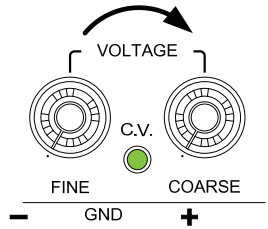
Connection



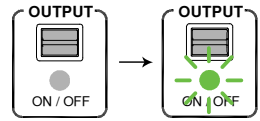
Verification step

1. Connect a multimeter as shown to the output terminals.

2. Turn the voltage coarse and fine knobs fully clockwise to the maximum positions.



3. Adjust VR301 so that the multimeter matches the following values

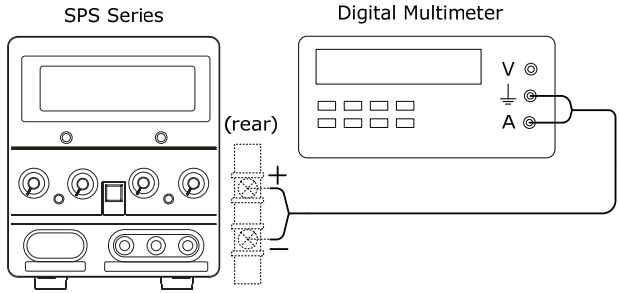


SPS-1820	18.50V
SPS-3610	36.50V
SPS-606	60.50V
SPS-2145	24.5V
SPS-1230	12.5V

4. Adjust VR2 so that the voltage value of the voltage display matches the voltage shown in the multimeter.

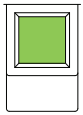
Rating Current Adjustment

Connection

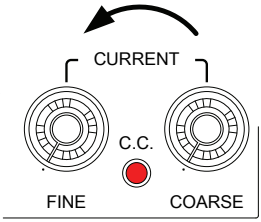


Verification step

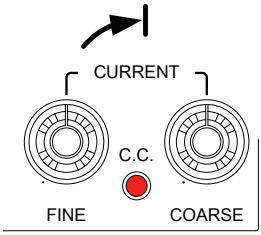
1. Press the AMPS key to set the current range to high.



2. Turn the current coarse and fine knobs fully ant-clockwise to the minimum positions.



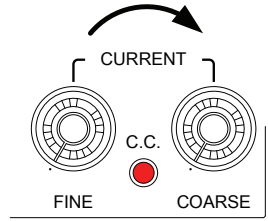
3. Turn the current coarse and fine knobs to the centered position



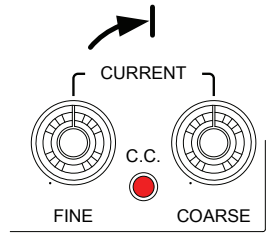
4. Connect a multimeter as shown in the connection diagram above.

5. Adjust VR304 so that the multimeter displays 0.00A.

6. Turn the current coarse and fine knobs fully clockwise to the maximum positions.



7. Turn the current coarse and fine knobs to the centered position

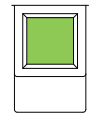


8. Adjust VR303 so that the multimeter displays the following values.

SPS-1820	20.10A
SPS-3610	10.10A
SPS-606	6.10A
SPS-2145	15.1A
SPS-1230	30.1A

9. Adjust VR2 so that the current value of the ammeter display matches the current shown in the multimeter.

10. Press the AMPS key to set the current range to low.



11. Adjust VR310 so that the multimeter displays the following values. (half of the rating current)

SPS-1820	10.0A
SPS-3610	5.0A

SPS-606	3.0A
SPS-2145	7.5A
SPS-1230	15.0A

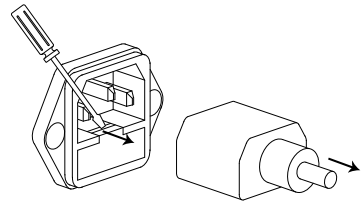
12. Adjust VR401 to set the OVP value.

APPENDIX

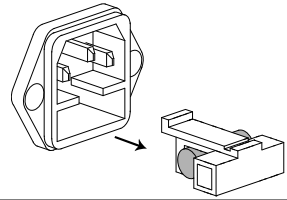
Fuse Replacement

Step

1. Take off the power cord and remove the fuse socket using a minus driver.



2. Replace the fuse in the holder.



Rating

Specification

		SPS-1230	SPS-1820	SPS-2415	SPS-3610	SPS-606
Max rating	Max Voltage	12V	18V	24V	36V	60V
	Max Current	30A	20A	15A	10A	6A
Input rating	Watts	500				
	VA	900				
Fuse	230V	T 10A 250V				
	115V	T 6.3A 250V				
Weight		3.3 kg				
Dimensions		128(W)x145(H)x285(D)mm				
Operation Environment		Indoor, Altitude up to 2000m, Installation Category II, Pollution degree 2				
Operation Temperature &Humidity		0˚ C to 40˚ C, <80%				
Storage Temperature & Humidity		-10˚ C to 70˚ C, <70%.				
Accessories		Test Lead (current < 4A) × 1 Operation Manual × 1				
Constant voltage Operation	Output voltage	0 to rating voltage (adjustable)				
Voltage Regulation	Line Regulation	≤5mV				
	Load regulation	≤5mV				
	Recovery time	≤500us(50% load change, minimum load 0.5A)				
	Ripple and noise	≤5mVrms, 100mVp-p				

	Temperature coefficient	≤100ppm/˚C
Constant Current	Output current	0 to rating current (adjustable)
	Line regulation	≤3mA
	Load regulation	≤3mA
	Ripple and Noise	≤30mA rms ≤10mA rms ≤10mA rms ≤5mA rms ≤3mA rms
Indicator Meter	Voltage display	3 1/2 Digits 0.39″ Green LED display
	Voltage Accuracy	±(0.5% of rdg + 2 digits)
	Current display	3 1/2 Digits 0.39″ Red LED display
	Current accuracy	±(0.5% of rdg + 2 digits)
Over voltage protection	range	5% rating to rating +5.5%
	accuracy	±(Vset 1%+0.6V)
Insulation	Between chassis and terminal	≥20MΩ (DC500V)
	Between chassis and AC cord	≥30MΩ (DC500V)

Declaration of Conformity

We
GOOD WILL INSTRUMENT CO., LTD.
(1) No.7-1, Jhongsing Rd., Tucheng Dist., New Taipei City, Taiwan
(2) No. 69, Lu San Road, Suzhou City (Xin Qu), Jiangsu Sheng, China
declare, that the below mentioned product
Type of Product: Power Supply
Model Number: SPS-1230, SPS-1820, SPS-3610, SPS-2415, SPS-606
are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (89/336/EEC, 92/31/EEC, 93/68/EEC) and Low Voltage Equipment Directive (73/23/EEC, 93/68/EEC). For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Equipment Directive, the following standards were applied:

◎ **EMC**

EN 61326-1: Electrical equipment for measurement, control and laboratory use — EMC requirements (1997+A1: 1998+A2:2001)	
Conducted Emission Class A	Electrostatic Discharge: EN 61000-4-2:1995+A1:1998
Radiated Emission	Radiated Immunity: EN 61000-4-3:1996+A1:1998
EN 55011:1998	Electrical Fast Transients: EN 61000-4-4:1995
Current Harmonic : EN61000-3-2: 2000	Surge Immunity: EN 61000-4-5:1995
Voltage Fluctuation : EN61000-3-3:1995	Conducted Susceptibility: EN 61000-4-6:1996
----------	Power Frequency Magnetic field: EN 61000-4-8:1993
----------	Voltage Dip/Interruption: EN 61000-4-11:1994

◎ **Safety**

Low Voltage Equipment Directive 73/23/EEC & amended by 93/68/EEC
Safety Requirements IEC/ EN 61010-1: 2001

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