

**Programmable Switch
Mode Power Supplies
PSA Series 1600 W**

User Manual

scientific

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Programmable Switch Mode Power Supplies PSA Series 1600 W

Table of Contents

Introduction	5
Safety instructions	6
Safety symbols	7
Chapter 1 Technical specifications	8
1.1 Specifications	8
1.2 Power supply outline drawings - dimension	11
Chapter 2 Panel controls	13
2.1 Front panel controls	13
2.2 Rear panel controls	14
2.3 Sockets, connector description used on rear panel	15
Chapter 3 Installation	17
3.1 AC Input mains connections	17
3.2 Cooling	17
3.3 Use of instrument on table top	17
3.4 Use of instrument in 19" Rack mounting cabinet	18
3.5 High Voltage Protection Cover for Safety	19
3.6 First time operation power ON	20
3.6.1 AC mains input	20
3.6.2 Connecting to AC mains	20
3.6.3 DC output check	21
3.6.4 DC constant current check	21
Chapter 4 Descriptions	22
4.1 Safety first - grounding	22
4.2 Input Voltage	22
4.3 Operating conditions	22
4.3.1 Temperature & humidity	22
4.3.2 Storage	22
4.4 Thermal protection	22
4.5 Cooling	23
4.6 Output	23
4.7 Connecting the load	23
4.8 Local & remote Sensing	24
4.9 Constant voltage and constant current mode	25
4.10 Hold up time	25

4.11	Over voltage protection	25
4.12	AC fail	25
4.13	Analog programming	25
4.14	Description of analog connector pins and application	26
4.15	Safe start - auto start mode	28
4.16	Connecting load	29
4.17	Connecting power supplies in series and parallel	30
4.18	Power supply as battery charger	30
Chapter 5	Maintenance	31
5.1	Troubleshooting	31
Chapter 6	Dispatch procedure for service & Warranty	33
6.1	Dispatch procedure for service	33
6.2	Warranty	33

Programmable Switch Mode Power Supplies PSA Series 1600 W

- Compact 1 U size
- Fast transient response
- High slew Rate
- Analog Programming
- Models with Output Voltage 16V to 1000 V, 1600 W Power

The PSA Series power supplies is designed for compact 1 U size with user friendly operation and higher efficiency.

Transient response better than 100 us, ensures that the output of the power supply recovers much faster and remains constant and oscillation free for dynamic loads. Power supplies can be remotely controlled programmed through analog programming.

With various protection features, over voltage protection, short circuit protection, protects expensive loads circuits in testing.

All the PSA models can be operated from line voltage from 195 to 270 V, 47 Hz ~ 63 Hz. Power factor correction also provides to ensure low harmonic content.

Safety instructions

The general safety instructions and symbols must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or instructions given in this manual violates safety standards of design, manufacture, and intended use of the instrument. Scientific assumes no liability for the customer's failure to comply with these requirements.

- Before applying power, verify all the safety precautions are taken, make all the connections firm.
- Make sure the protective ground of the unit is connected with system ground.
- Always operate the instrument only in prescribed operating conditions.
- Do not modify the instrument, This instrument is designed to meet all the safety and operating conditions. Any modification done may not be complying to the safety requirement and instrument may be damaged, causing hazardous conditions.

Environmental conditions

Please do not operate the instrument in the place that vibrates, dusty, under direct sunlight or where there is corrosive air. The Scientific Power supplies are designed for safety, applies to following conditions.

- Indoor use.
- Ambient temperature 0 ~ 50°C non condensing 75% RH, 0~40°C non condensing 95% RH
- Altitude up to 3000 meters
- Pollution degree 2

Installation category

These instruments are designed for installation category II, Over voltage category II.

Grounding

The instrument ground must be well connected to instrument chassis of AC power mains input supply. The instrument must be connected through three conductor power cable, with the ground wire firmly connected to the electrical safety ground of power outlet. Any interruption in protective ground conductor, or disconnection will cause potential hazard that might cause personal injury.

Mains Input rating

This power supply unit is designed for specific mains input connections, as specified in the Technical specifications. Do not use AC supply exceeding the limits. For safety reasons the mains AC may should not fluctuate more than $\pm 10\%$ of nominal voltage.

Fuse

Fuses must be changed by authorized Scientific service personal only for continued protection against risk and safety.

Live circuits

There are no serviceable part or alignment required by Operating personnel. Operator must not remove the instrument cover. No internal adjustment or component replacement is allowed by non-Scientific authorised personnel. Never replace components with power cable connected. To avoid injuries, always disconnect power, discharge circuits and remove external voltage source before touching components.

Safety symbols

Caution!

Caution ! : Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Follow the instructions for proper procedures.

Warning!

Warning ! : Denotes a hazard. Failure to follow instructions could result in **SEVERE** personal injury and/or property damage. Follow the instructions for proper procedures.

Symbols marked on instruments



Attention refer to the manual.



Hazardous voltage exists, **Caution!** Electric shock.



Indicates Protective Ground Terminal



Indicates Ground Terminal



Off (Supply)



On (Supply)

Chapter 1 Technical specifications

1.1 Specifications (Unless otherwise stated these specifications are defined over the temperature range of 0 to 40° C.)

A. DC Voltage, Current Specifications & Display : Models PSA16-100, PSA20-80, PSA32-50, PSA40-40, PSA60-26, PSA80-20 & PSA100-16

		PSA16-100	PSA20-80	PSA32-50	PSA40-40	PSA60-26	PSA80-20	PSA100-16
DC Outputs Voltage	V	16	20	32	40	60	80	100
DC Output Current	A	100	80	50	40	26.67	20	16
Power	W	1600						
Efficiency at 230V full load	%	80	80	83	83	85	85	85
Constant Voltage Mode								
Load regulation 0 ~ 100%	mV	2	2	4	4	4	4	4
Line Regulation	mV	1	1	1	1	1	1	1
Ripple BW=300 kHz	mVrms	5	5	5	5	5	7	8
Ripple 5Hz~1MHz	mVrms	8	8	8	8	8	10	12
Ripple 20 MHz	mVpp	30	30	30	40	40	45	50
Constant Current Mode								
Load regulation 0 ~ 100 %	mA	15	15	10	10	10	10	9
Line Regulation	mA	2	2	2	2	2	2	2
Ripple BW=300 kHz	mArms	35	35	35	30	28	25	22
Ripple BW=5 Hz ~1MHz	mArms	50	50	50	40	35	30	27
Ripple 20 MHz	mApp	130	120	120	100	90	80	70
Remote sense drop	V	1	1	2	2	2	2	2
Programming Speed								
Rise time (10% to 90%) into resistive load								
Time 100% load	ms	12	15	20	25	28	30	35
Time 10% load	ms	8	10	18	20	25	25	30
Fall time (90% to 10%) into resistive load								
Time 100% load	ms	20	20	22	22	25	35	50
Time 10% load	ms	200	210	225	240	250	350	400
Time No load	s	1.2	1.2	1.5	2.0	2.5	3.0	3.5
Recovery Time								
Recovery within	mV	80	80	80	80	80	100	120
time @ 50 – 100 % load step	μs	100	100	100	100	100	100	100
max deviation @ 230 V mains	V	0.15	0.15	0.15	0.15	0.15	0.25	0.5
Output Impedance mΩ	CV, 0-1kHz	< 1	< 1	< 2	< 10	< 10	< 10	< 10
	CV, 1-100kHz	< 5	< 5	< 10	< 30	< 30	< 30	< 30
Display								
Accuracy		Voltage : ± (0.5%+2D), Current : ± (0.5%+2D)						
Scale	Voltage (V)	0-16.0	0-20.0	0-32.0	0-40.0	0-60.0	0-80.0	0-100
	Current (A)	0-100	0-80.0	0-50.0	0-40.0	0-26.7	0-20.0	0-16.0
Resolution	Voltage (V)	0.1	0.1	0.1	0.1	0.1	0.1	1
	Current (A)	1	0.1	0.1	0.1	0.1	0.1	0.1

B. DC Voltage, Current Specifications & Display : Models PSA160-10, PSA300-5, PSA600-2.67, PS800-2 & PS1000-1.6

		PSA120-13	PSA160-10	PSA300-5	PSA600-2.67	PSA800-2	PSA1000-1.6
DC Outputs Voltage	V	120	160	300	600	800	1000
DC Output Current	A	13.3	10	5.33	2.67	2	1.6
Power	W	1600					
Efficiency at 230V full load	%	85	85	85	87	87	87
Constant Voltage Mode							
Load regulation 0 ~ 100%	mV	4	6	6	10	10	10
Line Regulation	mV	2	2	3	3	3	3
Ripple BW=300 kHz	mVrms	8	10	15	20	30	50
Ripple 5Hz~1MHz	mVrms	12	15	18	25	40	60
Ripple 20 MHz	mVpp	50	60	70	80	90	120
Constant Current Mode							
Load regulation 0 ~ 100 %	mA	9	8	8	8	8	8
Line Regulation	mA	2	2	2	2	2	2
Ripple BW=300 kHz	mArms	20	20	12	5	5	4
Ripple BW=5 Hz ~1MHz	mArms	25	20	15	8	6	5
Ripple 20 MHz	mApp	60	60	50	30	25	22
Remote sense drop	V	2	2	2	5	5	5
Programming Speed							
Rise time (10% to 90%) into resistive load							
Time 100% load	ms	50	80	120	150	200	250
Time 10% load	ms	40	70	110	130	180	220
Fall time (90% to 10%) into resistive load							
Time 100% load	ms	80	100	180	200	220	250
Time 10% load	ms	600	800	850	1000	1200	1500
Time No load	s	4.5	6	8	10	12	15
Recovery Time							
Recovery within	mV	150	200	300	500	600	800
time @ 50 – 100 % load step	μs	100	100	100	100	100	100
max deviation @ 230 V mains	V	0.8	1.0	1.5	2.0	2.5	3.0
Output Impedance mΩ	CV, 0-1kHz	< 10	< 10	< 20	< 20	< 30	< 40
	CV, 1-100kHz	< 30	< 30	< 60	< 60	< 80	< 100
Display							
Accuracy		Voltage : ± (0.5%+2D), Current : ± (0.5%+2D)					
Scale	Voltage (V)	0-120	0-160	0-300	0-600	0-800	0-1000
	Current (A)	0-13.3	0-10.0	0-5.33	0-2.60	2.00	0-1.60
Resolution	Voltage (V)	1	1	1	1	1	1
	Current (A)	0.1	0.1	0.01	0.01	0.01	0.01

C. Analog Programming and other specifications

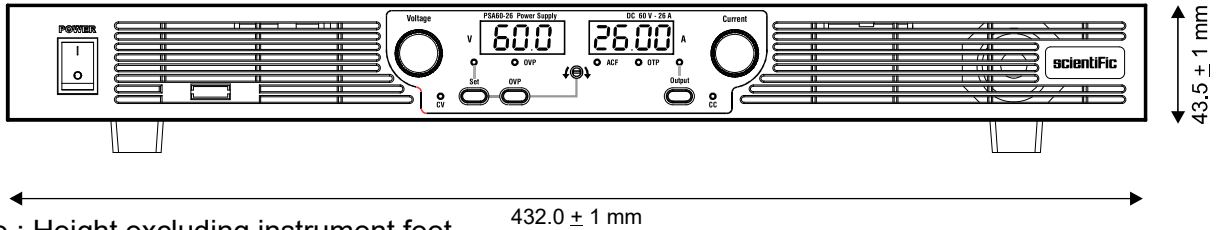
Temperature Coefficients	CV : 80 ppm/°C CC : 80 ppm after warm up of 30 min	
Output Stability	CV : 100 ppm/°C CC : 100 ppm after warm up of 30 min and during 8 hrs	
Analog Programming (Rear panel 25 pin D connector)		
Programming	V : 0 ~ 5 V, Accuracy : $\pm 0.5\%$ of Vout rated, Input impedance : 1 M Ω I : 0 ~ 5 V, Accuracy : $\pm 1\%$ of Iout rated Input impedance : 1 M Ω	
Monitoring	V out : 0 ~ 5 V, Accuracy : $\pm 1\%$ of V rated Output impedance : 150 Ω / 4 mA max I out : 0 ~ 5 V, Accuracy : $\pm 1\%$ of I rated Output impedance : 150 Ω / 4 mA max	
V reference	5.1 V \pm 15 mV	
Status outputs	Power Supply OK Logic 1 (High); AC Fail – Logic 0 (Low) DC Fail – Logic 0 (Low), for DC fails by $\pm 5\%$ set value CV / CC Status : CV :Logic 0 / CC Logic 1 Interlock : Short = Power Supply enabled , Open = Power Supply disabled DC ON status : ON = Logic 1 , OFF = Logic 0 OVP status Fault : Logic 0, else OK =Logic 1 OTP status Fault : Logic 0, else OK =Logic 1	
Remote shutdown	+5 V	
Front Panel	Controls	Mains ON/ OFF, Voltage and Current setting with multi-turn potentiometer (Coarse and fine), OVP Setting
	Indicators	Voltage, Current, CV, CC, Output ON, OVP, ACF, OTP
Protections	Over voltage , Over current, Short Circuit, Over temperature	
Output Terminals	Bus bar with M5 bolts	
Mains Input	AC input, Single phase, 195 V to 270 V, 50 / 60 Hz (47 ~ 63Hz) Input connector : IEC320/C14 , EN 60320/14 Internal Fuse L : 20 A, 6.3 x 32 mm ceramic fuse.	
Power Factor	0.99 @ full load / 0.98 @ 50% load	
Turn On delay	600 ms after mains switched ON	
Inrush current	<25A	
Hold up Time	20 ms	
Environment Conditions		
Operating Temperature	0 ~ +50°C; with 100% load; derated 75% at 60°C	
Storage	-40 ~ + 85°C	
Humidity	max. 95% non condensing at 40°C, max. 75% non condensing at 50°C	
Safety	Insulation : Input to Output : 3750 V for 1 min Input to case : 2500 Vrms Output to case : 600 V Insulation resistance : 100 M Ω at 25°C, 70% RH, 500 Vdc	
Dimension	W x D x H : 443 x 485 x 43.5 mm (1U, 19" Rack size) excluding connectors, terminals, switches, front and back panel controls, handles etc.	
Weight	11.0 kg approx.	
Cooling	Forced variable fan speed	
Standard Interface	Analog Programming	
Accessories Supplied	Mains Cable, User Manual	

Notes:

1. Subject to change without notice.
2. Sensing at the rear panel of the power supply unit at sense terminals.
3. Unit warm up time is 30 min.
4. Minimum output voltage guaranteed to maximum of 0.2% rated.
5. Minimum output current guaranteed to maximum of 0.4% rated.

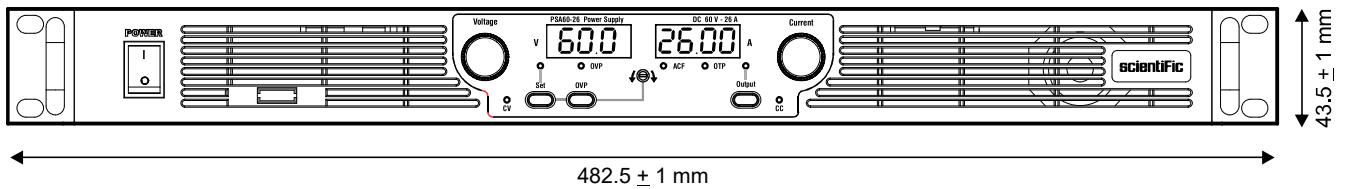
1.2 Power supply outline drawings - dimension

Front panel when unit is used on table top :



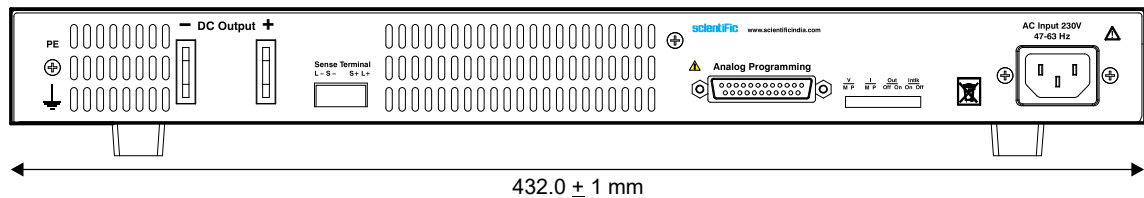
Note : Height excluding instrument feet

Front panel when unit is mounted in 19" rack cabinet :

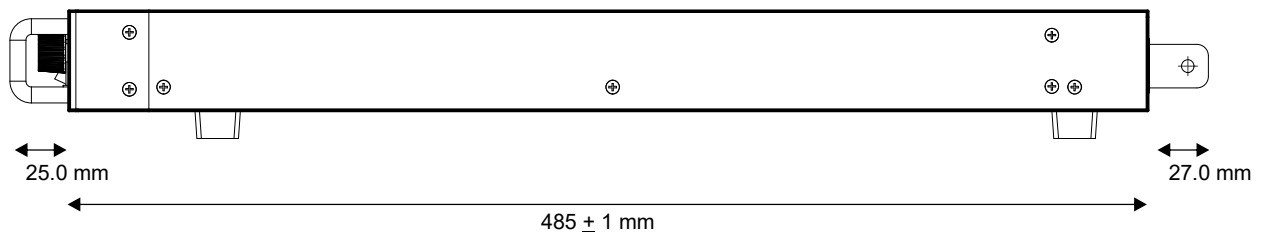


Note : When the power supply unit is mounted in 19" rack cabinet, instrument feet are removed and side rack mounting handle assemblies are fitted on both side.

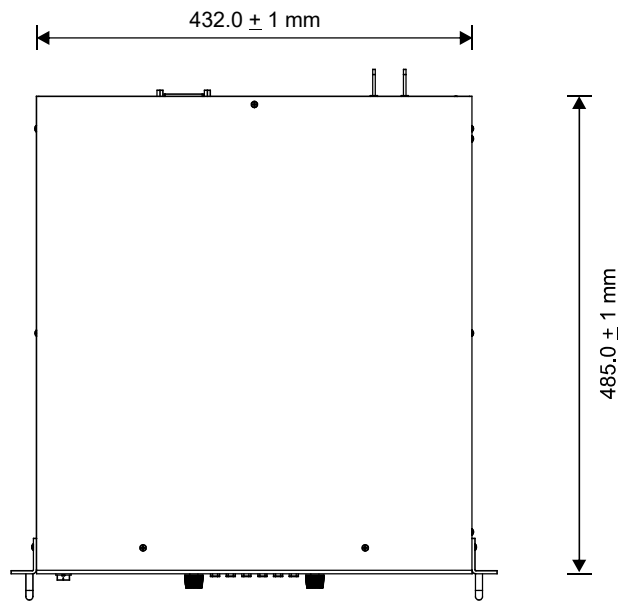
Rear panel when unit is used on table top :



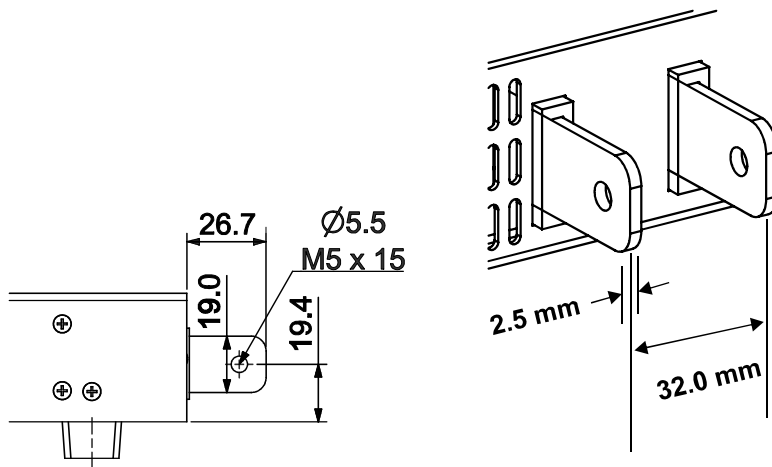
Side view when unit is used on table top :



Top view :



Output bus dimension :

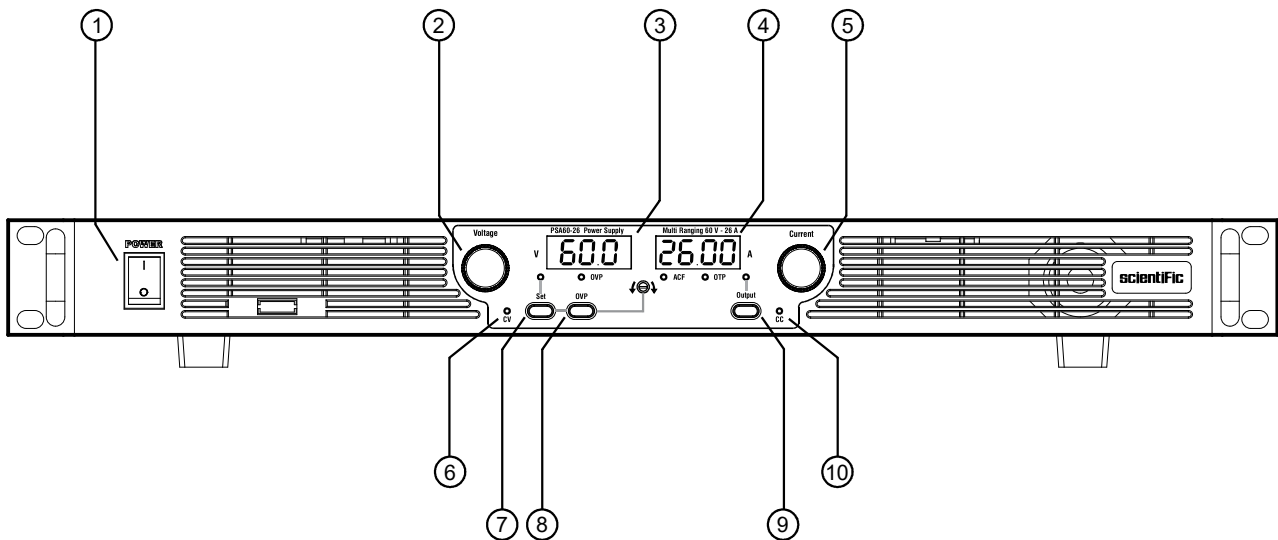


Chapter 2 Panel controls

The logical arrangement of the controls allows anyone to familiar with the operation of the equipment after a short time, however, even experienced users are also advised to read through these instructions so that all functions and the safety are understood. If the equipment is not used as described in this manual, the protection provided by the equipment may be impaired.

2.1 Front panel controls

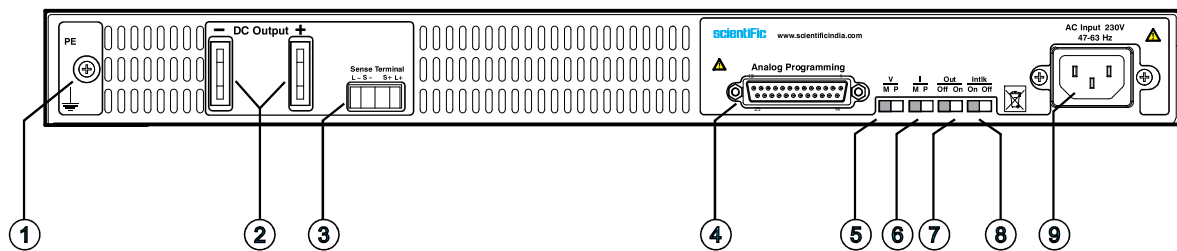
The front panel controls are arranged ergonomically to ease in operation with indicators. Before using the power supply unit, please read the following explanation to each control and connectors.



- ① AC Power Switch : Mains AC power ON/Off control, when switched to ON, supplies main AC power to unit.
- ② Voltage control : Voltage potentiometer control for setting the voltage. This is a 10 turn multi-turn potentiometer, which gives fine adjustment control.
- ③ Display Voltage : 3 digit display for setting and measured of output voltage.
- ④ Display Current : 3 digit display for setting and measured of output current.
- ⑤ Current control : Current potentiometer control for setting the current. This is a 10 turn multi-turn potentiometer, which gives fine adjustment control.
- ⑥ CV LED indicator : LED indicator for CV , lights when power supply is in constant voltage mode.
- ⑦ Set : Push button control for selecting setting for voltage and current. Keep Set pressed and adjust the voltage potentiometer to set the output voltage. Similarly current can be set. Set LED gets ON when Set push button is pressed.
- ⑧ OVP : Push button control for selecting setting for over voltage protection. Keep pressed and adjust the OV potentiometer with the help of screw driver to desired value of over voltage protection. Set LED gets ON when Set push button is pressed.
- ⑨ Out : Push button to control DC output ON / Off. Associated LED above lights when the output is ON.
- ⑩ CC LED indicator : LED indicator for CC , lights when power supply is in constant current mode.

2.2 Rear panel controls

The rear panel is arranged with mains inlet connector, output terminals and analog programming ports etc. .



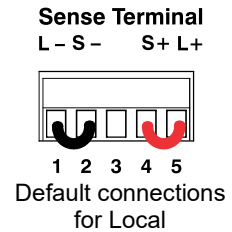
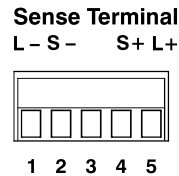
- ① PE : Terminal provided to make connection to protective earth.
- ② – DC Output + : DC Output Bus bars, to connect the load.
- ③ Sense Terminals : Remote sense terminals. Mating connector is provided with the instrument.
- ④ Analog Programming: 25 pin (F) D type connector for remote analog programming.
- ⑤ V/M-P : Switch selection for external voltage programming. To select external programming slide the switch to P. M is for manual programming from front panel.
- ⑥ I/M-P : Switch selection for external current programming. To select external programming, slide the switch to P. M is for manual programming from front panel.
- ⑦ Out/On-Off : Switch selection for auto output ON for when mains switch is powered ON. If kept at Off, the output will be Off, when power switch is made On.
- ⑧ INTLK/ On-Off : Switch selection for Interlock function enable / disable.
- ⑨ AC Input : AC mains inlet socket to power the instrument.

2.3 Sockets, connector description used on rear panel

The rear panel has different types of connections to other equipments for controlling, monitoring etc. , followings are connections for quick understanding. Detailed description on each is in specific inside the manual.

Sense Terminal

Pin 1	L -	Local sense -
Pin 2	S -	Remote sense -
Pin 3	NC	Not connected
Pin 4	S +	Remote sense +
Pin 5	L +	Local sense +



Programming Switch settings :

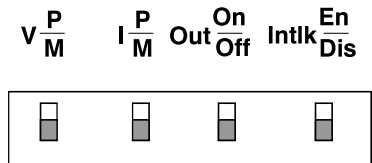
There are four slide switch on rear panel, the settings are ;

$\frac{V}{M} \frac{P}{M}$ Voltage Programming : When the switch is on M the voltage is set from the front panel, when set to P, the voltage is set from the analog connector.

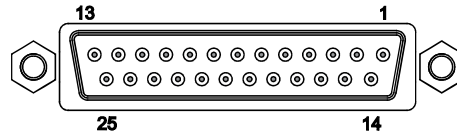
$\frac{I}{M} \frac{P}{M}$ Current Programming : When the switch is on M the current is set from the front panel, when set to P , the current is set from the analog connector.

$\frac{On}{Off}$ Output ON/OFF on mains switched ON : When the switch is at Off, the output of the power supply will be in OFF condition, when the mains switch is switched ON. If the switch is set to On, the output will be ON with mains switched ON.

$\frac{En}{Dis}$ Intlk selection : When the switch is set to Off, the power supply operates in normal condition. When the switch is set to On, the interlock function is enabled. See details further for operation.



Analog programming connector



Pin 1	Interlock +
Pin 2	Ground Analog Programming
Pin 3	Ground Analog Programming
Pin 4	Reserved, Please do not connected any circuit to this pin !
Pin 5	Over Voltage Status
Pin 6	Over Temperature Status
Pin 7	Reference Voltage output 5.1 V
Pin 8	Not Connected
Pin 9	Voltage Programming input
Pin 10	Current Programming input
Pin 11	Voltage Monitoring Output
Pin 12	Ground Analog Programming
Pin 13	CV / CC Status
Pin 14	Interlock –
Pin 15	Remote Shut Down input
Pin 16	Power Supply status
Pin 17	DC Output ON status
Pin 18	Reserved, Please do not connected any circuit to this pin !
Pin 19	AC Fail status output
Pin 20	DC Fail status output
Pin 21	Not connected
Pin 22	Ground Analog Programming
Pin 23	Ground Analog Programming
Pin 24	Current Monitoring Output
Pin 25	Not connected

Chapter 3 Installation

Your instrument is thoughtfully designed, manufactured, tested and inspected, found free of mechanical and electrical defects. When you receive the instrument, some inspections are necessary, and the condition must be understood and available before installing the instrument. Inspect the shipping container for damage if any after unpacking it. It is not recommended to use the instrument in the case of a damaged container. Keep all packing material until the inspection has been completed. If damage is detected, file a claim with carrier immediately and inform the Dealer, sales or authorized service facility nearest to you or Scientific.

If the contents in the container do not conform to the packing list, notify us or your dealer. Before putting this instrument in operation, make sure you go through the manual, safety and Cautions guidelines.

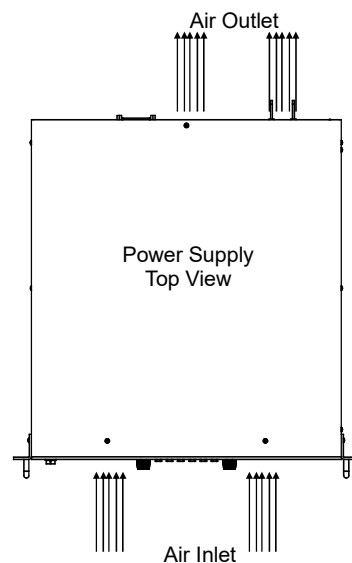
Ensure that the environmental conditions are fulfilled. Ensure that the instrument is not be used in place with vibrations, heating or exposed to sky, direct sunlight, for proper functioning and extensive life of service.

3.1 AC input mains connections

The mains AC socket (IEC compatible) is provided on the rear panel. Use the mains cord provided with the instrument, alternative ensure appropriate rating cable is used for connections as per the standard mains cord used in your country. This power supply unit is operated from 195 to 270 V, 47 ~ 63 Hz.

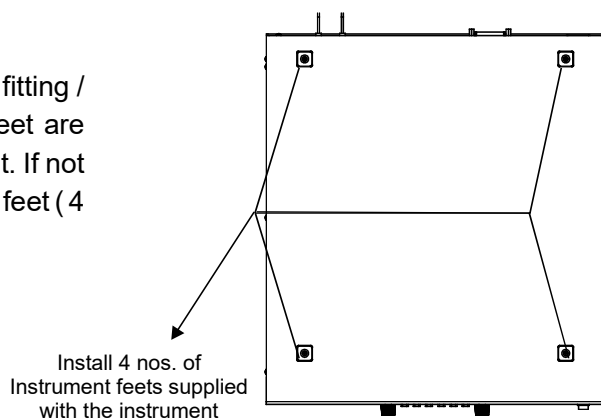
3.2 Cooling

The power supply unit is forced air cooled, it has two internal fans, the speed of the fans depends on the temperature of internal heat sinks. The air movement is from front to rear. Allow approximately 10 cms of free space on front and rear of the instrument, for free air movement. This allows stacking power supplies one above other and in 19" rack cabinets. For prolonged life of the power supply, the inlet temperature of air should be below 35°C. The instrument control circuit senses heat sink temperature, power delivered and adjust the fan speed accordingly. Thus the speed is controlled in pulsating mode, during this period, high pitch sound is produced, this is normal.



3.3 Use of instrument on table top

The power supply does not need any additional fitting / assembly of part. Ensure that the instrument feet are mounted on bottom side of the power supply unit. If not using appropriate screw driver, fix the instrument feet (4 nos.) provided with unit.



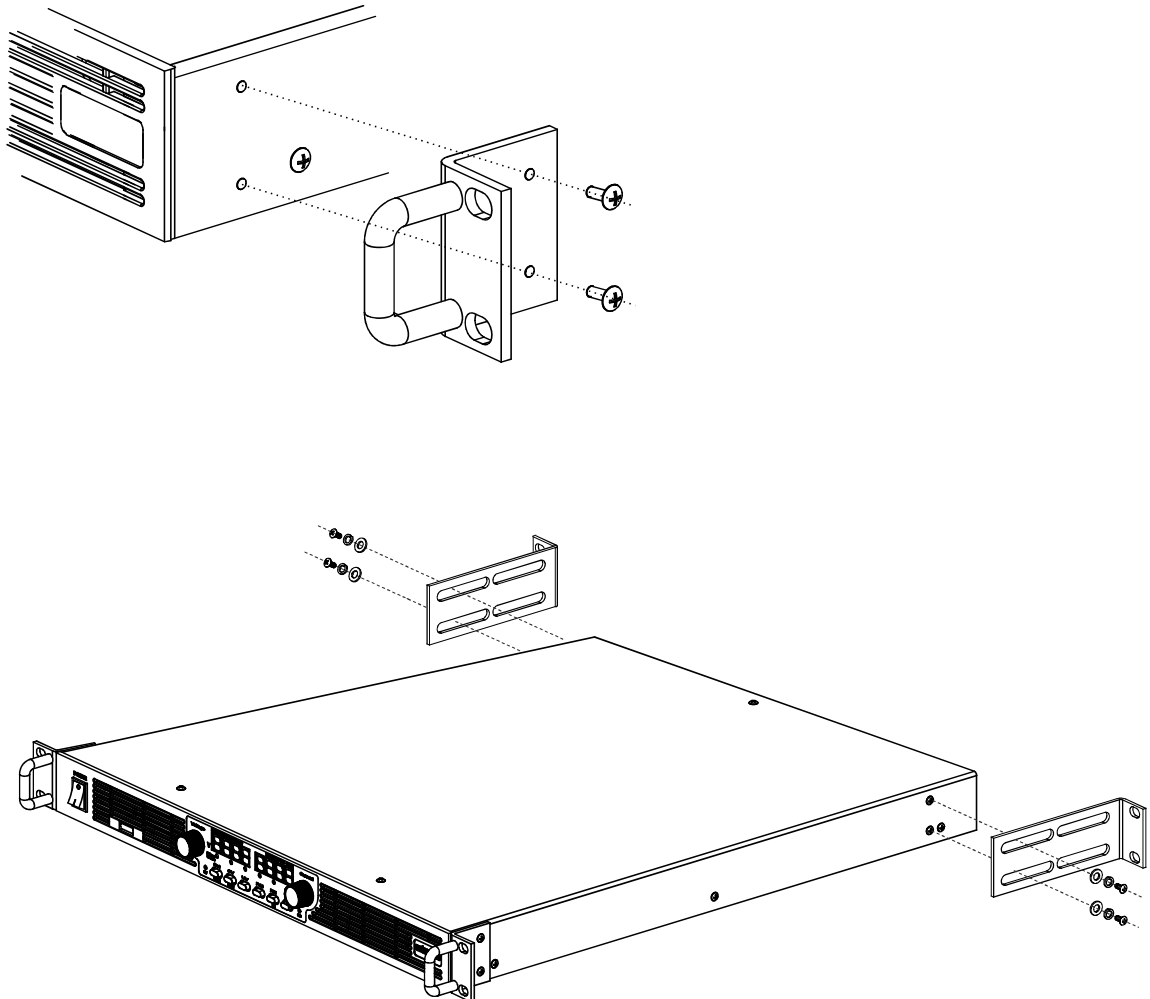
3.4 Use of instrument in 19" rack mounting cabinet

This power supply unit is designed to fit in standard 19" rack mount cabinet. it requires few parts to be installed before placing it in cabinet.

1. Use the front panel rack mount brackets and fix it on left and right side of the instrument as shown below. Figure below shows mounting of screws on right side, repeat the same for left side.
2. Use the rear panel support plate , if available , fix it on rear sides of the instrument, shown below. Else order the Rear Panel Support Plates optional available.

Caution !

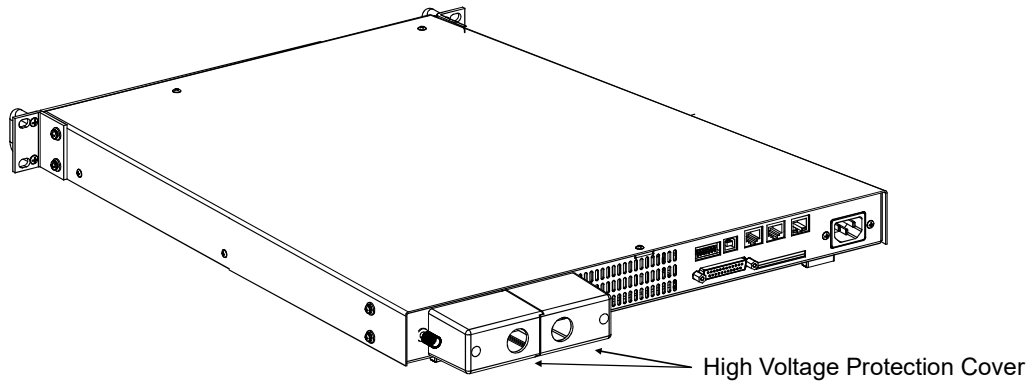
Ensure that the supplied screws used for mounting only, else use appropriate screws of size M3x 6 mm. Ensure that they do not penetrate more than 6 mm inside.



3.5 High Voltage Protection Cover for Safety

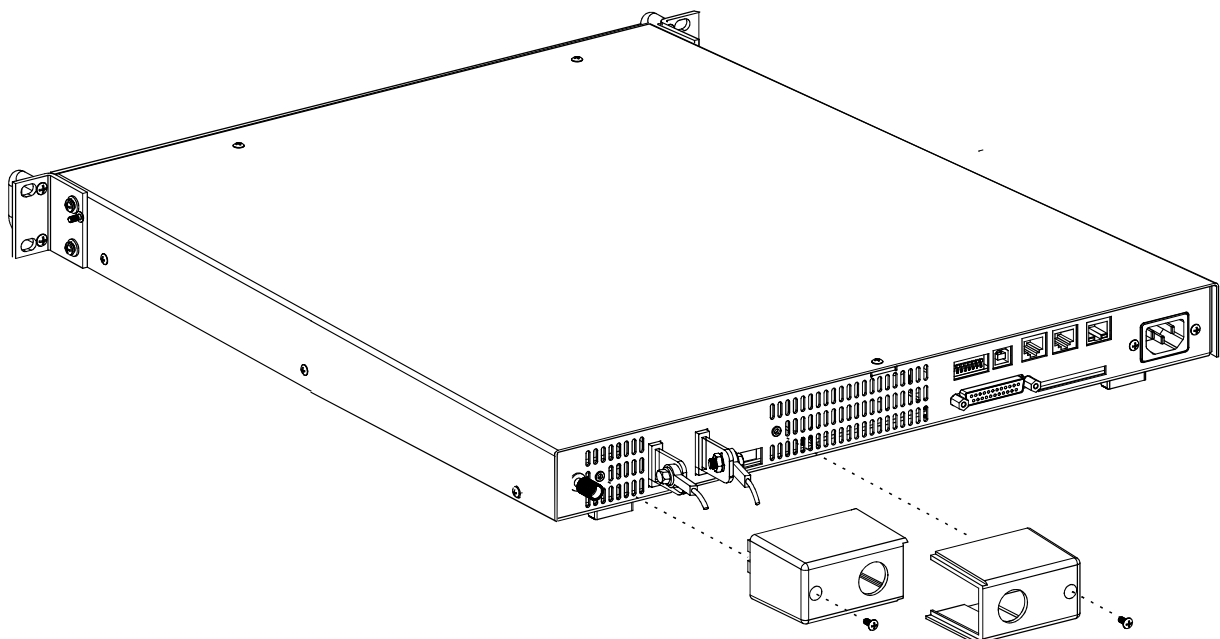
For safety, while using power supplies above 60V, the output terminals / Bus bars are to be protected for accidentally being touched for the safety of the operator.

A Safety protection cover is provided with power supply unit as an accessory. We highly recommend to install it to avoid any potential hazard to the operator / User / personnel.



Mounting of this part is very simple. Pass the cables through the protection cover before mounting the cables on bus bar. Connect the cables on bus bar, push the protection cover to touch the rear panel and fix with the screws.

Before any making electrical connections or removing the connections, ensure the power supply bus is fully discharged. Please refer to safety instructions, before connecting / disconnecting the output connections.



3.6 Firsttime operation power ON

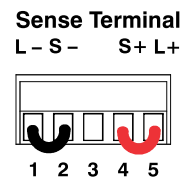
Prior to power ON , ensure the followings,

- POWER On/Off switch on front panel is in Off position.
- There is no condensation on the unit, if any, allow some time to get it dry.
- Slide switches on the rear panel are set to default (front panel control) positions as shown below.



- Remote sense wires are connected as shown below, if not, make the connection as shown.

Pin 1	L -	Local sense -
Pin 2	S -	Remote sense -
Pin 3	NC	Not connected
Pin 4	S +	Remote sense +
Pin 5	L +	Local sense +



The five pin sense plug can be pulled out from the socket, place the wires and re-insert the plug in sense terminal socket.

3.6.1 AC mains input

This power supply unit is designed for 230 V \pm 10% 50 Hz / 60 Hz.

Caution !

1. The Power Supply Unit must be connected to mains inlet having earth connection.
2. For safety the chassis of this unit is connected to protective earth potential.
3. Do not interrupt earth connection, else chassis will be floated and unsafe. Personal touching in this case liable to get electric shock.
4. Do not touch lead-wire connected with output terminal when the output is ON. Do not touch such parts immediately after output is cutoff. Failure to do so could result in serious injuries or could be fatal.
5. When the mains cord is connected , even in power off conditions, few components in power supply unit is still connected to the AC mains. To avoid any electrical shock, first remove the mains cord, wait for two to three minutes, before opening the instrument cover.

3.6.2 Connecting to AC mains

- Connect the AC mains inlet cable, after ensuring correct AC mains availability.
- Switch the POWER switch to ON position.
- The display will light and display will show voltage as the potentiometer setting and current zero as the load is not connected, this means the power supply is connected to AC mains and power supply is ready to use.
- Switch the POWER switch to Off position.

3.6.3 DC output check

- Connect the DVM/DMM in appropriate voltage range depending on power supply output voltage.
- Press the push button “Output”, the associated output LED will light, indicating the output is available on bus bar at the rear panel.
- Rotate the Voltage control potentiometer, the displayed voltage will vary with potentiometer variation.
- Observe the DMM reading and check with power supply display reading, the DMM reading should be within the stated accuracies of the output voltage.
- The minimum voltage reading is close to zero to maximum voltage as per specification of the model.
- Press the push button “Output”, the DC output will be switched off and output LED will be off.
- Switch Off the AC power switch.

3.6.4 DC constant current check

- Connect the DC shunt across the power supply output terminals with appropriate cables of current capacity. Ensure that the shunt and wire capacities are more than the power supply power.
- Connect the DMM in mV range across the DC shunt .
- Switch the POWER to ON position.
- Press and hold the “Set” push button, the associated output LED will light, indicating that voltage and or current now can be set , before the output is switched ON.
- Rotate the Voltage control potentiometer, such that the voltage set is approx. 1.00 Volts
- Rotate the Current control potentiometer, such that the current set is approx. 1.00 A.
- Press the “Output” push button, the associated output LED will light, indicating the output is available on bus bar at the rear panel.
- Observe the DMM reading and compare it with the current displayed reading, it should be in specified accuracy.
- The minimum to maximum constant current can be checked with connecting the appropriate DC shunts.
- Press the push button “Output”, the DC output will be switched off and output LED will be off.
- Switch off the AC power switch.

These two simple tests, ensure that the power supply is largely working and further can be checked and tested for the other modes and features after going through manual.

In Description chapter, all the features and modes are explained in details. Request to go through each for better understanding and use.

Chapter 4 Descriptions

4.1 Safety first - grounding

The power supply unit to be connected to the mains input as per the specification with firm protective earth grounding. The chassis of the unit is connected to ground potential. When the mains cord is connected, even in power off conditions, few components in power supply unit is still connected to the AC mains. To avoid any electrical shock, first remove the mains cord, wait for two to three minutes, before opening the instrument cover. Failure to do so will result in potential electric shock and serious injuries or could be fatal.

4.2 Input voltage

The power supply unit is designed 230 V \pm 10% 50 Hz / 60 Hz. The power supply cord must be used as per the country specific approved mains cord to avoid damage to unit and personal hazard.

There is no external fuse in the unit, a safety fuse is installed inside the unit. In event of fuse blown, the fuse must be replaced only by Scientific authorised service personal.

When power supply unit is switched ON, its inrush current is limited by internal circuitry. Switching ON and OFF at faster rate, may result in over heating of current limiter, resulting higher inrush current.

The power supply is designed with active power factor correction, therefore the power factor is very close to unity, also the input mains current is almost sine wave. It's standby power is also very low, resulting in very high efficiency and low losses - lower heat generation.

4.3 Operating conditions

4.3.1 Temperature and humidity

The power supply can be used safely at fully from 0 ~ 50 °C, with a condition that the surrounding free air movement is maintained for cooling. The normal humidity in ambient condition do not pose any problem, the heat produced in the instrument is sufficient to keep it dry.

In case of any condensation, allow the time to get it dry, before the instrument is switched ON and kept in use.

When power supply is mounted in 19" cabinet, ensure the free air movement. Industries and environment, with chemicals in air, e.g. chemical process industries, galvanizing industries, should take extra care to isolate the power supply unit by installing it in a clean room. This aggressive atmosphere, reacts with electronic component, damaging the parts and copper tracks etc. reducing the product life to standstill.

4.3.2 Storage

The power supply unit when not in used, or for transportation, should be kept in dry place. It can be stored or transported from -20 ~ 70°C without any problems.

4.4 Thermal protection

The power supply unit has thermal protection, against internal temperature when exceeds the safe limit. This only happens when adequate air circulation is not provided or very high environment temperature or in case of any fault in the unit. When this condition occurs, the power supply output gets switched OFF, the front panel "OTP" LED will light and the OT signal appear at analog connector on the rear panel.

Allow some time to cool down the power supply unit, you may observe the cooling fan speed is high. Once the temperature reaches below the set safe limit, the speed of fan reduces and in few minutes and it may stop.

To switch ON the output, press the Output switch, output LED will glow and output will be ON. If the problem reappears, check for space for air movement and clear the space. If it still persists, contact Scientific or dealer close to you.

4.5 Cooling

The power supply has two fans to cool down the internal temperature. The fresh air is taken from front side and exit on rear side. There is no ventilation holes on top and bottom side, this allows number of power supplies can be stack one over other. The speed of the fan is governed by internal circuitry, it starts at predefined temperature and power when drawn.

4.6 Output

The DC output of power supply unit is switchable to ON or OFF. This can be done by pressing the output switch on front panel or remotely from the analog programming connector.

The DC output is available on bus bar on the rear panel. The cable/ wire are connected with the help of M5 bolt and nut provided.

The output can be either CV (constant voltage) with current limiting or CC (constant current) with voltage limiting. The transition of mode from CV to CC, depending on the load current is very sharp and respective LED indicators CV or CC will light on the front panel.

The power supply is fully protected against all type of overload conditions including short circuit at output. The power supply has very low ripple and noise. If needed, the ripple and noise has to be measured directly on the sense terminals. To measure the ripple and noise very sensitive measuring instruments and probes are required. To measure the correct ripple amount, there are a few standardized methods for ripple and noise measurements. One of which is the JEITA-RC9131A standard.

4.7 Connecting the load

Caution !

Before connecting any output cables, turn OFF the output. While output is ON, there is potential electric shock hazard where the power supply models having output voltage greater than 40 V.

While connecting the cable, observe the following steps for precaution.

- Switch OFF the unit, disconnect the mains from the unit.
- Wait until the output capacitor gets discharge, for approximately 2 minutes.
- Connect the appropriate output cable on the output bus.
- If required connect the sense wires at load points, else local sense can be used.

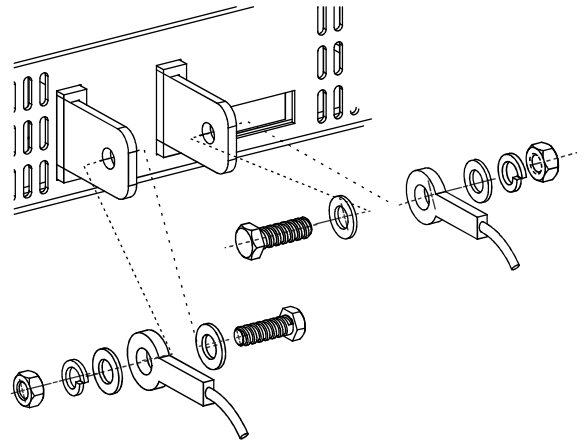
Select the output cable / wire with power rating higher than the power supply unit ratings. The size and length of the output cable is such that at maximum load the drop across each line conductor does not exceed the maximum permissible line drop of 1 V. If the drop is more, load regulation may not be maintained. In addition, there will be unnecessary power loss in cables.

The recommended cables for connecting the output are as below.

Model	Cable Size	Fixing Bolt size	Torque
PS16-100	25 mm ²	M5	20 Nm
PSA20-80	16 mm ²	M5	20 Nm
PS32-50	10 mm ²	M5	20 Nm
PSA40-40	10 mm ²	M5	20 Nm
PSA60-26	6 mm ²	M5	20 Nm
PSA100-16	4 mm ²	M5	20 Nm
PSA120-13	4 mm ²	M5	20 Nm
PSA160-10	2.5 mm ²	M5	20 Nm
PSA300-5	2.5 mm ²	M5	20 Nm
PSA600-2.67	1.5 mm ²	M5	20 Nm
PS800-2	1.5 mm ²	M5	20 Nm
PSA1000-1.6	1.5 mm ²	M5	20 Nm

The output cable is terminated with appropriate size of Copper lug. While making connection, place the copper lug directly to the bus, followed by washers and bolt. If the sequence is not followed, contact resistance will be introduced between the output bus and the cable, will cause excessive heat at bus. To reduce the output line inductance, keep both positive and negative cable close to each other.

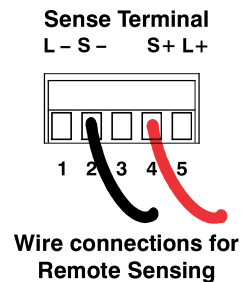
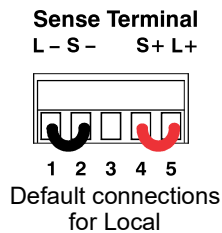
While connecting inductive loads, care must be taken to protect power supply unit from the spikes that may produced when output is switched ON and OFF. An appropriate rating of bypass diode should be connected at the output. The cathode of diode is connected to + ve output and anode to – ve output. The diode rating must be greater that the power supply voltage and current ratings. Similarly when the inductive motors are connected as load, that may give back emf. This back emf may cause a damage to the power supply , if protective measures are not taken. Connect a suitable surge suppressor of voltage of say 10 % to 15% of the maximum voltage of power supply unit.



Ensure that the output cable/ wire connected on output terminal are securely tightened before applying the power.

4.8 Local and remote sensing

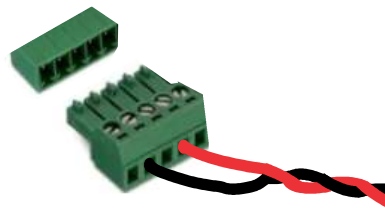
In most cases, local sensing is used. Power supply units are delivered with local sensing. On the rear panel, sense terminal block is provided. It has detachable connector plug. The plug is wired for local sensing as shown below.



Sense Terminal connections

Pin 1	L -	Local sense -
Pin 2	S -	Remote sense -
Pin 3	NC	Not connected
Pin 4	S +	Remote sense +
Pin 5	L +	Local sense +

Socket on Rear Panel



Detachable Sense Plug wired for Remote Sense

If the voltage regulation is to be maintained at load point, external wires are to be connected to sense points. Connect the wiring as shown above in the plug and insert the plug in remote sense socket. Before detaching or connecting the sense wires, switch off the power supply output, and ac mains to the unit. Wait for two minutes, until the output get discharged.

To keep the minimum external interference, the cables/ wires used to connect must be twisted pair. The wires should have good insulation to avoid any electrical contact with other equipments, ground or so. The power supply is floated and has no reference to other electrical circuit, unless physically connected. Such as

grounded positive power supply where the negative output terminal is connected to protective earth potential, similarly negative power supply where the positive output terminal is connected to protective earth potential.

4.9 Constant voltage and constant current mode

Power supply can be used in either constant voltage mode - CV, or constant current mode - CC. The mode is indicated by front panel LEDs.

Care must be taken while measuring ripple current voltage, it must be measured on output directly, otherwise few additional length of probe wire will add few mV of noise present in the field.

While using CC mode, do not use external Remote sense, otherwise it may add error in current set. While in CC mode DC fail signal will be generated usually.

4.10 Hold up time

Hold up time is the duration of time to which the output is available, when the mains ac input is switched OFF. This time depends on the load connected, lower the load current drawn higher will be the duration. If no load is connected, you will observe the display is still ON for some time, when AC power switched to OFF. This time helps the control system in power supply to communicate the failure of AC to other systems connected.

4.11 Over Voltage Protection

Over Voltage Protection (OVP) protects the load / circuits connected to the set over voltage value. When OVP occurs, the output gets switched OFF. To enable the output, press the Output switch again. Thus it protects the load circuit, in the event of excess of output voltage in local or in remote mode of operation.

The maximum over voltage can be set to approximately 105 % of the maximum settable voltage range.

When Over voltage protection is not required it should be set to the maximum value.

When over voltage occurs, the output gets switched OFF and output LED will be off, and OVP LED will light until the OVT gets cleared. To reset the power supply output, press the output ON/OFF switch.

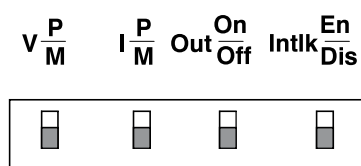
4.12 AC fail

The power supply is in use and it's mains AC input fails or it is low or it was intermittent because of bad power conditions, the ACF LED will light and output will get switched OFF. ACF LED lights until the power supply has energy, normally in seconds. After the AC fail gets cleared, mains power resumes, press output ON/OFF to enable the output.

When power supply is in operation and you switch OFF the power supply switch, then also ACF LED will light, however it is not a fault, just indication of AC mains switched OFF. If there is a problem in power supply ACF LED may light, even with mains is connected, this shows fault in power supply unit.

4.13 Analog programming

This programmable power supply can be controlled from remote analog inputs apart from the front panel controls. On rear panel slide switches enable power supply to be controlled through analog connector.



Either Voltage or Current or both can be programmed from analog connector.

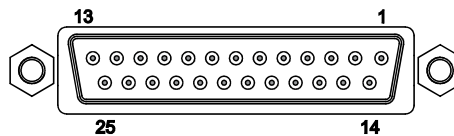
To maintain the power supply isolation and to prevent the ground loops, use an isolated programming source.

The power supply analog input and output signals are very sensitive and precise, any external disturbances may lead to errors in setting and measurements. Use a shielded cables for the analog control signals, if unshielded cable is use, provide EMI filters, suppressor to the cable. Keep the cable lengths as short as possible.

Apart from the setting the voltage and current, there are few status outputs are available which helps in remotely knowing the condition of power supply.

For measuring the voltage and current , monitor outputs are available in scale of 5 . Note that, the Analog connector input signals for remote control, have reference to – ve output terminals and they are not floated. Wrong connection can cause earth loops, may cause faults. Care must be taken before connecting the analog connector after ensuring.

Analog Connector Pin layout



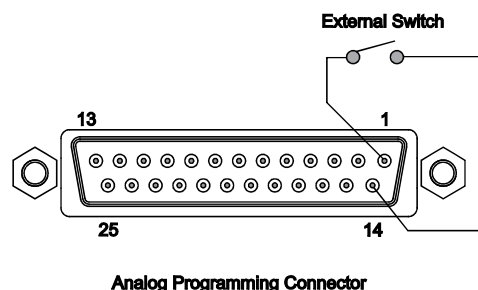
The Analog input output connector is D type 25 pin Female connector. Use appropriate mating connector always to give firm contacts and reliable connections.

4.14 Description of analog connector pins and their application

Pin 1 : Interlock + & Pin 14 Interlock –

The interlock function is enabled by selecting from slide switch Intlk to “On” on rear panel. The power supply is kept in output ON. When the external switch is ON (shorted) the output will be available, if external switch is OFF (open) the output will be switched OFF.

It can be used in combination with door switch contacts, for safety in process room, cabinet, other application is as a Emergency Stop Switch.



Pin 2 , Pin 3 , Pin 12, Pin 22, Pin 23 : Ground Analog Programming.

Pin 4 : Reserved , do not connect any external circuitry !

Pin 5 : Over Voltage status

When the over voltage occurs the status at pin 5 is updated, it goes low.

Pin 6 : Over Temperature status

When the inside temperature of the power supply unit increase beyond the set safe temperature, power supply output gets switched OFF and the status at pin 6 is updated. It goes low on over temperature, and remains until the normal conditions is attained.

Pin 7 : Reference voltage output 5.1 V

When power supply is to be controlled through remotely using external potentiometers, this reference voltage

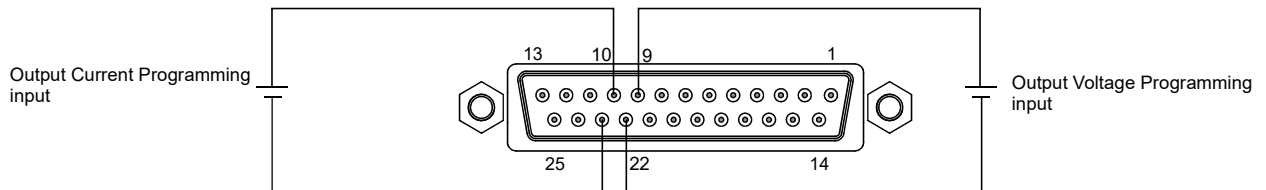
can be used as reference supply to potentiometers. The potentiometer value must be 10 k Ohms or higher to avoid any loading effect on reference voltage.

Pin 8 : Not connected

This pin is not used in this model, reserve for future use if any.

Pin 9 : Voltage programming input

In remote analog programming, to control the output voltage, V programming set value is fed to pin 9. Programming voltage in the scale of 5 V is applied.



The relation between the Vset and Vout is ;

$$V_{set} = (5 \times V_{out}) / V_{rated}$$

where Vset is voltage to be fed to pin 9 ; Vout is required output voltage ; Vrated is the rated output voltage of power supply unit , V rated is 40V , and if we wish to set output to 4V, then Vset will be $(5 \times 4) / 40 = 0.5 \text{ V}$

Pin 10 : Current programming input

In remote analog programming, to control the output current Iprogramming set value is fed to pin 10. Programming voltage in the scale of 5 V is applied.

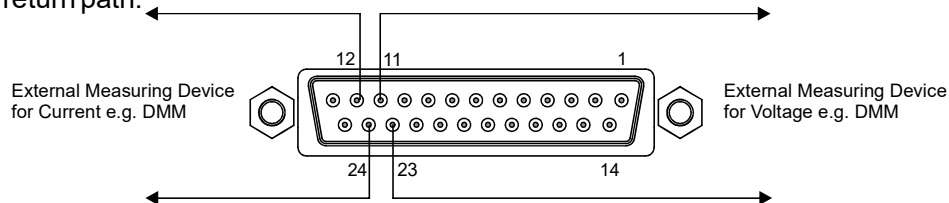
The relation between the Iset and Iout is ;

$$I_{set} = (5 \times I_{out}) / I_{rated}$$

where Iset is voltage to be fed to pin 10 ; Iout is required output current ; Irated is the rated output current of power supply unit. I rated is 40.0 A , and if we wish to set output to 4.00A , then Iset will be $(5 \times 4) / 40 = 0.5 \text{ V}$.

Pin 11 : Voltage monitoring output ; Pin 24 : Current monitoring output

In remote analog programming, you can monitor the output voltage and current on external measuring device e.g. on Digital Multimeter. The monitor output is in the scale of 5 V. These outputs are with reference Pin 12 and Pin 23 ground / return path.



The relation between the Vmonitor and Vout is ;

Vmonitor with 5 V reference ;

$$V_{monitor} = (5 \times V_{out}) / V_{rated}$$

where Vmonitor is output voltage from pin 11 ; Vout is output voltage ; Vrated is the rated output voltage of power supply unit. V rated is 40V, and if the output voltage is 4.00V, then V monitor will be $(5 \times 4.00) / 40 = 0.50 \text{ V}$.

Imonitor with 5 V reference ;

$$I_{monitor} = (5 \times V_{out}) / V_{rated}$$

where I_{monitor} is output voltage from pin 24 ; I_{out} is output current ; I_{rated} is the rated output voltage of power supply unit. I_{rated} is 40 A , and if the output current is 4.0 A, then I_{monitor} will be $(5 \times 4.0) / 40 = 0.5$ V .

Pin 13 : CV / CC status

The status for CV and CC is

Power supply when in CV : Low
Power supply when in CC : High

Pin 15 : Remote shut down On/Off

In remote programming, the output of power supply can be remotely switched OFF by applying TTL (5 V) at pin 15 of analog connector , with reference to ground at Pin 2. The power supply remain switched OFF, until the TTL voltage is goes 0V.

Pin 16 : Power supply OK

When the power supply is working and there is no fault , the power supply status is updated on pin 16 as,

Power is OK : High
Power supply is not OK : Low

Pin 17 : DC output ON

The status for DC output is updated at pin 17 as

Power supply Output ON : High
Power supply Output OFF : Low

Pin 18 : Not connected

This pin is not used. Please do not connected any circuit to this pin.

Pin 19 : AC fail status output

While ac mains to the power supply is not available due mains failure or power supply mains switch is switched OFF the status is updated on pin 19.

AC mains available : High
AC mains not available : Low

Pin 20 : DC Fail status output

If the output voltage drops or increases 5 % above the set voltage, the status is updated at pin 20 as,

DC output within 5 % of set value : High
DC output beyond 5 % of set value : Low

Pin 21 : Not connected

Pin 25 : Not connected

4.15 Safe start - auto start mode

When the power supply AC mains switch is pressed, ON, the DC output state can be controlled. The output can be made ON with mains AC ON, or OFF with mains AC ON. To select mode, use rear panel slide switch “Out - On/OFF” setting.

4.16 Connecting load

The load is connected on rear panel bus of power supply unit. The connecting wires/ cables should be of appropriate size, with good insulation. The power supply has floated output, this allows, if required the either of terminal can be connected to ground as per the load requirements. This means a positive or negative power supply can be configured.

While connecting load wire / cables, ensure that the power supply is switched OFF , wait for few minutes, until the output charge is discharged. Disconnect the mains, connecting the output wires and sense wires in local or remote sense as the case may be. Never change or remove the sense wire in power supply ON conditions, doing so it may cause a damage to the power supply unit as well as it's dangerous to do so for the person working on it.

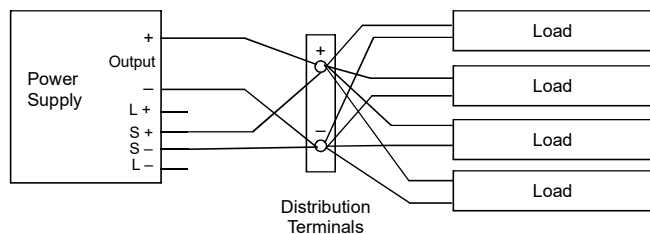
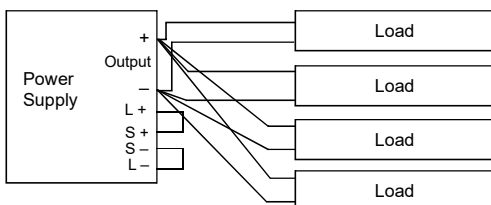
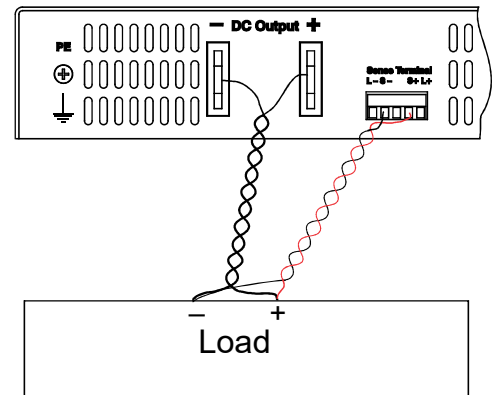
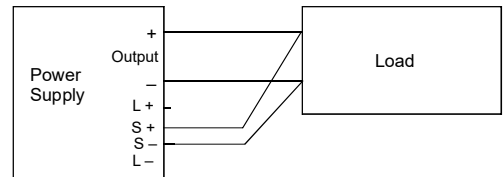
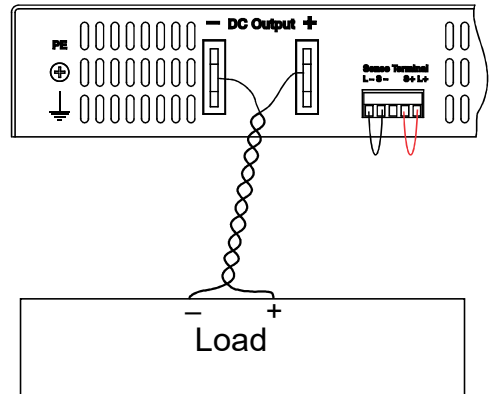
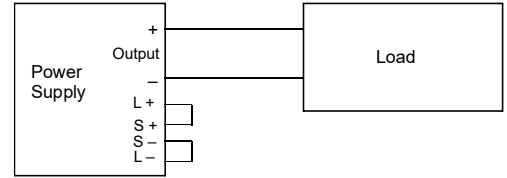
Connecting single loads

The load can be connected in either in local sense or in remote sense mode. In case of local sense mode the sense points are at output bus , where as when precise regulation is required at load points, the sense wires are connected across the load.

When the regulation is critical, remote sense to be used. Remove the local sense connections and move these sense wires to load end as shown in figure. While in remote sense, the sense wires should be twisted and or to be shielded to avoid any influence of surrounding noise. The sense wire length should be optimized to get the shortest length.

Connecting multiple load

When connecting multiple load, the loads can be connected directly on the output bus of power supply with local sensing or the power supply output can be connected to common bus, on which the multiple loads can be distributed. The regulation at common bus can be maintained by connecting the remote sense wires on common bus. angerous to do so for the person working on it.



4.17 Connecting power supplies in series & parallel

To increase the current or voltage rating of power supply system, it is possible to connect the power supplies in series for increasing the voltage rating and connecting in parallel to increase the current rating. While connecting ensure that the models are same. Do not connect other models in series or in parallel, else there are possibilities of damaging the power supply units.

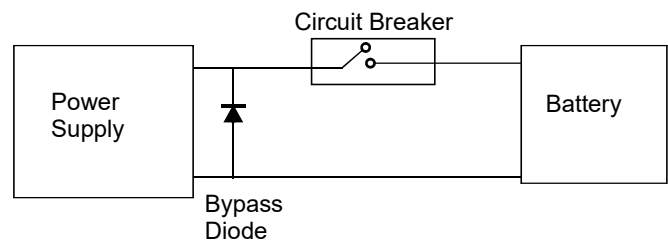
When the power supplies are connected in series the maximum output voltage will be the addition of all the units connected in series. Total maximum added output should be less than 600V.

In Remote control in analog programming care must be taken, the programming voltage fed has reference to output negative terminal and when the power supplies are in series the input programming voltage must be isolated else the power supplies connected will be short circuited through analog programming connectors return points / reference grounds.

When the power supplies are connected in parallel the current capacity gets multiplied by the number of units in parallel.

4.18 Power supply as battery charger

The PSA series power supplies can be used as battery charger, CV/CC mode regulates the charging current. To protect the power supply, use a circuit breaker in series with charging cable, in event of excess current or reverse polarity the circuit breaker will disconnect in very short time. The circuit breaker should have double the battery voltage and fast acting (normally type Z). To protect the accidental polarity reversal current large amount will flow through the power supply, which will damage the power supply, to avoid, a bypass diode is connected in parallel to output terminal of power supply. The diode should be of higher rating and should have high heat dissipating capability.



Chapter 5 Maintenance

There are no user serviceable part inside the power supply unit. The instrument is carefully tested and calibrated using standards traceable to National Laboratories. To prevent electrical shock, do not remove cover. If you have any questions concerning the maintenance or operation, contact Scientific Customer Support or nearest dealer to you.

No User internal calibration is required during the operational life time of power supply unit. Do not open the power supply unit cover, there exists high voltage points on the PCB circuitry. Only qualified and trained technical person understanding the potential hazards is expected to handle the inside faults if any. In such case we recommend to send the power supply unit to Scientific for service and repairs.

In case of power supply failure, when it needs service / repairs , there is no User repairs or replaceable parts inside the power supply unit. No User replaceable parts are listed in this manual. Repairs are only made by manufacturer or by authorized service facilities.

No periodic maintenance is required except to 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. Under no circumstances the cleaning fluid should get into the instrument. The use of cleaning agents can attack the plastic & paint surfaces.

5.1 Troubleshooting

These power supply units are designed for continuous use, as such there are very less probabilities of failures. However, in the event of failure following first hand troubleshooting will help to diagnosis the problem. If the problem is still not solved, please contact nearest dealer to you or Scientific Customer Support giving full details.

Problem Symtoms		Checks and solutions	
1	No Output	1.1	When power switch is ON no display , no output. Check the mains cord continuity. if faulty replace.
		1.2	Display is ON, but no output even pressing output button to ON. Check if the output cable is shorted. if faulty replace.
		1.3	Check if sense block wires are open or wrongly wired. if yes place it correctly S+ to positive and S- to negative bus outputs.
		1.4	Check if voltage and current both potentiometers are set to zeroes, if yes move potentiometers to desired values.
		1.5	Check the OVP LED lights, if yes over voltage has occurred, remove the conditions and reset the over voltage protection by pressing Output push button.
		1.6	Check for the Over temperature conditions, if yes remove the conditions and reset the output by pressing output push button.

	Problem Symtoms	Checks and solutions	
2	Voltage and or Current potentiometers do not work	2.1	Check if the power supply is in Remote analog programming mode. If yes bring the switches to manual mode.
3	Remote Programming does not work	3.1	Check if the power supply unit remote programming is not selected from the rear panel slide switch settings.
		3.2	Check if , analog programming voltages has higher DC offset. if yes , reduce it or use floated / isolated programming input signals.
4	Output voltage is higher than set value	4.1	Check if the sense wires are open at sense block or at load end if used remote sensing. If yes re-wire the same.
		4.2	Check if the output cable is too long and of lower rating. Reduce the output cable to the possible length and increase the cable capacity using higher cross section cable.
5	High Ripple voltage present of output	5.1	Check if the sense wires are open and output cable is too long. if sense wires open, re-connect the sense wire.
		5.2	Check if Remote sense is used and sense wires are too long and hanging. if yes, optimize the wire lengths and use twisted pair for sense wires.
6	There is no Fuse visible	6.1	There is no user replaceable fuse in the power supply. Only inside power supply unit there are fuses to protect the fault conditions. In case of these gets open, only Scientific qualified or authorized trained personal should replace the fuse.
8	Others	8.1	If fault still persist, the power supply unit should be sent to Scientific for necessary repairs. Please follow the instructions given in Dispatch procedure for servicing the power supply units on next page, before sending the unit.

Chapter 6 Dispatch procedure for service & warrantee

6.1 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 :

Before dispatching the instrument please write to us giving full details of the fault noticed.

1. 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.
2. Dispatch the instrument (only on the receipt of our advise) 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 or factory.

6.2 Warranty conditions

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 15 days 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.