

Notes :

**Programmable Switch Mode  
Power Supplies  
DCA Series 400 Watts**

**User Manual**

**scientiFic**

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Notes :

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Rev 1.03/ 0322

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Notes :

### 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.

## Programmable Switch Mode Power Supplies DCA Series 400 Watts

- Compact 2 U - 1/6<sup>th</sup> 19" rack size
- Multi range Output
- Fast transient response
- High slew Rate
- Analog Programming
- Universal Mains

The DCA power supplies is designed for compact 85 mm height (2U) - in 1/6<sup>th</sup> 19" Rack size with user friendly operation and higher efficiency. This range offer multi ranging output characteristic which delivers multiple voltage and current combination in a single power supply.

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 or programmed through analog programming.

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

All the DCA models have universal mains input range for worldwide operation. They can be operated from line voltage 90 V ~ 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.

	Problem Symtoms	Checks and solutions	
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.
7	Others	7.1	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.

	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.
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.

## 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 qualified 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 )

### Information on electrical and electronic equipment recycling

Our Equipment contain high quality components and material and are designated to facilitate recycling. After appropriate use of this equipment , when this is to be discarded , the equipment must not be treated as municipal waste. This must be disposed of separately via the appropriate return and collection system available. By following these instructions, you ensure that the product is treated correctly and help to reduce potential impacts on the environment and human health, which otherwise result from inappropriate handling. Recycling helps to conserve natural resources and protect environment.

For more information on collection and return, please contact dealer / from where you have purchased / to us giving full details.



## 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.



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.

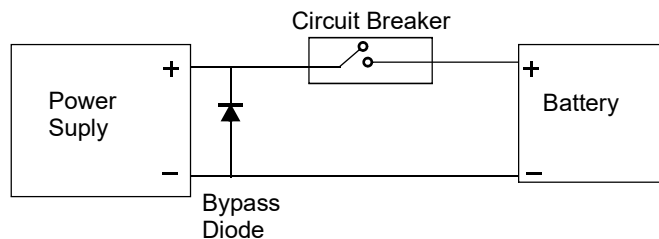
When the power supplies are connected in series the maximum output voltage will be the addition of all the units connected in series. Total maximum added output should be less than 600V.

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. There is no limit on number of power supplies connected in parallel.

#### 4.18 Power supply as battery charger

The DCA 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 the 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). In case of accidental polarity reversal large amount of current will flow through the power supply, which will damage the power supply. A bypass diode should be connected in parallel to output terminal to protect the power supply. The diode should be of higher rating and should have high heat dissipating capability.



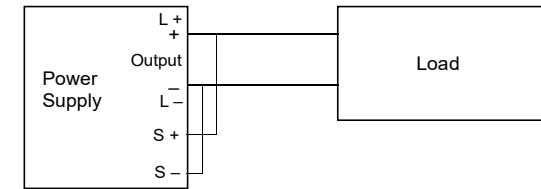
## Chapter 1 Technical specifications

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

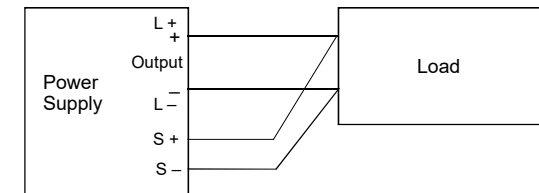
### 1.1 Specifications

	DCA20M40		DCA60M14		DCA160M5	
DC Outputs Voltage    V	20		60		160	
Multi Ranging *       V	10	20	30	60	80	160
DC Output Current     A	40	20	14	7	5	2.5
Power                    Watts	400					
Efficiency at 230V full load	82%		83%		83%	
Constant Voltage Mode						
Load regulation 0 ~ 100% (mV)	3		5		15	
Line Regulation (mV)	2		3		5	
Ripple (mVrms) BW= 20 MHz	5		7.5		15	
Ripple (mVpp) 20 MHz	40		50		60	
Constant Current Mode						
Load regulation 0 ~ 100 % (mA)	10		8		5	
Line Regulation (mA)	2		2		2	
Ripple (mArms) BW= 20 MHz	50		25		15	
Ripple (mApp) 20 MHz	150		75		50	
Remote sense drop typically       V	1		2			

		DCA20M40		DCA60M14		DCA160M5	
Programming Speed							
Rise time ( 10% to 90% ) into resistive load							
Time 100% load	ms	18	35	40	80	90	200
Time 10% load	ms	15	30	35	75	80	190
Fall time ( 90% to 10% ) into resistive load							
Time 100% load	ms	10	30	30	90	50	150
Time 10% load	ms	100	250	250	800	500	1500
Recovery Time							
Recovery within	mV	50		80		100	
time @ 50 step	us	100		100		100	
– 100 % load							
max deviation	mV	160	160	150	150	500	500
@ 230 V mains							
Output Impedance							
0-1kHz	CV mΩ	< 10		< 10		< 10	
1-100kHz	CV mΩ	< 30		< 30		< 30	
Output Capacitance		8.8 mF		1.98 mF		900 uF	
Temperature Coefficients		CV : 80 ppm/°C CC : 90 ppm after warm up of 30 min and during 8 hrs					
Output Stability		CV : 100 ppm/°C CC : 100 ppm after warm up of 30 min and during 8 hrs					
Analog Programming (Rear panel 9 pin D connector (Female))							
Programming		V : 0 ~ 5 V, Accuracy : ± 1 % of Vout rated, Input impedance : 1 MΩ I : 0 ~ 5 V, Accuracy : ± 1 % of Iout rated Input impedance : 1 MΩ					
Monitoring		V out : 0 ~ 5 V, Accuracy : ± 1% of Vout rated output impedance : 2 Ω / 0.4 mA max I out : 0 ~ 5 V, Accuracy : ± 1 % of Iout rated Output impedance : 2 Ω / 0.4 mA max					

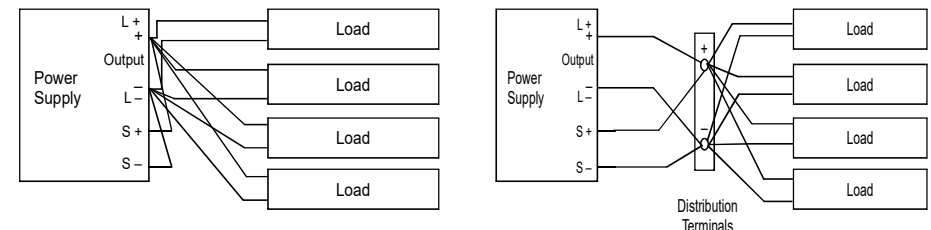


When the regulation is critical, remote sense to be used. Remove the local sense connections and move these sense wires to load end as shown in figure. While in remote sense, the sense wires should be twisted and or to be shielded to avoid any influence of surrounding noise. The sense wire length should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



### Connecting multiple load

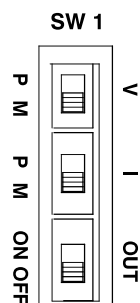
When connecting multiple load, the loads can be connected directly on the output bus of power supply with local sensing or the power supply output can be connected to common bus, on which the multiple loads can be distributed. The regulation at common bus can be maintained by connecting the remote sense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



### 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

reference to ground at Pin 8. The power supply remain switched OFF, until the TTL voltage is goes 0V.



#### 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. Figure shown below shows , the output will be on when AC mains is switched ON.

#### 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.

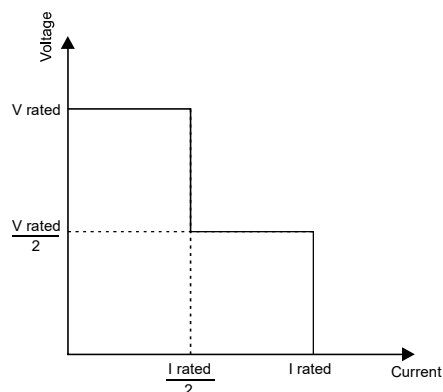
	DCA20M40	DCA60M14	DCA160M5
V reference	5.1 V $\pm$ 10 mV		
Status Input / outputs	Power Supply OK = PS OK = Logic High, Any Fault: PS OK = Logic LOW		
Remote shutdown	+5 V		
Front Panel controls	Mains ON/ OFF, Voltage and Current setting with Multi-turn Potentiometers switch settings : Set, Over voltage & Output		
Indicators :	LEDs for Set, CV, CC, Over Voltage & Output		
Display			
Resolution Voltage digit	3	3	3
Current digit	3	3	3
Accuracy	$\pm$ (0.5 % + 2 d)		
Display scale Voltage V	0 ~ 20.0	0 ~ 60.0	0 ~ 160
Current A	0 ~ 40.0	0 ~ 14.0	0 ~ 5.00
Protections	Over voltage : Adjustable from 0.5 V ~ 105 % of Vmax, Output shut-down, reset by Output switch. Over current : Selectable from CV to CC . Over temperature: Output gets OFF, after preset internal safe AC Fail: Output gets OFF, if input Voltage out of Safe Range		
Output Terminals	Bus bar and 2 wire connections for remote sense		
Parallel operation	6 units to increase current capacity		
Serial operation	2 Units in series of same models		
Mains Input	Universal AC input, Single phase, 90 ~ 270V, 50 / 60 Hz ( 47 ~ 63Hz) , Input connector : IEC320/C14 , EN 60320/14, Standby Power : 13 Watts @ 230V (Vout max, No load) Internal Fuse L : 6 A, 5 x 20 mm ceramic fuse.		
Power Factor	0.9 @ full load / 0.98 @ 50% load		
Turn On delay	600 ms after mains switched ON		
Inrush current	<25A		
Hold up Time	20 ms		

	DCA20M40	DCA60M14	DCA160M5
Environment Conditions			
Operating Temperature	0 ~ +50°C; with 100% load; derated to 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 MΩ at 25°C, 70% RH, 500 Vdc		
Dimension	W x D x H : 70 x 422 x 85 mm excluding connectors, terminals, switches, front and back panel controls, handles etc.		
Weight	2.9 kg		
Cooling	Forced , temperature controlled variable Fan speed		
Accessories Supplied	Mains Cable		

#### 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.

#### \* Multi range output



The relation between the  $V_{monitor}$  and  $V_{out}$  is ;

$V_{monitor}$  with 5 V reference ;

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

where  $V_{monitor}$  is output voltage from pin 3 ;  $V_{out}$  is output voltage ;  $V_{rated}$  is the rated output voltage of power supply unit

e.g. : in DCA60M14 model  $V_{rated}$  is 60V , and if the output voltage is 40V, then  $V_{monitor}$  will be  $(5 \times 40) / 60 = 3.3 \text{ V}$  .

$I_{monitor}$  with 5 V reference ;

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

where  $I_{monitor}$  is output voltage from pin 4 ;  $I_{out}$  is output current ;  $I_{rated}$  is the rated output voltage of power supply unit

e.g. : in DCA600M14 model  $I_{rated}$  is 14.0A , and if the output current is 7.0 A, then  $I_{monitor}$  will be  $(5 \times 7.0) / 14.0 = 2.5 \text{ V}$  .

Pin 5 PS OK 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 5.

If OVP, ACF, OTP are good than PS OK : High  
in case of fault PS OK : Low

Pin 6 Share for M/S mode : Share signal used in Master / Slave mode.

Pin 7 Reference Voltage output + 5V :

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 Ground Analog Programming :

Ground terminal for Analog Programming inputs.

Pin 9 RSD Remote Shutdown input :

In remote programming, the output of power supply can be remotely switched OFF by applying TTL ( 5 V ) at pin 9 of analog connector , with

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 1 ; Vout is required output voltage ; Vrated is the rated output voltage of power supply unit

e.g. : in DCA60M14 model V rated is 60V , and we wish to set output to 40V, then Vset will be  $(5 \times 40) / 60 = 3.33$  V

Pin 2 I Prog - 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 ;

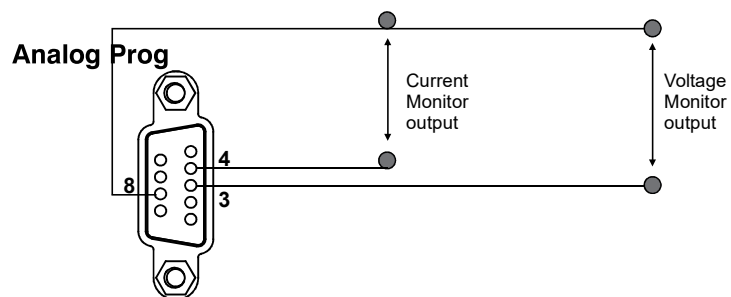
$$I_{set} = (5 \times I_{out}) / I_{rated}$$

where Iset is voltage to be fed to pin 2 ; Iout is required output current ; Irated is the rated output current of power supply unit

e.g. : in DCA60M14 model I rated is 14.0A , and we wish to set output to 10.00A , then Iset will be  $(5 \times 10.00) / 14.0 = 3.57$  V.

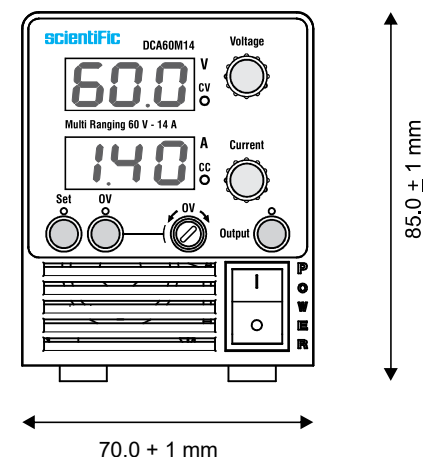
Pin 3 V Mon - Voltage Monitor output & Pin 4 I Mon - Current Monitor output :

In remote analog programming, you can monitor the output voltage and current on external measuring device e.g. on Digital Multimeter. The monitor outputs is in the scale of 5 V. These outputs are with reference Pin 8 ground / return path.



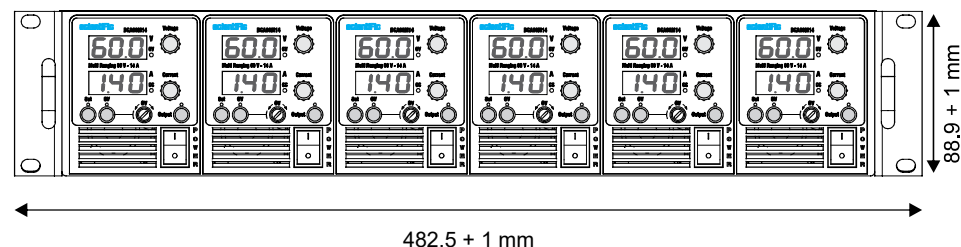
## 1.2 Power supply outline drawings - dimension

Front panel when unit is used on table top :



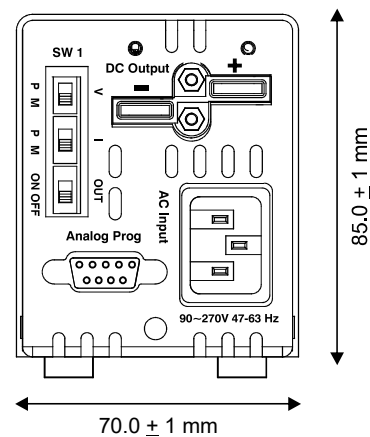
Note : Height excluding instrument feet

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

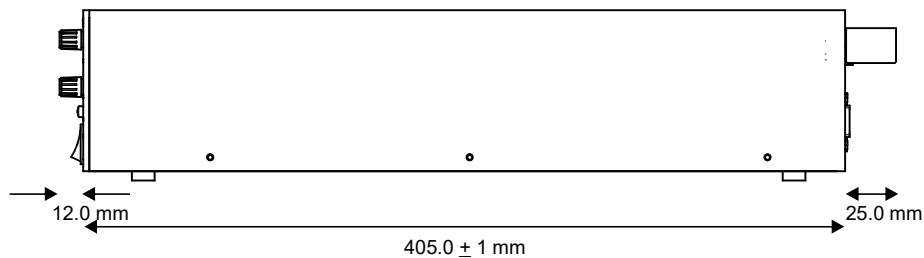


Note : When the power supply unit is mounted in 19" rack cabinet, instrument feet are removed and 6 units are assembled in 19" rack mount kit.

Rear panel when unit is used on table top :

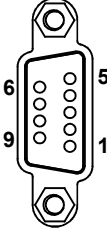


Side view when unit is used on table top :



connecting the analog connector after ensuring.

Analog Connector Pin layout

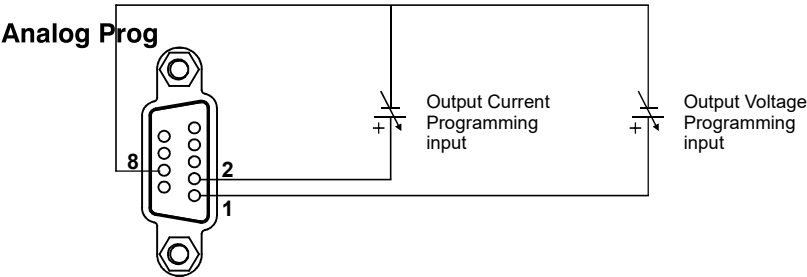
<b>Analog Prog</b> 	Pin 1	V Prog - Voltage Programming input
	Pin 2	I Prog - Current Programming input
	Pin 3	V Mon - Voltage Monitor output
	Pin 4	I Mon - Current Monitor output
	Pin 5	PS OKI Status output
	Pin 6	Share Bus for M/S mode
	Pin 7	Reference Voltage output + 5V
	Pin 8	Ground Analog Programming
	Pin 9	RSD Remote Shutdown input

The Analog input output connector is D type 9 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

Pin1 V Prog - Voltage Programming input :

In remote analog programming, to control the output voltage, V programming set value is fed to pin 1. Programming voltage in the scale of 5 V is applied.



When over voltage occurs, the output gets switched OFF and output LED will be off, and OVP LED will light. To reset the power supply output, press the output ON/OFF switch. The power supply returns to previous state, if the voltage at output terminals diminishes, else again the over voltage protection comes into action.

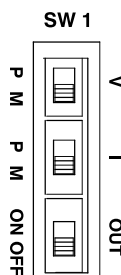
#### 4.12 AC fail

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 signal will be sent on pin 5 of analog programming connector and output will gets switched OFF.

When power supply is in operation and you switch OFF the power supply switch, then also ACF occurs, however it is not a fault, just indication of AC mains switched OFF.

#### 4.13 Analog programming

The 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.

Figure on left side shows voltage and current both in external programming mode.

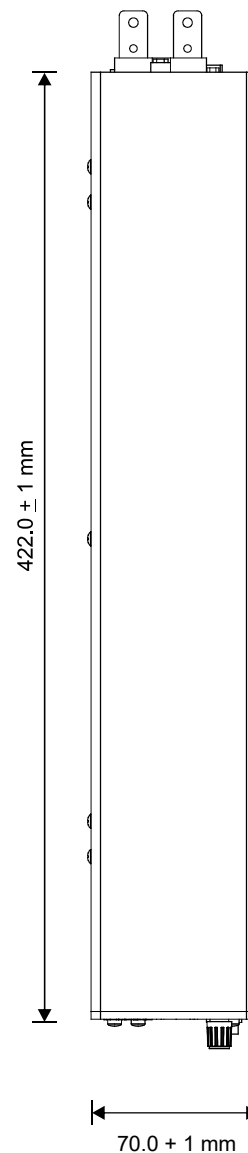
To maintain the power supply isolation and to prevent the ground loops, use an isolated programming source.

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.

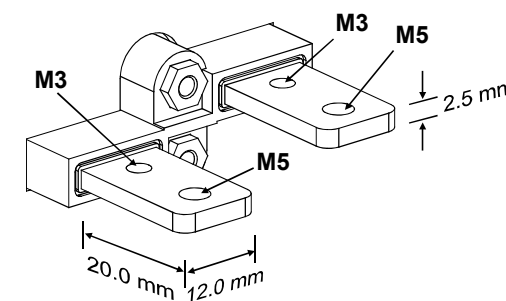
Apart from the setting the voltage and current, there are few status outputs are available which helps in remotely knowing the condition of power supply.

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

#### Top view :



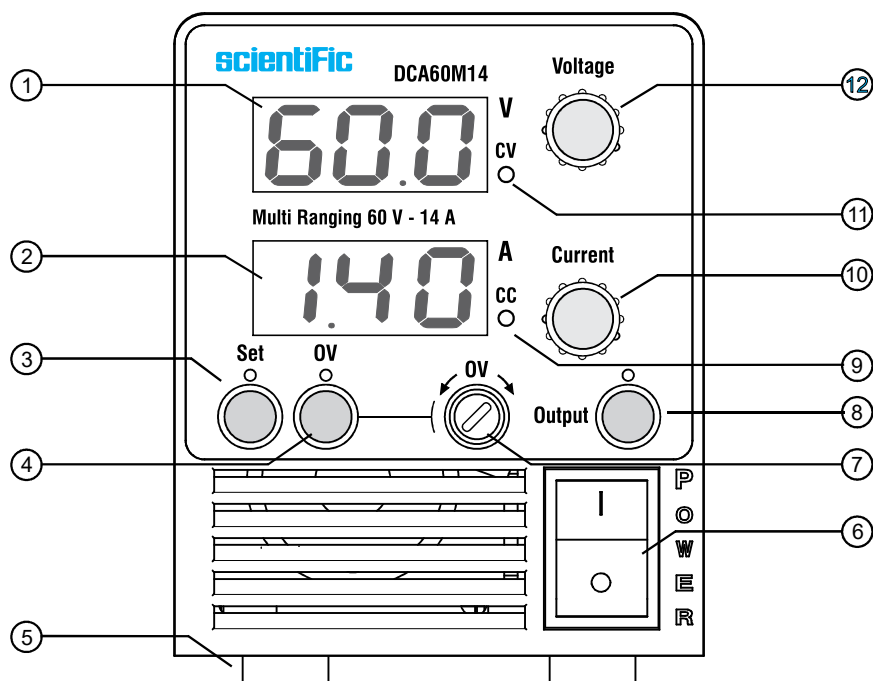
#### Output bus dimension :



## Chapter 2 Panel controls

### 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, terminals and IO connectors.



- ① Display Voltage : 3 digit display for setting and measured of output voltage.
- ② Display Current : 3 digit display for setting and measured of output current.

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. The DCA series has multi-ranging, the advantage is, it serve purpose of two models higher voltage - lower current and lower voltage - higher current in one unit.

Care must be taken while measuring ripple current voltage, it must be measured on output directly, other wise 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 minimum Over voltage can be set to approx. 105 % the set voltage or 1V. 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.



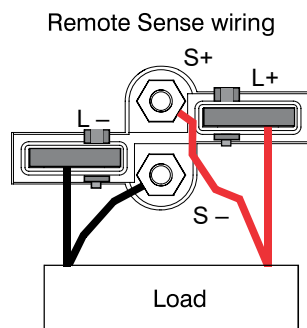
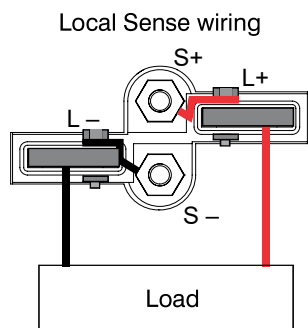
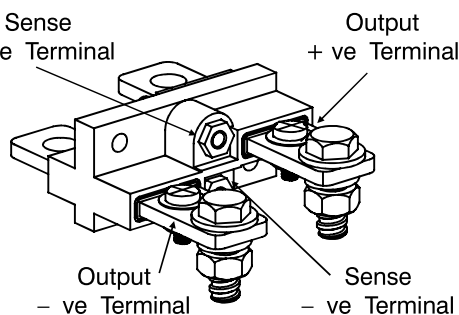
While connecting inductive loads, care must be taken to protect power supply unit from the spikes that may produced when output is switched ON and OFF. An appropriate rating of bypass diode should be connected at the output. The cathode of diode is connected to + ve output and anode to – ve output. The 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, two sense terminals are provided. Figure below shows the local sense connections.

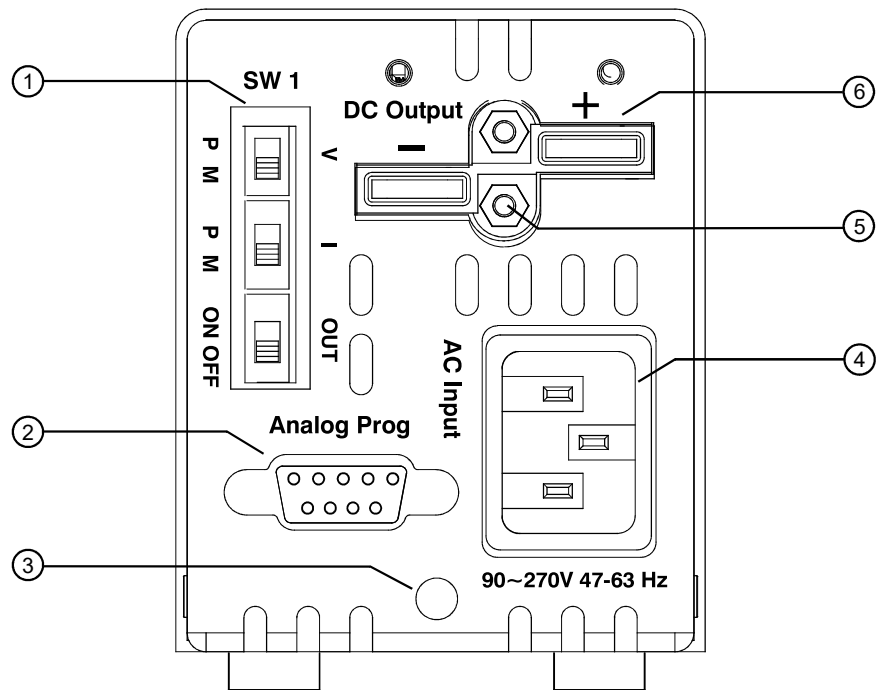
If the voltage regulation is to be maintained at load point, external wires are to be connected to sense points. Connect the wiring as shown below. Before detaching or connecting the sense wires, switch off the power supply output, and ac mains to the unit. Wait for two minutes, until the output get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



- ③ 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.
- ④ & ⑦ 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. OVP LED gets ON when OVT activates.
- ⑤ Instrument Feet : Used when the power supply unit is used on table top. These are removed when used in 19" rack mount kit.
- ⑥ AC Power Switch : Mains AC power ON/Off control, when switched to ON, supplies main AC power to unit.
- ⑧ Output : Push button to control DC output ON / Off. Associated LED above lights when the output is ON.
- ⑨ CC LED indicator : LED indicator for CC , lights when power supply is in constant current mode.
- ⑩ Current control : Current potentiometer control for setting the current. This is a multi-turn potentiometer, which gives fine adjustment control.
- ⑪ CV LED indicator : LED indicator for CV, lights when power supply is in constant voltage mode.
- ⑫ Voltage control : Voltage potentiometer control for setting the voltage. This is a multi-turn potentiometer, which gives fine adjustment control.

2.2 Rear panel controls

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



① SW1 Analog Programming switch : Used in Analog programming, for details please refer Analog programming section. Default position is down.

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.

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.

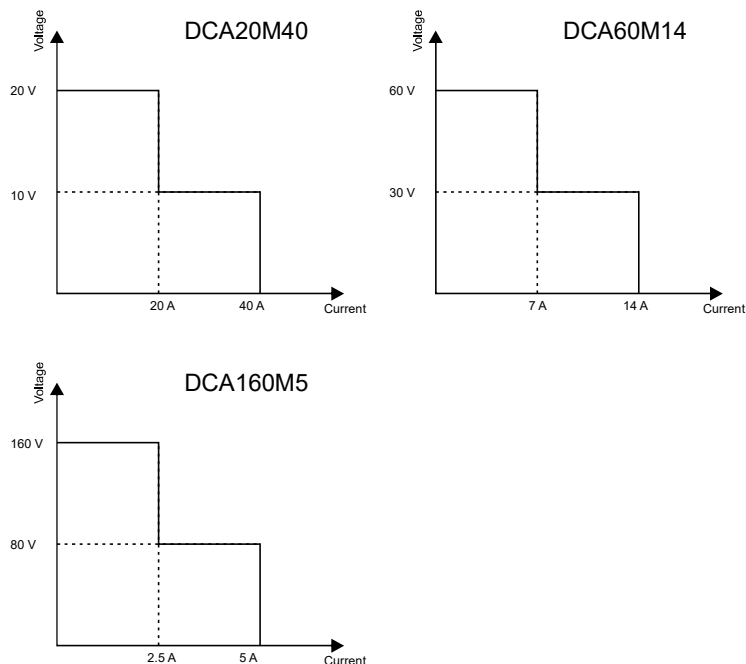
Select the output cable / wire with power rating higher than the power supply unit ratings. The size and length of the output cable is such that at maximum load the drop across each line conductor does not exceed the maximum permissible line drop of 1 V in DCA20M40 , 2 V in DCA60M14 & DCA160M5 and 5V in DCA600M1.33. 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
DCA20M40	10 mm <sup>2</sup>	M5	20 Nm
DCA60M14	4 mm <sup>2</sup>	M5	20 Nm
DCA160M5	1.5 mm <sup>2</sup>	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.

The output can be either CV (constant voltage) with current limiting or CC (constant current) with voltage limiting. These power supplies are design for multi-ranging, meaning it gives full current at half the voltage or half the current at full voltage. For example model DCA20M40 allows the drawing load current of maximum 40 A up to 10 V and maintains CV mode. Similarly we can draw load current of 20 A at 20 V maintaining the CV mode.



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.

V / P - M : Switch selection for external voltage programming. To select external voltage programming slide the switch to P, and to control from front panel / manual , slide to M.

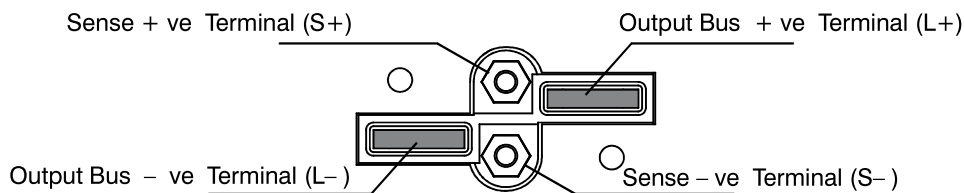
I / P - M : Switch selection for external current programming. To select external current programming slide the switch to P, and to control from front panel / manual , slide to M.

- ② Analog Programming Connector : 9 pin analog programming connector used for external / remote analog programming. For details please refer Analog Programming section.
- ③ PE (Earth connector) : Protective earth terminal , connected to mains inlet earth potential.
- ④ AC Input : AC mains inlet socket to power the instrument.
- ⑤ Sense Terminals : Remote sense terminals.
- ⑥ – DC Output + : DC Output Bus bars, to connect the load.

## 2.3 Sockets, connector description used on rear panel

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

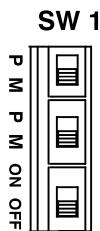
### Output Bus Terminals + ve and – ve



Output Bus Terminals is provided with,

1. Output Bus + ve Terminal
2. Output Bus – ve Terminal
3. Remote Sense + ve Terminal
4. Remote Sense – ve Terminal

### SW1 Programming Switch



Output ON/off on mains switch: When the switch is at OFF position , Output will be in OFF condition on mains switch ON. when the mains switch is switched to ON. If the switch is set to On, the output will be ON with mains switched ON.

V 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.

I 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.

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.

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.

Once the temperature reduced and is below the safe limit, output will switched ON automatically. 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 fan installed 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.

## 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 for universal mains input . The mains input can be connected from 90V to 270 V 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

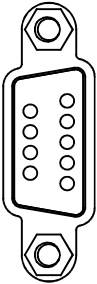
The power supply can be used safely at fully from 0 ~ 50 °C, with a condition that the surrounding free air movement is maintained for cooling. The normal humidity in ambient condition do not pose any problem, the heat produced in the instrument is sufficient to keep it dry.

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

### Analog Programming Connector

Analog Prog



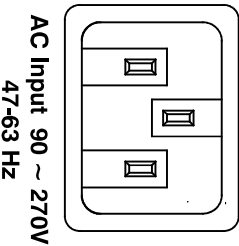
Pin 1	V Prog - Voltage Programming input
Pin 2	I Prog - Current Programming input
Pin 3	V Mon - Voltage Monitor output
Pin 4	I Mon - Current Monitor output
Pin 5	PS OK Status output
Pin 6	Share for Master / Slave Mode
Pin 7	Reference Voltage output + 5V
Pin 8	Ground Analog Programming
Pin 9	RSD Remote Shutdown input

### Earth / Ground Terminal



Earth / Ground Terminal to connect to safety earth.

### Mains Inlet Socket



Mains Inlet Socket to connect the AC mains.

## 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.

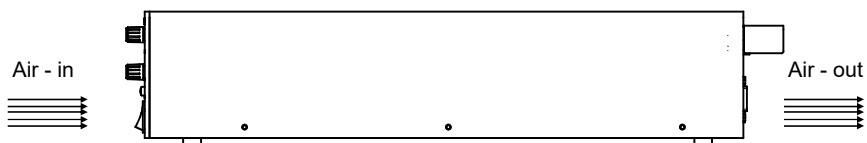
Ensure that the environmental conditions are fulfilled. Ensure that the instrument is not be used in place with vibrations, heating or exposed to sky, direct sunlight, for proper functioning and extensive life of service.

### 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 straight mains cord used in your country. This power supply unit can be operated from 90 V ~ 270V, 47 ~ 63 Hz.

### 3.2 Cooling

The power supply unit is forced air cooled, it has one internal fan, the speed of the fans depends on the temperature of internal heat sinks. The air movement



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.

### 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 knob, the displayed voltage will vary with knob 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. 1.00A.
- 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

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

While the power supply unit is delivered, it is ready for use on table top. No additional accessory needs to be fitted.

However, while using in 19" rack, the instrument feet needs to be remove.

### 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. Maximum 6 units can be fitted in 2U height in 19", with the help of optional 19" Rack mounting kit available at extra cost. You can order these kits, depending the number of units to be fitted. These are available, on order 2, 3, 4, 5 & 6 units.

1. Use the Rack mount kit parts and fix the desired number of units, with the supplied hardware.

#### 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.

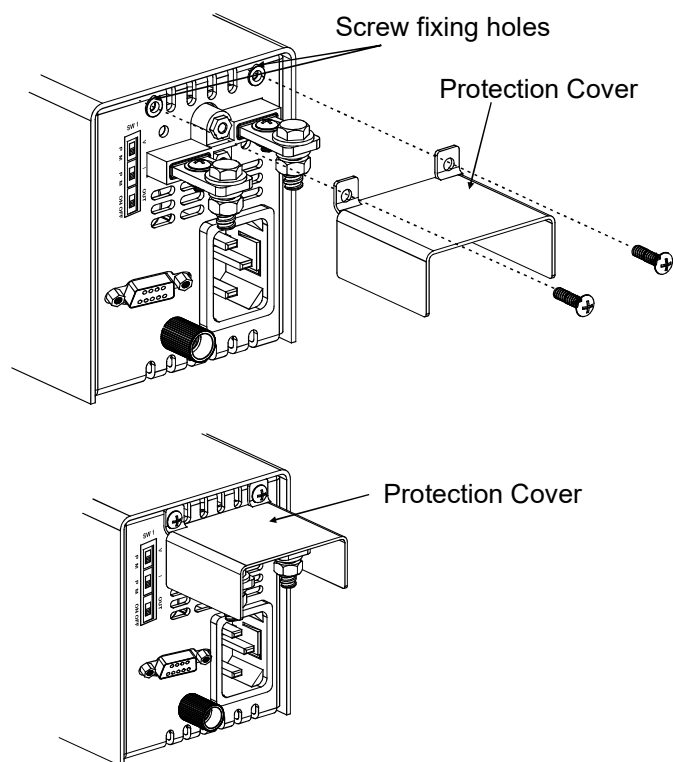
### 3.5 High Voltage Protection

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.

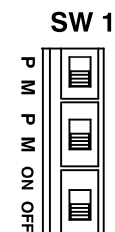
#### Assembling Protection Cover on rear panel



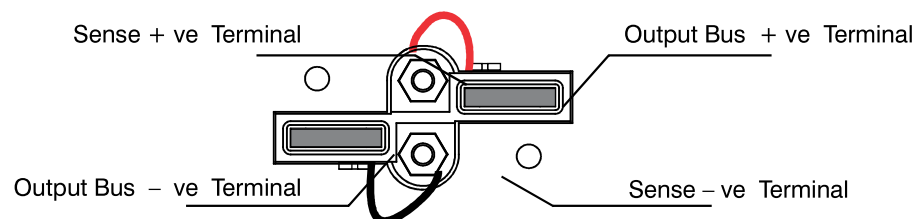
### 3.6 First time operation power ON

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.



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



#### 3.6.1 AC mains input

This power supply unit is designed for universal mains input. The mains input can be connected from 90V to 270 V 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 wires 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.