UNI

BENCHTOP INSTRUMENT

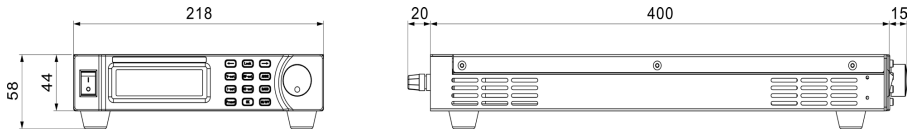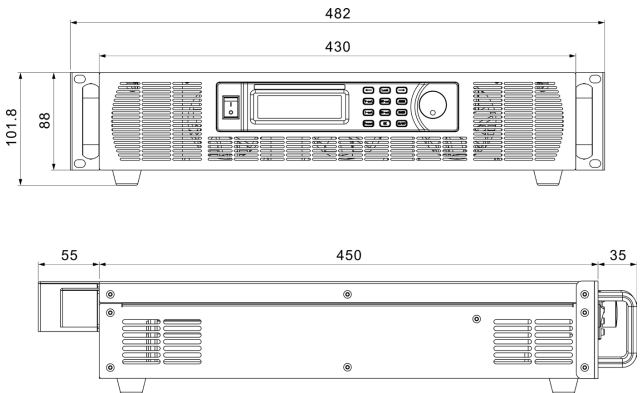**Single Output DC Power Supply**

Operation Manual V1.2

R&D TECH

9. DIMENTIONAL DRAWINGS

Dimensions of 1/2 1U frame

Dimensions of 2U frame

Dimensions of 3U frame

CONTENTS

Use of Operation Manual

Please read through and understand this Operation Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.

Calibration notification

We notify that the instruments included in this manual are in compliance with the features and specifications as stated in this manual. Before shipment, the instrument has been calibrated in factory. The calibration procedures and standards are compliant to the national regulations and standards for electronic calibration.

Warranty

We guarantee that the instrument has been passed strict quality check. We warrant our instrument's mainframe and accessories in materials within the warranty period of one year. We guarantee the free spare parts for products which are approved defective in this period. To get repair service, please contact with your nearest sales and service office. We do not provide any other warranty items except the one being provided by this summary and the warranty statement. The warranty items include but not being subjected to the hinted guarantee items related to tradable characteristics and any particular purpose. We will not take any responsibility in cases regarding to indirect, particular and ensuing damage, such as modifications to the circuit and functions by the users, repairing or component replacement by the users, or damage during transportation.

For product improvement, the specifications are subject to change without prior notice.

Time drift:	Voltage≤0.5%FS rms / Current≤1%FS rms
Temperature drift:	Voltage≤0.1%FS rms/°C / Current≤0.3%FS rms/°C
Transient response time:	≤5ms (10% ~ 90% load change)
Remote sensing:	Max compensation voltage 5V
Protection:	OVP, OCP, OTP and short circuit protection
OVP setting range:	0.1V to 110% of rated voltage
OCP setting range:	0.1A to 110% of rated voltage
Digital interface:	RS-232 & RS-485, support ModBus-RTU commands
Analog interface (optional):	0-5V, 0-10V o 4-20mA interface for voltage/current control and feedback
Cooling method:	Forced air cool
Operating environment:	0°C~40°C, 10%~80%RH
Storage environment:	-20°C ~70°C, 10%~90%RH
Accessories:	Operation manual x1, RS-232 cable x1

The above models are listed for reference only. Customer specifications are welcome.
For the purpose of product improvement, specifications are subject to change without prior notice.

12kW Series

Model		20-600	30-400	60-200	100-120	300-40	400-30	600-20	1000-12
DC Output	V	0~20V	0~30V	0~60V	0~100V	0~300V	0~400V	0~600V	0~1000V
	A	0~600A	0~400A	0~200A	0~120A	0~40A	0~30A	0~20A	0~12A
Line regulation	CV	≤0.2%FS							
	CC	≤0.2%FS							
Load regulation	CV	≤0.2%FS							
	CC	≤0.2%FS							
Ripple & Noise (20Hz~20MHz)	CV	≤1%FS+100mVrms	≤0.5%FS+100mVrms	≤0.3%FS+100mVrms					
	CC	≤0.3%FS+10mArms							
Setting/Reading Accuracy	CV	≤0.1%FS+20mV				≤0.1%FS+100mV		≤0.2%FS+100mV	
	CC	≤0.5%FS+200mA				≤0.3%FS+100mA	≤0.3%FS+30mA	≤0.3%FS+10mA	
Resolution	V	0.01V	0.01V	0.01V	0.1V	0.1V	0.1V	0.1V	1V
	A	0.1A	0.1A	0.1A	0.1A	0.01A	0.01A	0.01A	0.01A
Dimensions		482W*132H*570D mm (3U)							
Weight		Approx 25kg							
Input		3φ4W (L1, L2, L3, PE), 380V±10% 47~63Hz							

15kW Series

Model		30-500	50-300	60-250	100-150	150-100	300-50	600-25	1000-15	1500-10
DC Output	V	0~30V	0~50V	0~60V	0~100V	0~150V	0~300V	0~600V	0~1000V	0~1500V
	A	0~500A	0~300A	0~250A	0~150A	0~100A	0~50A	0~25A	0~15A	0~10A
Line regulation	CV	≤0.2%FS								
	CC	≤0.2%FS								
Load regulation	CV	≤0.2%FS								
	CC	≤0.2%FS								
Ripple & Noise (20Hz~20MHz)	CV	≤0.1%FS+100mVrms			≤0.5%FS+100mVrms		≤0.3%FS+100mVrms			
	CC	≤0.3%FS+10mArms								
Setting/Reading Accuracy	CV	≤0.1%FS+20mV					≤0.1%FS+100mV		≤0.2%FS+100mV	
	CC	≤0.5%FS+200mA				≤0.3%FS+100mA	≤0.3%FS+30mA		≤0.3%FS+10mA	
Resolution	V	0.01V	0.01V	0.01V	0.1V	0.1V	0.1V	0.1V	1V	1V
	A	0.1A	0.1A	0.1A	0.1A	0.1A	0.01A	0.01A	0.01A	0.01A
Dimensions		482W*132H*570D mm (3U)								
Weight		Approx 30kg								
Input		3φ4W (L1, L2, L3, PE), 380V±10% 47~63Hz								

SAFETY INSTRUCTION

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

Safety Symbols

The following safety symbols may appear in this manual or on the instrument:

1	WARNING	Identifies conditions or practices that could result in injury or loss of life.
1	CAUTION	Identifies conditions or practices that could result in damage to the instrument or to other properties.
2	DANGER	High voltage
1	ATTENTION	Refer to the manual
F		Protective conductor terminal
D		Earth (ground) terminal

Safety Guidelines

1 WARNING
- The power supply can be used only by qualified personnel.
- Before using the power supply, do not connect any load to the power supply before it's turned on. Make sure to disconnect the load before shutting down the power supply. Not following this instruction may cause damages to the power supply, which are not under warranty.
- Before turning on the power supply, make sure the chassis and upper cover are is properly grounded. Removing grounding device or improper GND terminal connection may cause electrical shot.

1 WARNING
- If you are running inductive load like magnetic coils, DC motors, stepper motors, etc., make sure to change the voltage/current slowly, and NEVER turn the power supply on or off with a inductive load connected.

1 CAUTION
- Before plugging into local AC mains, check and make sure that the output voltage is compatible to the load. (It is suggested to disconnect a load before plugging into local AC mains.)
- Do not use this power supply on a life support system or other systems with similar requirements.
- Do not use this power supply near water.
- Do not operate or touch this power supply with wet hands.
- Do not open the casing of the power supply when it is connected to AC mains.
- The max. output voltage of the power supply may be over 60VDC, avoid touch the metal contact part of the output terminals.

- Do not use the power supply in an atmosphere which contains sulfuric acid mist or other substances which cause corrosion to metal.
- Do not use the power supply in a dusty place or a highly humid place as such will cause power supply reliability degradation and instrument failures.
- Install the power supply in a place where is free from vibration.
- Install the power supply in a place where the ambient temperature is in range of -10°C~70°C. Note that the power supply operation may become unstable if it is operated in an ambient temperature exceeding the range of 0°C~40°C

Power supply	AC input voltage: refer to input label on rear panel.
1 WARNING	Connect the protective grounding conductor of the AC power cord to an earth ground to avoid electrical shock.

Fuse	• Fuse type: refer to the fuse rate label on the rear panel of the power supply.
1 WARNING	• Make sure the correct type of fuse is installed before power up. • Replace the AC fuse with the same type and rating as the original fuse. • Disconnect the power cord before fuse replacement. • Make sure the cause of fuse blowout is fixed before fuse replacement.

Operation environment	• Location: indoor, no direct sunlight, dust free, almost non-conductive pollution (note below). • Relative humidity: <80% • Altitude: <2000m • Temperature: 0°C ~ 40°C

Storage environment	• Location: indoor • Relative humidity: <70% • Temperature: -10°C ~ 70°C

6kW Series

Model		20-300	30-200	60-100	100-60	300-20	600-10	1000-6
DC Output	V	0~20V	0~30V	0~60V	0~100V	0~300V	0~600V	0~1000V
	A	0~300A	0~200A	0~100A	0~60A	0~20A	0~10A	0~6A
Line regulation	CV	≤0.2%FS						
	CC	≤0.2%FS						
Load regulation	CV	≤0.2%FS	≤0.2%FS	≤0.1%FS	≤0.2%FS	≤0.2%FS	≤0.1%FS	≤0.2%FS
	CC	≤0.2%FS	≤0.2%FS	≤0.1%FS	≤0.2%FS	≤0.2%FS	≤0.1%FS	≤0.2%FS
Ripple & Noise (20Hz~20MHz)	CV	≤0.5%FS+100mVrms		≤0.3%FS+100mVrms				
	CC	≤0.3%FS+10mArms						
Setting/Reading Accuracy	CV	≤0.1%FS+20mV				≤0.1%FS+100mV		≤0.2%FS+100mV
	CC	≤0.5%FS+100mA		≤0.3%FS+100mA		≤0.3%FS+10mA		
Resolution	V	0.01V	0.01V	0.01V	0.1V	0.1V	0.1V	1V
	A	0.1A	0.1A	0.1A	0.01A	0.01A	0.01A	0.001A
Dimensions		482W*88H*520D mm (2U)						
Weight		Approx 15kg						
Input		1φ3W (L, N, PE), 220V±10% 47~63Hz						

7.5kW Series

Model		30-250	60-125	100-75	300-25	600-12	1000-8
DC Output	V	0~30V	0~60V	0~100V	0~300V	0~600V	0~1000V
	A	0~250A	0~125A	0~75A	0~25A	0~12A	0~8A
Line regulation	CV	≤0.2%FS					
	CC	≤0.2%FS					
Load regulation	CV	≤0.2%FS					
	CC	≤0.2%FS					
Ripple & Noise (20Hz~20MHz)	CV	≤0.5%FS+100mVrms	≤0.3%FS+100mVrms				
	CC	≤0.3%FS+10mArms					
Setting/Reading Accuracy	CV	≤0.1%FS+20mV			≤0.1%FS+100mV		≤0.2%FS+100mV
	CC	≤0.5%FS+100mA		≤0.5%FS+30mA	≤0.3%FS+10mA		
Resolution	V	0.01V	0.01V	0.1V	0.1V	0.1V	1V
	A	0.1A	0.1A	0.01A	0.01A	0.01A	0.001A
Dimensions		482W*88H*520D mm (2U)					
Weight		Approx 18kg					
Input		3φ4W (L1, L2, L3, PE), 380V±10% 47~63Hz					

8. SPECIFICATIONS

1.8kW Series

Model		30-60	60-30	100-18	300-6	600-3	1000-1
DC Output	V	0~30V	0~60V	0~100V	0~300V	0~600V	0~1000V
	A	0~60A	0~30A	0~18A	0~6A	0~3A	0~1A
Line regulation	CV	≤0.2%FS					
	CC	≤0.2%FS					
Load regulation	CV	≤0.2%FS	≤0.1%FS	≤0.1%FS	≤0.1%FS	≤0.1%FS	≤0.1%FS
	CC	≤0.2%FS	≤0.1%FS	≤0.1%FS	≤0.1%FS	≤0.1%FS	≤0.1%FS
Ripple & Noise (20Hz~20MHz)	CV	≤0.3%FS+50mVrms		≤0.3%FS+100mVrms			
	CC	≤0.3%FS+10mArms					
Setting/Reading Accuracy	CV	≤0.1%FS+20mV			≤0.1%FS+100mV		
	CC	≤0.3%FS+30mA			≤0.3%FS+10mA		
Resolution	V	0.01V	0.01V	0.1V	0.1V	0.1V	1V
	A	0.01A	0.01A	0.01A	0.001A	0.001A	0.001A
Dimensions		218W*44H*435D mm (1U half width)					
Weight		Approx.5.5kg					
Input		1φ3W (L, N, PE), 220V±10% 47~63Hz					

3.6kW Series

Model		30-120	60-60	100-36	300-12	600-6	1000-3
DC Output	V	0~30V	0~60V	0~100V	0~300V	0~600V	0~1000V
	A	0~120A	0~60A	0~36A	0~12A	0~6A	0~3A
Line regulation	CV	≤0.2%FS					
	CC	≤0.2%FS					
Load regulation	CV	≤0.2%FS	≤0.1%FS	≤0.1%FS	≤0.1%FS	≤0.1%FS	≤0.2%FS
	CC	≤0.2%FS	≤0.1%FS	≤0.1%FS	≤0.1%FS	≤0.1%FS	≤0.2%FS
Ripple & Noise (20Hz~20MHz)	CV	≤0.3%FS+50mVrms	≤0.3%FS+100mVrms				
	CC	≤0.3%FS+10mArms					
Setting/Reading Accuracy	CV	≤0.1%FS+20mV			≤0.1%FS+100mV		≤0.2%FS+100mV
	CC	≤0.3%FS+50mA		≤0.3%FS+30mA	≤0.3%FS+10mA		
Resolution	V	0.01V	0.01V	0.1V	0.1V	0.1V	1V
	A	0.1A	0.01A	0.01A	0.01A	0.001A	0.001A
Dimensions		482W*88H*520D mm (2U)					
Weight		Approx 14kg					
Input		1φ3W (L, N, PE), 220V±10% 47~63Hz					

1. PRODUCT INTRODUCTION

1.1 Description

Programmable switching DC power supply series cover large range of outputs, rated power from 1.8kW to 100kW, rated voltage up to 5000V, rated current up to 10000A.

IGBT module adjustment and PWM modulation facilitate series with high efficiency, high accuracy and high stability. High gain amplifier circuit design makes the series with fast response. Improvement on circuits brings stronger anti-interference performance. Active air duct design and optimized cooling channels effectively reduce temperature rise.

Over Voltage Protection, Over Current Protection and Over Temperature Protection keep the series and their load safe from unexpected conditions. For more complicated applications, the series are available with many optional functions: remote sensing, remote ON/OFF control, timer switch, square waveform output, PV curve output, etc.

The series can be made to customer order. Please contact us for more details.

1.2 Features

- Max. output voltage 5000V, Max. output current 10000A
- Applying IGBT module and 19-inch standard size
- **4 digits LCD display for voltage and current**
- Constant voltage and constant current operations, auto CV/CC switch
- Front panel operation: preset voltage and current, output ON/OFF
- Multiple protections: OVP, OCP, OTP and OLP
- Transient response time 5ms
- **Communication: RS-232 and RS-485 interface**
- Optional function
  - Remote control: 0-5V, 0-10V or 4-20mA signal to control output voltage and current
  - Remote Sensing: compensate the voltage drop
  - Remote ON/OFF control: using a replay to control the output
  - Timer Switch: turn on or off the output as per preset time
  - Square Waveform Output: output square waveform according to preset time and cycles
  - Reverse polarity protection: to protect power supply from damage by reverse current from EUT
  - PV curve output for solar panel tests
  - LAN interface
  - System bus interface
- Customized specifications and functions acceptable

1.2 List of Models

1.8kW Series					
Model	Output voltage	Output current	Rated power	Size	Input volage
30-60	0~30V	0~60A	1.8kW	1/2 1U	1P 220V
60-30	0~60V	0~30A	1.8kW	1/2 1U	1P 220V
100-18	0~100V	0~18A	1.8kW	1/2 1U	1P 220V
300-6	0~300V	0~6A	1.8kW	1/2 1U	1P 220V
600-3	0~600V	0~3A	1.8kW	1/2 1U	1P 220V
1000-1	0~1000V	0~1A	1kW	1/2 1U	1P 220V

3.6kW Series					
Model	Output voltage	Output current	Rated power	Size	Input volage
30-120	0~30V	0~120A	3.6kW	2U	1P 220V
60-60	0~60V	0~60A	3.6kW	2U	1P 220V
100-36	0~100V	0~36A	3.6kW	2U	1P 220V
300-12	0~300V	0~12A	3.6kW	2U	1P 220V
600-6	0~600V	0~6A	3.6kW	2U	1P 220V
1000-3	0~1000V	0~3A	3kW	2U	1P 220V

6kW Series					
Model	Output voltage	Output current	Rated power	Size	Input volage
20-300	0~20V	0~300A	6kW	2U	1P 220V
30-200	0~30V	0~200A	6kW	2U	1P 220V
60-100	0~60V	0~100A	6kW	2U	1P 220V
100-60	0~100V	0~60A	6kW	2U	1P 220V
300-20	0~300V	0~20A	6kW	2U	1P 220V
600-10	0~600V	0~10A	6kW	2U	1P 220V
1000-6	0~1000V	0~6A	6kW	2U	1P 220V

7.3 Trouble Shooting

Problem	The power supply cannot startup. (No display)
Solution	1. Ensure the power supply or power cord is working properly. 2. Check the fuse. If the fuse is blown, disconnect the unit from the power supply. And then replace with a new fuse of identical rating. 3.
Problem	When operating in the CV mode, the voltage suddenly drops and the CC indicator lights on.
Solution	The power supply is in current protection mode. The desired current value is below the circuit gain; therefore the power supply is switched to CC mode. Tune the current knob clockwise to increase the current range.
Problem	The power supply output is unstable.
Solution	1. The power supply needs at least 15 minutes to warm up and reach the specifications as stated in this manual. 2. The power supply is below the minimum requirement.
Problem	The display meter dims when load capacity increases.
Solution	The input power wire is too small. Please replace with a bigger wire to make sure it is enough for input.
Problem	In CV mode, the output voltage is not able to be set to demanded value.
Solution	In CV mode, the CV indicator always lights on. If the CV indicator lights off and CC indicator lights on, it means the power supply is in CC mode, because the output current exceeding current limit. Firstly, check the load to make sure it is in good condition. Then tune the current knob to the maximum to get proper voltage output. If the current is set at maximum but still can't solve problem, please change to another power supply with higher rated output current.
Problem	In CC mode, the output current is not able to be set to demanded value.
Solution	In CC mode, the CC indicator always lights on. If the CC indicator lights off and CV indicator lights on, it means the power supply is in CV mode, because the output voltage exceeding voltage limit. Firstly, check the load to make sure it is in good condition. Then tune the voltage knob to the maximum to get proper current output. If the voltage is set at maximum but still can't solve problem, please change to another power supply with higher rated voltage current.

If the above solutions cannot solve the problems, please contact your local distributor/dealer or the manufacturer for repairing.

7. MAINTENANCE

1 WARNING

The following instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than contained in the operating instructions unless you are qualified to do so.

7.1 Inspection

1. Inspect the instrument at regular intervals so that it maintains its initial performance for a long time.
2. Check the input power cord for damage of the vinyl cover and overheating of the plug and cord stopper. Check the terminal screws and binding posts for loosening.
3. Remove dust from the inside of the casing and ventilation holes of the cover by using a compressed air of the exhaust air of a vacuum cleaner.

7.2 Cleaning

1. Before cleaning, disconnect the AC mains.
2. To clean the power supply, use a soft cloth dampened in a solution of mild detergent and water. Do not spray cleaner directly onto the instrument, since it may leak into the cabinet and cause damage.
3. Do not use chemicals containing benzene, benzene, toluene, xylene, acetone, or similar solvents.
4. Do not use abrasive cleaners on any portion of the instrument.

7.5kW Series					
Model	Output voltage	Output current	Rated power	Size	Input volage
30-250	0~30V	0~250A	7.5kW	2U	3P 380V
60-125	0~60V	0~125A	7.5kW	2U	3P 380V
100-75	0~100V	0~75A	7.5kW	2U	3P 380V
300-25	0~300V	0~25A	7.5kW	2U	3P 380V
600-12	0~600V	0~12A	7.5kW	2U	3P 380V
1000-8	0~1000V	0~8A	8kW	2U	3P 380V

12kW Series					
Model	Output voltage	Output current	Rated power	Size	Input volage
20-600	0~20V	0~600A	12kW	3U	3P 380V
30-400	0~30V	0~400A	12kW	3U	3P 380V
60-200	0~60V	0~200A	12kW	3U	3P 380V
100-120	0~100V	0~120A	12kW	3U	3P 380V
300-40	0~300V	0~40A	12kW	3U	3P 380V
400-30	0~400V	0~30A	12kW	3U	3P 380V
600-20	0~600V	0~20A	12kW	3U	3P 380V
1000-12	0~1000V	0~12A	12kW	3U	3P 380V

15kW Series					
Model	Output voltage	Output current	Rated power	Size	Input voltage
30-500	0~30V	0~500A	15kW	3U	3P 380V
50-300	0~50V	0~300A	15kW	3U	3P 380V
60-250	0~60V	0~250A	15kW	3U	3P 380V
100-150	0~100V	0~150A	15kW	3U	3P 380V
150-100	0~150V	0~100A	15kW	3U	3P 380V
300-50	0~300V	0~50A	15kW	3U	3P 380V
500-30	0~500V	0~30	15kW	3U	3P 380V
600-25	0~600V	0~25A	15kW	3U	3P 380V
1000-15	0~1000V	0~15A	15kW	3U	3P 380V
1500-10	0~1500V	0~10A	15kW	3U	3P 380V

The above models are listed for reference only. Customer specifications are welcome.

2. GENERAL KNOWLEDGE

2.1 CC and CV Mode

The DC power supply is to supply voltage and current in constant voltage (CV) or constant current (CC) mode within the rated output range. The working characteristics of these series Power Supplies is called a constant voltage/constant current automatic cross-over type. This permits continuous transition from constant current to constant voltage modes in response to the load change. The intersection of constant voltage and constant current modes is called the crossover point. Fig. 2-1 shows the relationship between this crossover point and the load.

In CV mode, a regulated output voltage is provided. The output voltage remains constant as the load increases while the output current changes in response to the load changes, up till the present current limit point is reached. At that point, the output current becomes constant and the output voltage drops in proportion to the further increases in load. The pint is indicated by the front panel LED indicators. The crossover point is reached when the CV indicator goes off and the CC indicator comes on.

Similarly, in CC mode, crossover from the CC to CV mode automatically occurs from a decrease in the load. A regulated output current is provided. The output current remains constant as the load decreases while the output voltage changes in response to the load changes.

A power supply with CV and CC operation mode can be operated in only one mode according to load situation. The output characteristics are shown as Fig. 2-1. According to Fig.2-1, the power supply is in CV mode when the actual load is over the preset load capacity; and the power supply is in CC mode when the actual load is below the preset load capacity.
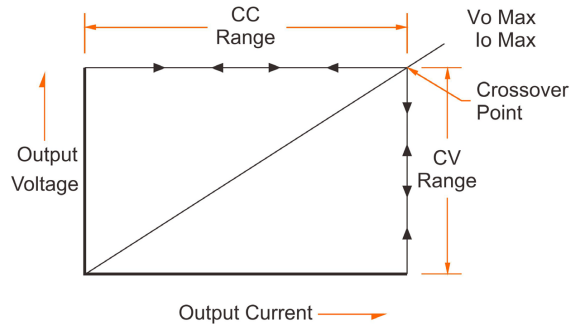

Fig.2-1

Set Vs = preset voltage, Is = preset current value, hence preset load capacity Rs – Vs/Is
If we have an actual load capacity RL=Vo/Io, when RL>Rs, the power supply is in CV operation mode. When RL<Rs, the power supply is in CC operation mode.

Remarks*1:

Baud rate available: 1200; 2400; 4800; 9600; 14400; 19200; 38400; 43000; 57600; 115200.
Due to the limitation of the single register data range (0~65535), the baud rate must be divided by 10 when setting, that is, remove the last 0 and then write it.

Cautions:

1) To ensure stable communication operation, default baud rate is set to 9600 in the factory.
2) The communication protocol contains the address of the register used by the factory, which is is not listed here. Please do not use the address outside the scope of the list, otherwise it may cause the system data to be changed and the power supply cannot work properly.
3) The ID number of each single unit is default at "1". If it is necessary to change ID number, please refer to command 0x29 to set new ID.
4) When connecting more than 1 units of the DC power supply, each unit must set with a different ID number. Units with same ID number CAN NOT be connected for remote control.
5) When the host PC sends commands to the power supply, if there is no data returned, please check the hardware connection of the communication interface, port settings and make sure the commands sent are correct.
6) If the command is sent and received normally and still cannot be output properly, please check the operation of the command. The command should include the three basic operations: starting the command, setting voltage and setting current.
7) The broadcast address is 0. If the command is sent with 0 as the broadcast address, the power supplies of all addresses will respond.
8) Communication reading and sending data are integer numbers, and the floating point number of the actual value needs to be converted to the nth power of 10 (n is the number of decimal points).

6.7.2 Register Definition

		Input Register				
No	Type	Description	Address (Decimal)	Address (Hex)	Target	Function Code 04 (Read)
1	Read	Output voltage (feedback value)	100	0x0064	Byte	√
2	Read	Output current (feedback value)	101	0x0065	Byte	√
3	Read	Rated voltage	103	0x0067	Byte	√
4	Read	Rated current	104	0x0068	Byte	√
5	Read	Voltage decimal point	106	0x006a	Byte	√
6	Read	Current decimal point	107	0x006b	Byte	√

		Discrete Input Status				
No	Type	Description	Address (Decimal)	Address (Hex)	Target	Function Code 02 (Read)
1	Read	Constant Current mode (CC)	116	0x0074	Bit	√
2	Read	Constant Voltage mode (CV)	117	0x0075	Bit	√
3	Read	Over Voltage Protection (OVP)	120	0x0078	Bit	√
4	Read	Over Current Protection (OCP)	121	0x0079	Bit	√
5	Read	Over Temperature Operation (OTP)	122	0x007a	Bit	√

		Cycle						
							Function Code	
No	Type	Description	Address (Decimal)	Address (Hex)	Target	01 (Read)	05 (Write single)	15 (Write multiple)
1	R/W	Output switch	133	0x0085	Bit	√	√	√
2	R/W	Lock	134	0x0086	Bit	√	√	√
3	R/W	OVP allowed	136	0x0088	Bit	√	√	√
4	R/W	OCP allowed	137	0x0089	Bit	√	√	√
5	R/W	Power on allowed	142	0x008e	Bit	√	√	√

		Holding Register						
							Function Code	
No	Type	Description	Address (Decimal)	Address (Hex)	Target	03 (Read)	06 (Write single)	16 (Write multiple)
1	R/W	ID	148	0x0094	Byte	√	√	√
2	R/W	Voltage setup value	149	0x0095	Byte	√	√	√
3	R/W	Current setup value	150	0x0096	Byte	√	√	√
4	R/W	Baud rate[*1]	156	0x009c	Byte	√	√	√
5	R/W	OVP limit	157	0x009d	Byte	√	√	√
6	R/W	OCP limit	158	0x009e	Byte	√	√	√

2.2 Application of Capacitive Load

When the power supply is connected to a big capacitive load, it always causes increase to the output voltage in a power supply. The output voltage may make fast increase to the Over Voltage Protection point. It may also cause slow decrease when the output voltage is turned down.

To solve this problem, connect a power resistor in parallel to the output terminals of the power supply; at the same time, connect a diode in serial between output terminals and the load.
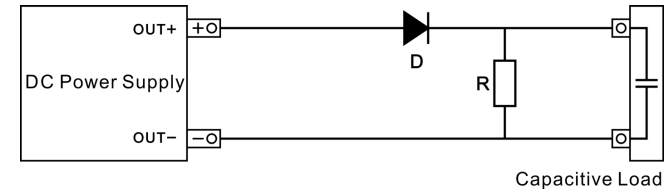

Fig.2-2

2.3 Application of Inductive Load

When an inductive load is connected to the power supply, it will cause a reverse polarity induction electric motive force when the power supply is turned on or off, or when preset the output voltage. The pulse noise caused by an inductive load will also affect the power supply, especially when the pulse noise has the same polarity with the output of power supply.

To avoid effect or damage to the power supply, connect a diode in serial between the output terminals of power supply and the load; at the same time, connect a power resistor and a capacitor in parallel to the load to make a R-C snubber circuit, which will significantly restraint generation of the noise.
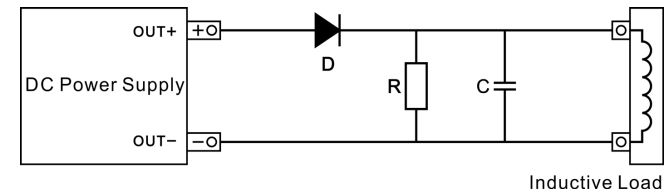

Fig.2-3

2.4 Application of Battery Load

When use the power supply to charge a battery, such as accumulator and ni-mh battery, the recommended protection measures is to connect a diode between the power supply and the battery. When the output electrolytic capacitor of the power supply is charged, connecting a load (battery) may cause sparks. This is normal. After the two of them get to equal voltage, the sparks will disappear.
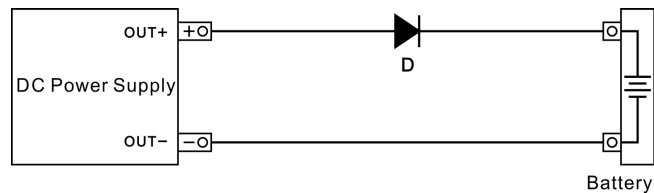

Fig.2-4

2.5 Application of Pulse Load

Even if the peak current of a pulse load, such as motor, bulb, DC-DC or DC-AC converter module, does not exceed the rated current of the power supply, it will also cause voltage drop or instability to the output.

A basic solution is to connect a inductor in serial between the power supply and the load. Or, choose a power supply with higher rated current.

If the pulse circuit has a small pulse width or low peak current, another solution is to connect a capacitor with large capacity. A reference to choose capacity of a capacity is: 1000uF capacity to a 1A current.
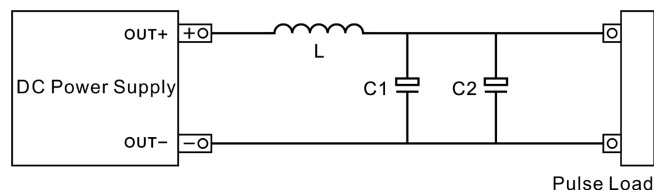
Fig.2-5

DC-DC load current waveform
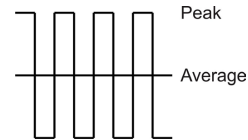
Fig.2-6

DC-AC load current waveform

Fig.2-7

6.6.7 Set Output Voltage and Current Value

Control command:

ID	Function Code	Address of First Register	Numbers of Registers	Bytes	Voltage	Current	CRC Check Code
01	10	0095	0002	04	0190	01F4	3B3A

Feedback data:

ID	Function Code	Address of First Register	Numbers of Registers	CRC Check Code
01	10	0095	0002	51E4

Remarks:

1) While the output is ON, the power supply operating mode cannot be changed, nor can the voltage, current, or time values be changed.
2) In cycle mode, the voltage, current, and time under each sequence number must be set. If the voltage and current are set to 0, the power output is 0. If the time is set to 0, this sequence number is not run.

6.7 Complete Command Frame

6.7.1 Function Code

Below function codes are supported.

Function Code	Function Code HEX	Description	Bit Operation / Byte Operation	Numbers of Operation
01	0x01	Read cycle status	Bit Operation	Single or multiple
02	0x02	Read discrete input status	Bit Operation	Single or multiple
03	0x03	Read holding register	Byte Operation	Single or multiple
04	0x04	Read input register	Byte Operation	Single or multiple
05	0x05	Write single cycle	Bit Operation	Single
06	0x06	Write single holding register	Byte Operation	Single
15	0x0f	Write multiple cycles	Bit Operation	Multiple
16	0x10	Write Multiple holding register	Byte Operation	Multiple

Bit operation: Read/write cycle, read/write data bit by bit.
Byte Operation: Read/write register, read/write data byte by byte.

6.6.3 Read Output Voltage Value

Control command:

ID	Function Code	Address of First Register	Numbers of Registers	CRC Check Code
01	04	0064	0001	7015

Feedback data:

ID	Function Code	Bytes	Output Voltage	CRC Check Code
01	04	02	0283	F9F1

Voltage: 0x0283 into decimal system is 643.

643 divide by 10 (1 decimal point) is 64.3, then we get voltage value 64.3V.

6.6.4 Read Output Voltage and Current Value

Control command:

ID	Function Code	Address of First Register	Numbers of Registers	CRC Check Code
01	04	0064	0002	3014

Feedback data:

ID	Function Code	Bytes	Output Voltage	Output Current	CRC Check Code
01	04	04	0283	0001	CA14

Voltage: Voltage value is 64.3V

Current: 0x0001 into decimal system is 1.

1 divide by 100 is (2 decimal points) 0.01, then we get current value 0.01A.

6.6.5 Read Rated Voltage Value

Control command:

ID	Function Code	Address of First Register	Numbers of Registers	CRC Check Code
01	04	0067	0001	8015

Feedback data:

ID	Function Code	Bytes	Rated Voltage	CRC Check Code
01	04	02	03E8	B98E

Voltage: 0x03E8 into decimal system is 1000.

1000 divide by 10 is (1 decimal point) 100.0, then we get voltage value 100.0V.

6.6.6 Set Output Voltage Value

Control command:

ID	Function Code	Register Address	Data	CRC Check Code
01	06	0095	01F4	99F1

Feedback data:

ID	Function Code	Register Address	Data	CRC Check Code
01	06	0095	01F4	99F1

Set output voltage at 50V. There is 1 decimal point for voltage value (50.0). From the display, this value should be 500 in decimal system. 500 into hex system is 0x01F4.

2.6 Application of Load with Reverse Polarity Current

When the power supply is connected to a load that will cause reverse polarity current to the power supply output, the output voltage will increase, because the power supply cannot absorb the reverse polarity current from the load.

A solution is to connect a diode in serial between the output terminal and the load; at the same time, connect a discharge resistor in parallel to the load to absorb the reverse polarity current. When the reverse polarity current is a peak surge, connect the large electrolytic capacitor in parallel to the two ends of the load.
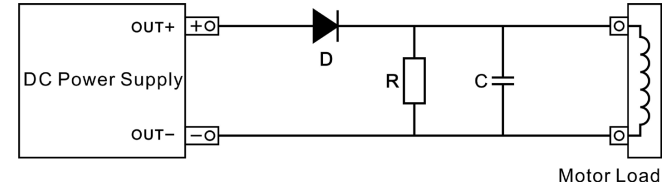

Motor Load

Fig.2-8

2.7 Using a Mechanic Switch to Connect or Disconnect Output

If use a mechanic switch to connect or disconnect the power supply output, when the output is 100A or above, there will be electric discharge during connecting and disconnecting. This will result in noise from the switching point. The noise may go through the load wire to the power supply's control amplifier, and cause instability to the output. In this situation, connect a RC snubber circuit to the load switch contact point.
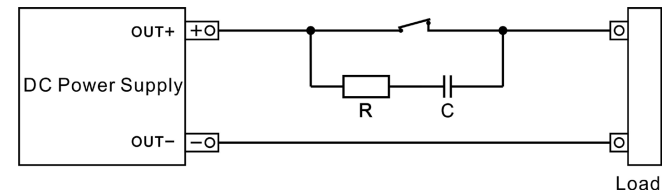

Load

Fig.2-9

3. INSTALLATION AND CONNECTION

3.1 Installation

1. When the power supply is working, heat will be generated. The power supply should be placed in a well-ventilated environment, and avoid places with high heat dissipation, high humidity and dust. Please arrange appropriate installation space according to the size of the power supply.
2. The front and back of the power supply should have good ventilation conditions, and avoid overlapping with other products. The distance between the back of the power supply and other objects should not be less than 500mm.
3. When the power supply is working, it will generate a magnetic field to affect the surrounding environment. To avoid the impact, please install those equipments which are sensitive to the influence of the magnetic field in an unaffected location.

3.2 Connection

1. Make sure that the AC input voltage matches the input voltage of the power supply.
2. Make sure that the AC input power switch and the power switch of the power supply are in the OFF state.
3. According to the rated power of the power supply, select appropriate input cable to correctly connect the input of this power supply to the AC input, and carefully check to ensure that the connection is correct.
4. To ensure safety, when selecting the output cable connected to the load, the safe current must be considered to prevent fire caused by overheating caused by the short circuit of the load. At the same time, using an output cable with a larger wire diameter can obtain a better adjustment rate on the load. So when selecting the wire diameter of the output cable, please select appropriate wire diameter that meets the requirements between the output of the power supply and the load according to the rated power of the power supply.
5. Make the correct connection. Please refer to table 3-1 for the selection of appropriate copper cable. Use the shortest DC output cable. If the output cable is too long, there will be voltage drop on the output cable, leading to decrease of the output performance of the power supply. If the output cable length is more than 3 meters, please use an output cable with double wire diameter.
6. In practical applications, the contact resistance of the output terminal of the power supply, the cross-sectional area of the output cable, the material and the length of the output cable are all factors that affect the output performance of the power supply. Therefore, the voltage measured on the output terminal will be higher than the voltage on the load. In this consideration, please select an output cable that should be able to meet this potential difference not greater than 0.5V.
7. If several loads are connected to the same power supply at the same time, each load needs to use a separate set of output cables to connect to the output of the power supply.

6.5 Command Format

Control Command Format (commands from PC to power supply)

1st bit: ID number of the DC power supply, 1-16 (when the ID number is 0, all ID numbers of the MCU board will response.)

2nd bit: control command

3rd bit: data length

Data bit: 16-bit data, high bit in the front

CRC check bit: MODBUS format, low bit in the front

Feedback Data Format (commands from power supply to PC)

1st bit: ID number of the DC power supply, 1-16

2nd bit: control command

3rd bit: data length

Data bit: 16-bit data, high bit in the front

CRC check bit: MODBUS format, low bit in the front

NOTE: The MCU control board responses to the PC right after receiving commands.

6.6 Commands Examples

Below commands examples are for power supply 100.0V 10.00A.

6.6.1 Output ON/OFF

Control command:

ID	Function Code	Register Address	ON/OFF	CRC Check Code
01	05	0085	FF00	9DD3
01	05	0085	0000	DC23

Feedback data: the feedback data should be the same as control command data.

6.6.2 Read Output Status

Control command:

ID	Function Code	Address of Start Register	Numbers of Registers	CRC Check Code
01	01	0085	0001	EC23

Feedback data:

ID	Function Code	Address of First Register	Output Status	CRC Check Code
01	01	01	01	9048
01	01	01	00	5188

6.3 Set Baud Rate and Address

1. Set baud rate
   1) Press BAUD key to enter baud rate setup mode (refer to Fig.6-1)
   2) Baud rate can be selected from below range by tuning the adjustment knob:
      1200; 2400; 4800; 9600; 14400; 19200; 38400; 43000; 57600; 115200
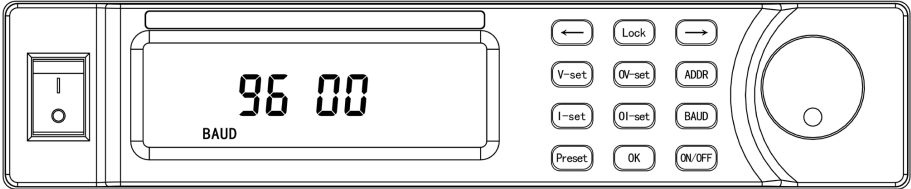   Baud rate is default at 9600.

Fig.6-1

2. Set address
   1) Press ADDR key to enter instrument address setup mode (refer to Fig.6-2).
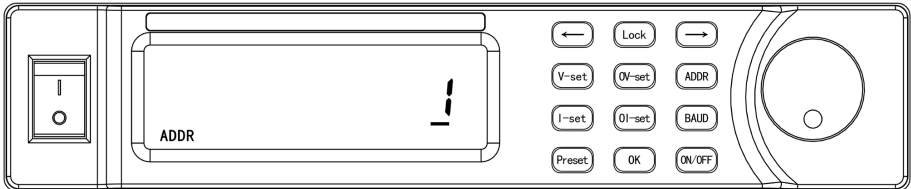   2) Instrument address can be set from 1 to 255.

Fig.6-2

6.4 Data

The data frame consists of four parts: Address, Function Code, Data, and Check Code.

Command format: Asynchronous, 1start bit, 8 data bits, 1 stop bit

Baud rate: 1200; 2400; 4800; 9600; 14400; 19200; 38400; 43000; 57600; 115200; default at 9600

Communication mode: Master-slave mode

To ensure reliability during communication, time interval between each data frame shall be more than 3.5 times of single byte character transmission time. For example, baud rate as 9600, time interval between each data frame is more than 11*3.5/9600=0.004s.

After the host PC sends the data request, the data request cannot be sent multiple times in succession without receiving the power supply's returned data, but should wait for some time. If there is still no data reply, it is considered as overtime, and the data request can be sent again at this time.. Considering that the maximum length of the returned data frame can reach 256 bytes, the timeout decision time is generally set to 0.5 seconds.

The address field (ID) is single-byte data. The power supply responds only when the requested data frame ID matches the power supply ID.

Table 3-1 Suggested Cable Wire Diameter

Rated power	Input Cable Wire diameter (mm^2)		Output Current (A)	Output Cable Wire diameter (mm^2)
	1 phase 220Vac input	3 phase 380Vac input		
3KW	4	——	5	1
6KW	6	——	10	2.5
9KW	10	4	20	4
12KW	16	6	30	6
20KW	——	10	50	16
30KW	——	16	100	35
60KW	——	35	200	50
100KW	——	70	300	70
150KW	——	95	500	185
200KW	——	120	1000	400

4. PANEL INTRODUCTION

4.1 Control Panel
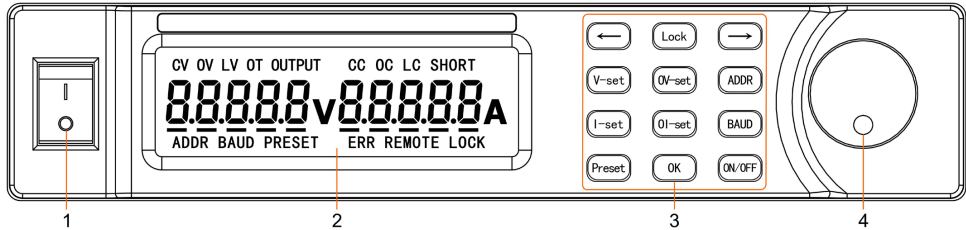
Fig.4-1 Control panel

1	Power switch	3	Function keys
2	Display meter	4	Adjustment knob

4.1.1 Function Keys
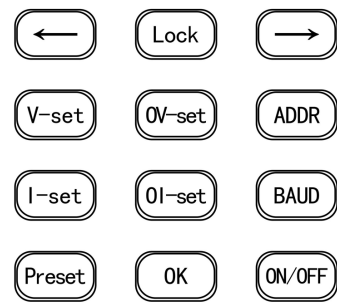
Fig.4-2 Key pad

No.	Name	Description
	V-set	Press this key to enter output voltage setup mode.
	I-set	Press this key to enter output current setup mode.
	Preset	Press this key to enter or exit preset voltage/current mode.
	OV-set	Press this key to enter over voltage setup mode.
	OI-set	Press this key to enter over current setup mode.
	OK	Press this key to confirm the newly input values.
	ADDR	Press this key to enter instrument address setup mode.
	BAUD	Press this key to enter baud rate setup mode.
	ON/OFF	Press this key to turn on or off the output.
	←	Press this key to move cursor to the left.
	→	Press this key to move cursor to the right.
	Lock	Press this key to lock front panel operation.

6. REMOTE CONTROL

The power supply is equipped with RS-232 and RS-485 interfaces, supporting Modbus protocols. There is PC software to facilitate remote control by PC. User can choose RS-232 or RS-485 interface for communication.

6.1 RS-232 / 485 Interface Definition (1U Frame)

Pin out of the RS-232 interfaces are given as below.

Connector illustration:
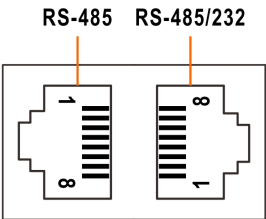
Pin out definition:

Pin	Pin out RS-485	Pin out RS-485/232
1	A (D+)	A (D+)
2	B (D-)	B (D-)
3	NC	RXD
4	NC	TXD
5	NC	GND
6	NC	NC
7	NC	NC
8	NC	NC

6.2 RS-232 / 485 Interface Definition (2U / 3U Frame)

Connector illustration:
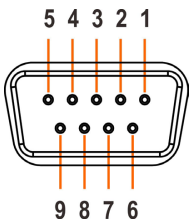
Pin out definition:

Pin	Pin out RS-232
1	NC
2	TXD
3	RXD
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC

Connector illustration:
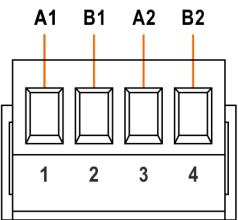
Pin out definition:

Pin	Pin out RS-485
1	A1 (D+)
2	B1 (D-)
3	A2 (D+)
4	B2 (D-)

5.9 Remote Sensing Operation (Only Available With CV Mode Output)

The power supply provides high output current, so the voltage drop on the load lead cannot be ignored. When the output current of the power supply is high, to ensure that the load can acquire the correct voltag, the power supply provides Sense (remote sense) working mode. In this mode, the power supply can automatically compensate for the voltage drop caused by the load lead to ensure that the power supply output value set by users is consistent with the voltage acquired by the load.

Before using the remote sensing function, make sure that the power supply is under remote sensing mode. Before set the remote sensing function, the output must be turned OFF. The remote sensing cable is suggested not to twist with current carrying cable of the load.

1 **Sensing terminals S+ and S- must be always connected to output terminals in either mode.**

Local Sensing Mode (Factory Default)
In this mode, compensation for the voltage drop caused by the load lead is disabled.
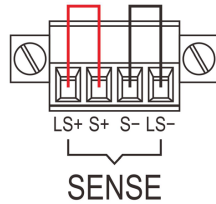
Operation steps:
1) Use the junction wires provided with power supply to short the sensing terminals S+/S- and local sampling terminals LS+/LS-.
2) Connect the output terminals +/- to the load.

Remote Sensing Mode
In this mode, compensation for the voltage drop caused by the load lead is enabled.

Operation steps:
1) Remove the junction wires between sensing terminals S+/S- and local sampling terminals LS+/LS-.
2) Connect sensing terminals S+/S- to the two ends of the load respectively. Pay attention to the polarity when making connections.
3) Connect the output terminals +/- to the load.

1

Remote Sensing Mode can not be used while the power supply outputs in CC mode. In Constant Current (CC) mode, the output voltage value changes according to changes of load consumption. Using remote sensing in CC mode will cause unstable output voltage and may damage the load due to the unnecessary compensation.
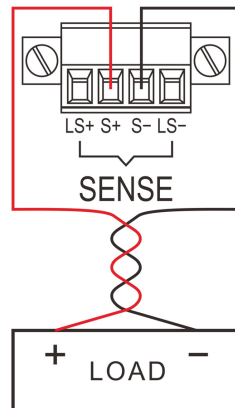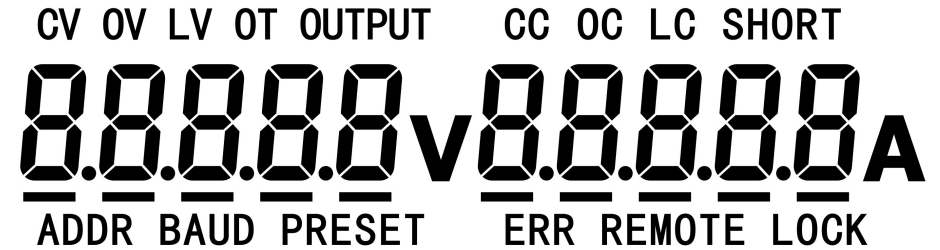
4.1.2 Display Meter

Fig.4-3 Display meter

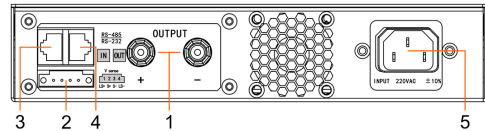| No.	Name	Description
1	8.8.8.8.8v	Voltmeter: display the output voltage. Voltage value is Volt (V).
2	8.8.8.8.8A	Ammeter: displays the output current. Current value unit is Amp (A).
3	CV	CV indicator: "CV" appears when the power supply is under constant voltage operation mode.
4	OV	OV indicator: "OV" appears when the power supply is under over voltage value setup or under over voltage protection mode.
5	LV	LV indicator: this indicator is reserved for special functions made to customer's request.
6	OT	"OT" appears when the power supply is under over temperature protection mode.
7	OUTPUT	Output indicator: "OUTPUT" appears when the power supply's output is ON.
8	CC	CC indicator: "CC" appears when the power supply is under constant current operation mode.
9	OC	OC indicator: "OC" appears when the power supply is under over current value setup or under over current protection mode.
10	LC	LC indicator: this indicator is reserved for special functions made to customer's request.
11	SHORT	Short indicator: "SHORT" appears when the power supply is under short circuit protection mode.
12	ADDR	ADDR indicator: "ADDR" appears when the power supply is under remote address setup mode or remote address display mode.
13	BAUD	BAUD indicator: "BAUD" appears when the power supply is under baud rate setup mode or baud rate display mode.
14	PRESET	PRESET indicator: "PRESET" appears when the power supply is under voltage and current preset mode.
15	ERR	ERR indicator: "ERR" appears for alarm.
16	REMOTE	REMOTE indicator: "REMOTE" appears when the power supply is under remote control.
17	LOCK	LOCK indicator: "LOCK" appears when the front panel operation is locked.

4.2 Rear Panel

Fig.4-4 Rear panel of 1/2 1U cabinet

No.	Name	Description
1	Output terminals	Positive polarity output terminal (Red). Negative polarity output terminal (Black).
2	Sense	Remote sense interface (available for 30-60 and 60-30 only)
3	RS-485	RS-485 interface
4	RS-485/RS-232	RS-485 and RS-232 interface
5	AC input socket	For connection to local AC mains.
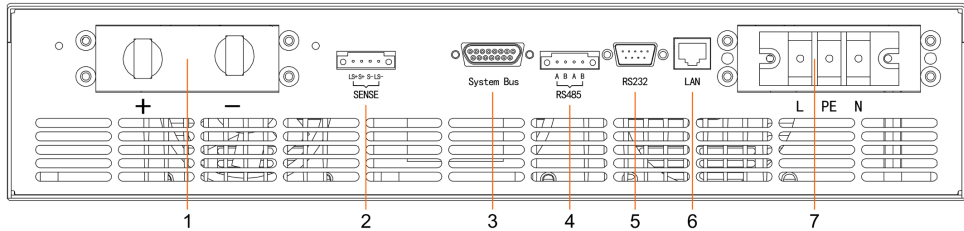
Fig.4-5 Rear panel of 2U cabinet

No.	Name	Description
1	Output terminals	Positive polarity output terminal (Red). Negative polarity output terminal (Black).
2	Sense	Remote sense interface (available for 300V and below models only)
3	System Bus	System bus interface (optional)
4	RS-485	RS-485 interface
5	RS-232	RS-232 interface
6	LAN	LAN interface
7	AC input terminals	For connection to local AC mains.

5.6 Lock Front Panel

The power supply provides front panel lock function to avoid wrong operation.

Press LOCK key on front panel. "LOCK" indicator appears on display meter (refer to Fig.5-13), indicating that the front panel operation is locked. Output is going on. Press ON/OFF key; the output can be turned off but cannot be turned on again.
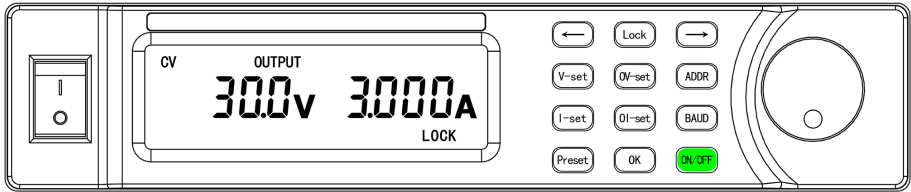
Fig.5-13

5.7 Constant Voltage Operation

1. Press power switch to turn on the power supply.
2. Set output current to the maximum, and output voltage to the minimum.
3. Press ON/OFF key to turn on output.
4. After output ON, "CV" and "OUT" indicators appear on the display meter.
5. Adjust the output voltage to rated voltage of the load, and set the output current to the maximum.
6. Press ON/OFF key again to turn off output.
7. Connect to load.
8. Press ON/OFF key again to turn on output.
9. The power supply outputs voltage as per setting value. The output current value changes according to load consumption. That is, the current decreases when resistance increases; and the current increases while resistance decreases.

5.8 Constant Current Operation

1. Press power switch to turn on the power supply.
2. Set output current to the maximum, and set output voltage to the minimum.
3. Press ON/OFF key to turn on output.
4. After output ON, "CC" and "OUT" indicators appear on the display meter.
5. Set the output current to rated current of the load, and set output voltage to the maximum.
6. Press ON/OFF key again to turn off output.
7. Connect to load.
8. Press ON/OFF key again to turn on output.
9. The power supply outputs current as per setting value. The output voltage value changes according to load consumption. That is, the voltage decreases when resistance increases; and the current decreases while resistance decreases.

5.5 Set OVP and OCP Limits

The over voltage protection (OVP) limit and over current protection (OCP) limit can be set to meet different test purposes.

1. Press OV-set or OI-set key to enter OVP or OCP limit setup mode (refer to Fig.5-9 and Fig.5-10).
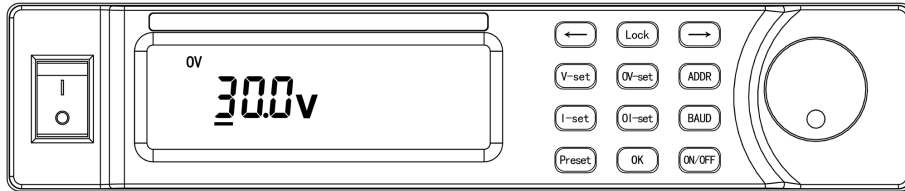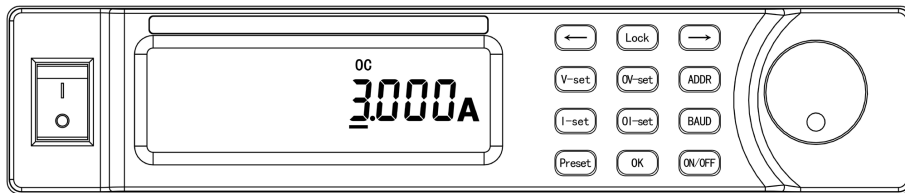2. Tune the adjustment knob to set an OVP or OCP limit value. Press OK key to confirm.

Fig.5-9

Fig.5-10

3. When the output value exceeds the above limit, OV and ERR icons appear, indicating the power supply under OVP mode (refer to Fig.5-11); OC and ERR indicators appear, indicating the power supply under OCP mode (refer to Fig.5-12).
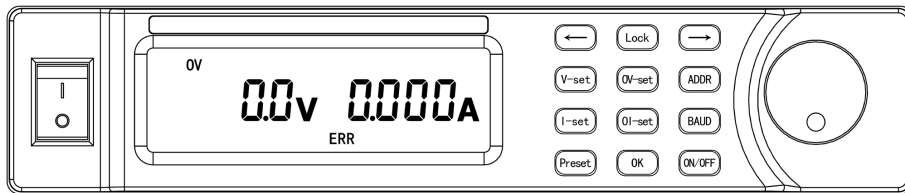
Fig.5-11
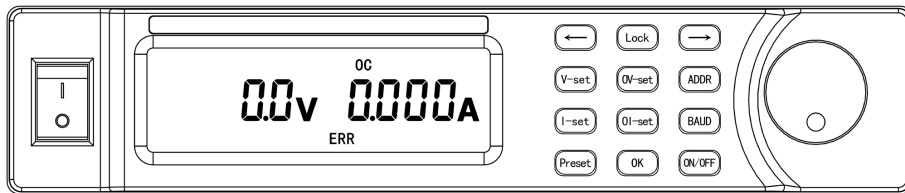
Fig.5-12

The output is shut down under OVP or OCP mode. The beeper alarms at the same time. Press ON/OFF key to disarm the alarm. Check if the OVP or OCP limits are suitable, or check if the load is abnormal.

5. OPERATION INSTRUCTION

5.1 Power On

1. Before power on:
   Make sure the input voltage is in compliance with rated input. And make sure of correct connection.
   DO NOT connect any load to the power supply in this preparation operation.
2. After power on, all characters on the display meter flash for a short time (refer to fig.5-1). Then the display meter displays the last voltage and current values before power off for a short time (refer to fig.5-2), and then the power supply enters standby mode (refer to fig.5-3).
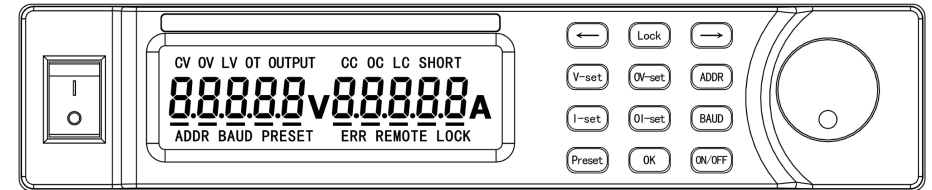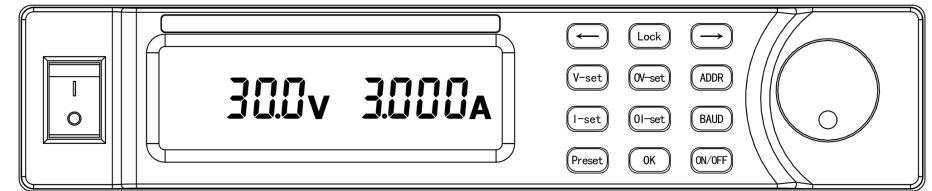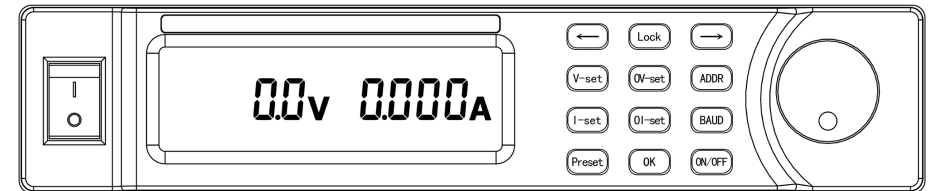

Fig.5-1

Fig.5-2

Fig.5-3

5.2 Set Output Voltage

1. Press V-set key to enter voltage setup mode.
2. Tune the adjustment knob to set a desired voltage value.
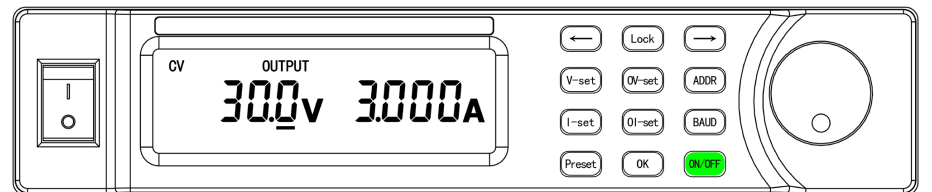3. Press ON/OFF key to turn on output (refer to Fig.5-4). ON/OFF key lights up.

Fig.5-4

4. After output is on, OUTPUT indicator appears. The CV or CC indicator appears according to load condition.

5. As shown in Fig.5-4, there is an underscore in the voltage value. It means that the voltage value is under setup mode. The output voltage can be adjusted. Tune the adjustment knob to adjust voltage value. Use direction keys ← and → to move cursor to the next digit for adjustment.

   Under voltage setup mode, the displayed voltage value is setup value, not real output value. The displayed current value is real output value.

6. Press OK key to confirm the above setup and exit voltage setup mode. Now the displayed voltage and current values are real output values (refer to Fig.5-5).
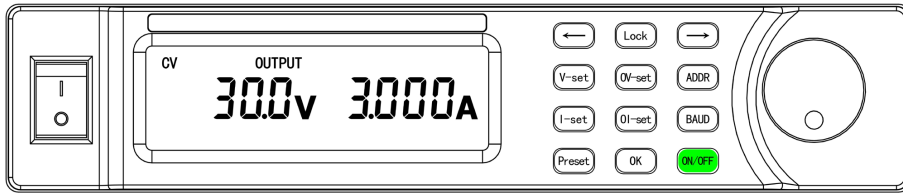

Fig.5-5

5.3 Set Output Current

NOTE: Connect to load before the output is ON.

1. Press I-set key to enter current setup mode.
2. Tune the adjustment knob to set a desired current value.
3. Press ON/OFF key to turn on output (refer to Fig.5-6). ON/OFF key lights up.
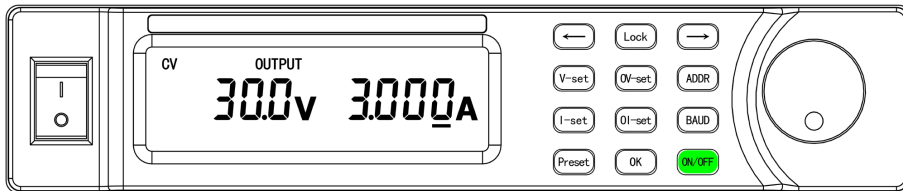

Fig.5-6

4. After output is on, OUTPUT indicator appears. The CV or CC indicator appears according to load condition.

5. As shown in Fig.5-6, there is an underscore in the current value. It means that the current value is under setup mode. The output current can be adjusted. Tune the adjustment knob to adjust current value. Use direction keys ← and → to move cursor to the next digit for adjustment.

   Under current setup mode, the displayed voltage value is real output value. The displayed current value is setup value, not real output value.

6. Press OK key to confirm the above setup and exit voltage setup mode. Now the displayed voltage and current values are real output values (refer to Fig.5-7).
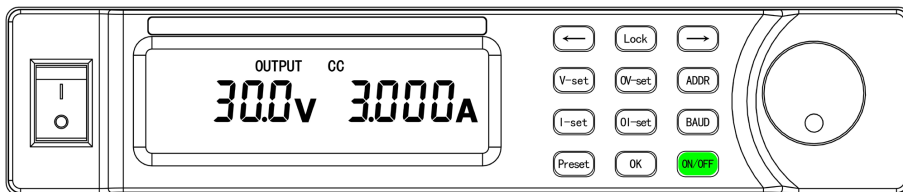

Fig.5-7

5.4 Preset Voltage and Current

The power supply has preset voltage and current function. Under output ON mode, use this function to preset voltage and current to achieve a step change on voltage and current.

1. Press V-set key and then press PRESET key to enter preset voltage mode (refer to Fig.5-8).

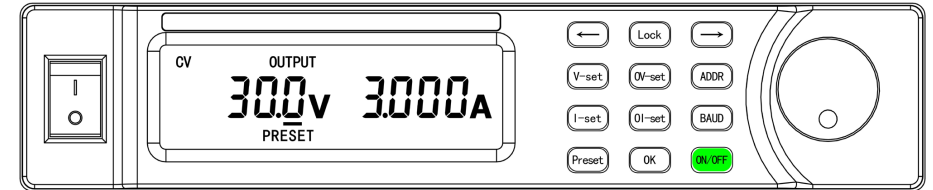   An underscore beneath voltage value and the PRESET icon appear at the same time. The underscore flashes.

Fig.5-8

2. Tune the adjustment knob to set a voltage value. The output voltage dose not change.

3. Press OK key to confirm the above setup. After confirmation, the underscore flashes no more, and the output voltage changes to the newly preset value.

   Tune the adjustment knob, the preset voltage value changes and the underscore flashes again. The output voltage value changes only after pressing OK key to confirm the newly preset value.

4. If make preset value under output OFF mode:

   Press ON/OFF key to start output. But the output value is the last setup value.

   Press OK key or short press the adjustment knob, the power supply makes output to the newly preset values.

5. Press PRESET key again to exit preset mode.

Apply the same procedures to preset output current.