LINEAR DC POWER SUPPLY

USER MANUAL

REGULATED LINEAR DC POWER SUPPLY

Please read this manual carefully before operating the power supply.

1. Introduction

The variable DC power supplies covered in this manual are regulated linear DC power supplies designed for laboratory, school and manufacturing applications. The output voltage and current can both be continuously adjusted from 0 to maximum rated value by means of the coarse and fine potentiometers. As linear power supplies, they have excellent ripple and load regulation, and are suitable for general electronic design work. These power supplies can be used as constant voltage source or constant current source. All of the models come with over-voltage, so you can also use them for electroplating, anodizing, battery charging, and DC motor testing, etc.

2. Specifications

2-1 General

AC Input：	110V/220V±10% , 47-63 Hz
Rating:	See Table 2-1
Operating environment:	Indoor use with dry and dust free air for cooling
	Altitude up to 2000 m
	Temperature: -10°C to 40°C
	Relative humidity: <80%

Storage environment: Temperature:-10^{0}C to 70^{0}C

Relative humidity: <70%

Table 2-1

Model	Max. Voltage	Max. Current	Fuse Rating	Dimension (mm)
HY1503D	15V	3A	5A/250V	270×128×145
HY1803D	20V	3A	5A/250V	270×128×145
GPS-1850D	20V	5A	5A/250V	270×128×145
HY3003D*	30V	3A	5A/250V	270×128×145
HY3005D*	30V	5A	5A/250V	270×128×145
HY3006D	30V	6A	5A/250V	270×128×145
HY6003D	60V	3A	5A/250V	270×128×145
HY3003DX	30V	3A	5A/250V	270×128×145
HY3005DX	30V	5A	5A/250V	270×128×145
HY5003D	50V	3A	5A/250V	270×128×145
HY5005D	50V	5A	5A/250V	270×128×145

*GPS-3050D and HY3005D are identical, while HY3003D and GPS-3030D are identical.

2-2 Front Panel Descriptions

(1) Digital ammeter: displays the actual output; this equates to the set value if in CC mode.

(2) Digital voltmeter: Displays the actual output voltage; this equates to the set value when in CV mode.

(3) Current calibration: Use this screw to calibrate the current meter if necessary.

(4) Voltage calibration: Use this screw to calibrate the voltage meter if necessary.

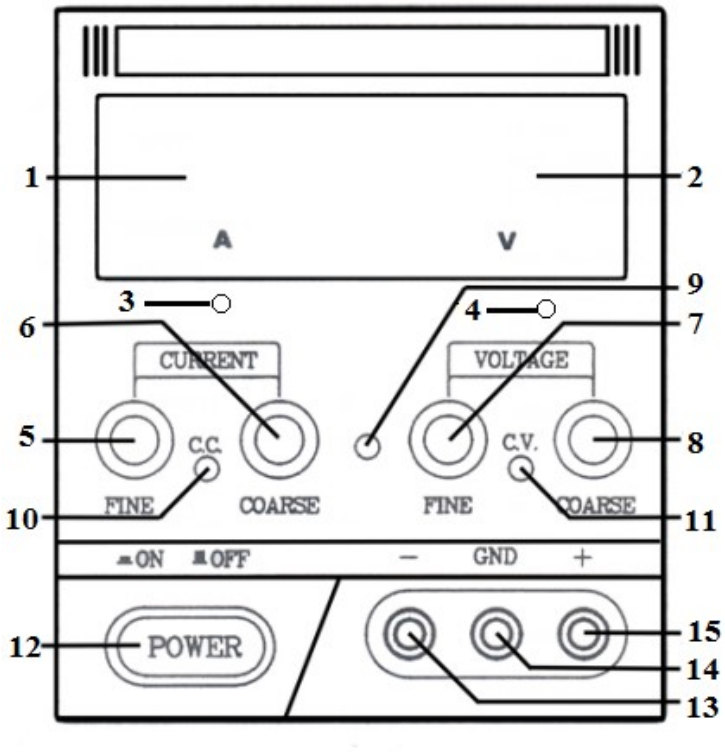
(5) Current fine: for fine adjustment of the current limit.

(6) Current coarse: for coarse adjustment of the current limit.

(7) Voltage fine: for fine adjustment of the voltage limit.

(8) Voltage coarse: for coarse adjustment of the voltage limit.

(9) Output button: When this button is pushed to 'In' position, the power supply output is enabled, and the output is connected to the terminals (marked as OUT); conversely, the power supply output is stopped when this button is in the 'Out' position (marked as STOP). Note: the marking is slightly confusing - STOP means output is disabled, and OUT means output is turned on.



(10) CC indicator: this indicator turns red when the power supply is in constant current (CC) mode (See 3-2).

(11) CV indicator: this indicator turns red when the power supply is in constant voltage (CV) mode (See 3-2).

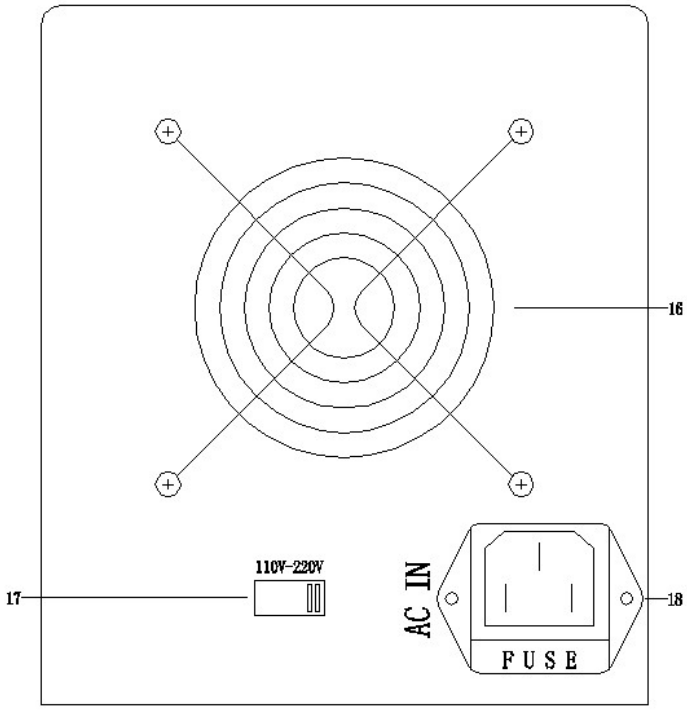
(12) Power button: When this button is pushed to "In" position, the power supply is turned on, and the display comes on; conversely, the power supply is off when this button is in the "Out" position.

(13) "-" Output terminal: Negative polarity (black).

(14) "GND" terminal: Ground terminal (green). The GND terminal is connected to case and AC ground.

(15) "+" Output terminal: Positive polarity (red).

Warning: For electrochemical applications (e.g., plating and anodizing), remove the short connector between "–" and ground terminals.



2-2 Back panel

(16) Cooling fan: the fan turns on as long as the power supply is on.

(17) AC voltage selector switch: use this switch to select the input AC of either 110V or 220V. Default is set at 110V.

Warning: the voltage indicated on the AC selector switch must match the AC voltage, otherwise the power supply will be damaged (plugging a power supply rated for 110V into 220V AC), or the maximum output would not be reached (plugging a 220V power supply into 110V AC). Damage caused by plugging into wrong AC voltage is not under warranty.

(18) AC Input. The fuse is located here. To replace the fuse, remove the AC power cord, and use a flat head screwdriver to pop out the fuse holder.

2-3 Technical Parameters

1) CV mode:

Line regulation:	<0.01%+3mV
Load regulation:	< 0.01%+3mV (Max. current<3A)
Load regulation:	< 0.01%+5mV (Max. current>3A)
Ripple & noise :	< 0.5mVrms (5Hz-1MHz) (Max. current <3A)
	<1.0mVrms (5Hz-1MHz) (Max. current >3A)
Recovery time :	< 100μS (load-variant 50%, min. load current 0.5A)
Temperature coefficient:	< 300PPM/^{0}C

2) CC Mode:

Line regulation:	<0.2%+3mA

Load regulation: < 0.2%+3mA

Ripple & noise : < 3mArms

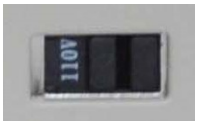
3) Display accuracy: ±1%±1 digit

3. Operation Instructions

3-1 Installation

1) Before plugging into AC outlet

Warning: The correct input voltage of the power supply is shown on the AC selector switch, e.g. for 120V AC, the switch itself should show 110V on the voltage selector switch as shown in picture below:



The AC voltage should be within 10% of that, e.g., if the specified input voltage is 110V, the power supply will work with AC voltage of 110V±10%.

Warning: Changing the AC voltage selector setting must be done with the power supply unplugged.

Warning: To avoid electrical shock, the power cord ground conductor must be connected to AC ground.

Warning: Make sure the output is stopped before turning the power supply on or off. Shutting down improperly can cause the power supply to fail when it's turned on next time. Damages due to improper startup and/or shutdown are not under warranty.

Warning: When running an inductive load like magnetic coils, DC motors, stepper motors, etc., make sure to set the output to zero before turning on the output; once output is on, change the voltage/current slowly, and NEVER turn the power supply output on or off, or worse yet, shutting down or turning on the power supply with a inductive load connected!

2) Installation: For better heat dissipation, the two sides and back of the power supply should have at least 10cm space from the walls.

3-2 Constant Voltage / Constant Current Characteristics

The power supply is a regulated constant current / constant voltage (CC CV) power supply, which is characterized by automatic crossover from constant current (CC) to constant voltage (CV), and vise versa. At any moment, the power supply automatically determines whether to operate in CV or CC mode, depending on the voltage and current limit (set by the front knobs), and the load connected (if no load is connected, it simply means that the load resistance is infinite; conversely, if a short is connected, the load resistance is zero).

Note: The power supply is in CC mode if indicator light 10 is red; it's in CV mode if indicator light 11 is red. In order to understand the crossover, it is important to note that the voltage and the current are related by the Ohm's

law, so only one of the two is an independent variable. The law dictates that the output current I in amps (A) is always equal to the output voltage V in volts (V) divided by the load resistance R in ohms (Ω):

$$I = \frac{V}{R}$$

For example, if the load resistance (R) is such that the current limit (set by knobs 5 and 6) is higher than the voltage limit (set by knobs 7 and 8) divided by R (i.e., voltage limit is lower than current limit for the load R connected), the power supply operates in the constant voltage (CV) mode. When in CV mode, the output voltage remains constant even if the load resistance changes (e.g., if load resistance decreases, the current increases), up to the point when the preset current limit is reached. The crossover point is reached when the voltage and current limit are reached simultaneously. Beyond the crossover point, the indicator changes from CV to CC, and the current limit becomes the lower limit, and the output current remains constant and the output voltage drops in proportion to the further decrease of the load resistance.

Similarly, crossover from constant current (CC) to constant voltage (CV) mode automatically occurs when the resistance of the load is increased. A good example of this behavior is charging a 12V lead acid battery. Initially, the open circuit voltage of the power supply may be set at 13.8V. A discharged battery when connected to the power supply may demand high charging current beyond the current limit set for the power supply (or the maximum current capacity of the power supply), and the power supply will operate in constant current mode, with the maximum charging current equal to the set current limit. As the battery becomes more charged, the voltage will increase, and eventually reach 13.8V. Beyond that point, the current demand from the battery will drop and fall below the set limit.

The crossover is signaled by the indicator light changing from CC to CV.

3-3 Operating Procedures

Warning: Make sure the output is stopped when connecting or disconnecting a load.

Warning: If load resistance is <1 ohm, make sure the voltage is set to <5V when enabling the output.

a) Make sure that the AC voltage matches the input voltage shown on the AC selector switch.

b) Make sure power button is in OFF position and output is stopped; plug power cord into the AC outlet.

c) Turn the power supply on by pressing the power button to ON position.

d) With no load connected, push the output button in to enable output.

e) Adjust current knobs (knobs 5 or 6) to slightly above minimum position with CV indicator light red. If it's necessary to limit the current while in the CV mode, follow section 3-4 to set the current limit.

f) Set voltage (knobs 7 and 8) to the desired voltage. This voltage should be the operating voltage in CV mode; the maximum voltage in CC mode; or the charging voltage recommended by battery manufacturer if charging a battery.

g) Stop the output. Connect the external load to the output terminals. Make sure both "+" and "-" terminals are connected correctly. When connecting a battery to be charged, you must make sure that polarity is correct.

1) **Constant Voltage (CV) Operations**

h) Push the output button in to enable output; turn up the current knobs to maximum, or leave the current knobs unchanged if correct current limit has been set following section 3-4.

i) Once finished, stop the output, and then turn off the power supply.

j) For applications with the same settings, skip steps d)-g), and simply connect the load before enabling output.

2) **Constant Current Operation**

h) Push the output button in to enable output.

i) Turn the current knobs up until you reach the desired current level. Make sure CC light is red.

j) Once finished, stop the output, and then turn off the power supply.

k) For applications with the same settings, skip steps d)-i), and simply connect the load before enabling output.

3) **Battery Charging Operation**

Warning: At no time should a battery be connected to the power supply when the power supply is turned off, or with the output voltage of the power supply set to lower than the battery voltage.

Warning: Before the battery is connected to the power supply, make sure that the power supply output voltage is higher than the battery voltage. If the AC power is lost, stop the output or remove the battery immediately from the power supply.

h) Push the output button in to enable output. If the CC light is on, adjust current knobs to make sure the

current meter is reading the maximum charging current recommended by the battery manufacturer. If the CV light is on, either the battery is not depleted enough or the current limit is set too high.

i) Watch the charging progress, when the current is below 1A or 1/10 of the maximum charging current, it is probably time to end the charge. Make sure the AC power never goes off line during the charging process.

j) Stop the output. Disconnect the battery from the power supply, and then turn off the power supply.

4) **Inductive Load**

 **Warning:** it is critical to change the current on the inductive load slowly. Sudden changes of power supply output can cause the inductive load to generate a reverse EMF much larger than the voltage from the power supply, and cause damage to the power supply. Turning on or off the power supply with an inductive load connected can cause power supply to fail beyond repair. Damages like this are not under warranty.

h) Adjust all 4 knobs (both current and voltage) to minimum position.

i) Push the output button in to enable output.

f) For CV operation, turn the current knobs to maximum position; slowly turn up the voltage until it reaches desired voltage level. For CC operation, turn the voltage knobs to maximum; slowly increase the current until it reaches the desired current level.

g) Once finished, slowly turn down either the current or voltage knobs until the output is zero before stopping the output. After the load is disconnected, it is safe to turn off the power supply.

3-4 Setting Current Limit for CV Operation

Note: this step is only needed if it is necessary to set a current limit for constant voltage operation or when charging a battery; for most of applications requiring constant voltage, simply turn the current knobs to maximum position, which sets the current limit to the maximum value allowed by the power supply.

1) With no load connected, turn current knobs to minimum position. Turn the power supply on with output stopped.
2) Connect a resistive load between + and – terminals, or temporarily short the + and – terminals of the power supply with a test lead with sufficient thickness.
3) Push the output button in to enable output.
4) Make sure CC light is red. If needed, adjust the COARSE voltage knob (knob 8) up.
5) Adjust the current control (knobs 5 & 6) to reach the desired current level, repeat 4) if needed.
6) The current limit has now been set. Do not change the current knobs (5&6) if you want to keep the same current limit, or mark the positions of the knobs 5&6 so you can return to the same level.
7) Stop the output, then remove the load between the (+) and (-) terminals and go to section 3.3.

4. Trouble Shooting & Maintenance

Warning: The following instructions are to be performed by knowledgeable personnel only. To avoid electrical shock, do not perform any servicing other than the contained in the operation instructions. For further

questions, please contact factory support at support@volteq.com.

4-1 Fuse Replacement

All of the models mentioned are equipped with a fuse. If the fuse is blown, the power supply will not turn on. It is a good idea to determine and fix the cause of the blown fuse, then replace only with a fuse of correct rating and type.

Warning: For continued fire protection, replace fuse only with fuse of the specified type and rating. All replacement fuses must be slow-blowing type.

5. Warranties and Attachment

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Power cord 1

Warranty: this product is covered by standard one-year manufacturer's warranty, which includes parts and labor for one year from the date of purchase. Damages caused by user error, harmful environment, force of nature are not under warranty.