

REGULATED DC POWER SUPPLY

USER MANUAL

SINGLE OUTPUT SWITCH MODE DC POWER SUPPLY



Please read this manual carefully before operating the power supply.

1. Introduction

Volteq HY series single output switch mode DC power supplies are regulated variable DC power supplies designed to provide the most often required DC outputs in scientific and research institutions, schools and colleges, industrial R&D, as well as manufacturing and testing.

The output voltage is continuously adjustable between 0 and the rated voltage by means of the coarse and fine potentiometers; the output current is continuously adjustable between 0 and the rated current by means of a current adjustment knob. Both outputs are accurately displayed on the digital voltmeter and ammeter.

The DC power supplies in this series have high efficiency, superior load and line regulation, and low ripple noise. These power supplies have high level of protection including over voltage, over temperature, and over load protection. They can act as constant voltage as well as constant current sources. Because of the excellent protection, these power supplies are widely used for electroplating, anodizing, electroforming, electro-winning, battery charging and equalizing, and other applications requiring excellent reliability and robustness.

2. Specifications

2-1 General

AC Input	110V/220V, 110V, or 220V \pm 10%, 50/60 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

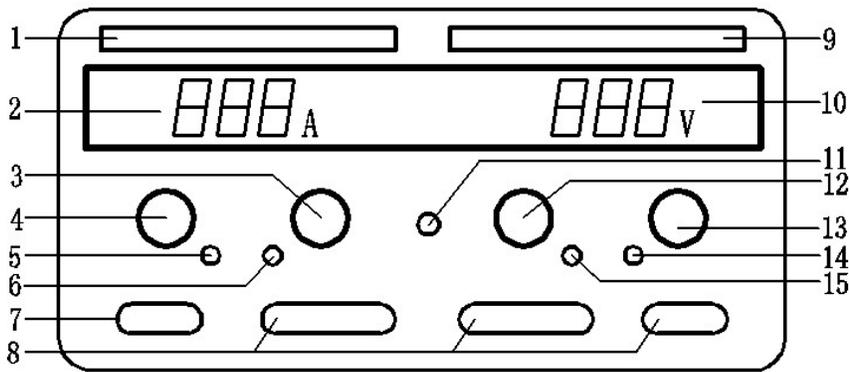
Relative humidity: <80%

Table 2-1

Model	Max. Voltage	Max. Current	Fuse Rating	Weight (lbs)
HY1520EX	15V	20A	10A/250V	14
HY1530EX	15V	30A	10A/250V	15
HY3010EX	30V	10A	10A/250V	14
HY3020EX	30V	20A	10A/250V	15
HY3030EX	30V	30A	15A/250V	15
HY5020EX	50V	20A	15A/250V	17
HY6020EX	60V	20A	15A/250V	16

2-2 Front Panel Descriptions

- (1) Trademark: Volteq.
- (2) Digital ammeter: displays the actual output always; this equates to the set value if in CC mode.
- (3) Current knob (Coarse): for coarse adjustment of current limit.
- (4) Current knob (Fine): for fine adjustment of current limit.
- (5) CC indicator light: this indicator turns red when the power supply is in constant current (CC) mode (See 3-2).



(6) OV indicator: this indicator turns red when the power supply is over-voltage protected. The power supply will not respond to user control until it's reset (See 4-2).

(7) On/Off Power button: When this button is pushed to "In" position, the power supply is turned on; conversely, the power supply is off when this button is in the "Out" position.

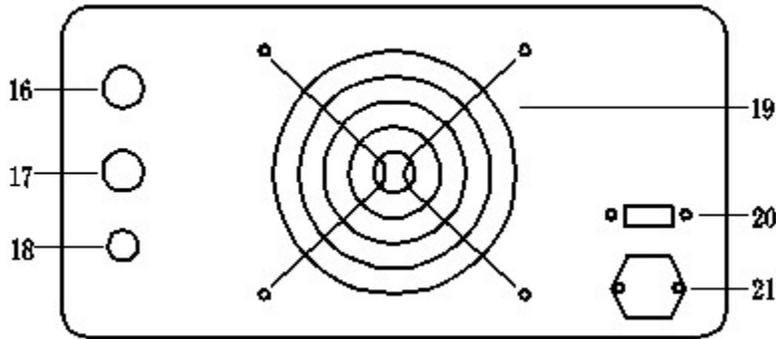
! **Note:** For models with air switch, this button enables/disables the output. Turn the air switch on first before turning this button on; conversely, turn this button off before switching off the air switch in the back. For the models without air switch, this button turns the power on and off.

(8) Front output terminals: from left to right, labeled as negative, ground ("GND"), and positive. The output is between the + and - terminals, while the ground terminal is for grounding the case only. To reduce the ripple, the negative

output terminal ("-") is usually shorted with "GND". Only select models include the front terminals.

Warning: the front terminals are rated for less than 10A only. Use only the rear output terminals if current draw is more than 10A, and tighten the connection to reduce contact resistance.

anodizing), remove the short connector



rates to the set value when in CV mode.

th a flat head screwdriver (not included).

it.

≥ limit.

in constant voltage (CV) mode (See 3-2).

(15) Over-temperature (OT) indicator: this indicator turns red when the internal temperature of the power supply is too high, and the power supply output is disabled. See 4-3 for more details.

2-3 Back Panel Descriptions

(16) Positive Terminal.

(17) Negative Terminal.

(18) Ground Terminal: this is connected to the case.

(19) Cooling fan: the fan is turned on briefly when the power supply is energized; afterwards it is turned on when internal temperature of the power supply rises above 45°C.

(20) AC voltage selector switch: use this switch to select the input AC of either 110V or 220V for select models.



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



Warning: the voltage indicated on the power supply 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).

(21) AC Input. For power supply models not equipped with air switch, the fuse is located here. To replace the fuse, remove the AC power cord, and use a flat head screwdriver to remove the fuse holder.

2-3 Technical Parameters

- 1) Voltage stabilization: $\leq 0.2\%$
- 2) Current stabilization: $\leq 0.5\%$
- 3) Load stabilization: $\leq 0.3\%$
- 4) Ripple and noise: $\leq 1\%$ (RMS)
- 5) Display accuracy: $\pm 1\% \pm 1$ digit

3. Operation Instructions

3-1 Installation

- 1) Before plugging into AC outlet

The input voltage of the power supply is typically shown on the top rear part of the case. AC voltage should be within 10% of the input voltage specified, e.g., if the specified input voltage is 110V, the power supply will work with AC voltage of $110V \pm 10\%$.

 **Warning:** The voltage indicated on the power supply (look for a sticker on the case close to the rear) must match the AC voltage, otherwise the power supply will be damaged (plugging a power supply rated for 110V into 220V AC; such damages are not under warranty), or the maximum output will not be reached (plugging a 220V power supply into 110V AC). If the power supply is equipped with an AC voltage selector switch in the back, the selector switch must show the correct value in the middle, e.g. for 120V AC, the switch itself should show 110V in the voltage

selector switch as shown in picture below:



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

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

! Warning: Do not connect any load to the power supply before it's turned on. Likewise, make sure to disconnect the load before shutting down the power supply. 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 connecting the load, change the voltage/current slowly, and NEVER turn the power supply on or off 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. The cooling fan is controlled by thermistor and will turn on automatically when the temperature of the heat sink is above 45°C. The power supply comes with over-temperature (OT) protection, and will disable itself when the inside temperature of the device is too high. The power supply resets itself once the temperature falls below the 40°C. To ensure proper operation, make sure the ambient temperature is below 40°C and there is sufficient ventilation.

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 vice 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 5 is on; it's in CV mode if indicator light 14 is on.

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 3 and 4) is higher than the voltage limit (set by knobs 12 and 13) 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 change from CC to CV.

3-3 Operating Procedures

- a) With the power switched off, leave the OV limit (11) to maximum position (factory default) or adjust per instructions at 3-5.
- b) Make sure that the AC line voltage matches the input voltage of the power supply.
- c) Make sure there is no load connected, plug power cord into the AC outlet.
- d) Turn the power supply on.



Caution: For models with air switch, the green On/Off button enables/disables the output. Turn on the air

switch first before turning this button on; conversely, turn this button off before switching off the air switch in the back. For the models without air switch, this button turns the power on and off.

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

- e) Adjust current knobs (knobs 3 or 4) to slightly above zero so that CV indicator light is on, and set voltage (knobs 12 and 13) to the desired output voltage.
- f) Connect the external load to the output terminals. Make sure both "+" and "-" terminals are connected correctly. For output more than 10A, you must use the rear terminals.
- g) Turn the current knob to maximum to ensure that the power supply stays in CV mode. If it's necessary to limit the current while operating in the CV mode, follow 3-4 first to set the current limit.
- h) Once finished, turn the current down to $< 1A$, disconnect the load, and then turn off the power supply.

2) **Constant Current Operation**

- e) Adjust current knobs (knobs 3 or 4) to slightly above zero so that CV indicator light is on, adjust voltage control (knob 12 & 13) to set voltage to the desired voltage limit (this is the upper voltage limit and typically above the operating voltage). If charging a battery, set the voltage to the normal charging voltage recommended by the battery manufacturer.
- f) Connect the external load to the output terminals. Make sure both "+" and "-" terminals are connected correctly in terms of polarity. For output more than 10A, you must use the rear terminals.
- g) Turn the current knobs slowly up until you reach the desired current level. Make sure CC light is red.

h) Once finished, turn the current down to $< 1A$, disconnect the load, and then turn off the power supply.

3) Battery Charging Operation



Warning: at no time should the 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.

e) Find out if the battery has a maximum allowed charging current that is lower than the maximum rated current of the power supply. If yes, set the current limit following instructions in section 3-4. Use a magic marker to mark the position of the coarse current knob (3). If not, skip this step.

f) Turn the coarse current knob (3) to minimum position or slightly above zero while still keeping the CV light on. Use knobs 12 and 13 to set the voltage to desired charging voltage recommended by the battery manufacturer.

g) Connect the battery while making sure that the polarity is correct (+ to + and - to -). Disconnect the battery immediately if you made a mistake. For output more than 10A, you must use the rear terminals.



Warning: damage caused by wrong polarity is not under warranty.

h) Turn the coarse current knob up to the marked position, or the maximum position if it's safe to charge at the maximum output of the power supply. If the CC light is on, adjust this knob slightly to make sure the current meter is reading the maximum charging current. If the CV light is on, it simply means that the battery is not depleted enough to charge at the maximum current allowed.

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

k) 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.

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

f) Connect the external load to the output terminals. Make sure both "+" and "-" terminals are connected correctly.

For output more than 10A, you must use the rear terminals.

g) 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.

h) Once finished, slowly turn down either the current or voltage knobs until the output is zero before disconnecting the load. 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; for most of applications requiring constant voltage, simply turn the current knobs 3 & 4 to maximum position, which basically sets

the current limit to the maximum value allowed by the power supply.

1) With no load connected, turn all 4 knobs to minimum position. Turn the power supply on.

 **Caution:** For models with air switch, the green On/Off button enables/disables the output. Turn on the air switch first before turning this button on; conversely, turn this button off before switching off the air switch in the back. For the models without air switch, this button turns the power on and off.

2) Connect a resistive load between + and – terminals, or temporarily short the + and – terminals of the power supply with a test lead.

3) Adjust the COARSE voltage knob (knob 13) slightly up for the CC indicator to turn red.

4) Adjust the CURRENT control (knobs 3 & 4) to reach the desired current level, repeat 3) if needed.

5) The current limit has now been preset. Do not change the CURRENT knobs (3&4) if you want to keep the same current limit, or mark the positions of knobs 3&4 so you can return to the same level.

6) Turn the voltage knobs down so the current meter reads less than 1A, then remove the load between the (+) and (-) terminals and go to section 3.3(1) for CV operation procedures.

3-5 Setting Over-voltage Protection Limit

The power supply has over-voltage protection with adjustable protection limit.

 **Note:** For most applications, we recommend leaving the OV limit at maximum (factory default setting), which is typically 2V above the maximum rated voltage output. To return to factory default, turn the OV adjustment screw to the maximum position clockwise (11). You must do so before turning the power supply on.

For very sensitive applications, it may be desirable to set OV level to a specific value, by following the steps below:

- 1) Determine the maximum voltage allowed by your application (the OV limit). This should be slightly higher than the operating voltage. If for whatever reason there is a voltage surge above this limit (measured at the output terminals), the OV light will turn red, and the power supply will no longer respond to user input (with the output turned off). For easier communication, we assume that 12.0V is the working voltage and 13.0V is the OV limit.
- 2) With no load connected, make sure the OV level (11) is set to maximum. Turn the power supply on.
- 3) Use knobs 12 and 13 to adjust the voltage to 13.0V; adjust current knobs if necessary to stay in CV mode.
- 4) Slowly turn the OV adjustment (11) counterclockwise, stop as soon as the OV light turns red. The OV limit is set at 13.0V now.
- 5) To reset the power supply, turn the knob 12 and 13 counterclockwise to minimum position, and turn the power supply off.
- 6) Once the power supply is completely off, turn it back on, and set the voltage to 12.0V. Note that if voltage is set to higher than 13.0V, the OV protection will kick in.

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

Some models are equipped with air switch, which is a reset-able breaker and does not require a fuse. The rest of the models 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 correct the cause of the blown fuse, then replace only with a fuse of the correct rating and type. The fuse is located on the rear panel where power cord is plugged into the device, as shown below:



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

4-2 Rest OV Protection

When OV light is red, the power supply is in OV protected state, and will not respond to user input until the power supply is properly reset. To reset the power supply, follow the procedures below:

- 1) Disconnect the load and turn the power supply off.
- 2) Turn the OV limit (11) to the maximum position clockwise; or leave it to the correct setting if you have

already set it up properly.

- 3) Turn the voltage knobs down (knob 12 & 13).
- 4) With no load connected, turn the power supply on. The power supply is reset and ready to be used.

4-3 Recovery from Over-temperature Protection

If the internal temperature is too high, the power supply is disabled due to over-heating, and the OT indicator turns red.

When this happens, disconnect the load; correct the cause of the over-heating, and the power supply will recover automatically. Typical cause of over-heating includes:

- 1) Not enough ventilation due to space limit.
- 2) Ambient temperature is too high.
- 3) The cooling fan stops working.
- 4) Output exceeds the rated range.

 **Caution:** the power supply can be operated at the maximum outputs (both current and voltage) for less than 15 minutes. For continuous operation, either the voltage or the current should be below 80% of the maximum rated value.

5. Warranties and Attachment

User manual	1
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.