

This series is a kind of high-precision single output power supply. It uses two groups of 3LED to display output voltage and current values of the power supply. In addition, the power supply possesses automatic transfer function to regulate voltage and current. And its circuit is composed of compensating pipe power exhaustion steering circuit, operational amplifier and reference voltage regulator with temperature compensation. Therefore, the circuit is stable and reliable. The output power voltage of the power supply may randomly be regulated from 0 to nominal voltage value. When it is in the state of current regulation, the current regulation output current can continuously be regulated from 0 to nominal current value.

This series of power supplies are characterized by small volume, good performance and new style, and are first choices for scientific and research institutions, colleges, factories and electrical appliance maintenance units.

Mode	Rated Output		Dimension
	Voltage(V)	Current(A)	D×W×H(mm)
TPR-1510D	0-15V	0-10A	340×260×155
TPR-1520D	0-15V	0-20A	375×260×155
TPR-1530D	0-15V	0-30A	375×260×155
TPR-3010D	0-30V	0-10A	340×260×155
TPR-3020D	0-30V	0-20A	375×260×155
TPR-3030D	0-30V	0-30A	425×260×155
TPR-6405D	0-64V	0-5A	340×260×155
TPR-6410D	0-64V	0-10A	375×260×155
TPR-6420D	0-64V	0-20A	425×260×155

## 2. Technical parameters

(1) Input voltage:

$$AC220V_{-5}^{+10} \% \quad 50Hz \pm 2Hz \quad \text{or} \quad AC110V_{-5}^{+10} \% \quad 60Hz \pm 2Hz$$

(2) Rated output voltage: see table (can be regulated continuously)

(3) Rated output current: see table (can be regulated continuously)

(4) Current effect:  $CV \leq 2 \times 10^{-4} + 1mV$

$$CC \leq 2 \times 10^{-3} + 10mA$$

(5) Load effect:  $CV \leq 2 \times 10^{-4} + 5mV$  (output current  $\leq 10A$ )

$$\leq 5 \times 10^{-4} + 10mV \quad (\text{output current} > 10A)$$

$$CC \leq 2 \times 10^{-3} + 15mA \quad (\text{output current} \leq 10A)$$

$$\leq 5 \times 10^{-3} + 20mA \quad (\text{output current} > 10A)$$

(6) Ripples and noises:  $CV \leq 1.5mVr.m.s.$  (Output current  $\leq 10A$ )

$$\leq 3mVr.m.s. \quad (\text{Output current} > 10A)$$

$$CC \leq 10mAr.m.s. \quad (\text{Output current} \leq 10A)$$

$$\leq 15mAr.m.s. \quad (\text{Output current} > 10A)$$

(7) Protection: Protection of current limitation

(8) Instruction:

Digital voltmeter and ammeter, LED three digital displays.

Precision: voltmeter  $\pm 1\% + 2$  figures    Ammeter  $\pm 2\% + 2$  figures

(9) Environmental conditions:  $0-40^{\circ}C$  relative humidity  $< 90\%$

(10) Overall dimensions:

$$310mm \times 265mm \times 165mm \quad (\text{Output current} \leq 10A)$$

$$390mm \times 265mm \times 165mm \quad (\text{Output current} > 10A)$$

(11) Working hours: constantly working more than 8 hours

## 3. Working principles

The regulated power supply is composed of rectifier filter circuit; auxiliary power supply circuit; reference voltage and voltage and current

regulation amplified circuit; regulated circuit and voltage and current regulation sampling circuit etc.

The pane drawings are shown as Figure1.

Take 0-30V for example. When the output voltage is changed due to the change of power supply voltage or load current, then the changed signals were compared by voltage regulation sampling circuit and reference voltage, and the error signals were amplified by comparison amplifier and the output voltage was regulated as the set value by amplifying circuit controlling and regulating tube. Since the comparison amplifier is composed of integrated operational amplifier, therefore the power gain is very high, and the output terminal has minor variation in voltage, which can also be regulated so as to achieve the goal of highly stable output.

Current regulation is basically the same with voltage regulation, therefore both are highly stable.

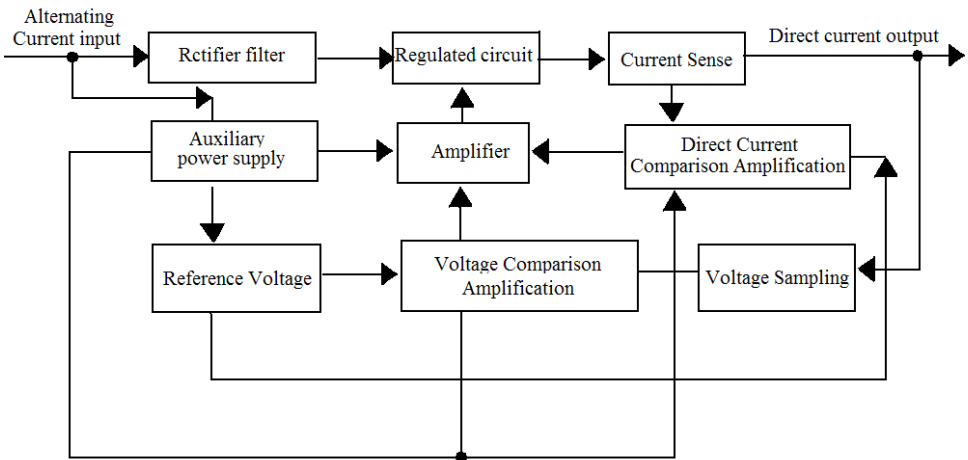


Figure 1

The function of every element in circuit is as the following:

After the voltage being reduced, the input 220V 50Hz alternating

currents supply the main circuit rectifier and the auxiliary power supply rectifier respectively. The main circuit rectifier selects circuit through transformer winding (i.e. regulation tube power loss controlling circuit) and connects to the transformer winding corresponding with output voltage. The rectified filter circuit is composed of  $V_7 \sim V_{10}$ ,  $C_6$ ,  $C_{20}$ , and adopts bridge rectification and high volume capacitor filter, so the alternating component of the output direct voltage is very small in quantity.

The auxiliary power supply composes auxiliary power circuit with  $N_3$ ,  $V_1 \sim V_4$ ,  $V_6$ ,  $C_1 \sim C_3$  and relevant resistance. It is mainly used as the positive and negative of the integrated operational amplifier and  $V_5$  integrated reference voltage of regulator.

The selective circuit of transformer winding is composed of  $N_4$  (LM324 four operational amplifiers),  $V_{23} \sim V_{31}$  and  $R_{20} \sim R_{37}$ ,  $K_1 \sim K_3$ . After the voltage being parted by resistance, the input voltage of the regulation power supply is added to the same reversal phase end of the three operational amplifiers, the opposite reversal phase ends of the three operational amplifiers connect to three voltages respectively. When the output voltage changes among  $0 \sim 3.75V$ ,  $3.75V \sim 11.25V$ ,  $11.25V \sim 15V$ ,  $15V \sim 18.75V$ ,  $18.75V \sim 22.5V$ ,  $22.5V \sim 26.5V$ ,  $26.5V \sim 32V$ , the output of the three operational amplifiers have eight combinations, namely,  $K_1$ ,  $K_2$ ,  $K_3$  relays have eight different make-and-break combinations, that is, the alternative voltage attached to circuit of the main rectifier filter has eight different values, and they correspond with the output voltage of the regulated power supply. When the output voltage is high, the alternative voltage is also high, and when the output voltage is low, consequently, the alternative voltage is low, thus ensures the power consumption of high-power regulation tube not too high.

Reference voltage circuit is composed of  $V_5$  and  $R_1$ ,  $C_4$ , and is produced on the integrated regulator which passed through current-limiting resistance  $R_1$ , with temperature compensation by +12V of the auxiliary power supply, therefore the reference voltage is very stable.

The output voltage sampling and voltage comparison amplified circuit are composed of  $N_1$  voltage comparator and relevant resistance capacitance. The sampling voltage is directly taken from output wire connecting terminal  $X_2$ , and connects to the reversal phase of  $N_1$  voltage comparator amplifier. Reference voltage connects to the same phase of  $N_1$  voltage comparator after the voltage of the resistance  $R_{16}$ , regulation resistance  $RP_2$ ,  $RP_6$  and  $RP_7$  being parted. Because of the secondary voltage regulation with temperature compensation, the reference voltage has good stability.  $RP_6$  and  $RP_7$  regulation resistance are placed on the panel; the reference value of the same phase input terminal of the comparison amplifier can only be changed by regulating the resistance values of regulation resistance  $RP_6$  and  $RP_7$  so as to regulate the output magnitude of voltage.

Current regulation sampling and comparison amplifying circuit are composed of  $N_2$  and resistance  $R_9 \sim R_{12}$  and regulation resistance  $RP_1$ ,  $RP_4$ , and  $RP_5$  ect. The voltage on the reversal terminal of the input operational amplifier  $N_2$  is reduced by the electricity produced by the circuit transmitting  $R_{10}$ ,  $R_{12}$  sampling resistance, so the voltage on the reversal terminal of the  $N_2$  operational amplifier reflects the amount of output current. The input voltage of the same terminal is produced by the reduced voltage reference. When the voltage on the same terminal is higher than that on the reversal, the operational amplifier inputs higher level, and the current regulation circuit doesn't work and the power supply is in a stable voltage position. When the

voltage on the same terminal is lower than that on the reversal, the operational amplifier is lower than level and the current regulation circuit work and the circuit is in a current stable position. For example: when the load resistance becomes smaller, and the output current is going to increase and the voltage drop on the both terminals of  $R_{10}$ ,  $R_{12}$  sampling resistance will be increased, that is when the input voltage on the reversal terminal of the operational amplifier  $N_2$  is increasing, for the reference voltage on the same terminal remains unchanged, therefore the output voltage of the operational amplifier will be dropped, which makes the output voltage decrease, thus ensures the invariableness of the output current. For this reason, changing the resistance value of  $RP_4$  and  $RP_5$  changes the reference voltage, and the constant output current value is also changed.

$V_{20}$  and  $V_{46}$  are regulating tubes in parallel, which maintain certain amount of output current and guarantee sufficient power, selected high-power dynatron with the same parameters to be in parallel, and connected equalizing resistance ( $R_{10}$ ,  $R_{12}$  ect) in emitter to avoid damaging regulating tubes because of uneven distribution of current.

This power supply uses one three binary voltmeter and ammeter to display the output voltage and current at due time. Therefore, the output voltage value and current value of every loop can be surveyed in a timely manner.

#### **4. The control and instruction of the panel**

##### **1. The function of every element on the panel**

- (1) Digital ammeter: indicating the output current value
- (2) Digital voltmeter: indicating the output voltage value

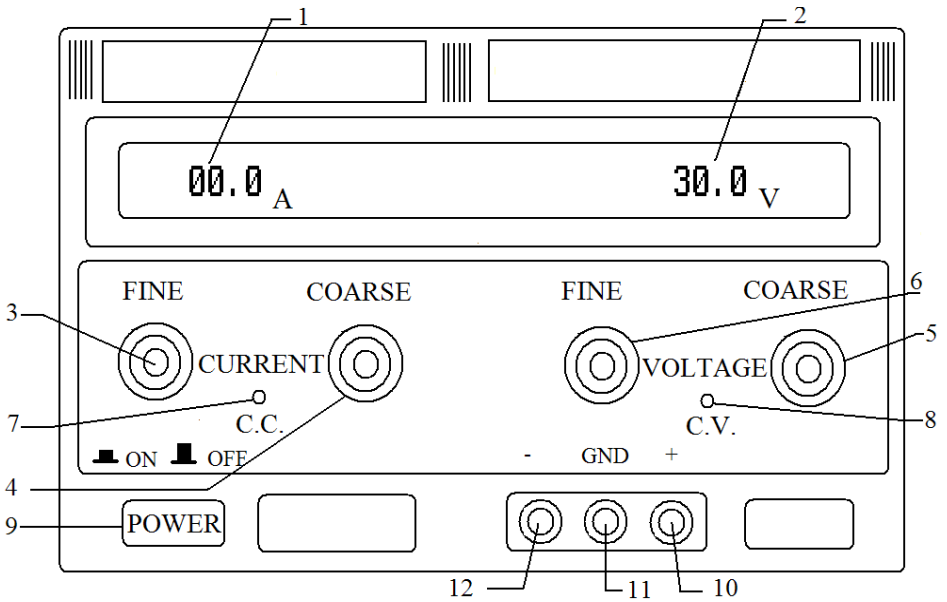


Figure 2

(3) Fine regulation knob of current regulation: Fine regulate the value of output current or current-limiting protection.

(4) Coarse regulation knob of current regulation: Coarsely regulate the value of output current or current-limiting protection

(5) Coarse regulation knob of output voltage: Coarsely regulate the value of output voltage

(6) Fine regulation knob of output voltage: Fine regulate the value of output voltage

(7) Current regulation indicator light: When the power supply is under the condition of current regulation, the indicator light is on.

(8) Voltage regulation indicator light: When the power supply is under the condition of voltage regulation, the indicator light is on.

(9) Power switch: When the power switch is placed “ON” (that is when the power switch is lowered down), the machine is “on”, at this moment the

voltage regulation indicator lights on or current regulation light is on. Conversely, the machine is off (that is when the switch is up)

(10) Direct current output positive terminal: the anode of the output voltage connects to positive terminal of the load.

(11) Cabinet ground terminal: the cabinet connects to the ground.

(12) Direct current output negative terminal: the negative electrode of output voltage connects to the negative terminal of the load.

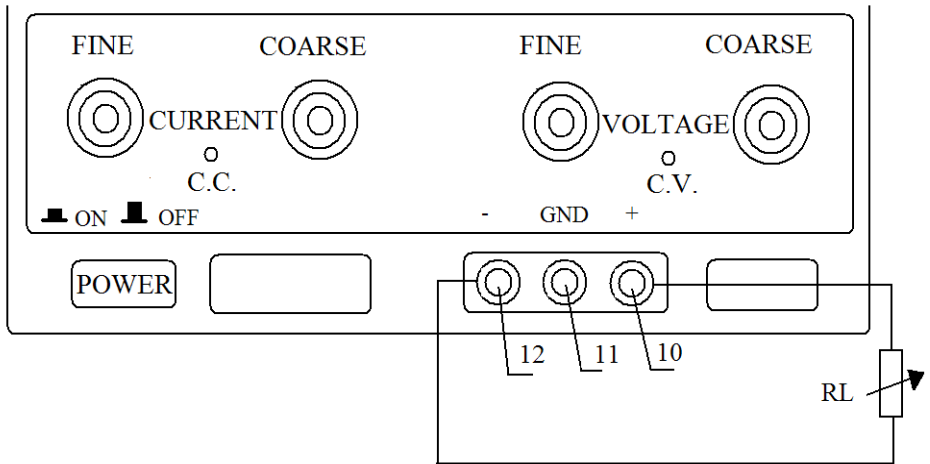
**Pay attention: please make sure the output terminals have been screwed when connected with load, otherwise the output terminal maybe burn out.**

## **2. The method for use**

(1)When the power supply is used as the voltage regulated power supply, first of all, the current regulation knobs (3) and (4) should be clockwise regulated to the maximum, then turn on the power supply switch (9), and regulate output voltage regulation knob (5) and (6) respectively to regulate voltage to the necessary voltage values. Firstly regulate coarse regulation knob of output voltage (5) to regulate the output voltage value near to the necessary value, and then regulate the fine regulation knob of output voltage to get the accurately necessary value. At this moment, the voltage regulation indicator lights (8) will be on.



(2) The method of load connection



(Figure 3)

The method of load connection as the Figure 3 shows. After turning on the power supply, the digital meter (1) shows the value of output current, while the digital meter (2) shows the value of output voltage. When the power supply is under the condition of voltage regulation, the voltage regulation indicator light (8) should be on. If the value of output current over the rated current value, and the voltage regulation light is off while the current regulation light is on, it means that the power supply is under the condition of current limitation protection. At this moment, the load should be regulated to make the power supply work normally.

(3) When the power supply is used as the current regulated power supply, and after turning on the power supply switch(9), first, the voltage regulation knobs (5) and (6) should be clockwise regulated to the maximum, at the same time the current regulation indicators (3) and (4) should be counterclockwise

regulated to the minimum, then connect the necessary load, and clockwise regulate current regulation knobs (3) and (4) to make the output current to the necessary regulated current value. At the moment, voltage regulation indicator light is off while the current regulation indicator light will be on.

(4) When the power supply is used as voltage regulation power supply, the current regulation knobs (3) and (4) should be regulated to the maximum. However, the power supply can randomly set current limitation protection. The method for the setting: turn on the power supply, connect suitable variable load and then regulate the load resistance to make the output current equal to the necessary current value of the current limitation protection, and then regulate the current regulation knobs (3) and (4) to make the current regulation indicator under the critical state. At this moment the current limitation protection is set.

(5) The output indicator of the power supply is three binary. (That is LED three digital displays). If more precise values need to be obtained, more precise measuring instrument should be used to adjust in the outer circuit.

### **3. Matter need attention**

(1) The power supply has perfect current limitation and short circuit protective functions. Since compensating tube power loss controlling circuit has been set in the circuit, so when there are overload in output, the power loss of the high-power compensating tube is not so high, it will not cause any damage to the power supply. However, when there are overload, the output current of the power supply is limited to the maximum current limitation. That is to say about 12V or 22V. So the power supply still has power loss, and in order to reduce unnecessary wearing of the machine and the loss of

energy, the power should be switched off and fault should be eliminated. When the output positive terminal has a short circuit with the output negative terminal, the power supply will shut up outputs. Of course, the power supply has no power loss. After eliminating the fault of short circuit, the power supply will be work normally.

(2)After using, it should be placed in dry and ventilated area and be kept clean, if it is not used for a long time, the plug should plugged off.

(3)When maintaining the regular power supply, the input power supply should be cut off.

(4)The power supply is that of high power; please pay attention to ventilation cooling when the power supply is used under the full power. Also pay more attention when the surface of the radiator is very hot.

(5)Power failures may be caused by improperly using power supply or environment abnormal as well as the ineffectiveness of electron component inside the machine. When there are power failures, the output voltage may exceed the maximum voltage of the rated power, please pay attention when use! Beware of unnecessary load damage.

(6)The protective ground terminal of the three-core power cord should be reliably connected with the ground to ensure safety in use.

## **5. Attachment**

User manual	1
Power cord	1