SAFETY TERMS AND SYMBOLS

These terms may appear in this manual or on the product:

WARNING. Warning statements identify condition or practices that could result in injury or loss of life.

CAUTION. Caution statements identify conditions or practices that could result in damage to this product or other property.

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

DANGER High Voltage

DANGER Hot Surface

ATTENTION refer to Manual

Protective Conductor Terminal

Earth（ground） Terminal

PRECAUTION APPENDIX

The Selection of Output Test Lead and Feedback Test Lead:

For safety assurance, please select the adequate output test lead according to the following list:

UL (CSA) Model	Conductor				Maximum Conductive Resistor Ω/km	Permissible Current A(amp)
	Wire No. AWG	Component pc/mm	Cross Section Area $(mm)^2$	Outer Diameter mm		
1015 TEW (Twisted Wire)	24	11/0.16	0.22	0.64	88.6	7.64
	22	17/0.16	0.34	0.78	62.5	10.0
	20	21/0.18	0.53	0.95	39.5	13.1
	18	34/0.18	0.87	1.21	24.4	17.2
	16	26/0.254	1.32	1.53	15.6	22.6
	14	41/0.254	2.08	2.03	9.90	30.4
	12	65/0.254	3.29	2.35	6.24	40.6
	10	65/0.32	5.23	3.00	3.90	55.3

Remark:

1. The ambient temperature of "Permissible Current" is at 40℃, the withstanding temperature of conductor is at 105℃ according to the condition of the distributed single wire.
2. The permissible current listed as above is suggested to be used under 70%.
3. If the feedback test leads are in need, the level above UL(CSA) AWG24, 22, 20... can be accepted. Besides, when the load is a capacitive load, please use the twine wire by twisting (+)output test lead with (S+) feedback test lead. Same way used on (-) output test lead and (S-) feedback test lead.
4. When the current value exceeds above suggestive list, can select more wires used in parallel according to above list.

FOR UNITED KINGDOM ONLY

NOTE
This lead/appliance must only be wired by competent persons

WARNING
THIS APPLIANCE MUST BE EARTHED

IMPORTANT
The wires in this lead are coloured in accordance with the following code:

Green/
Yellow: Earth
Blue : Neutral
Brown: Live (Phase)

As the colours of the wires in main leads may not correspond with the colours marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol ⏚ or coloured Green or Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the Letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse; refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of 0.75mm ^{2} should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any moulded mains connector that requires removal/replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if a engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

EC Declaration of Conformity

We
GOOD WILL INSTRUMENT CO., LTD.
declare that the below mentioned product

GPR-11H30D, GPR-7550D, GPR-3510HD, GPR-1820HD

satisfies all the technical relations application to the product within the scope of council:
Directive: 2014/30/EU; 2014/35/EU; 2011/65/EU; 2012/19/EU
The above product is in conformity with the following standards or other normative documents:

◎ **EMC**

EN 61326-1 EN 61326-2-1	Electrical equipment for measurement, control and laboratory use— EMC requirements **(2013)**		
Conducted & Radiated Emission	**EN 55011:2009+A1:2010 Class B**	**Electrical Fast Transients**	**EN 61000-4-4 :2012**
Current Harmonics	**EN 61000-3-2 :2014**	**Surge Immunity**	**EN 61000-4-5 :2014**
Voltage Fluctuations	**EN 61000-3-3 :2013**	**Conducted Susceptibility**	**EN 61000-4-6 :2014**
Electrostatic Discharge	**EN 61000-4-2 :2009**	**Power Frequency Magnetic field**	**EN 61000-4-8 :2010**
Radiated Immunity	**EN 61000-4-3 :2006+A2:2010**	**Voltage Dip/Interruption**	**EN 61000-4-11 :2004**

Low Voltage Equipment Directive 2014/35/EU	
Safety Requirements	**EN 61010-1: 2010**

GOOD WILL INSTRUMENT CO., LTD.
No. 7-1, Jhongsing Road, Tucheng Dist., New Taipei City 236, Taiwan
Tel: +886-2-2268-0389 **Fax: +866-2-2268-0639**
Web: www.gwinstek.com **Email: marketing@goodwill.com.tw**

GOOD WILL INSTRUMENT (SUZHOU) CO., LTD.
No. 521, Zhujiang Road, Snd, Suzhou Jiangsu 215011, China
Tel: +86-512-6661-7177 **Fax: +86-512-6661-7277**
Web: www.instek.com.cn **Email: marketing@instek.com.cn**

GOOD WILL INSTRUMENT EURO B.V.
De Run 5427A, 5504DG Veldhoven, The Netherlands
Tel: +31(0)40-2557790 **Fax:+31(0)40-2541194**
Email:sales@gw-instek.eu

CONTENTS

1. INTRODUCTION

The regulated DC power supply have been designed to provide for the most often required in the laboratory, schools and production lines.

The output voltage is continuously adjusted between 0 to rated voltage in one range by coarse and fine potentiometer, the load current can be varied from 0 to rated current adjusted by coarse and fine potentiometer. Both outputs can be accurately read on voltmeter and ammeter.

Both stability and ripple are extremely good to meet the requirements of modern circuit design. The unit can be used as either constant voltage or current source. The various mode of operation are described in greater details in the Operation Instruction Section.

For application, the unit can be connected up in series or parallel to get higher Voltage or Amps than maximum. And it provides continuous or dynamic load with internal selection for applying to audio production lines.

2.SPECIFICATION

2-1. General

Main supply : 100V/120V/220V/240V±10% 50/60Hz(Switch selectable).
Rating, dimension and weight : See Table 2-1.

Table 2-1

MODEL	Max. Rating		Input Rating		Fuse Type and Rating		Dimensions	Weight
	Volts(V)	Amps(A)	Watts	VA	100V/120V	220V/240V	WXHXD(m/m)	Kg
GPR-11H30D	110	3	520	700	T8A 250V	T4A 250V	225(W) 145(H) 420(D)	13.5
GPR-7550D	75	5	570	780	T10A 250V	T5A 250V		18.5
GPR-3510HD	35	10	570	780	T10A 250V	T5A 250V		18.5
GPR-1820HD	18	20	650	850	T10A 250V	T5A 250V		18.5

WARNING: Voltage more than 60V DC is of a lethal shock hazard to the user. Be careful when connecting power supplies in series to achieve voltage higher than 60V DC totally or 60V DC between any connection and earth ground.

Operation mode : Series Operation.
Operation Environment : Indoor use,
Altitude up to 2000m,
Installation Category II,
Pollution degree 2.
Operation Temperature &Humidity : 0℃ to 40℃, <80%.
Storage Temperature & Humidity : -10℃ to 70℃, < 70%.
Accessories : Test Lead GTL-105(current < 4A) or GTL-104(4≦current≦10A) ×1
Note: No Test Lead included to the unit with its current greater than 10A.
Operation Manual ×1

2-2.Constant Voltage Operation

(1) Output Voltage ranges 0 to rating voltage adjustable continuously.
(2) Voltage regulation
line regulation≦0.01%+3mV.
load regulation≦0.01%+5mV.
load regulation≦0.02%+5mV (≧10A).
(3) Recovery time≦100 μs (50% Load change, minimum load 0.5A).
(4) Ripple & Noise≦1mVrms (5Hz~1MHz).
(5) Temperature coefficient≦300ppm/℃.

2-3.Constant Current Operation

(1) Output current range 0 to rating current adjustable continuously.
(2) Current regulation
line regulation≦0.2%+3mA.
load regulation≦0.2%+5mA.
(3)Ripple current≦5mA rms.(≦20A),≦10mA rms (≦30A).
≦20mA rms(≦50A).

2-4.Indicator Meter

Display	: 3 1/2 Digits 0.5" Red LED display.
Accuracy	: ±(0.5% of rdg + 2 digits).
Voltage range	: 19.99V of full scale(rating voltage≦18V).
	199.9V of full scale(rating voltage≦180V).
	1999V of full scale(rating voltage≦1800V).
Current range	: 1.999A of full scale(rating current≦1.8A).
	19.99A of full scale(rating current≧18A).
	199.9A of full scale(rating current≦180A).

2-5.Insulation

Between chassis and output terminal	: 100MΩ or above(DC1000V).
Between Chassis and AC cord	: 100MΩ or above (DC1000V).

3.THEORY OF OPERATION

3-1.Low Voltage Circuit(FIG. 1)

The power supply comprises an AC input circuit and transformer, a bias supply consisting of a rectifier and filter and reference voltage source, a main regulator circuit consisting of the main rectifier and filter, a series regulator, a current comparator, a voltage comparator, a reference voltage amplifier, tag a instant over load protection circuit and a relay control circuit. The circuit element consists of several of integrated circuit (U201,U202,U203,U204,U101,U205).

The circuit arrangement is shown as block diagram in Fig. 1.

Single Phase input power is applied to transformer through the input circuit.

Auxiliary rectifier D101-D104 provides a bias voltage filtered by capacitor C101, C102 for the preregulator U101, Q101,Q102, that provides a regulator voltage for element of action.

The main rectifier, a full wave bridge rectifier, provides the power which is filtered by capacitor C401~C404 and then regulated via a series regulator and delivered to the output.

U204 provides a reference voltage for U205, acts as a current limiter, when the current is over predominate rating, it will be acted to decrease the current. U201 provides a reference voltage for U202, which is a inverter amplifier, U205 is a current comparator, via OR gate and driver amplifier to series regulator Q203.

Q201 is an instant over load protection circuit, it acts when adding instant load by controlling Q203 current magnitude of I_B to limit output current.

The relay control circuit provides limited power dissipation for series regulator.

3-2.High Voltage Circuit(FIG.2)

The power supply comprises of an AC input circuit and transformer, a bias supply consisting of a rectifier and filter and reference voltage source, a main rectifier circuit consisting of the main rectifier and filter, a series regulator a current comparator, a voltage comparator, a reference voltage amplifier and a transistor driver consisting of rectifier and filter.

The circuit element includes several of integrated circuit (U201, U202, U203, U204, U101, U205).

The circuit is described in the block diagram Function Description.

Single phase input power is applied to transformer through the input circuit.

Auxiliary rectifier D101-D104 provides a bias voltage filtered by capacitor C101, C102 for the preregulator U101, Q101, Q102, that provides a regulator voltage for element of action.

The bias voltage is provided by auxiliary rectifier (D302-D305) to turn the transistor (Q303~Qn) on.

The main rectifier is made by rectifiers and filters and then regulated via a series regulator and delivered to the output.

U204 provides a reference voltage for U205, acts as a current limiter, when current is over predominate rating, it is activated to decrease the current. U201 provides a reference voltage for U202, which is a inverter amplifier, U205 is a comparator amplifier. It may be made comparator for reference voltage and detector feedback voltage, and delivered to Q202,Q203 after output voltage is calibrated.

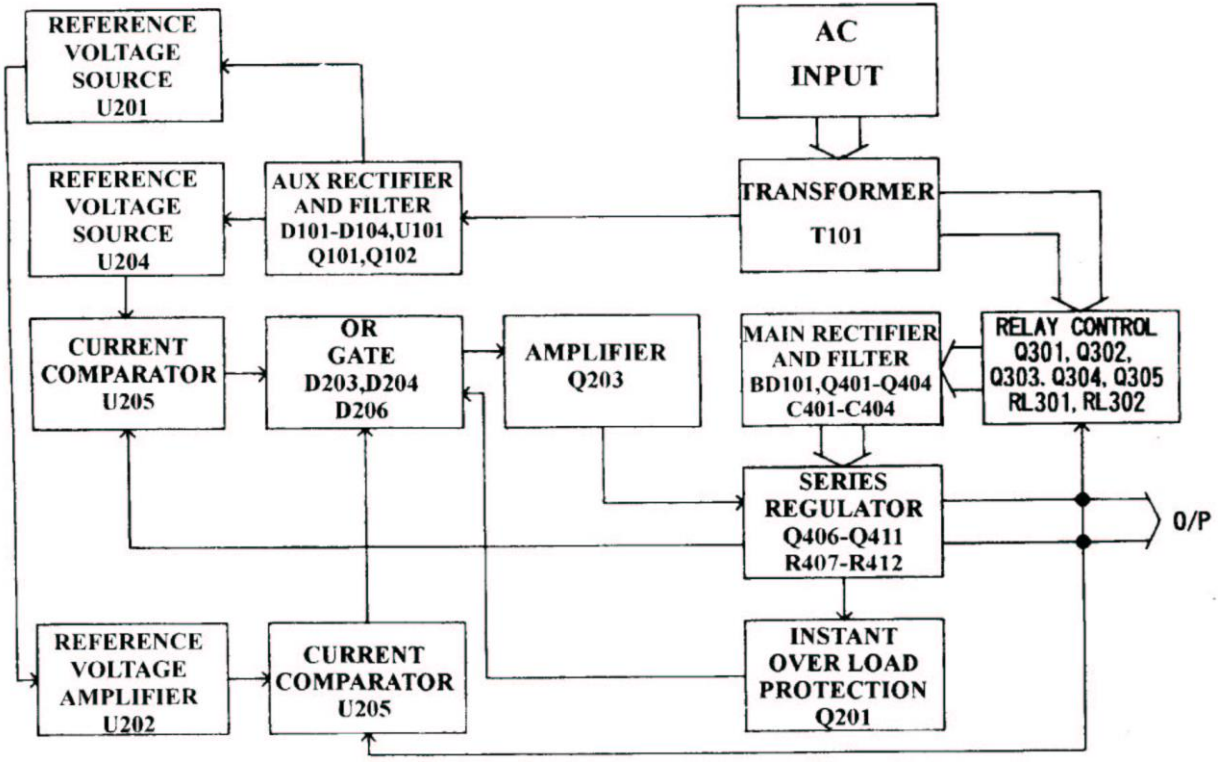

Fig. 1 Block diagram (Less than 100V)

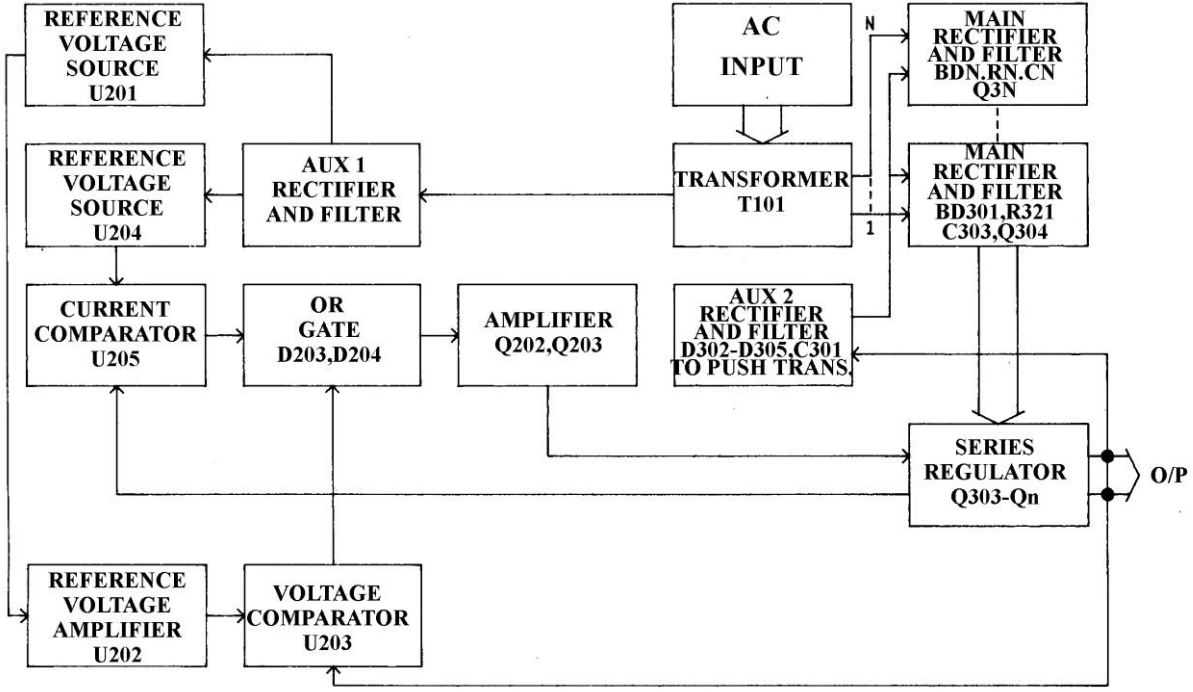

Fig. 2 Block Diagram (more than 100V)

4.PANEL CONTROLS AND INDICATORS

4-1.Front panel

(1)	CV Indicator	Lights when the power is on and in constant voltage operation.
(2)	CC Indicator	Lights when in constant current operation.
(3)	Voltage coarse	For the coarse adjustment of the output voltage.
(4)	Voltage fine	For the fine adjustment of the output voltage.
(5)	Current coarse	For the coarse adjustment of the output current.
(6)	Current fine	For the fine adjustment of the output current.
(7)	“+” output terminal	Positive polarity (Red).
(8)	“GND” terminal	Earth and chassis ground (Green).
(9)	“ – “output terminal	Negative polarity (Black).
(10)	Voltmeter	Indicates the output voltage.
(11)	Ammeter	Indicates the output current.
(12)	Power control	On/Off switch.

4-2.Rear panel

(13)	Fuse holder	
(14)	Power socket	
(15)	HI-LO switch	HI position selects high voltage range(120V, 240V AC inputs), LO position Selects low voltage range (100V,220V AC inputs).
(16)	AC selects switch	With (15) HI-LO switch selects the permit operation from 100, 120V, 220 or 240VAC, 50/60Hz line voltage.
(17)	Cooling FAN	Ventilates the hot air out to prevent output stage from thermo shock, and improves the temperature coefficient.
(18)	“S+” terminal	Positive polarity sense terminal.
(19)	“+” terminal	Positive polarity output terminal.
(20)	“-” terminal	Negative polarity output terminal.
(21)	“S-” terminal	Negative polarity sense terminal.
(22)	GND terminal	Earth and chassis ground.

***Note: If the load current is greater than “10A”, then the “18” ~ “22” terminal is used, and the output is connected from the rear panel.**

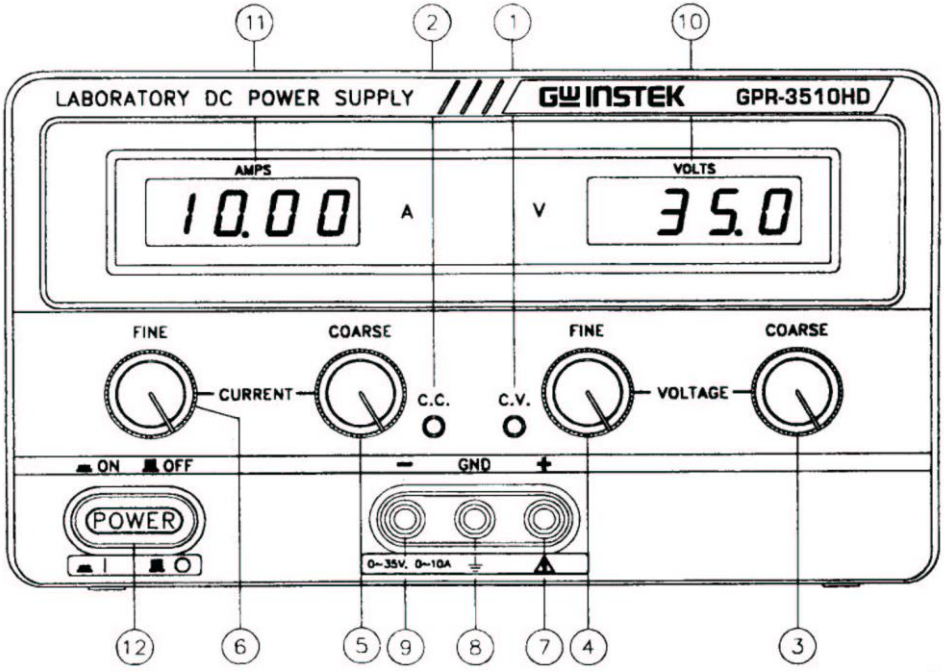

Fig. 4-1 Front Panel

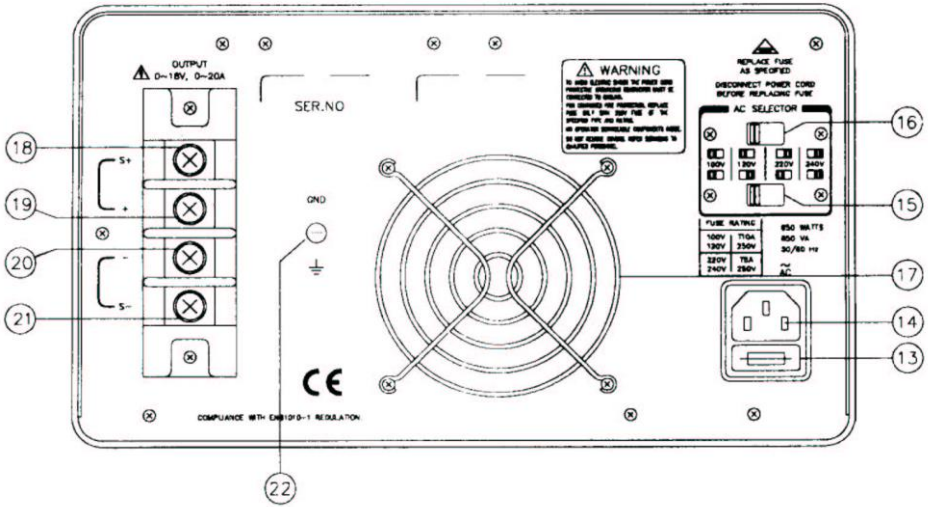

Fig. 4-2 REAR PANEL

5.OPERATION INSTRUCTIONS

5-1.Precaution

(1)AC input

AC input should be within the range of line voltage±10% 50/60Hz.

WARNING. To avoid electrical shock, the power cord protective grounding conductor must be connected to ground.

(2)Installation

Avoid using the power supply in a place where ambient temperature exceeds 40℃. The heat sink locate at rear of the power supply must have sufficient air space for radiation.

CAUTION. To avoid damaging the power supply, don't use it in a place where ambient temperature exceeds 40℃.

(3)Output voltage overshoot

Voltage between output terminals never exceeds the preset value when the power is turned on or off.

5-2.Setting Current Limit

(1) Determine the maximum safe current for the device to be powered.
(2) Temporarily short the (+) and (-) terminals of the power supply together with a test lead.
(3) Rotate the COARSE VOLTAGE control away from zero sufficiently for the CC indicator to light.
(4) Adjust the CURRENT control for the desired current limit. Read the current value on the Ammeter.
(5) The current limit (overload protection) has now been preset. Do not change the CURRENT control setting after this step.
(6) Remove the short between the (+) and (-) terminals and hook up for constant voltage operation.

5-3.Constant Voltage / Constant Current Characteristic

The working characteristic of this series Power Supplies is called a constant voltage/constant current automatic crossover 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.5-1 shows the relationship between this crossover point and the load.

For example, if the load is such that the power supply is operating in the constant voltage mode, a regulated output voltage is provided. The output voltage remains constant as the load increases, up until the point where the preset current limit is reached. At that point, the output current becomes constant and the output voltage drops in proportion to further increases in load. The crossover point is indicated by the front panel LED indicators. The crossover point is reached when the CV indicator is off and the CC indicator is on.

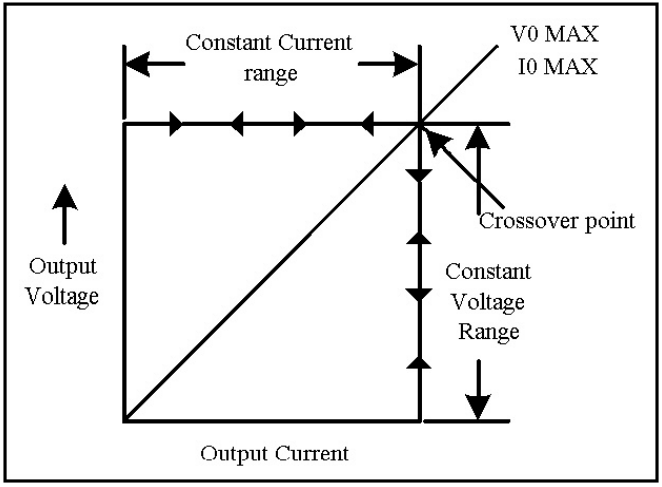

Fig. 5-1 Constant Voltage/Constant Current Characteristic.

Similarly, crossover from the constant current to the constant voltage mode automatically occurs from a decrease in load, a good example of this would be seen when charging a 12 volt battery. Initially, the open circuit voltage of the power supply may be preset for 13.8 volts. A low battery will place a heavy load on the supply and it will operate in the constant current mode, which may be adjusted for a 1 amp charging rate. As the battery becomes charged, and its voltage approaches 13.8 volts, its load decreases to the point where it no longer demands the full 1 amp charging rate. This is the crossover point where the power supply goes into the constant voltage mode.

5-4.Operation mode

(1) Single Operation

Use the supply for single operation.

A. Set Power switch to “OFF” position.

B. Make sure that line voltage is correct for the input power voltage.

C. Plug power cord into the power outlet.

D. Set Power switch to “ON” position.

E. Adjust “Voltage” and “Current” control to the desired output voltage and current.

F. Connect the external load to the output binding posts. Make sure both “+” and “-” terminals are connected correctly.

(2) Series Operation

Two power supplies can be connected in series to provide higher voltage and rating current output. See Fig. 5-2 for the connection scheme.

When connected in series, the VOLTAGE controls of each power supply exercise control over a 0 to rating range. Add the two voltmeter readings together to determine the total output voltage, or an external voltmeter may be connected across the load.

Load current can be monitored from either supply; the readings will be identical since they are connected in series. Also, since the supplies are connected in series, it is only necessary to set the current limit on one of the supplies; the other can be set for maximum.

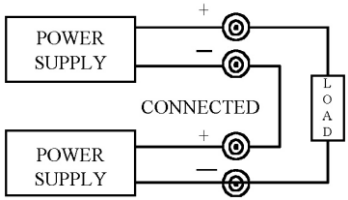

FIG. 5-2 Connecting Two Power Supplies in Series

WARNING: Voltage more than 60V DC are a lethal shock hazard to the user. Be careful when connecting power supplies in series to achieve voltage higher Than 60V DC total or 60V DC between any connection and earth ground.

6. MAINTENANCE

WARNING

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

6-1.Fuse Replacement

If the fuse is blown, the CV or CC indicators will be off and the power supply can not be operated. The fuse should not normally blow unless a problem has developed in the unit. Try to determine and correct 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 (see Fig. 4-2).

WARNING: For continued fire protection. Replace with 250V fuse of the specified type and rating, and disconnect the power cord before replacing fuse.

6-2.Line Voltage conversion

The primary winding of the power transformer is tapped to permit operation from 100, 120, 220, or 240 VAC, 50/60 Hz line voltage. Conversion from one line voltage to another is done by change AC selects switch as shown in Fig. 4-3.

The rear panel identifies the line voltage to which the unit was factory setted. To convert to a different line voltage, perform the following procedure:

(1) Make sure the power cord is unplugged.

(2) Change the AC selects switch to the desired line voltage position.

(3) A change in line voltage may also require a corresponding change of fuse value. Install the correct fuse value as listed on rear panel.

6-3.Internal adjustments

The unit was accurately adjusted at the factory before shipment. So, readjustment is suggested only when the accuracy of circuit is affected by the repair, or when you have the reason to believe that the unit is out of accuracy. The recommended calibration device is a multimeter with an accuracy of ±0.1% dcv or better. (GOOD WILL model GDM-8135 or equivalent).

6-3-1.Low Voltage Model(Less than 100V)

If readjustment is required, proceed the following steps. Locations of the adjustment are shown in Fig. 6-1 and Fig.6-2.

(1) Adjustment of the Rating Voltage

A. Connect an accurate(±0.1%) external multimeter to measure the DC voltage at output terminals of the power supply.
B. Set the COARSE and FINE VOLTAGE controls to minimum (fully counterclockwise).
C. Adjust trimmer VR204 for a reading of 0 volts on the multimeter.
D. Turn the COARSE and FINE VOLTAGE controls to maximum (fully clockwise).
E. Adjust trimmer VR201 for a reading of rate volts × 1.05 on the multimeter.
F. Set the COARSE and FINE VOLTAGE controls for a reading of rating of rate volts on the multimeter.
G. Adjust trimmer VR201 (Fig. 6-1) for a reading of rate volts on the voltmeter (Digital Panel meter, digital type) of the power supply.

(2)Adjustment of the rating Current

A. Set the COARSE and FINE VOLTAGE controls to 5 volts.
B. Set the COARSE and FINE CURRENT controls to minimum (fully counterclockwise).
C. Connect the external multimeter to measure DC current at the output terminals of the power supply.
D. Set the COARSE and FINE CURRENT controls to maximum (fully clockwise).
E. Adjust trimmer VR205 for a reading of rate amps × 5 on the multimeter.
F. Readjust the CURRENT control for a reading of rate amps on the multimeter.
G. Adjust trimmer VR202 (Fig. 6-1) to calibrate the Ammeter of the power supply for the same reading as the multimeter.

6-3-2.High Voltage Model (More than 100V)

If readjustment is required, proceed the following steps. Locations of the adjustment are shown in Fig. 6-1 and Fig.6-3.

(1).Adjustment of the Rating Voltage

A. Connect an accurate (±0.1%) external multimeter to measure the DC voltage at output terminals of the power supply.
B. Set the COARSE and FINE VOLTAGE controls to minimum (fully counterclockwise).
C. Adjust trimmer VR204 for a reading of 0 volts on the multimeter.
D. Turn the COARSE and FINE VOLTAGE controls to maximum (fully clockwise).
E. Adjust trimmer VR201 for a reading of rate volts × 1.05 on the multimeter.
F. Set the COARSE and FINE VOLTAGE controls for a reading of rating of rate volts on the multimeter.
G. Adjust trimmer VR201 (Fig. 6-1) for a reading of rate volts on the voltmeter (Digital Panel meter, digital type) of the power supply.

(2).Adjustment of the rating Current

A. Set the COARSE and FINE VOLTAGE controls to 5 volts.
B. Set the COARSE and FINE CURRENT controls to minimum (fully counterclockwise).
C. Connect the external multimeter to measure DC current at the output terminals of the power supply.
D. Set the COARSE and FINE CURRENT controls to maximum(fully clockwise).
E. Adjust trimmer VR205 for a reading of rate amps × 5 on the multimeter.
F. Readjust the CURRENT control for a reading of rate amps on the multimeter.
G. Adjust trimmer VR202 (Fig. 6-1) to calibrate the Ammeter of the power supply for the same reading as the multimeter.

Note: Be sure to wear rubber insulating gloves whenever this power supply is operated to prevent electric shock hazards.

6-4. Cleaning

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.

Do not use chemicals containing benzene, toluene, xylene, acetone, or similar solvents.

Do not use abrasive cleaners on any portion of the power supply.

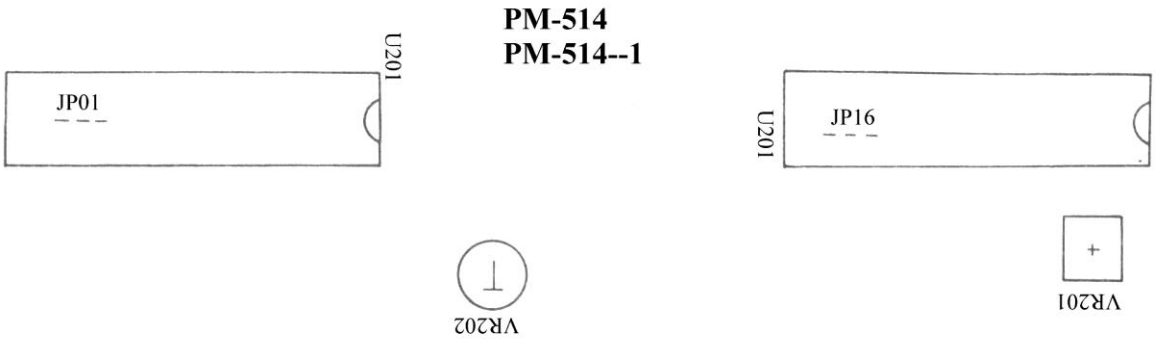

Fig. 6-1 Adjustment Location

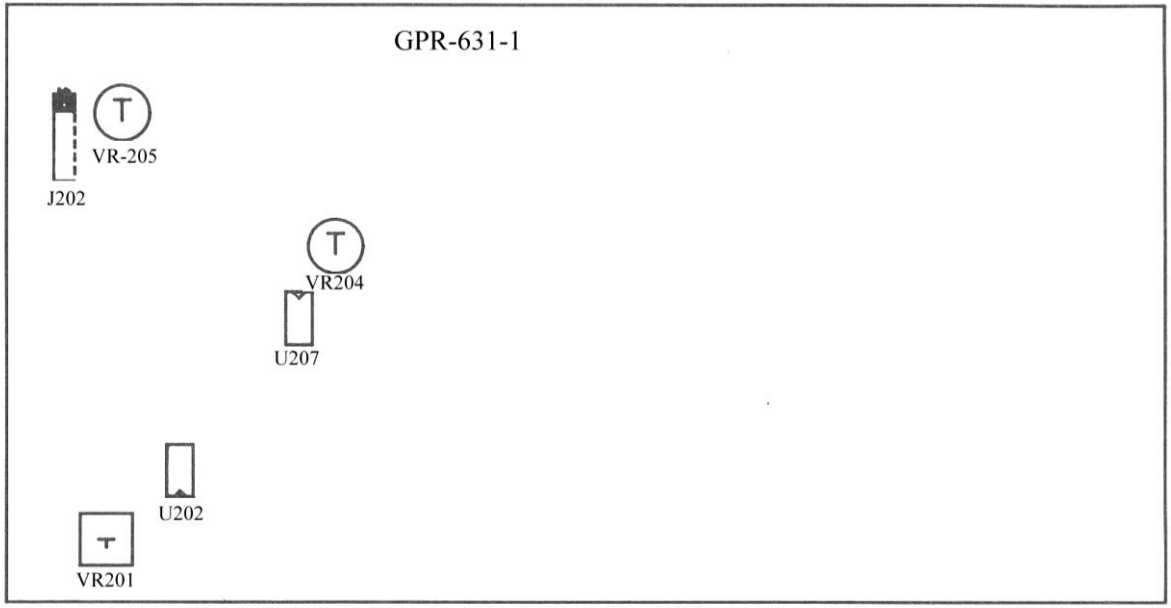

Fig. 6-2 Adjustment Location

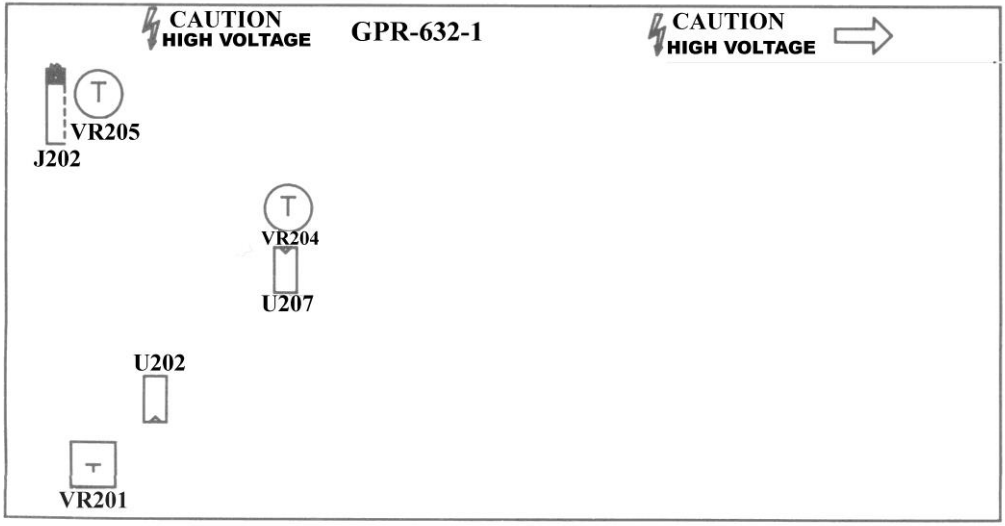

Fig. 6-3 Adjustment Location