



**DUAL DC POWER SUPPLY  
MODEL 6205C**

**OPERATING AND SERVICE MANUAL  
FOR SERIALS 2208A-00101**

**\*For Serials above 2208A-00101  
Check for inclusion of change page.**



## SECTION I GENERAL INFORMATION

### 1-1 DESCRIPTION

1-2 This power supply, Figure 1-1, is completely transistorized and suitable for either bench or relay rack operations. The dual supply consists of two independently controlled dual range sections; both identical to the other. Each section can furnish either a 0-40 Volt output at 300mA or a 0-20 Volt output at 600mA. Each section has its own front panel meter and operating controls. The operating modes (40V or 20V) are selected by means of the front panel RANGE switches. The VOLTAGE controls permit each output voltage to be continuously adjusted throughout either output range.

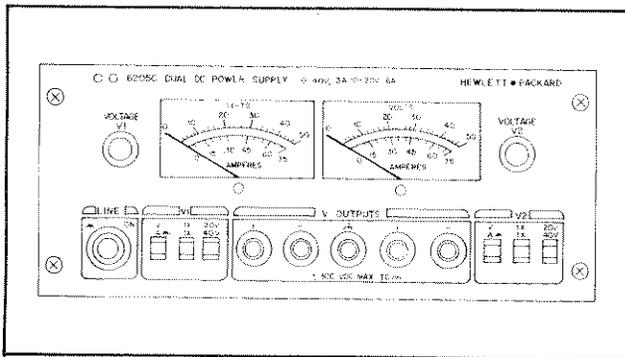


Figure 1-1. DC Power Supply, Model 6205C

1-3 Both sections of the supply are of the regulated, Constant Voltage/Current Limiting, type. Each section is fully protected from overloads by the fixed current limit which is set by means of an internal adjustment.

1-4 Both front and rear terminals are available for each section. Either the positive or negative terminals may be grounded or the supply can be operated at up to a maximum of 300 Volts off ground. Each meter can be used to measure either output voltage or output current in one of two ranges. The voltage or current ranges are selected by the applicable meter button on the front panel.

1-5 Two sets of programming terminals, located at the rear of the unit, allow ease in adapting to the many operational capabilities of the supply. A brief description of these capabilities is given below:

a. Remote Programming. The power supply

may be programmed from a remote location by means of an external voltage source or resistance.

b. Remote Sensing. The degradation in regulation which would occur at the load because of the voltage drop which takes place in the load leads can be reduced by using the power supply in the remote sensing mode of operation.

c. Series and Auto-Series Operation. Power supplies may be used in series when a higher output voltage is required in the voltage mode of operation or when greater voltage compliance is required in the constant current mode of operation. Auto-Series operation permits one knob control of the total output voltage from a "master" supply.

d. Parallel and Auto-Parallel Operation. The power supply may be operated in parallel with a similar unit when greater output current capability is required. Auto-Parallel operation permits one knob control of the total output current from a "master" supply.

e. Auto-Tracking. The power supply may be used as a "master" supply, having control over one (or more) "slave" supplies that furnish various voltages for a system.

### 1-6 SPECIFICATIONS

1-7 Detailed specifications for the power supply are given in Table 1-1.

### 1-8 OPTIONS

1-9 Options are factory modifications of a standard instrument that are requested by the customer. The following options are available for the instrument covered by this manual. Where necessary, detailed coverage of the options is included throughout the manual.

011

#### Overvoltage Protection "Crowbar":

A completely separate circuit for protecting delicate loads against power supply failure or operator error. This independent device monitors the output voltage and within 10 $\mu$ sec imposes a virtual short-circuit (crowbar) across the power supply output if the preset trip voltage is exceeded. When Option 11 is requested by the customer the device is connected at the factory.

Trip Voltage Range: 2.5 to 44 Volts, screwdriver adjustable.

Detailed coverage of Option 11 is included in Appendix A at the rear of manuals that support power supplies containing Option 11.

- 015 Three Digit Graduated Decadial Voltage Control: Dial that replaces voltage control knobs permitting accurate resettability.
- 028 230Vac Input: Supply as normally shipped is wired for 115Vac input. Option 28 consists of reconnecting the input transformer for 230Vac operation.
- 040 Interfacing for Multiprogrammer operation. Prepares standard HP power supplies for resistance programming by the HP Multiprogrammer. Multiprogrammer operation requires that the power supply be subjected to a special calibration and a protection checkout. The special calibration insures that the power supply can be accurately set to zero and to its maximum rated output voltage or current when programmed by the Multiprogrammer. The protection checkout insures that the power supply will not be damaged by the rapid repetitive programming possible with the Multiprogrammer.
- 910 One additional operating and service manual shipped with the supply.

**1-10 ACCESSORIES**

1-11 The accessories listed in the following chart may be ordered with the power supply or separately from your local Hewlett-Packard field sales office (refer to list at rear of manual for addresses).

<u>Part No.</u>	<u>Description</u>
14513A	Rack Kit for mounting one 3½" high supply. (Refer to Section II for details.)
14523A	Rack Kit for mounting two 3½" high supplies. (Refer to Section II for details.)

**1-12 INSTRUMENT AND SERVICE MANUAL IDENTIFICATION**

1-13 Hewlett-Packard power supplies are identified by a two-part serial number. The first part is the serial number prefix, a number-letter combination that denotes the date of a significant design change and the country of manufacture. The first two digits of the prefix indicate the year (20 + 80, 21 + 81, etc.), the second two digits indicate the week, and the letter "A" designates the USA as the country of manufacture. The second part of the serial number is different sequential number assigned to each power supply, starting with 00101.

1-14 If the serial number on your instrument does not agree with those on the title page of this manual, a yellow Manual Change sheet supplied with the manual defines the difference between your instrument and the instrument described by this manual.

**1-15 ORDERING ADDITIONAL MANUALS**

1-16 One manual is shipped with each power supply. Additional manuals may be purchased directly from your local Hewlett-Packard Sales office. Specify the model number, instrument serial number prefix, and the manual part number provided on the title page. (When ordered at the same time as the power supply, additional manuals may be purchased by adding Option 910 to the order and specifying the number of additional manuals desired.)

Table 1-1. Specifications

<p><b>INPUT:</b> 115Vac <math>\pm</math>10%, single phase, 48-440Hz.</p> <p><b>OUTPUT:</b> Two independent outputs, each of which can be set at either 0-40 Volts @ 0.3 Amp or 0-20 Volts @ 0.6 Amp.</p> <p><b>LOAD REGULATION:</b> Less than 0.01% plus 4mV for a full load to no load change in output current.</p> <p><b>LINE REGULATION:</b> Less than 0.01% plus 4mV for any line voltage change within the input rating.</p> <p><b>RIPPLE AND NOISE:</b> Less than 200<math>\mu</math>Vrms 1mV p-p.</p> <p><b>TEMPERATURE RANGES:</b> Operating: 0 to 50°C. Storage: - 40 to +75°C.</p> <p><b>TEMPERATURE COEFFICIENT:</b> Less than 0.02% plus 1mV per degree Centigrade.</p> <p><b>STABILITY:</b> Less than 0.10% plus 5mV total drift for 8 hours after an initial warm-up time of 30 minutes at constant ambient, constant line voltage, and constant load.</p> <p><b>OUTPUT IMPEDANCE (Typical):</b> Approximated by a 25 milliohm resistance in series with a 1 microhenry inductance.</p> <p><b>TRANSIENT RECOVERY TIME:</b> Less than 50<math>\mu</math>sec for output recovery to within 10mV following a full load current change in the output.</p> <p><b>OVERLOAD PROTECTION:</b> A fixed current limiting circuit protects the power supply for all overloads including a direct short placed across the terminals in constant voltage operation.</p> <p><b>METERS:</b> Each front panel meter can be used as either a</p>	<p>0-50 or 0-5 Volt voltmeter or as a 0-0.75 or 0.075 Amp ammeter.</p> <p><b>OUTPUT CONTROLS:</b> Range buttons select desired operating mode for each section and ten-turn VOLTAGE controls set desired output voltages.</p> <p><b>OUTPUT TERMINALS:</b> Five output posts (two for each section of supply and one chassis ground) are provided on the front panel and two output terminal strips (one per section) are located on the rear of the chassis. All power supply output terminals are isolated from the chassis and either the positive or negative terminals may be connected to the chassis through separate ground terminals located on the output terminal strips.</p> <p><b>ERROR SENSING:</b> Error sensing is normally accomplished at the front terminals if the load is attached to the front or at the rear terminals if the load is attached to the rear terminals. Also, provisions are included on the rear terminal strips for remote sensing.</p> <p><b>REMOTE RESISTANCE PROGRAMMING:</b> 200 ohms per Volt.</p> <p><b>REMOTE VOLTAGE PROGRAMMING:</b> 1 Volt per Volt.</p> <p><b>COOLING:</b> Convection cooling is employed. The supply has no moving parts.</p> <p><b>SIZE:</b> 3<math>\frac{1}{2}</math>" H x 12-5/8" D x 8<math>\frac{1}{2}</math>" W. Two of the units can be mounted side by side in a standard 19" relay rack.</p> <p><b>WEIGHT:</b> 10 lbs. net, 13 lbs. shipping.</p> <p><b>FINISH:</b> Light gray front panel with dark gray case.</p> <p><b>POWER CORD:</b> A three-wire, five-foot power cord is provided with each unit.</p>
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## SECTION II INSTALLATION

### 2-1 INITIAL INSPECTION

2-2 Before shipment, this instrument was inspected and found to be free of mechanical and electrical defects. As soon as the instrument is unpacked, inspect for any damage that may have occurred in transit. Save all packing materials until the inspection is completed. If damage is found, a claim should be filed with the carrier. Hewlett-Packard Sales and Service office should be notified.

### 2-3 MECHANICAL CHECK

2-4 This check should confirm that there are no broken knobs or connectors, that the cabinet and panel surfaces are free of dents and scratches, and that the meter is not scratched or cracked.

### 2-5 ELECTRICAL CHECK

2-6 The instrument should be checked against its electrical specifications. Section III contains a "brief" checkout procedure and section V includes a complete performance check to verify proper instrument operation.

### 2-7 INSTALLATION DATA

2-8 The instrument is shipped ready for bench operation. It is necessary only to connect the instrument to a source of power and it is ready for operation.

### 2-9 LOCATION

2-10 This instrument is air cooled. Sufficient space should be allotted so that a free flow of cooling air can reach the sides and rear of the instrument when it is in operation. It should be used in an area where the ambient temperature does not exceed 50°C.

### 2-11 OUTLINE DIAGRAM

2-12 Figure 2-1 is an outline diagram showing the dimensions of the instrument.

### 2-13 RACK MOUNTING

2-14 This instrument may be rack mounted in a standard 19 inch rack panel either alongside a similar unit or by itself. Figures 2-2 and 2-3

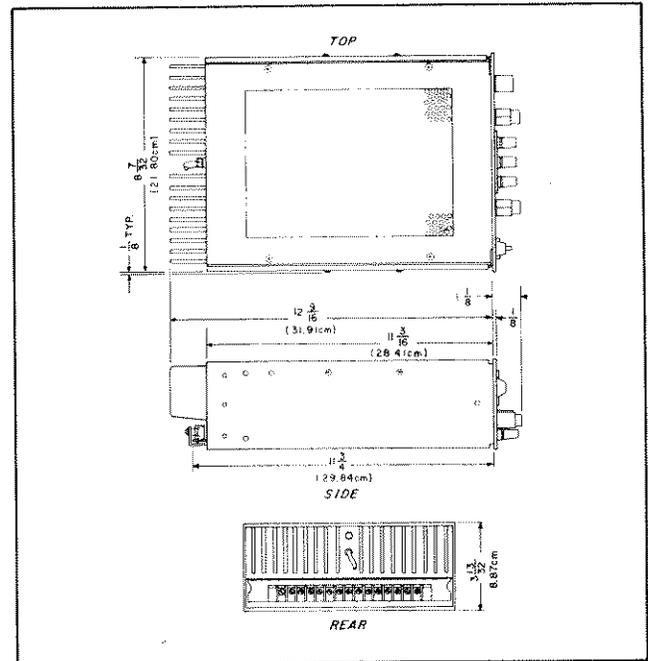


Figure 2-1. Outline Diagram

show how both types of installations are accomplished.

2-15 To mount to units side-by-side, proceed as follows:

- a. Remove bottom cover and clip tabs on main P.C. board surrounding switch. This allows LINE switch and small section of P.C. board to move forward with front panel. Replace bottom cover.
- b. Remove four screws from front panels of both units.
- c. Slide rack mounting ears between the front panel and case of each unit.
- d. Slide combining strip between the front panels and cases of the two units.
- e. After fastening rear portions of units together using the bolt, nut, and spacer, replace panel screws.

2-16 To mount a single unit in the rack panel, proceed as follows:

- a. Bolt rack mounting ears, combining straps, and angle brackets to each side of center

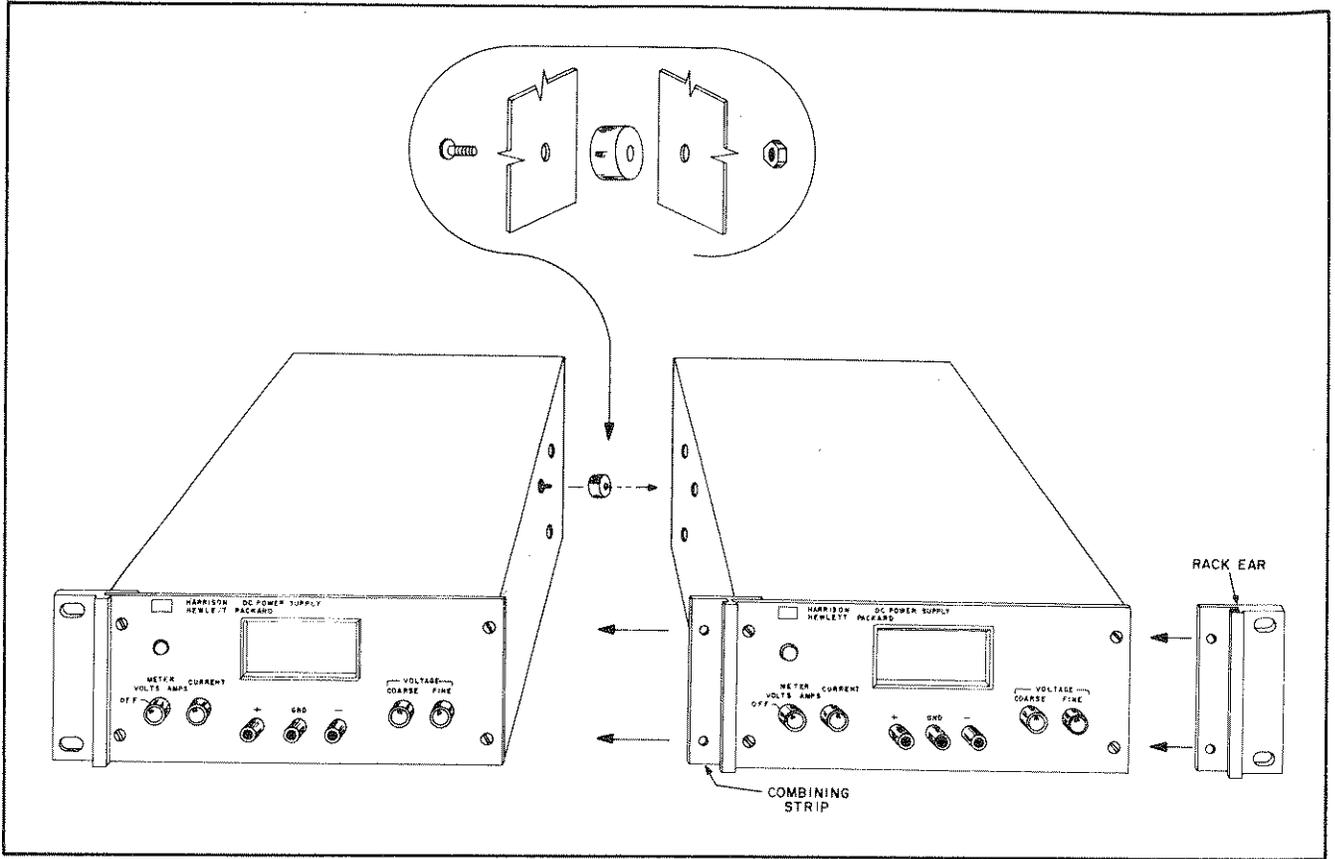


Figure 2-2. Rack Mounting, Two Units

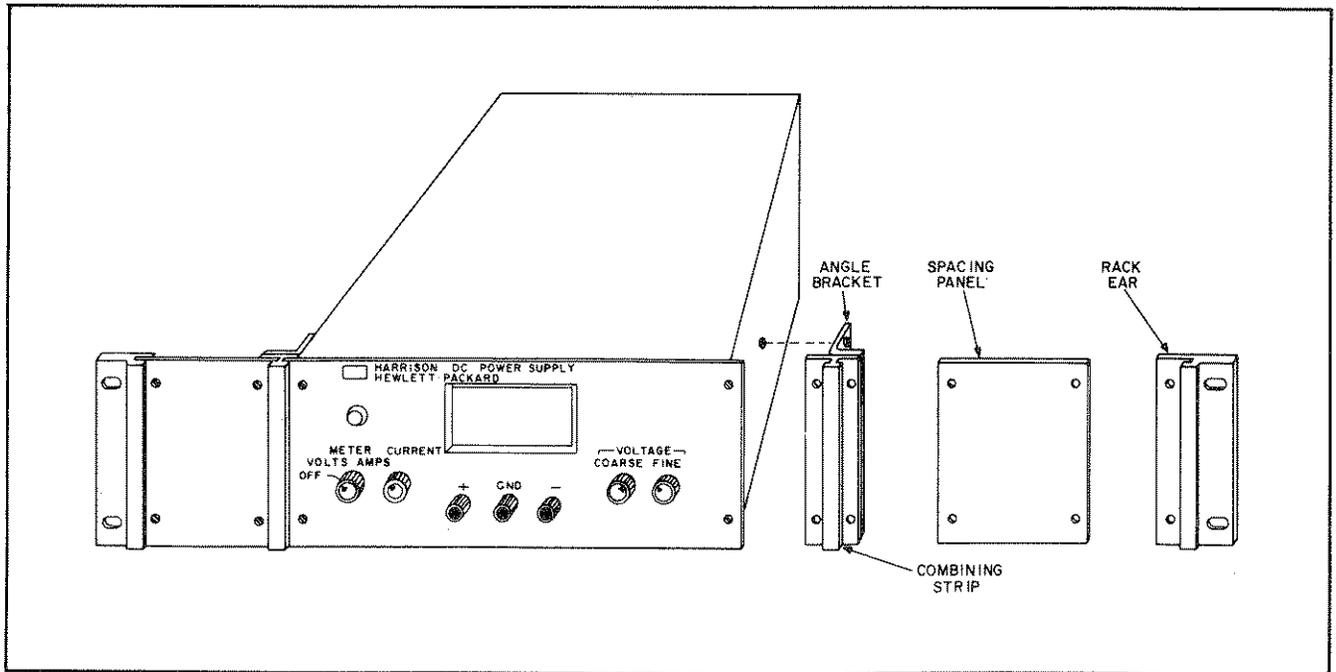


Figure 2-3. Rack Mounting, One Unit

spacing panels. Angle brackets are placed behind combining straps as shown in Figure 2-3.

b. Remove four screws from front panel of unit.

c. Slide combining strips between front panel and case of unit.

d. Bolt angle brackets to front sides of case and replace front panel screws.

## 2-17 INPUT POWER REQUIREMENTS

2-18 This power supply may be operated from either a nominal 115 Volt or 230 Volt 48-440 Hertz power source. The unit, as shipped from the factory, is wired for 115 Volt operation. The input power required when operated from a 115 Volt 60 Hertz power source at full load is 31 Watts and 0.35 Amperes.

## 2-19 CONNECTIONS FOR 230 VOLT OPERATION

2-20 Normally, the two primary windings of the input transformer are connected in parallel for operation from 115 Volt source. To convert the power supply to operation from a 230 Volt source, the power transformer windings are connected in series as follows:

a. Unplug the line cord and remove the unit from case.

b. Connect windings in parallel, as shown in Figure 2-4.

c. Replace existing fuse with 1 Ampere fuse. Return unit to case and operate normally.

## 2-21 POWER CABLE

2-22 To protect operating personnel, The National Electrical Manufacturers Association (NEMA) recommends that the instrument panel and cabinet be grounded. This instrument is equipped with a three conductor power cable. The third conductor is the ground conductor and when the cable is plugged into an appropriate receptacle, the instrument is grounded. The offset pin on the power cable three-prong connector is the ground connection.

2-23 To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the green lead on the adapter to ground.

## 2-24 REPACKAGING FOR SHIPMENT

2-25 To insure safe shipment of the instrument, it is recommended that the package designed for

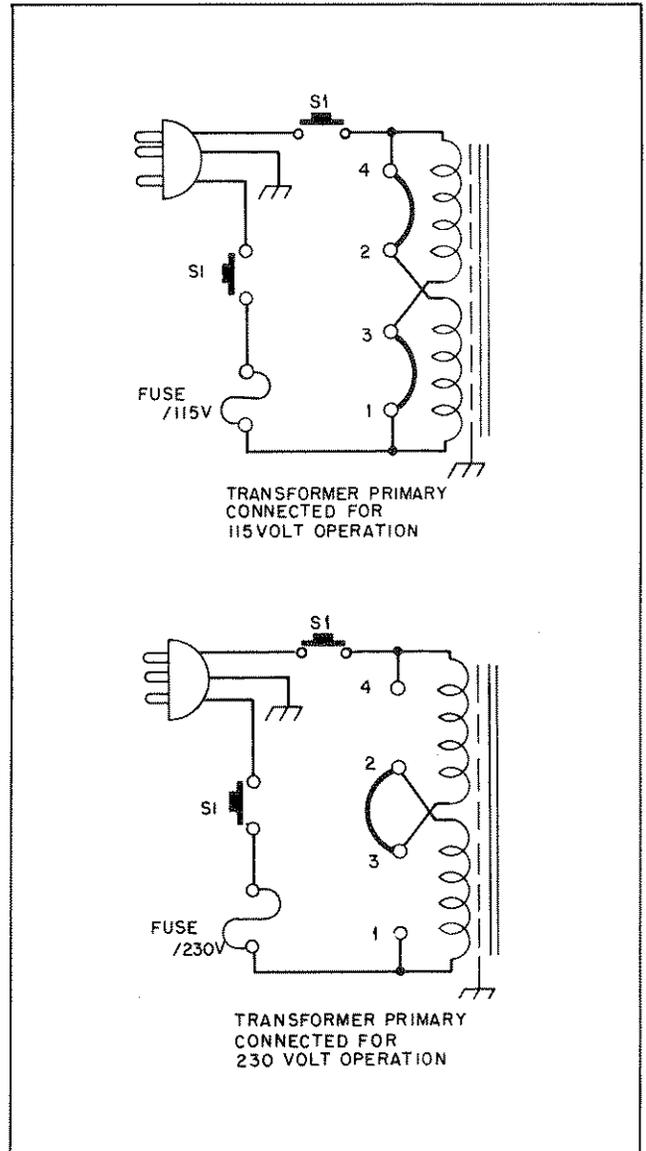


Figure 2-4. Primary Connections

the instrument be used. The original packaging material is reusable. If it is not available, contact your local Hewlett-Packard field office to obtain the materials. This office will also furnish the address of the nearest service office to which the instrument can be shipped. Be sure to attach a tag to the instrument which specifies the owner, model number, full serial number, and service required, or a brief description of the trouble.

## SECTION III OPERATING INSTRUCTIONS

### 3-1 TURN-ON CHECKOUT PROCEDURE

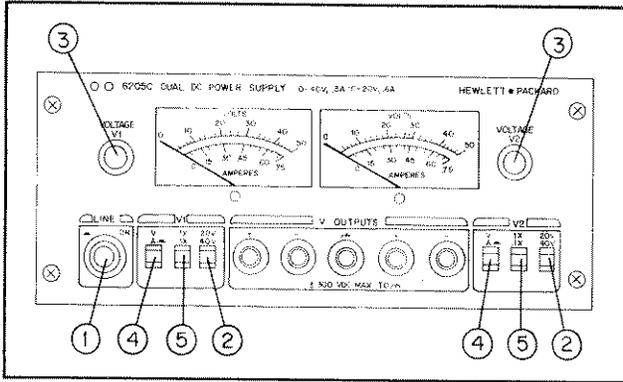


Figure 3-1. Front Panel Controls and Indicators

3-2 The front panel controls and indicators are shown in Figure 3-1. The normal turn-on sequence, is described below:

- A. Push LINE button ①.
- B. Set range button ② to desired operating mode 20 V or 40 V and meter buttons ④ and ⑤ to V and X1 positions.
- C. Adjust voltage control ③ until desired output voltage is indicated on meter.
- D. Set range button ② to highest current range (20 V) turn-off supply. Short circuit output terminals.
- E. Set meter button ④ to A position and circuit output current on meter.
- F. Remove short and connect load to output terminals (front or rear).
- G. For Model 6205C, this procedure should be used for both sections of supply.

### 3-3 OPERATING MODES

3-4 The power supply is designed so that its mode of operation can be selected by making strapping connections between particular terminals on the terminal strip at the rear of the power supply. The terminal designations are stenciled in white on the power supply above their respective terminals. Although the strapping patterns illustrated in this section show the positive terminal grounded, the operator can ground either terminal or operate the power supply up to 300Vdc off ground (floating). The following paragraphs describe the procedures for utilizing the various op-

erational capabilities of the supply. A more theoretical description concerning these operational features is contained in Application Note 90 and in various Tech Letters. Copies of these can be obtained from your local Hewlett-Packard field office.

### 3-5 NORMAL OPERATING MODE

3-6 The power supply is normally shipped with its rear terminal strapping connections arranged for Constant Voltage/Current Limiting, local sensing, local programming, single unit mode of operation. This strapping pattern is illustrated in Figure 3-2. The operator selects a constant voltage output using the front panel controls (local programming, no strapping changes are necessary).

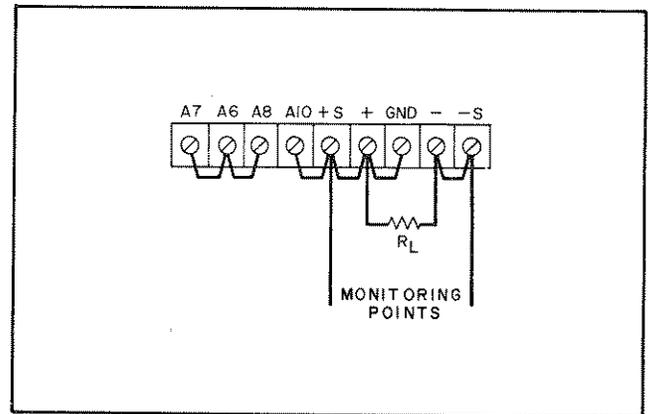


Figure 3-2. Normal Strapping Pattern

### 3-7 CONSTANT VOLTAGE

3-8 To select a constant voltage output turn on the supply and, with no load connected, adjust the VOLTAGE controls for the desired output voltage. To check the current limit, connect an external ammeter across the output of the supply, turn the VOLTAGE controls fully clockwise, and observe the reading. The current limit is factory adjusted to approximately 100mA above the current rating of the supply. If the existing current limit is not compatible with the anticipated load requirements, the limit can be changed as outlined in the following paragraphs.

### 3-9 CHANGING CURRENT LIMIT

3-10 The current limit can be varied by adjusting resistor R81, located on the printed wiring board. This adjustment procedure is described in Paragraph 5-74. In Models 6204B and 6206B, the current limit may be reduced to a value lower than that attainable by adjusting R81, by adding an external resistor as shown in Figure 3-3. The approximate value of the external resistance ( $R_X$ ) can be determined by using the following equation

$$R_X \approx \frac{1.75}{I_E} - R_I$$

where:  $I_E$  = the output current

$R_I$  = the internal current sampling resistance for the particular operating mode to be used.

1.75 = the approximate voltage drop across the internal sampling resistance at the current limit crossover point.

#### NOTE

The power supply's performance will be somewhat degraded if it is operated too close to (within 100mA) the current limit crossover point.

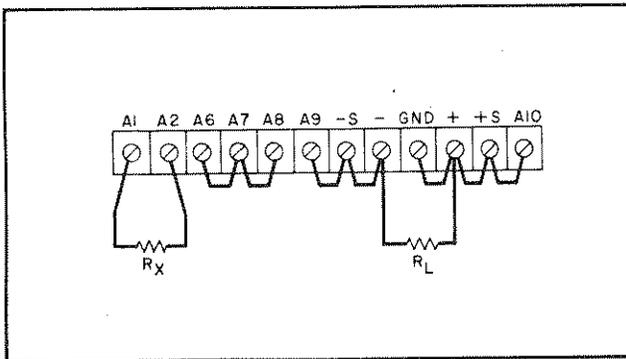


Figure 3-3. Current Limit Alteration

### 3-11 CONNECTING LOAD

3-12 Each load should be connected to the power supply output terminals using separate pairs of connecting wires. This will minimize mutual coupling effects between loads and will retain full advantage of the low output impedance of the power supply. Each pair of connecting wires should be as short as possible and twisted or shielded to reduce noise pickup. (If shield is used, connect one end to power supply ground terminal and leave the other end unconnected.)

3-13 If load considerations require that the output power distribution terminals be remotely located from the power supply, then the power supply output terminals should be connected to the remote distribution terminals via a pair of twisted or shielded wires and each load separately connected to the remote distribution terminals. For this case, remote sensing should be used (Paragraph 3-25).

### 3-14 OPERATION BEYOND NORMAL RATED OUTPUT

3-15 Although the supply can deliver greater than the rated output on both the lower and higher voltage ranges without being damaged, it can not be guaranteed to meet all of its performance specifications. Generally when operating the supply in this manner, the output is unstable when connected to a load. When greater than the lower rated voltage is required, the higher voltage range should be used. This range will deliver half as much output current and all specifications will apply as listed in Table 1-1. However, if the line voltage is maintained above its nominal value, the supply will probably operate within specifications above its rated output.

### 3-16 OPTIONAL OPERATING MODES

#### 3-17 REMOTE PROGRAMMING, CONSTANT VOLTAGE

3-18 The constant voltage output of the power supply can be programmed (controlled) from a remote location if required. Either a resistance or voltage source can be used for the programming device. The wires connecting the programming terminals of the supply to the remote programming device should be twisted or shielded to reduce noise pickup. The VOLTAGE controls on the front panel are disabled according to the following procedures.

3-19 Resistance Programming (Figure 3-4). In this mode, the output voltage will vary at a rate determined by the programming coefficient (200 ohms per Volt for Model 6204B and 6204C or 300 ohms per Volt for Model 6206B). The output voltage will increase by 1 Volt for each 200 ohms (or 300 ohms) added in series with the programming terminals. The programming accuracy is 1% of the programmed voltage. If greater programming accuracy is required, it may be achieved by adjusting R13 as outlined in Section V.

3-20 The output voltage of the power supply should be zero Volts  $\pm$  20 millivolts when zero ohms is connected across the programming terminals. If a zero ohm voltage closer than this is required, it may be achieved by changing resistor R6 or R8 as described in Section V.

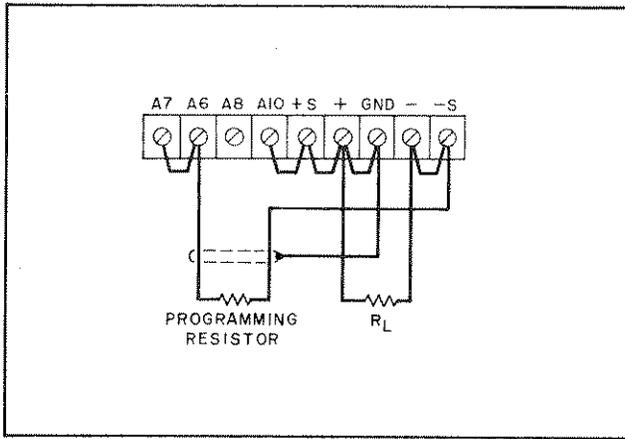


Figure 3-4. Remote Resistance Programming

3-21 To maintain the stability and temperature coefficient of the power supply, use programming resistors that have stable, low noise, and low temperature (less than 30ppm per degree Centigrade) characteristics. A switch can be used in conjunction with various resistance values in order to obtain discrete output voltages. The switch should have make-before-break contacts to avoid momentarily opening the programming terminals during the switching interval.

3-22 Voltage Programming (Figure 3-5). Employ the strapping pattern shown on Figure 3-5 for voltage programming. In this mode, the output voltage will vary in a 1 to 1 ratio with the programming voltage (reference voltage) and the load on the programming voltage source will not exceed 25 microamperes.

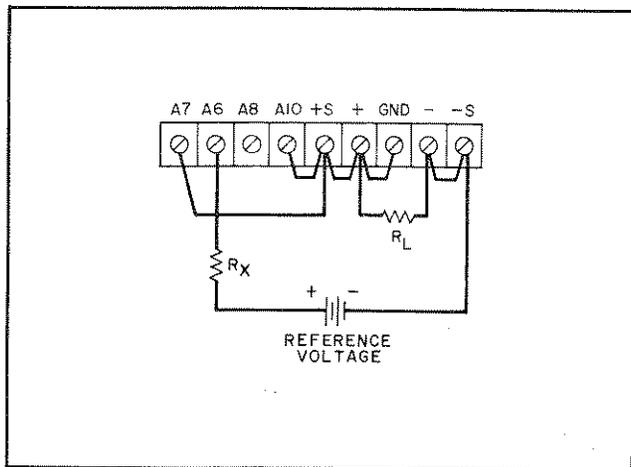


Figure 3-5. Remote Voltage Programming

3-23 The impedance ( $R_X$ ) looking into the external

programming voltage source should be approximately 1000 ohms if the temperature and stability specifications of the power supply are to be maintained. The programming accuracy is 1% of the programmed voltage.

3-24 Methods of voltage programming with gain are discussed in Application Note 90, Power Supply Handbook; available at no charge from your local Sales Office.

3-25 REMOTE SENSING (See Figure 3-6)

3-26 Remote sensing is used to maintain good regulation at the load and reduce the degradation of regulation which would occur due to the voltage drop in the leads between the power supply and the load. Remote sensing is accomplished by utilizing the strapping pattern shown in Figure 3-6. The power supply should be turned off before changing strapping patterns. The leads from the +S terminals to the load will carry less than 10 milliamperes of current, and it is not required that these leads be as heavy as the load leads. However, they must be twisted or shielded to minimize noise pick-up.

**CAUTION**

Observe polarity when connecting the sensing leads to the load.

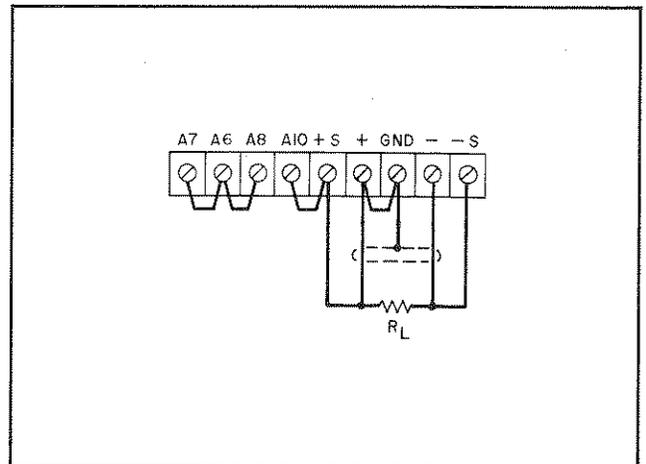


Figure 3-6. Remote Sensing

3-27 For reasonable load lead lengths, remote sensing greatly improves the performance of the supply. However, if the load is located a considerable distance from the supply, added precautions must be observed to obtain satisfactory operation. Notice that the voltage drop in the load leads sub-

tracts directly from the available output voltage and also reduces the amplitude of the feedback error signals that are developed within the unit. Because of these factors it is recommended that the drop in each load lead not exceed 1 Volt. If a larger drop must be tolerated, please consult a sales engineer.

**NOTE**

Due to the voltage drop in the load leads, it may be necessary to readjust the current limit in the remote sensing mode.

3-28 Another factor that must be considered is the inductance of long load leads which could affect the stability of the feedback loop and cause oscillation. In these cases, it is recommended that the output capacitor (C20) be physically removed from the power supply and placed across the output terminals.

3-29 Although the strapping patterns shown in Figures 3-4 and 3-5 employ local sensing, notice that it is possible to operate a power supply simultaneously in the remote sensing and the remote programming modes.

**3-30 SERIES OPERATION**

3-31 Normal Series Connections (Figure 3-7). Two or more power supplies can be operated in series to obtain a higher voltage than that available from a single supply. When this configuration is used, the output voltage is the sum of the volt-

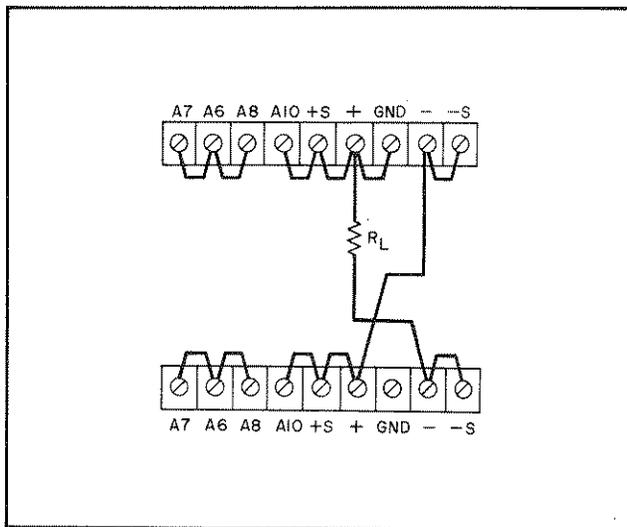


Figure 3-7. Normal Series Connections

ages of the individual supplies. Each of the individual supplies must be adjusted in order to obtain the total output voltage. The power supply contains a protective diode connected internally across the output which protects the supply if one power supply is turned off while its series partner(s) is on.

3-32 Auto-Series Connections (Figure 3-8). The Auto-Series configuration is used when it is desirable to have the output voltage of each of the series connected supplies vary in accordance with the setting of a control unit. The control unit is called the master; the controlled units are called slaves. At maximum output voltage, the voltage of the slaves is determined by the setting of the front panel VOLTAGE control on the master. The master supply must be the most positive supply of the series. The current limit settings of all series

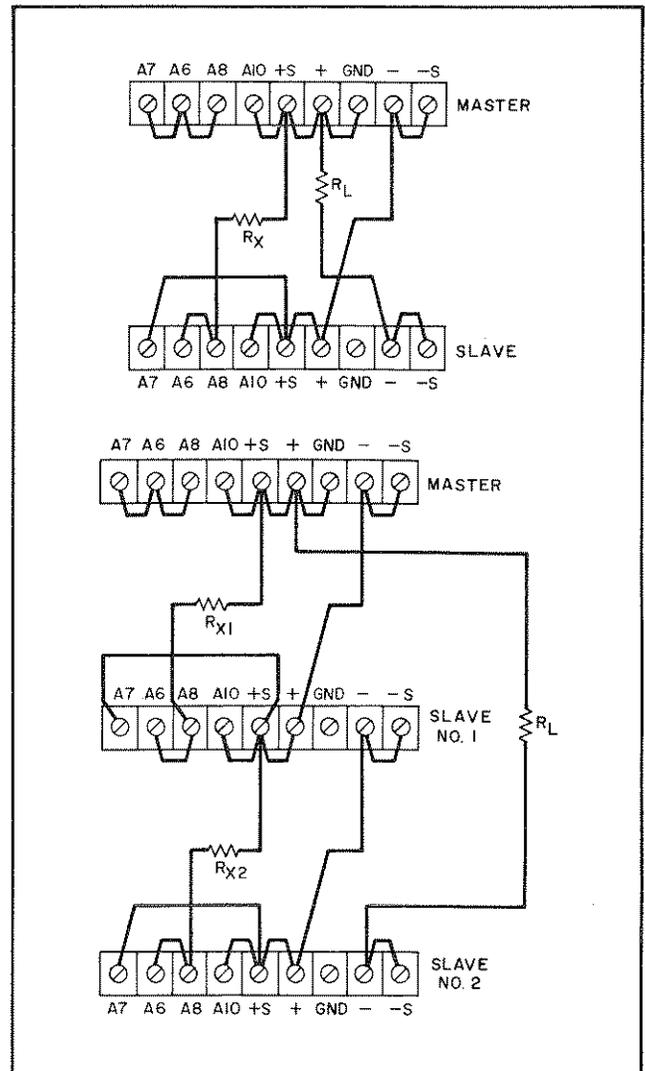


Figure 3-8. Auto-Series, Two and Three Units

units are effective and the current limit for the entire configuration is equal to the lowest current limit setting. If any of the settings are too low, automatic crossover to current limiting operation will occur and the output voltage will drop. Remote sensing and programming can be used; however, the strapping arrangements shown in the applicable figures show local sensing and programming.

3-33 In order to maintain the temperature coefficient and stability specifications of the power supply, the external resistors ( $R_X$ ) shown in Figure 3-8 should be stable, low noise, low temperature coefficient (less than 30ppm per degree Centigrade) resistors. The value of each resistor is dependant on the maximum voltage rating of the master supply. The value of  $R_X$  is this voltage divided by the voltage programming current of the slave supply ( $1/K_p$  where  $K_p$  is the resistance programming coefficient for constant voltage operation). The

voltage programming current of the model 6205C is 1/200 ohms per volt, or 5 milliamps.

3-34 Auto-Parallel. The strapping patterns for Auto-Parallel operation of two and three power supplies are shown in Figure 3-9. Auto-Parallel operation permits equal current sharing under all load conditions, and allows complete control of the output current from one master power supply. The output current of each slave will be approximately equal to the master's regardless of the load conditions. Because the output current controls of each slave are operative, they should be set to maximum to avoid having the slave revert to constant current operation; this would occur if the master output current setting exceeded the slave's. In Model 6205C, it is necessary to make internal connections in order to operate the supply in this mode. The internal connections, specified in Figure 3-9, are made to the sampling terminals of the current sampling resistor, R54 (see Figure 5-2).

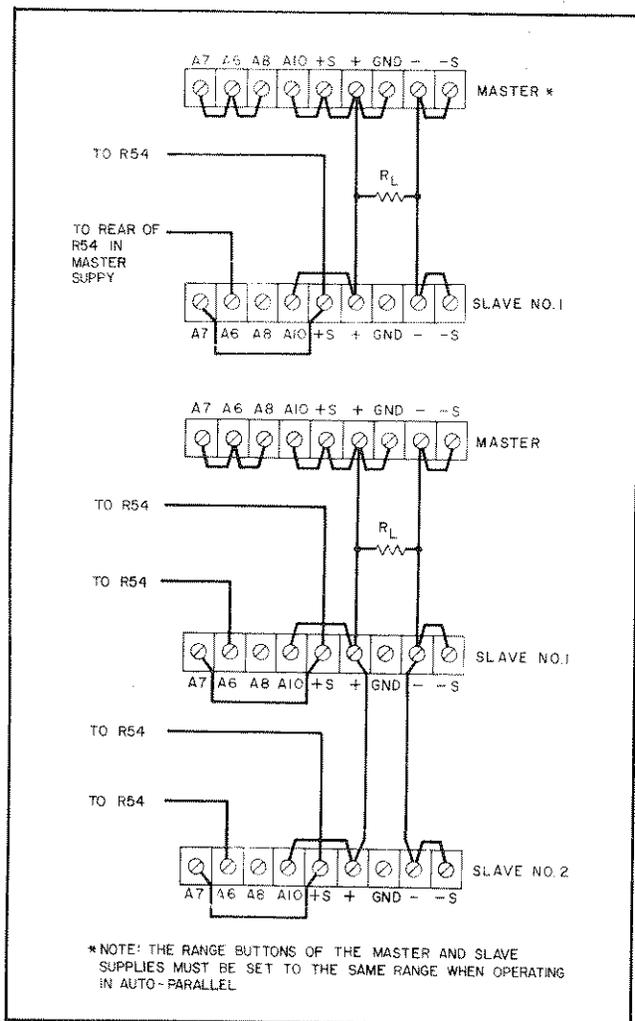


Figure 3-9. Auto-Parallel, Two and Three Units

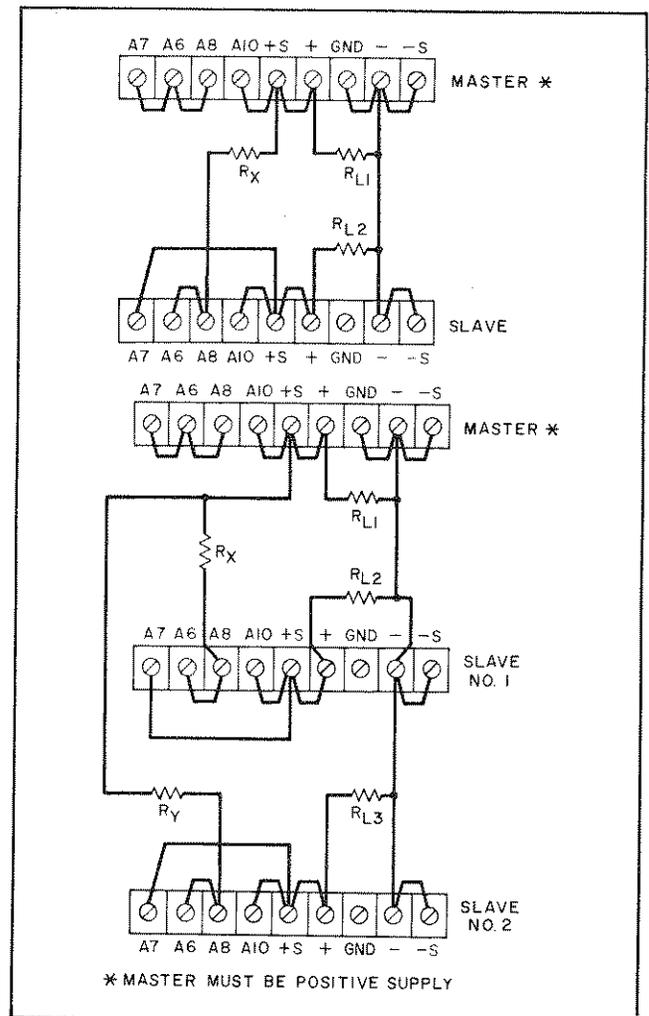


Figure 3-10. Auto-Tracking, Two and Three Units

**3-35 AUTO-TRACKING OPERATION (See Figure 3-10)**

3-36 The Auto-Tracking configuration is used when it is necessary that several different voltages referred to a common bus, vary in proportion to the setting of a particular instrument (the control or master). A fraction of the master's output voltage is fed to the comparison amplifier of the slave supply, thus controlling the slave's output. The master must have the largest output voltage of any power supply in the group (must be the most positive supply in the example shown on Figure 3-10).

3-37 The output voltage of the slave is a percentage of the master's output voltage, and is determined by the voltage divider consisting of  $R_X$  (or  $R_X$  and  $R_Y$ ) and the voltage control of the slave supply,  $R_P$ , where:

$$E_S = \frac{E_{MRP}}{R_X + R_P}$$

Turn-on and turn-off of the power supplies is controlled by the master. Remote sensing and programming can be used; although the strapping patterns for these modes show only local sensing and programming. In order to maintain the temperature coefficient and stability specifications of the power supply, the external resistors should be stable, low noise, low temperature (less than 30ppm per °C) resistors.

**3-38 SPECIAL OPERATING CONSIDERATIONS****3-39 PULSE LOADING**

3-40 The power supply will automatically cross over from constant voltage to constant current operation in response to an increase (over the preset limit) in the output current. Although the preset limit may be set higher than the average output current high peak currents (as occur in pulse loading) may exceed the preset current limit and cause crossover to occur. If this crossover limiting is

not desired, set the preset limit for the peak requirement and not the average.

**3-41 OUTPUT CAPACITANCE**

3-42 An internal capacitor, across the output terminals of the power supply, helps to supply high-current pulses of short duration during constant voltage operation. Any capacitance added externally will improve the pulse current capability, but will decrease the safety provided by the current limiting circuit. A high-current pulse may damage load components before the average output current is large enough to cause the current limiting circuit to operate.

**3-43 REVERSE VOLTAGE LOADING**

3-44 A diode is connected across the output terminals. Under normal operating conditions, the diode is reverse biased (anode connected to negative terminal). If a reverse voltage is applied to the output terminals (positive voltage applied to negative terminal), the diode will conduct, shunting current across the output terminals and limiting the voltage to the forward voltage drop of the diode. This diode protects the series transistors and the output electrolytic capacitors.

**3-45 REVERSE CURRENT LOADING**

3-46 Active loads connected to the power supply may actually deliver a reverse current to the power supply during a portion of its operating cycle. An external source cannot be allowed to pump current into the supply without loss of regulation and possible damage to the output capacitor. To avoid these effects, it is necessary to preload the supply with a dummy load resistor so that the power supply delivers current through the entire operating cycle of the load device.