TM 11-6625-2965-14&P

TECHNICAL MANUAL

OPERATOR'S ORGANIZATIONAL
DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE MANUAL
[INCLUDING REPAIR PARTS
AND SPECIAL TOOLS LISTS]

POWER SUPPLY PP-7548/U
(HEWLETT-PACKARD MODEL 6205B]
[NSN 6625-00-437-4861]

HEADQUARTERS, DEPARTMENT OF THE ARMY
25 FEBRUARY 1980

WARNING

HIGH VOLTAGE is used during the performance of maintenance as instructed in this manual. DEATH ON CONTACT may result if personnel fail to observe safety precautions.

DO NOT ATTEMPT to make internal connections or perform adjustments unless another person, capable of performing first aid, is present.

For electric shock protection, use only extension cord and power receptacles with a safety-ground connector, or otherwise connect the chassis to a safety ground.

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

All Hewlett-Packard products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period. No other warranty is expressed or implied. We are not liable for consequential damages.

TECHNICAL MANUAL

No. 11-6625-2965-14&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *25 February 1980*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS)

POWER SUPPLY PP-7548/U (HEWLETT-PACKARD MODEL) (NSN 6625-00-437-4861)

REPORTING OF ERRORS

YOU can improve this manual by recommending improvements using DA Form 2028-2 located in the back of the manual. Simply tear out the self-addressed form, fill it out as shown on the sample, fold it where shown, and drop it in the mail.

If there are no blank DA Forms 2028-2 in the back of your manual, use the standard DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to the Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703.

In either case a reply will be furnished direct to you.

This manual is an authentication of the manufacturer's commercial literature which, through usage, has been found to cover the data required to operate and maintain this equipment. Since the manual was not prepared in accordance with military specifications, the format has not been structured to consider levels of maintenance.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

SECTION O
INSTRUCTIONS

0-1. SCOPE

This manual applies directly to Power Supply PP-7548/U (Hewlett-Packard Model 6205) having serial prefix number 7L2301 and up. For serial prefixes below 7L2301 refer to Appendix E. For serials above 7L4450 check for inclusion of change page.

0-2. INDEXES OF PUBLICATIONS

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWOs) pertaining to the equipment.

0-3. MAINTENANCE FORMS, RECORDS AND REPORTS

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those described by TM 38-750, The Army Maintenance Management System,

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/ NAVSUPINST 4030.29/AFR 71-12/MCO P4030.29A, and DLAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

0-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS(EIR)

If your Power Supply PP-7548/U (HP-6205) needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don’t like about your equipment. Let us know why you don’t like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications and Electronics Materiel Readiness Command and Fort Monmouth, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey 07703. We'll send you a reply.

0-5. ADMINISTRATIVE STORAGE

Administrative storage of equipment issued to and used by Army activities shall be in accordance with paragraph 2-5.

0-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

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.

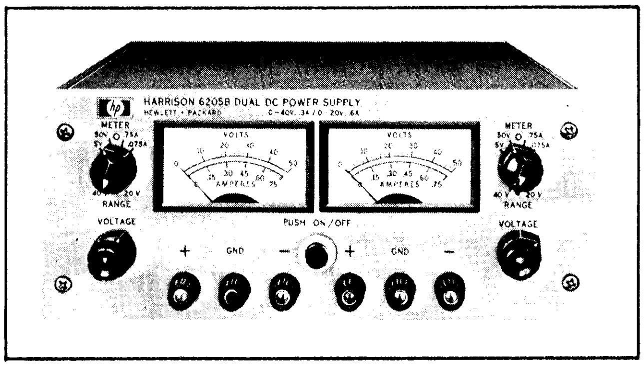


Figure 1-1. DC Power Supply, Model 6205B

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 switch 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.

Option No.	Description
07	Voltage 10-Turn Pot: A single control that replaces both coarse and fine voltage controls and improves output nettability.
11	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 10µsec 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.

13 Three Digit Graduated Decadial Voltage Control: Control that replaces coarse and fine voltage controls permitting accurate resettability.

28 230Vac Input: Supply as normally shipped is wired for l15Vac input. Option 28 consists of reconnecting the input transformer for 230Vac operation.

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).

hp Part No.	Description
C05	8” Black Handle that can be attached to side of supply.
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 three-part serial number tag. The first part is the power supply model number. The second part is the serial number prefix, which consists of a number-letter combination that denotes the date of a significant design change. The number designates the year, and the letter A through L designates the month, January through December respectively, with “I” omitted. The third part is the power supply serial number.

1-14 If the serial number prefix on your power supply does not agree with the prefix on the title page of this manual, change sheets are included to update the manual. Where applicable, backdating information is given in an appendix at the rear of the manual.

1-15 ORDERING ADDITIONAL MANUALS

1-16 One manual is shipped with each power supply, Additional manuals may be purchased from your local Hewlett-Packard field office (see list at rear of this manual for addresses). Specify the model number, serial number prefix, and hp Part number provided on the title page.

Table 1-1. Specifications

INPUT:
l15Vac ±10%, single phase, 48-440 Hz.

OUTPUT:
Two independent outputs, each of which can be set at either 0-40 Volts @ 0.3 Amp or 0-20 Volts @ 0.6 Amp.

LOAD REGULATION:
Less than 0,01% plus 4mV for a full load to no load change in output current.

LINE REGULATION:
Less than 0.01% plus 4mV for any line voltage change within the input rating.

RIPPLE AND NOISE:
Less than 200µVrms 1mV p-p,

TEMPERATURE RANGES:
operating: 0 to 50°C. Storage: -40 to + 75°C.

TEMPERATURE COEFFICIENT:
Less than 0.02% plus lmV per degree Centigrade.

STABILITY.
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.

INTERNAL IMPEDANCE AS A CONSTANT VOLTAGE SOURCE:
Less than 0.02 ohms from dc to lkHz.
Less than 0.5 ohms from lkHz to 1OOkHz.
Less than 3.0 ohms from 1OOkHz to lMHz.

TRANSIENT RECOVERY TIME:
Less than 50µsec for output recovery to within 10mV following a full load current change in the output.

OVERLOAD PROTECTION:
A fixed current limiting circuit protects the power supply for all overloads including a direct short placed across the terminals in constant voltage operation.

METERS:
Each front panel meter can be used as either a 0-50 or 0-5 Volt voltmeter or as a 0-0.75 or 0.075 Amp ammeter.

OUTPUT CONTROLS:
RANGE switches select desired operating mode for each section and coarse and fine VOLTAGE controls set desired output voltages.

OUTPUT TERMINALS:
Six “five-way” output posts (three for each section of supply) are provided on the front panel and two output terminal strips (one per section) are located on the rear of the chassis. A1l 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 termina1 strips.

ERROR SENSING:
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 termina1 strips for remote sensing.

REMOTE RESISTANCE PROGRAMMING:
200 ohms per Volt.

REMOTE VOLTAGE PROGRAM MING:
1 Volt per Volt.

COOLING:
Convection cooling is employed. The supply has no moving parts.

SIZE:
3~½" H x 12-5/8" D x 8½" W. Two of the units can be mounted side by side in a standard 19” relay rack.

WEIGHT:
10 lbs, net, 13 lbs. shipping.

FINISH:
Light gray front panel with dark gray case.

POWER CORD:
A three-wire, five-foot power cord is provided with each unit.

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 V includes an " in-cabinet" 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 show how both types of installations are accomplished.

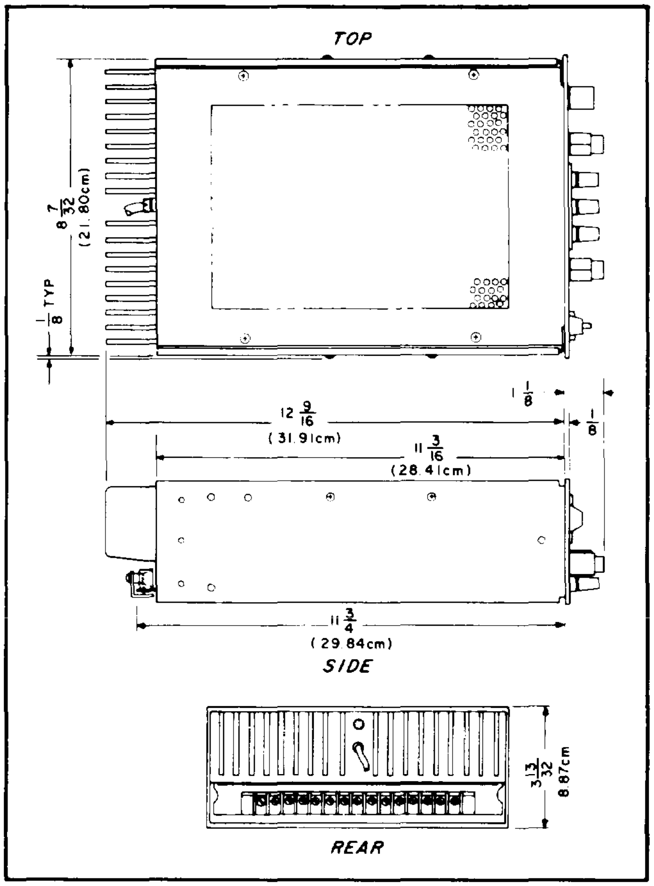


Figure 2-1. Outline Diagram

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

a. Remove the four screws from the front panels of both units.

b. Slide rack mounting ears between the front panel and case of each unit.

c. Slide combining strip between the front panels and cases of the two units.

d. 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

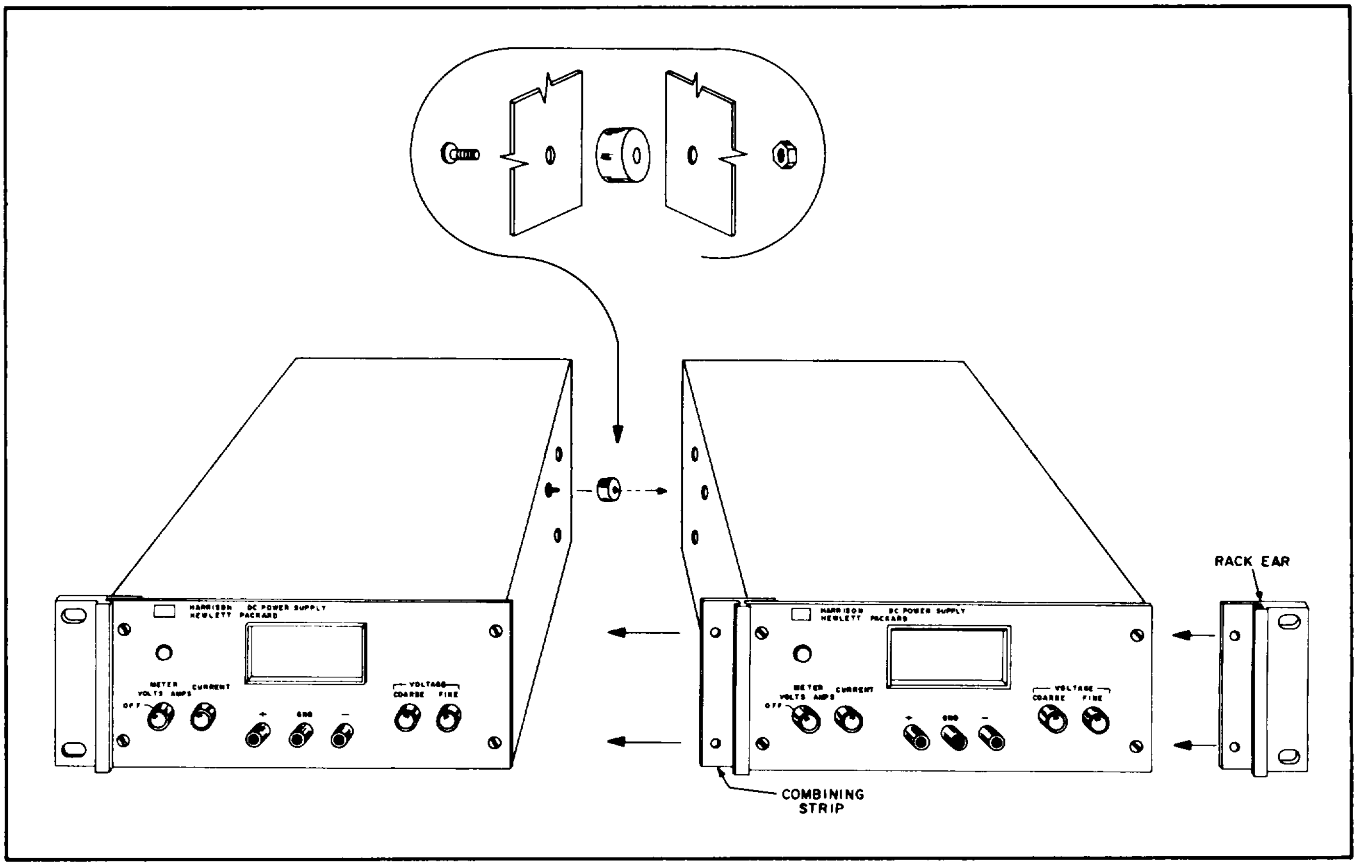


Figure 2-2. Rack Mounting, Two Units

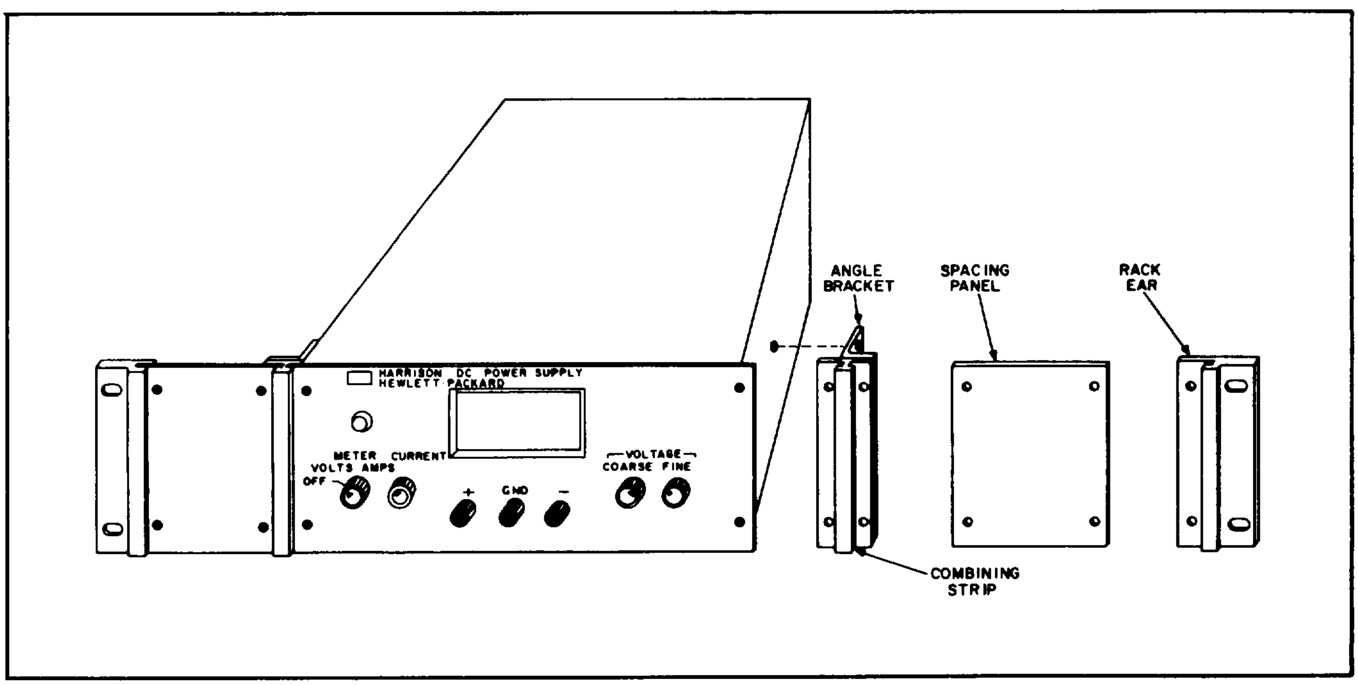


Figure 2-3. Rack Mounting, One Unit

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. Break the copper between 54 and 55 and also between 50 and 51 on the printed circuit board. The se are shown in Figure 2-4, and are labeled on copper side of printed circuit board.

c. Add strap between 50 and 55.

d. Replace existing fuse with 1 Ampere, 230 Volt 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 the

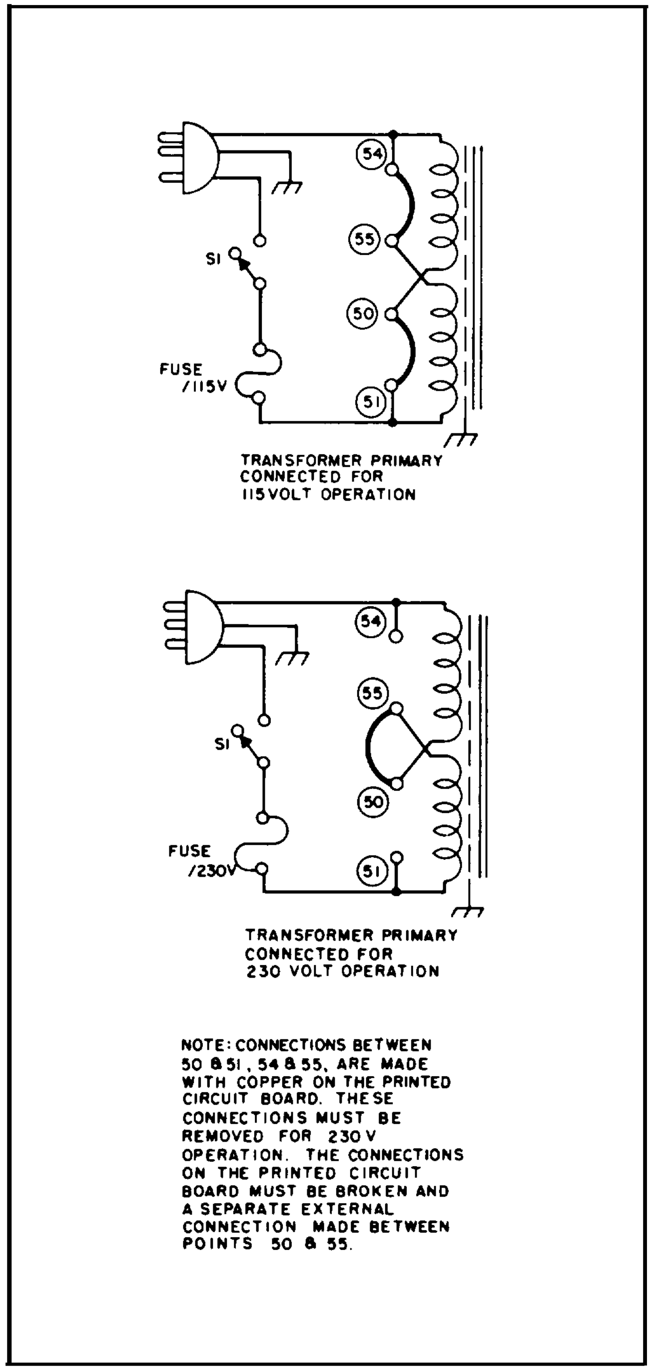


Figure 2-4. Primary Connections

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

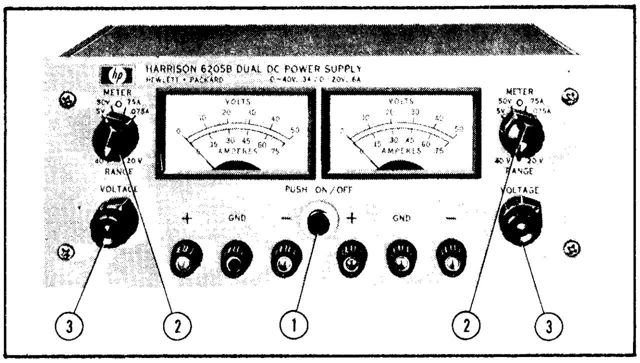


Figure 3-1. Front Panel Controls and Indicators

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

A. Push ON/OFF button ① and observe that button lights,

B. Set range switch ② to desired operating mode and meter switch to desired voltage range.

C. Adjust coarse and fine voltage controls ③ until desired output voltage is indicated on meter.

D. Set meter switch to highest current range and short circuit output terminals.

E. Observe short circuit output current on meter.

F. Remove short and connect load to output terminals (front or rear),

G. For Model 6205B, 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 operational 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).

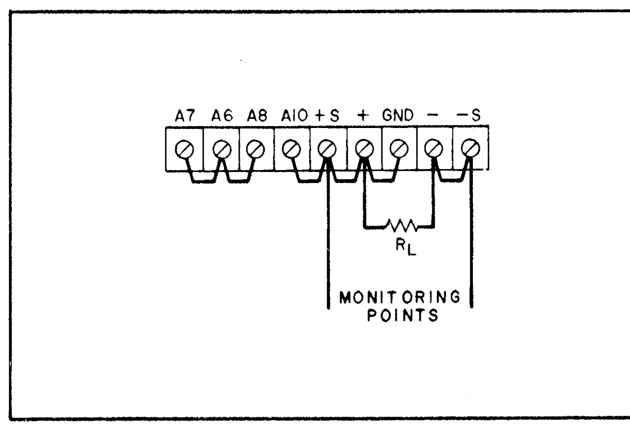


Figure 3-2. Norma 1 Strapping Pattern

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 (Rx) can be determined by using the following equation

$$R_x = \frac{1.75}{I_E}$$

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 10OmA) the current limit crossover point.

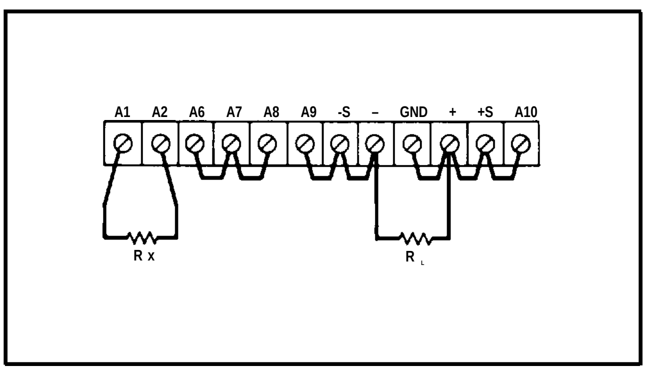


Figure 3-3. Current Limit Alteration

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 termina1s. 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 nomina1 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 6205B or 300 ohms per Volt for Model 6206 B). 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 changing resistor R13 as outlined in Section V.

3-20 The output voltage of the power supply should be zero Volts ± 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.

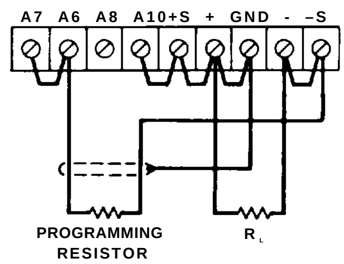


Figure 3-4. Remote Resistance Programming

3-21 To maintain the stability and temperature coefficient of the power supply, u se 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 microampere.

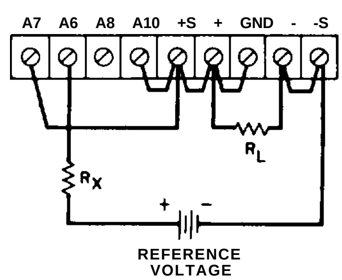


Figure 3-5. Remote Voltage Programming

3-23 The impedance (Rx) 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 hp 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.

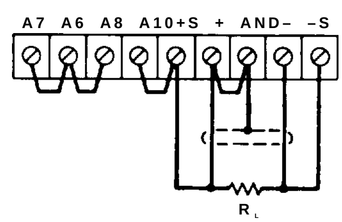


Figure 3-6. Remote Sensing

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 subtracts 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 hp 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 voltages 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

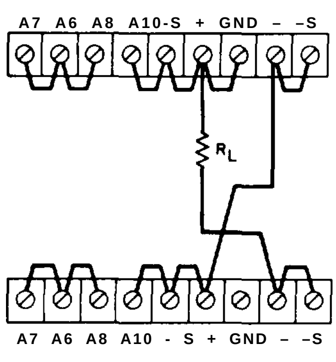


Figure 3-7. Normal Series Connections

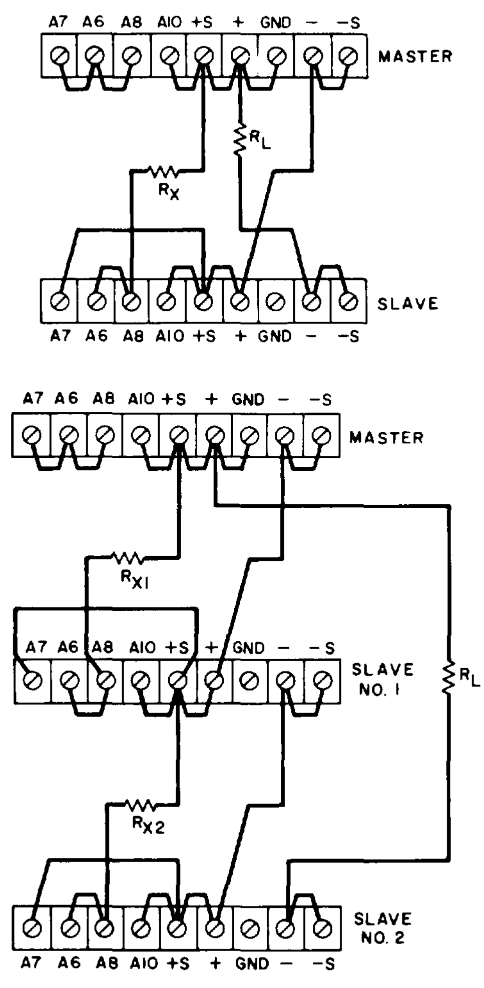


Figure 3-8, Auto-Series, Two and Three Units

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 (Rx) 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 Rx is this voltage divided by the voltage programming current of the slave supply (l/Kp where Kp is the voltage programming coefficient). The voltage contribution of the slave is determined by its voltage control setting.

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 6205B, 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 terminals of the current sampling resistor, R54 (see Figure 5-2).

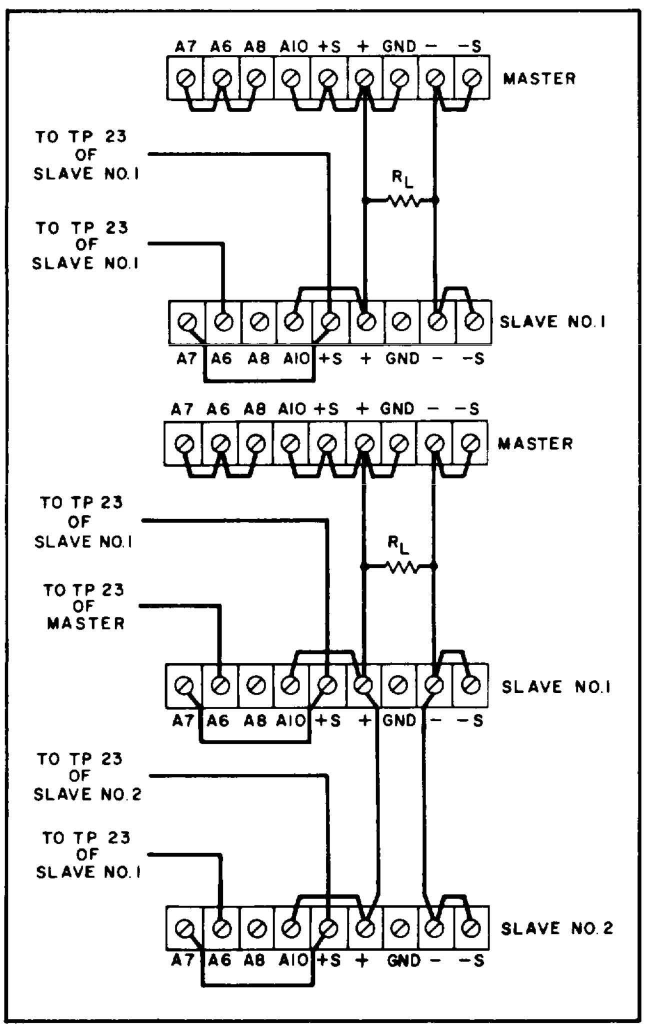


Figure 3-9. Auto-Parallel, Two and Three Units

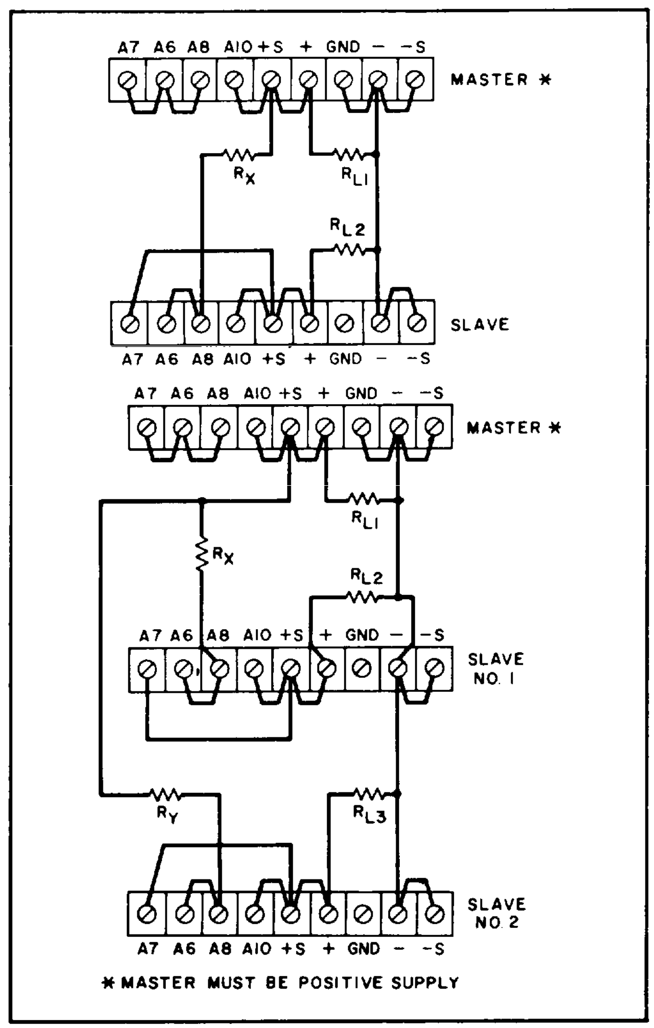


Figure 3-10. Auto-Tracking, Two and Three Units

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:

$$E_S = \frac{E_M R_P}{R_x + R_p}$$

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, acress 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.

SECTION IV
PRINCIPLES OF OPERATION

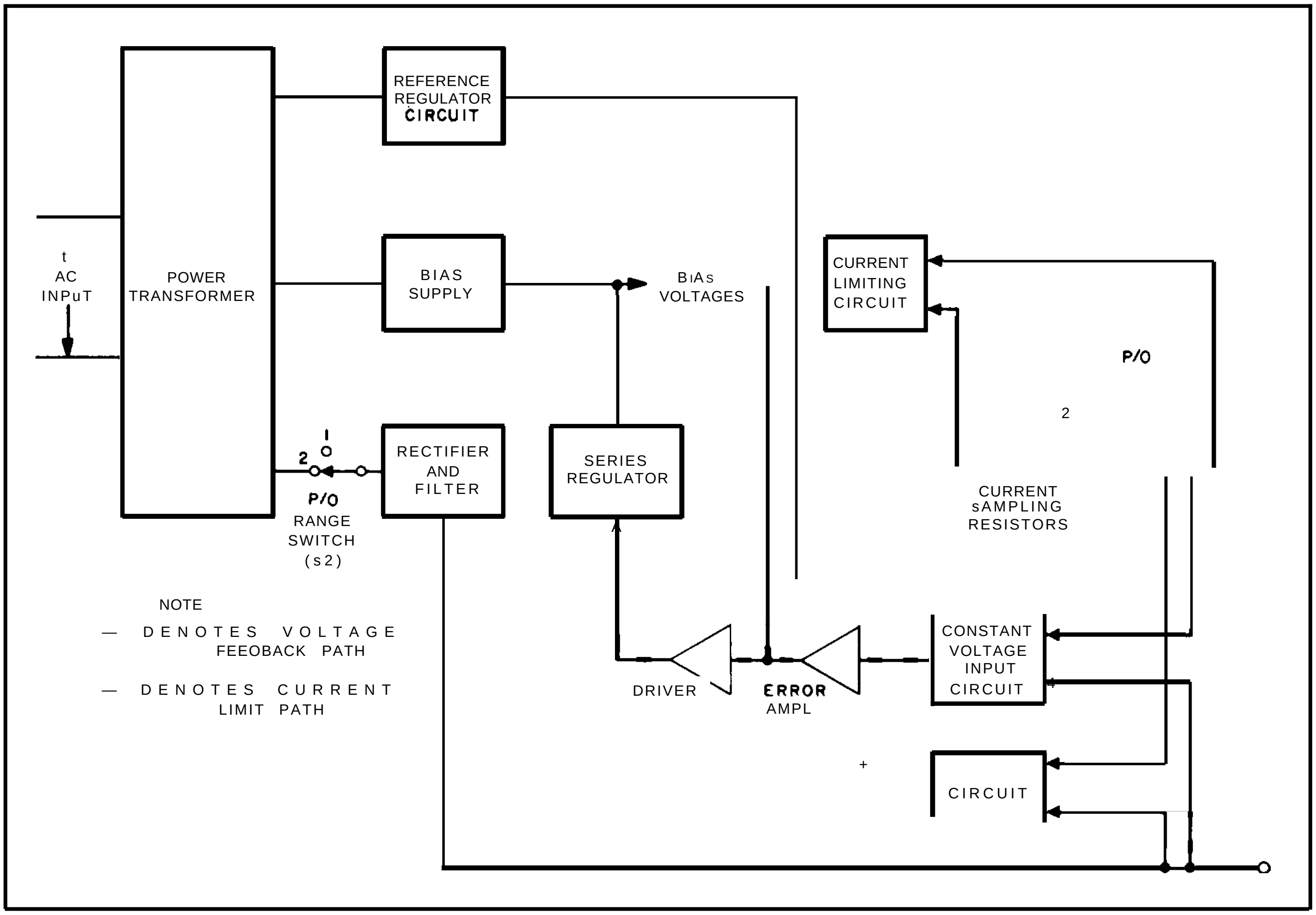


Figure 4-1. Overall Block Diagram

4-1 OVERALL DESCRIPTION

4-2 Figure 4-1 shows one section of the Model 6205B dual power supply. The supply consists of two dual range sections; each identical to the other. Each section consists ofa rectifier and filter, a series regulator, an error amplifier and driver, a constant voltage input circuit, a current limiting circuit, a reference regulator circuit, a bias supply, and a metering circuit. Since both sections of the supply are identical, only one section is described below.

4-3 The ac line voltage is first applied to the power transformer, The tap for the appropriate voltage range is selected by S2. The input is then rectified and filtered. This raw dc is then fed to the series regulator which alters its conduction to obtain the proper regulated dc output voltage.

4-4 Any changes in output voltage are felt by the constant voltage comparator which compares a portion of the output with a fixed reference volts ge. If a difference exists, the comparator circuit sends a n error signal to the series regulator via the error amplifier and driver stages. This error signal changes the conduction of the series regulator so that a constant output voltage is maintained.

4-5 Changes in output current are reflected in the voltage drop across the current sampling resistor network. If this voltage drop exceeds a preset limit, the current limit transistor conducts, sending a turn-down signal to the series regulator via the driver. This signal changes the conduction of the series regulator so that the output current is limited to the proper value.

4-6 The reference circuit provides stable reference voltages used in the constant voltage comparator and current limit circuits. The bias circuit provides the less critical bias voltages used in the supply.

4-7 The meter circuit provides a continuous indication of output voltage or current in both ranges.

4-8 DETAILED CIRCUIT ANALYSIS

4-9 FEEDBACK LOOP

4-10 The feedback loop functions continuously to keep the output voltage constant during normal operation of the supply. For purposes of this discussion, assume that the output voltage instantaneously rises (goes positive) due to a variation in the external load circuit. Note that the change may be in the form of a slow rise in the output voltage or a positive going ac signal. An ac signal is coupled to summing point A6 through capacitor Cl and a dc voltage is coupled to A6 through R 10.

4-11 The rise in output voltage causes the voltage at A6 and thus the base of Q1A to decrease (go negative). Q1A now decreases its conduction and its collector voltage rises. The positive going error voltage is amplified and inverted by Q3 and fed to the base of the series transistor(s) via emitter follower Q4. The negative going input causes the series transistor(s) to decrease its conduction so that it drops more of the line voltage, reducing the output voltage to its original level.

4-12 If the external load resistance decreases to a certain crossover point, the supply will operate in the current limiting mode. In the current limit mode, Q1O conducts sending a negative going, turn-down signal to the series regulator via driver Q4 .

4-13 SERIES REGULATOR

4-14 The series regulator consists of transistor stage Q7 (and Q6 on Model 6206 B). The regulator serves as a series control element by altering its conduction so that the output voltage is kept constant and the current limit is never exceeded, The conduction of the transistor(s) is controlled by the feedback voltage obtained from driver Q4. Diode CR11, connected across the regulator circuit, protects the series transistor(s) against reverse voltages that could develop across it during parallel or auto-parallel operation if one supply is turned on before the other.

4-15 CONSTANT VOLTAGE COMPARATOR

4-16 The circuit consists of the coarse and fine programming resistors (Rl0A and R 10 B), and a differential amplifier stage (Ql and associated components). Transistor Q1 consists of two transistors housed in a single package. The transistors have matched characteristics minimizing differential voltages due to mismatched stages. Moreover, drift due to thermal differentials is minimized, since both transistors operate at essentially the same temperature.

4-17 The constant voltage comparator continuously compares a fixed reference voltage with a portion of the output voltage and, if a difference exists, produces an error voltage whose amplitude and phase is proportional to the difference. The error output is fed back to the series regulator, through the (mixer) error and driver amplifiers. The error voltage changes the conduction of the series regulator which, in turn, alters the output voltage so that the difference between the two input voltages applied to the differential amplifier is reduced to zero. The above action maintains the output voltage constant.

4-18 Stage Q1B of the differential amplifier is connected to a common (+S) potential through impedance equalizing resistor R5. Resistors R6 and R8 are used to zero bias the input stage, offsetting minor base-to-emitter voltage differences in Q1. The base of Q1A is connected to a summing point at the junction of the programming resistors and the current pullout resistors, R12 and R13. Instantaneous changes in output voltage result in an increase or decrease in the summing point potential. Q1A is made to conduct more or less, in accordance with summing point voltage change. The resultant output error voltage is fed back to the series regulator via the remaining components of the feedback loop. Resistor Rl, in series with the base Q1A, limits the current through the programming resistors during rapid voltage turn-down. Diodes CR1 and CR2 form a limiting network which prevent excessive voltage excursions from over driving stage Q1A. Capacitor Cl, shunting the programming resistors, increases the high frequency gain of the input amplifier. Resistor R1 3, shunting pullout resistor R12, is factory selected so that all of the + 6.2 Volt reference is dropped across R12 and R13. Linear constant voltage programming is assured with a constant current flowing through R1O. C20 stabilizes the feedback loop and may be removed to avoid current surges and increase the programming speed.

4-19 ERROR AMPLIFIER AND DRIVER

4-20 The error and driver amplifiers amplify the error signal from the constant voltage comparator circuit to a leve1 sufficient to drive the series regulator transistor(s). Driver Q4 also receives a current limiting input if Q10, the current limiting transistor, conducts.

4-21 Stage Q3 contains a feedback equalizer network, C5 and R30, which provides for high frequency roll off in the loop gain in order to stabilize the feedback loop. Q17 establishes a stable emitter bias potential for error amplifier Q3. Emitter follower transistor(s) Q4 (and Q5) serves as the driver (and predriver) element for the series regulator.

4-22 CURRENT LIMIT CIRCUIT

4-23 The current limit circuit limits the output current to a preset value determined by the setting of R81. Switch S2B selects the proper sampling resistance to maintain an equal voltage drop acress the current sampling network in both ranges.

4-24 When S2 is set to the 20 Volt position, R54 and R55 are connected in parallel. When S2 is set to the 40 Volt position, the current sampling network consists solely of R54. Note that in the twenty Volt range, twice as much current can be delivered as in the forty Volt range. Since the twenty Volt range has a sampling resistance equal to half the value of that for the forty Volt range, an equal sampling resistor voltage drop is obtained in both ranges. This also applies to S2 in the 6206B.

4-25 R81 sets the bias of Q10, and thus, the threshold point at which Q10 conducts and current limiting begins. If this threshold is exceeded, Q10 begins to conduct, forward biasing CR16 and sending a turn-down signal to the series regulater via the driver. If the current through the current sampling network decreases below the threshold point, Q10 turns off and no longer affects the operation of the supply.

4-26 REFERENCE CIRCUIT

4-27 The reference circuit (see schematic) is a feedback power supply similar to the main supply. It provides stable reference voltages which are used throughout the unit. The reference voltages are a 11 derived from smoothed dc obtained from the full wave rectifier (CR22 and CR23) and filter capacitor C10. The +6.2 and -6.2 voltages, which are used in the constant voltage input circuit for comparison purposes, are developed across temperature compensated Zener diodes VR1 and VR2. Resistor R43 limits the current through the Zener diodes to establish an optimum bias level.

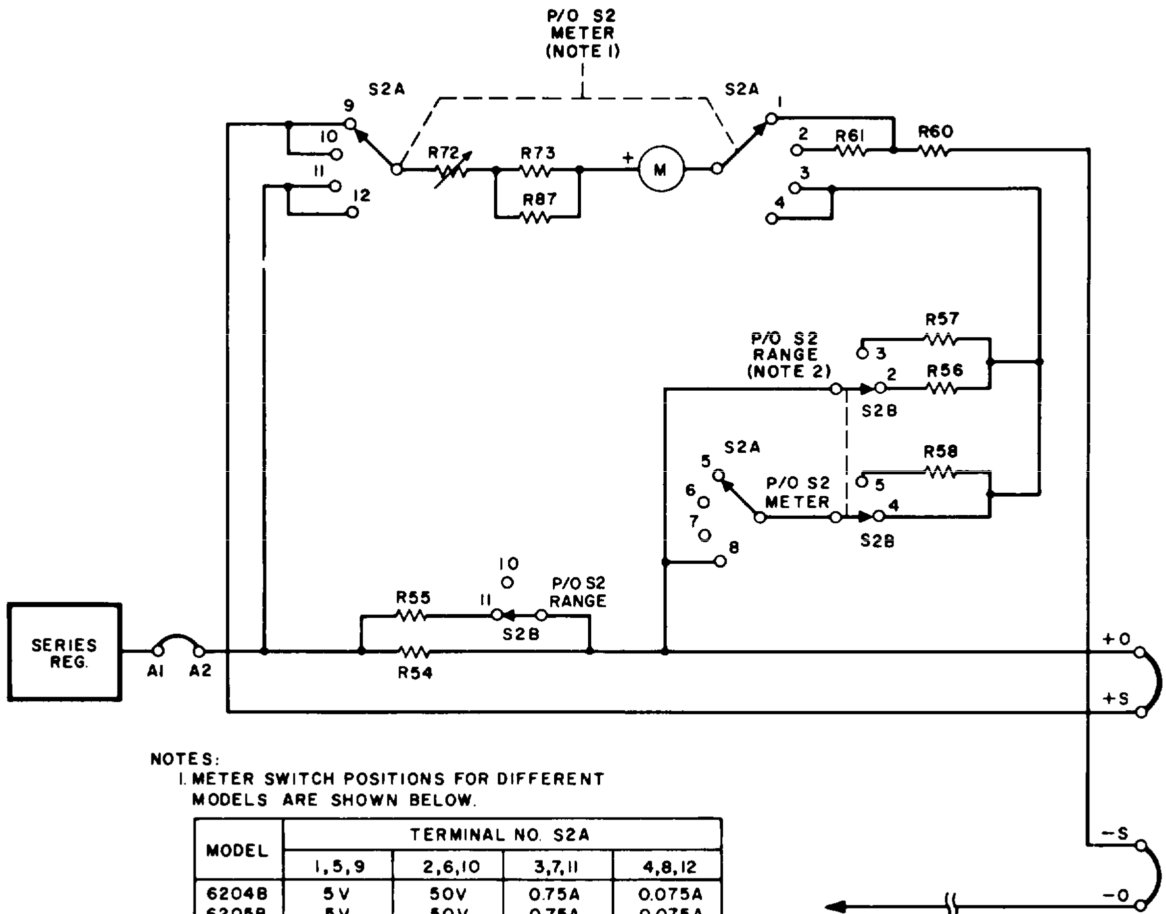
4-28 The reference circuit consists of series regulating transistor Q9 and error amplifier Q8. Output voltage changes are detected by Q8 whose base is connected to the junction of a voltage divider (R41, R42) connected directly across the supply. Any error signals are amplified and inverted by Q8 and applied to the base of series transistor Q9. The series element then alters its conduction in the direction, and by the amount, necessary to maintain the voltage across VR1 and VR2 constant. Resistor R46, the emitter resistor for Q8, is connected in a manner which minimizes changes in the reference voltage caused by variations in the input line. Output capacitor C9 stabilizes the regulator loop.

4-29 METER CIRCUIT (Figure 4-2)

4-30 The meter circuit provides continuous indications of output voltage or current on a single multiple range meter. The meter can be used either as a voltmeter or an ammeter depending upon the position of the METER section of switch S2 on the front panel of the supply. This switch also selects one of two meter ranges on each scale. The meter circuit consists **of** METER-RANGE switch S2, various multiplying resistors and the meter movement.

4-31 When measuring voltage, the meter is placed directly across the output of the supply between the +S and -S terminals. With the METER section of S2A in the higher voltage position (terminals A2 and A10) multiplying resistors R60, R61, R72, and the parallel combination of R73 and R87, are in series with the meter. For low output voltages, the METER switch S2A can be set to the first position (terminals 1 and 9) which removes R61 from its series position allowing a larger percentage of the output voltage to be felt acress the meter.

4-32 When measuring current; the meter circuit is connected across the current sampling resistor network as shown on Figure 4-2 and indicates the output current that flows through the network. The RANGE section S2B connects the appropriate resistance in series with the meter so that its maximum deflection range is full-scale in the high current (low voltage) operating mode and half-scale in the low current (high voltage) operating mode. This circuit obviates the need for a dual current scale which would be necessary since the voltages dropped across the current sampling network in both operating modes are equal for proportional currents.



NOTES:

1. METER SWITCH POSITIONS FOR DIFFERENT MODELS ARE SHOWN BELOW.

MODEL	TERMINAL NO. S2A			
	1,5,9	2,6,10	3,7,11	4,8,12
6204B	5V	50V	0.75A	0.075A
6205B	5V	50V	0.75A	0.075A
6206B	7V	70V	1.20A	0.120A

2. RANGE SWITCH POSITIONS FOR DIFFERENT MODELS ARE SHOWN BELOW.

MODEL	TERMINAL NO. S2B	
	2,4,11	3,5,10
6204B	20V	40V
6205B	20V	40V
6206B	30V	60V

Figure 4-2. Multiple Range Meter Circuit, Simplified Schematic

SECTION V
MAINTENANCE

5-1 INTRODUCTION

5-2 Upon receipt of the power supply, the performance check (Paragraph 5-10) should be made. This check is suitable for incoming inspection. If a fault is detected in the power supply while making the performance check or during normal operation, proceed to the troubleshooting procedures (Paragraph 5-48). After troubleshooting and repair (Paragraph 5-58), perform any necessary adjustments and calibrations (Paragraph 5-60). Before returning the power supply to normal operation, repeat the performance check to ensure that the fault has been properly corrected and that no other faults exist. Before doing any maintenance checks, turn-on power supply, allow a ha if-hour warm-up, and read the general information regarding measurement techniques (Paragraph 5-3).

5-3 GENERAL MEASUREMENT TECHNIQUES

5-4 The measuring device must be connected across the sensing leads of the supply or as close to the output terminals as possible when measuring the output impedance, transient response, regulation, or ripple of the power supply in order to achieve valid measurements. A measurement made acress the load includes the impedance of the leads to the load and such lead lengths can easily have an impedance several orders of magnitude greater than the supply impedance, thus invalidating the measurement.

5-5 The monitoring device should be connected to the +S and -S terminals (see Figure 3-2) or as shown in Figure 5-1. The performance characteristics should never be measured on the front terminals if the load is connected across the rear terminals. Note that when measurements are made at the front terminals, the monitoring leads are connected at A, not B, as shown in Figure 5-1. Failure to connect the measuring device at A will result in a measurement that includes the resistance of the leads between the output terminals and the point of connection.

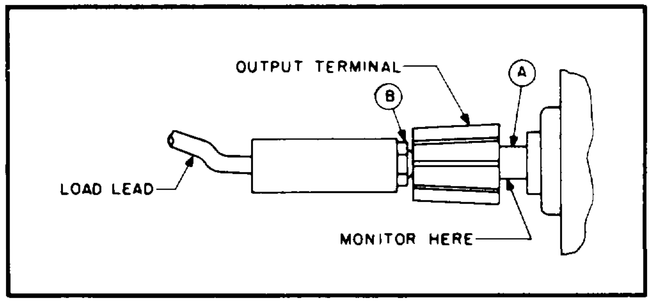


Figure 5-1. Front Pane1 Terminal Connections

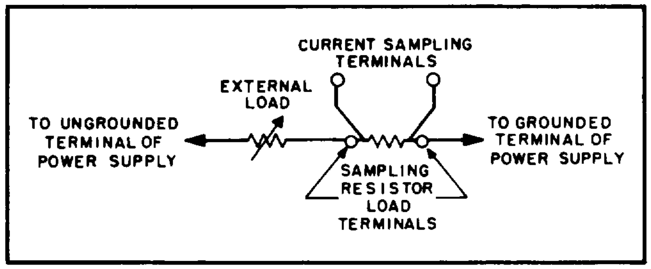


Figure 5-2. Output Current Measurement Technique

5-6 For output current measurements, the current sampling resistor should be a four-terminal resistor. The four terminals are connected as shown in Figure 5-2. In addition, the resistor should be of the low noise, low temperature coefficient (less than 30ppm/°C) type and should be used at no more than 5% of its rated power so that its temperature rise will be minimized.

5-7 When using an oscilloscope, ground one terminal of the power supply and then ground the case of the oscilloscope to this same point. Make certain that the case is not also grounded by some other means (power line). Connect both oscilloscope input leads to the power supply ground terminal and check that the oscilloscope is not exhibiting a ripple or transient due to ground loops, pick-up, or other means.

5-8 TEST EQUIPMENT REQUIRED

5-9 Table 5-1 lists the test equipment required to perform the various procedures described in this Section.

NOTE

A satisfactory substitute for a differential voltmeter is to arrange a reference voltage source and null detector as shown in Figure 5-3. The reference voltage source is adjusted so that the voltage difference between the supply being measured and the reference voltage will have the required resolution for the measurement being made. The voltage difference will be a function of the null detector that is used. Examples of satisfactory null detectors are hp 419A null detector, a dc coupled oscilloscope utilizing differential input, or a 50mV meter movement with a 100 division scale. For the latter, a 2mV change in voltage will result in a meter deflection of four divisions.

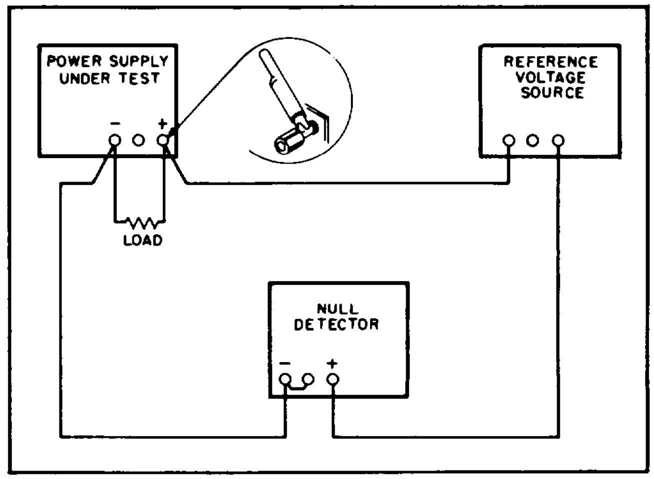


Figure 5-3. Differential Voltmeter Substitute, Test Setup

CAUTION

Care must be exercised when using an electronic null detector in which one input terminal is grounded to avoid ground loops and circulating currents.

Table 5-1. Test Equipment Required

TYPE	REQUIRED CHARACTERISTICS	USE	RECOMMENDED MODEL
Differential Voltmeter	Sensitivity: lmV full scale (min.). Input impedance: 10 megohms (min.).	Measure dc voltages; calibration procedures	hp 3420 (See Note)
Variable Voltage	Range: 90-130 Volts Equipped with voltmeter accurate within 1 Volt.	Vary ac input	
AC Voltmeter	Accuracy: 2%. Sensitivity: lmV full scale deflection (min.).	Measure ac voltage and ripple	hp 403 B
Oscilloscope	Sensitivity: 10µV/cm. Differential input.	Display transient response waveforms	hp 140 A plus 1402A plug in.
Oscillator	Range: 5Hz to 600kHz Accuracy: 2%	Impedance Checks	hp 200 CD
DC Voltmeter	Accuracy: 1%. Input resistance: 20,000 ohms/Volt (min.).	Measure dc voltages	hp 412A
Repetitive Load Switch	Rate: 60-400 Hz, 2µsec rise and fall time.	Measure transient response	See Figure 5-6

Table 5-1. Test Equipment Required (Continued)

TYPE	REQUIRED CHARACTERISTICS	USE	RECOMMENDED MODEL
Resistor	6204B, 6205B; 133Ω, ± 10% 15W 6206B; 120Ω, ±10% 15W	Load Resistor, HIGH range	----
Resistor	Value: 5Ω , 0.5%, 4.5 Watts, 20ppm, 4-Terminal.	Current sampling	R54 or R55, Section VI
Resistor	Value: 6204B and 6205B, 28Ω, 2W (min.). 6206B, 27Ω, 10W (min.).	Load resistor, low range	----
Resister	1KΩ ± 1%, 2 Watt non-inductive	Measure impedance	----
Resistor	100 ohms, ±5%, 10 Watt	Measure impedance	----
Resistor	Value: See Paragraph 5-67. ± 0.1%, 5 Watt	Calibrate programming current	----
Capacitor	500µf, 50WVdc	Measure impedance	----
Decade Resistance Box	Range: 0-150K (min.). Accuracy: 0.1% plus 1 ohm Make-before-break contacts.	Measure programming coefficients	----

5-10 PERFORMANCE TEST

5-11 The following test can be used as an incoming inspection check and appropriate portions of the test can be repeated either to check the operation of the instrument after repairs or for periodic maintenance tests. The tests are performed using a 115Vac 60 Hz, single phase input power source. If the correct result is not obtained for a particular check, do not adjust any controls; proceed to troubleshooting (Paragraph 5-48).

NOTE

For Model 6205B supplies, the following performance checks should be performed twice in order to check both independent sections of the supply.

5-12 CONSTANT VOLTAGE TESTS

5-13 For Constant Voltage measurements, the measuring device must be connected acress the rear sensing terminals of the supply in order to achieve valid indications. A measurement made acress the load includes the impedance of the leads to the load and such lead lengths can easily have an impedance several orders of magnitude greater than the supply impedance (1 milliohm at dc), thus invalidating the measurement.

5-14 To avoid mutual coupling effects, each monitoring device must be-connected directly to the sensing terminals by separate pairs of leads. The load resistor is connected acress the output terminals and must be selected according to the output voltage and current of the supply. When measuring the constant voltage performance specifications, the CURRENT controls should be set well above the maximum output current which the supply will draw, since the onset of constant current action will cause a drop in output voltage, increased ripple, and other performance changes not properly ascribed to the constant voltage operation of the supply.

5-15 Voltage Output and Voltmeter Accuracy. To check the output voltage, proceed as follows:

a. Connect 133 ohm load resistor (120 ohms for Model 6206B) across rear output terminals of supply.

b. Connect differential voltmeter acress +S and -S terminals of supply observing correct polarity.

c. Set METER switch to highest voltage range and RANGE switch to highest voltage mode and turn on supply.

d. Adjust VOLTAGE controls until front panel meter indicates exactly the maximum rated output voltage.

e. Differential voltmeter should indicate maximum rated output voltage within 3%.

5-16 Output Current and Ammeter Accuracy. To check the output current, proceed as follows:

a. Connect test setup shown in Figure 5-4.

b. Set METER switch to lowest current range and RANGE switch to high voltage mode.

c. Turn on supply and adjust VOLTAGE controls until front panel meter indicates exactly 300 mA (0.5 Ampere for Model 6206B supplies).

d. Differential voltmeter should read 1.5 ± 0.045Vdc.

MODEL NO.	RESISTANCE (OHMS)	
	R_X	R_Y
6204B	5	128
6205B	5	128
6206B	5	117

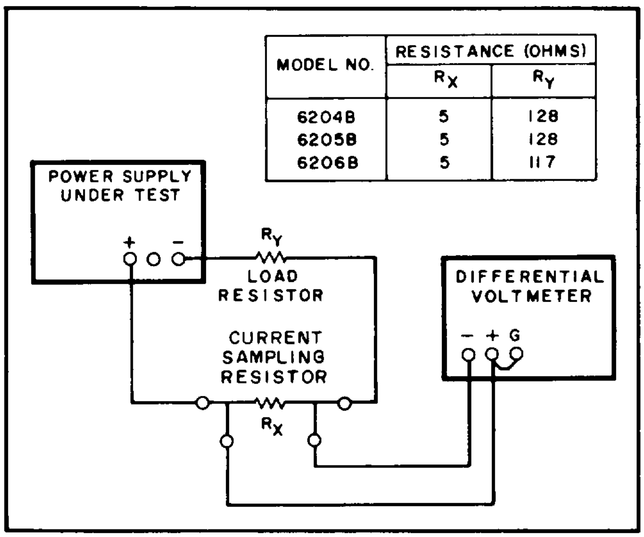


Figure 5-4. Output Current, Test Setup

5-17 Load Regulation.

Definition: The change ΔE_{OUT} in the static value of dc output voltage resulting from a change in load resistance from open circuit to a value which yields maximum rated output current (or vice versa).

5-18 To check the constant voltage load regulation, proceed as follows:

a. Connect test setup as shown in Figure 5-5.

b. Turn CURRENT controls fully clockwise.

c. Turn-on supply and adjust VOLTAGE controls until front panel voltmeter indicates exactly the maximum rated output voltage.

d. Read and record voltage indicated on differential voltmeter.

e. Disconnect load resistors.

f. Reading on differential voltmeter should not vary from reading recorded in Step d by more than 8mVdc for Models 6204B and 6205B or 10mVdc for Model 6206B supply.

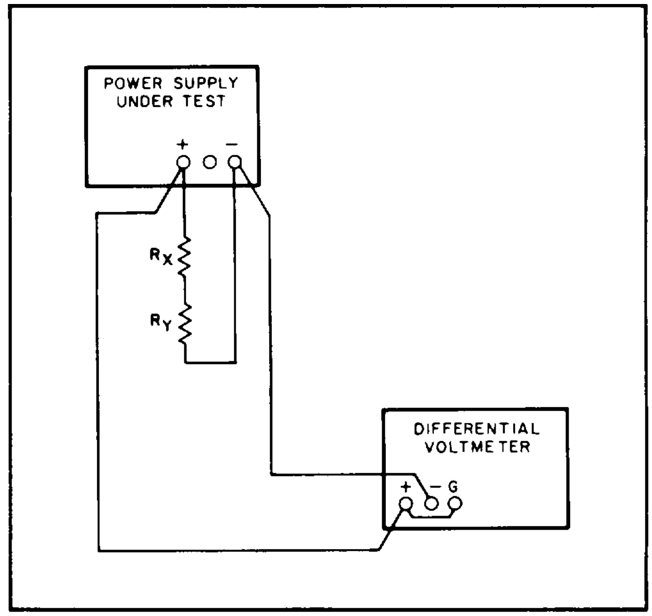


Figure 5-5. Load Regulation, Test Setup

5-19 Line Regulation.

Definition: The change, ΔE_{OUT} in the static value of dc output voltage resulting from a change in ac input voltage over the specified range from low line 10% less than nominal to high line 10% more than nominal or from high line to low line.

5-20 To test the constant voltage line regulation, proceed as follows:

a. Connect variable auto transformer between input power source and power supply power input.

b. Turn CURRENT controls fully clockwise.

c. Connect test setup shown in Figure 5-5.

d. Adjust variable auto transformer for low line (104Vac).

e. Set METER switch to highest current range and turn on supply.

f. Adjust VOLTAGE controls until front panel voltmeter indicates exactly the maximum rated output voltage.

g. Read and record voltage indicated on differential voltmeter.

h. Adjust variable auto transformer for high line (126Vac).

i. Reading on differential voltmeter should not vary from reading recorded in Step g by more than 8mVdc for Models 6204B and 6205B or 10mVdc for Model 6206B.

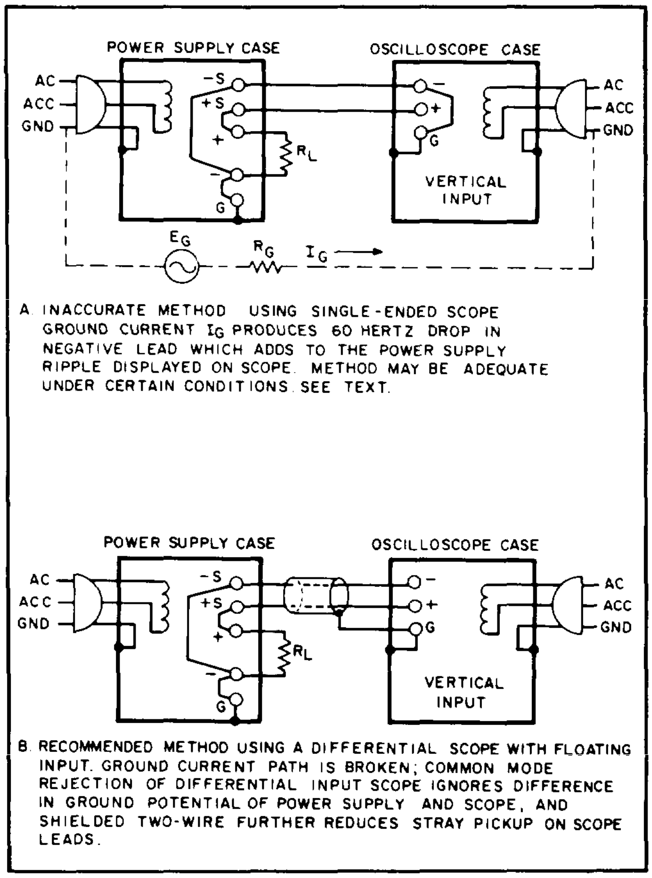
5-21 Ripple and Noise.

Definition: The residual ac voltage which is superimposed on the dc output of a regulated power supply. Ripple and noise may be specified and measured in terms of its RMS or (preferably) peak-to-peak value.

Ripple and noise measurement can be made at any input ac line voltage combined with any dc output voltage and load current within rating.

5-22 The amount of ripple and noise that is present on the power supply output is measured either in terms of the RMS or (preferably) peak-to-peak value. The peak-to-peak measurement is particularly important for applications where noise spikes could be detrimental to a sensitive load, such as logic circuitry. The RMS measurement is not an ideal representation of the noise, since fairly high output noise spikes of short duration could be present in the ripple and not appreciably increase the RMS value.

5-23 The technique used to measure high frequency noise or " spikes" on the output of a power supply is more critical than the low frequency ripple and noise measurement technique; therefore the former is discussed separately in Paragraph 5-31,



A. INACCURATE METHOD USING SINGLE-ENDED SCOPE GROUND CURRENT I_G PRODUCES 60 HERTZ DROP IN NEGATIVE LEAD WHICH ADDS TO THE POWER SUPPLY RIPPLE DISPLAYED ON SCOPE. METHOD MAY BE ADEQUATE UNDER CERTAIN CONDITIONS. SEE TEXT.

B. RECOMMENDED METHOD USING A DIFFERENTIAL SCOPE WITH FLOATING INPUT. GROUND CURRENT PATH IS BROKEN; COMMON MODE REJECTION OF DIFFERENTIAL INPUT SCOPE IGNORES DIFFERENCE IN GROUND POTENTIAL OF POWER SUPPLY AND SCOPE, AND SHIELDED TWO-WIRE FURTHER REDUCES STRAY PICKUP ON SCOPE LEADS.

Figure 5-6. CV Ripple and Noise, Test Setup

5-24 Ripple and Noise Measurements. Figure 5-6A shows an incorrect method of measuring p-p ripple. Note that a continuous ground loop exists from the third wire of the input power cord of the supply to the third wire of the input power cord of the oscilloscope via the grounded power supply case, the wire between the negative output terminal of the power supply and the vertical input of the scope, and the grounded scope case. Any ground current circulating in this loop as a result of the difference in potential E_G between the two ground points causes an IR drop which is in series with the scope input. This IR drop, normally having a 60HZ line frequency fundamental, plus any pickup on the unshielded leads interconnecting the power supply and scope, appears on the face of the CRT. The magnitude of this resulting noise signal can easily be much greater than the true ripple developed between the plus and minus output terminals of the power supply, and can completely invalidate the measurement.

5-25 The same ground current and pickup problems can exist if an RMS voltmeter is substituted in place of the oscilloscope in Figure 5-6. However, the oscilloscope display, unlike the true RMS meter reading, tells the observer immediately whether the fundamental period of the signal displayed is 8.3 milliseconds (1/120 Hz) or 16.7 milliseconds (1/60Hz). Since the fundamental ripple frequency present on the output of an hp supply is 120Hz (due to full-wave rectification), an oscilloscope display showing a 120Hz fundamental component is indicative of a "clean" measurement setup, while the presence of a 60HZ fundamental usually means that an improved setup will result in a more accurate (and lower) value of measured ripple.

5-26 Although the method shown in Figure 5-6A is not recommended for ripple measurements, it may prove satisfactory in some instances provided certain precautionary measures are taken. One method of minimizing the effects of ground current flow (IG) is to ensure that both the supply and the test instrument are plugged into the same ac power buss.

5-27 To minimize pick up, a twisted pair or (preferably) a shielded two-wire cable should be used to connect the output terminals of the power supply to the vertical input terminals of the scope. When using a twisted pair, care must be taken that one of the two wires is connected both to the grounded terminal of the power supply and the grounded input terminal of the oscilloscope. When using shielded two-wire cable, it is essential for the shield to be connected to ground at one end only to prevent any ground current flowing through this shield from inducing a signal in the shielded leads.

5-28 To verify that the oscilloscope is not displaying ripple that is induced in the leads or picked up from the grounds, the (+) scope lead should be shorted to the (-) scope lead at the power supply terminals. The ripple value obtained when the leads are shorted should be subtracted from the actual ripple measurement.

5-29 If the foregoing measures are used, the single-ended scope of Figure 5-6A may be adequate to eliminate non-real components of ripple so that a satisfactory measurement can be obtained. However, in stubborn cases or in measurement situations where it is essential that both the power supply case and the oscilloscope case be connected to ground (e. g. if both are rack-mounted), it may be necessary to use a differential scope with floating input as shown in Figure 5-6B. If desired, two single-conductor shielded cables may be substituted in place of the shielded two-wire cable with equal success. Because of its common mode rejection, a differential oscilloscope displays only the difference in signal between its two vertical input terminals, thus ignoring the effects of any common mode signal introduced because of the difference in the ac potential between the power supply case and scope case. Before using a differential input scope in this manner, however, it is imperative that the common mode rejection capability of the scope be verified by shorting together its two input leads at the power supply and observing the trace on the CRT. If this trace is a straight line, the scope is properly ignoring any common mode signal present. If this trace is not a straight line, then the scope is not rejecting the ground signal and must be realigned in accordance with the manufacturer's instructions until proper common mode rejection is attained.

5-30 To check the ripple and noise output, proceed as follows:

a. Connect the oscilloscope or RMS voltmeter as shown in Figures 5-6A or 5-6B.

b. Adjust VOLTAGE control until front pane 1 meter indicates maximum rated output voltage.

c. The observed ripple and noise should be less than 200μVrms and lmV p-p.

5-31 Noise Spike Measurement. When a high frequency spike measurement is being made, an instrument of sufficient bandwidth must be used; an oscilloscope with a bandwidth of 20 MHz or more is adequate. Measuring noise with an instrument that has insufficient bandwidth may conceal high frequency spikes detrimental to the load.

5-32 The test setup illustrated in Figure 5-6A is generally not acceptable for measuring spikes; a differential oscilloscope is necessary. Furthermore, the measurement concept of Figure 5-6B must be modified if accurate spike measurement is to be achieved:

1. As shown in Figure 5-7, two coax cables, must be substituted for the shielded two-wire cable.

2. Impedance matching resistors must be included to eliminate standing waves and cable ringing, and the capacitors must be connected to block the dc current path.

3. The length of the test leads outside the coax is critical and must be kept as short as possible; the blocking capacitor and the impedance matching resistor should be connected directly from the inner conductor of the cable to the power supply terminals.

4. Notice that the shields of the power supply end of the two coax cables are not connected to the power supply ground, since such a connection would give rise to a ground current path through the coax shield, resulting in an erroneous measurement.

5. Since the impedance matching resistors constitute a 2-to-1 attenuator, — the noise spikes observed on the oscilloscope should be less than 0.5mV p-p instead of lmV.

5-33 The circuit of Figure 5-7 can also be used for the normal measurement of low frequency ripple and noise; simply remove the four terminating re-

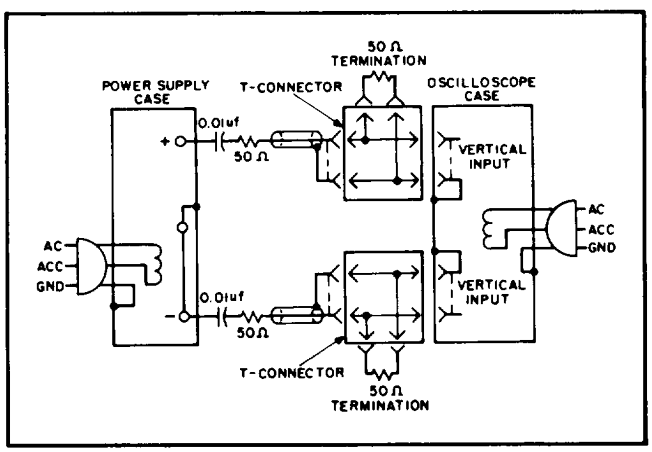


Figure 5-7, CV Noise Spike, Test Setup

sisters and the blocking capacitors and substitute a higher gain vertical plug-in in place of the wide-band plug-in required for spike measurements. Notice that with these changes, Figure 5-7 becomes a two-cable version of Figure 5-6C.

5-34 Transient Recovery Time.
Definition: The time "X" for output voltage recovery to within "Y" millivolts of the nominal output voltage following a "Z" Amp step change in load current - where: "Y" is specified as 10 millivolts. The nominal output voltage is defined as the dc level half way between the static output voltage before and after the imposed load change, and "Z" is the specified load current change, which is 5 Amperes.

5-35 A mercury-wetted relay, as connected in the load switching circuit of Figure 5-8 should be used for loading and unloading the supply. When this load switch is connected to a 60Hz ac input, the mercury-wetted relay will open and close 60 times per second. Adjustment of the 25K control permits adjustment of the duty cycle of the load current switching and reduction in jitter of the oscilloscope display.

5-36 The maximum load ratings listed in Figure 5-4 must be observed in order to preserve the mercury-wetted relay contacts. Switching of larger load currents can be accomplished with mercury pool relays; with this technique fast rise times can still be obtained, but the large inertia of mercury pool relays limits the maximum repetition rate of load switching and makes the clear display of the transient recovery characteristic on an oscilloscope more difficult.

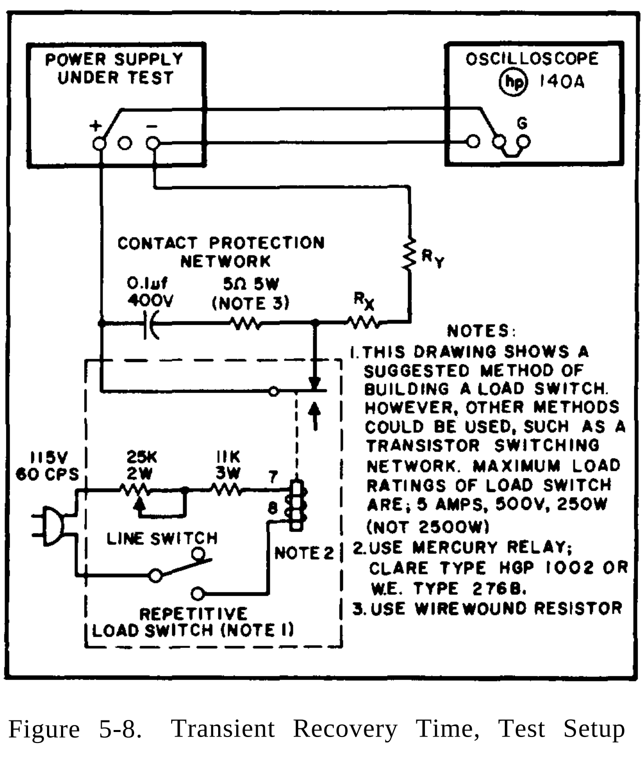


Figure 5-8. Transient Recovery Time, Test Setup

5-37 To check the transient recovery time of the supply, proceed as follows:

a. Connect test setup shown in Figure 5-8.

b. Set METER switch to highest current range and RANGE switch to lowest voltage mode.

c, Turn on supply and adjust VOLTAGE controls until front panel meter indicates exactly the maximum rated output current.

d. Close line on repetitive load switch setup.

e. Adjust 25KΩ potentiometer until a stable display is obtained on oscilloscope. Waveform should be within the tolerances shown on Figure 5-9 (output should return to within 10mV of original value in less than 50 microseconds).

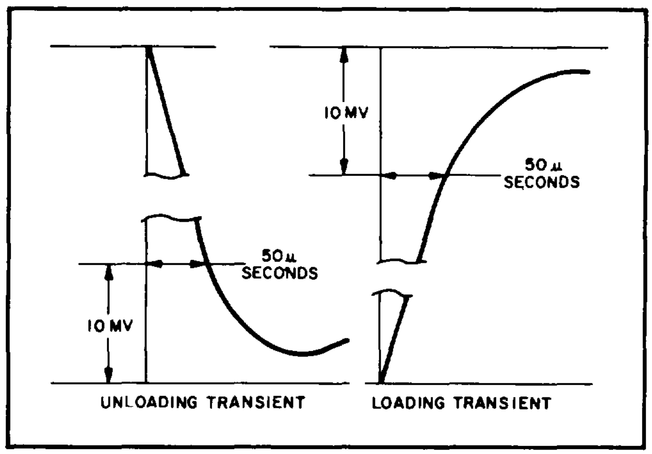


Figure 5-9. Transient Recovery Time, Waveforms

5-38 OUTPUT IMPEDANCE

5-39 To check the output impedance, proceed as follows:

a. Connect test setup shown in Figure 5-10.

b. Set METER switch to highest voltage range.

c. Turn on supply and adjust VOLTAGE controls until front panel meter reads 20 Volts.

d. Set AMPLITUDE control on oscillator to 10 Volts (E_{in}), and FREQUENCY control to 100 Hz.

e. Record voltage across output terminals of the power supply (E_o) as indicated on ac voltmeter.

f. Calculate the output impedance by the following formula:

$$Z_{out} = \frac{E_O R}{E_{in} - E_O}$$

E_O = rms voltage across power supply output terminals.

R = 1000

E_{in} = 10 Volts

g. The output impedance (Z_{out}) should be less than 0,020 ohms.

h. Using formula of Step f, calculate output impedance at frequencies of 50kHz and 500kHz. Values should be less than 0.5 ohm and 3.0 ohms, respectively.

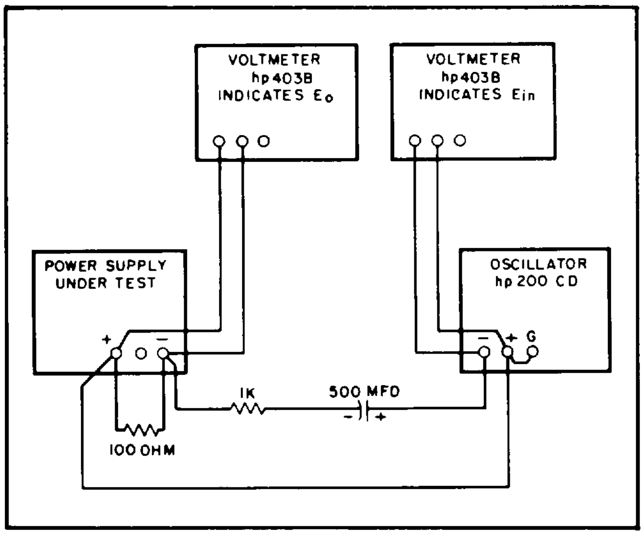


Figure 5-10. Output Impedence, Test Setup

5-40 <u>Temperature Coefficient.</u>
Definition: The change in output voltage per degree Centigrade change in the ambient temperature under conditions of constant input ac line voltage, output voltage setting, and load resistance.

5-41 The temperature coefficient of a power supply is measured by placing the power supply in an oven and varying it over any temperature span within its rating. (Most hp power supplies are rated for operation from 0°C to 55°C.) The power supply must be allowed to thermally stabilize for a sufficient period of time at each temperature of measurement.

5-42 The temperature coefficient specified is the maximum temperature-dependent output voltage change which will result over any 5°C interval. The differential voltmeter or digital voltmeter used to measure the output voltage change of the supply should be placed outside the oven and should have a long term stability adequate to insure that its drift will not affect the overall measurement accuracy.

5-43 To check the temperature coefficient, proceed as follows:

a. Connect test setup shown in Figure 5-5.

b. Turn CURRENT controls fully clockwise and adjust front panel VOLTAGE controls until the front panel voltmeter indicates 10Vdc.

c. Insert the power supply into the temperature-controlled oven (differential voltmeter and load resistance remain outside oven). Set the temperature to 30°C and allow 30 minutes warm-up.

d. Record the differential voltmeter indication.

e. Raise the temperature to 40°C and allow 30 minutes warm-up.

f. The differential voltmeter indication should change by less than 90mV from indication recorded in Step d.

5-44 <u>Output Stability.</u>
Definition: The change in output voltage for the first eight hours following a 30 minute warm-up period. During the interval of measurement all parameters, such as load resistance, ambient temperature, and input line voltage are held constant.

5-45 This measurement is made by monitoring the output of the power supply on a differential voltmeter or digital voltmeter over the stated measurement interval; a strip chart recorder can be used to provide a permanent record. A thermometer should be placed near the supply to verify that the ambient temperature remains constant during the period of measurement. The supply should be put in a location immune from stray air currents (open doors or windows, air conditioning vents); if possible, the supply should be placed in an oven which is held at a constant temperature. Care must be taken that the measuring instrument has a stability over the eight hour interval which is at least an order of magnitude better than the stability specification of the power supply being measured. Typically, a supply may drift less over the eight hour measurement interval than during the ½ hour warm-up period.

5-46 Stability measurement can be made while the supply is remotely programmed with a fixed wire-wound resistor, thus avoiding accidental changes in the front panel setting due to mechanical vibration or "knob-twiddling. "

5-47 To check the output stability, proceed as follows:

a. Connect test setup shown in Figure 5-5.

b. Turn CURRENT controls fully clockwise and adjust VOLTAGE controls for 40Vdc output.

c. Allow 30 minutes warm-up then record the differential voltmeter indication.

d. After 8 hours, differential voltmeter should change by less than 45mV from indication recorded in Step c.

5-48 TROUBLESHOOTING

5-49 Before attempting to troubleshoot this instrument, ensure that the fault is with the instrument and not with an associated circuit. The performance test (Paragraph 5-10) enables this to be determined without having to remove the instrument from the cabinet.

5-50 A gcod understanding of the principles of operation is a helpful aid in troubleshooting, and it is recommended that the reader review Section IV of the manual before attempting to troubleshoot the unit in detail. Once the principles of operation are understood, refer to the overall troubleshooting procedures in Paragraph 5-53 to locate the symptom and probable cause.

5-51 The schematic diagram at the rear of the manual (Figure 7-1) contains normal voltage readings taken at various points within the circuits. These voltages are positioned adjacent to the applicable test points (identified by encircled numbers). Component and test point designations are marked directly on the main printed wiring board.

5-52 If a defective component is located, replace it and re-conduct the performance test. When a component is replaced, refer to the repair and replacements and adjustment and calibration paragraphs in this section.

5-53 OVERALL TROUBLESHOOTING PROCEDURE

5-54 To locate the cause of trouble follow Steps 1, 2, and 3 in sequence.

(1) Check for obvious troubles such as open fuse, defective power cord, input power failure, or defective voltage or current meter. Next remove the top cover (held by four retaining screws) and inspect for open connections, charred components, etc. If the trouble source cannot be detected by visual inspection, proceed with Step 2.

(2) In almost all cases, the trouble can be caused by improper dc bias or reference voltages; thus, it is a good practice to check voltages in Table 5-2, before proceeding with Step 3.

(3) Disconnect the load and examine Table 5-3 to determine your symptom and probable cause.

Table 5-2. Reference Circuit Troubleshooting

STEP	METER COMMON	METER POSITIVE	NORMAL INDICATION	NORMAL RIPPLE (P-P)	IF INDICATION ABNORMAL, TAKE THIS ACTION
1	+S	33	6.2 ± 0.3Vdc	.3mV	Check 12.4 Volt bias or VR1 (See next paragraph)
2	31	+S	6.2 ± 0.3Vdc	.4mV	Check 12.4 Volt bias or VR2 (See next paragraph)
3	+S	37	12.4 *1. 0Vdc	2.8μV	Check Q8, Q9, CR22, CR23, C1O, T1
4	38	41	7.5 ± .7Vdc	1V	Check C12, CR8, CR24, CR25

Table 5-3. Overall Trouble shooting

SYMPTOM	CHECKS AND PROBABLE CAUSES
High output voltage	a. Front panel meter defective. b. Series regulator feedback loop defective. Refer to Table 5-4.
Low output voltage	a. Fuses blown (Check CR26-CR29 or C14 for short).

Table 5-3. Overall Troubleshooting (Continued)

SYMPTOM	CHECKS AND PROBABLE CAUSES
	b. Front panel meter defective. c. Series regulator feedback loop defective. Refer to Table 5-5.
Will not current limit	a. Q10 open. R81 defective.
High ripple	a. Check operating setup for ground loops. b. If output floating, connect lµf capacitor between output and ground. c. Ensure that supply is not crossing over to current limit mode under loaded conditions.
Poor line regulation	a. Check reference circuit (Paragraph 5-55). b. Check reference circuit adjustment (Paragraph 5-69).
Poor load regulation (constant voltage)	a. Measurement technique. (Paragraph 5-17) b. Check reference circuit (Paragraph 5-55) and adjustment (Paragraph 5-69). c. Ensure that supply is not going into current limit.
Oscillates (constant voltage)	a. Check C5 for open, adjustment of R30 (Paragraph 5-72).
Poor stability (constant voltage)	a. Check ± 6.2Vdc reference voltages (Paragraph 5-55). b. Noisy programming resistor R10. c. CR1, CR2 leaky. d. Check Rl, R12, R13, for noise or drift. e. Stage Q1 defective.

5-55 To check the zener diodes in the reference circuit, proceed as follows:

a. Connect differential voltmeter across zener diode.

b. Connect appropriate load resistor, given in Figure 5-4, across (+) and (-) output terminals.

c. Turn VOLTAGE control fully clockwise.

d. Set METER switch to highest current range and turn on supply.

e. Adjust CURRENT controls until panel meter reads exactly the maximum rated output current.

f. Read and record voltage indicated on differential voltmeter.

g. Short out load resistor by closing S1.

h. If reading on differential voltmeter differs by more than 1.07mV for 6204B and 6205B or .946mV for 6206B from the reading in Step f, replace zener diode.

5-5b Series Regulating Feedback Loop. When troubleshooting the series regulating loop, it is useful to open the loop since measurements made anywhere within a closed loop may appear abnormal. With a loop closed, it is very difficult to separate cause from effect. As described in Tables 5-4 and 5-5, the conduction or cutoff capability of each stage is checked by shorting or opening a previous stage, as follows:

1. Shorting the emitter to collector of a transistor simulates saturation, or the full ON condition.

2. Shorting the emitter to base of a transistor cuts it off, and simulates an open circuit between emitter and collector.

5-57 Although a logical first choice might be to break the loop somewhere near its mid-point, and then perform successive subdividing test, it is more useful to trace the loop from the series regulator backwards a stage at a time, since loop failures occur more often at the higher power levels.

Table 5-4. High Output Voltage Troubleshooting

STEP	ACTION	RESPONSE	PROBABLE CAUSE
1	Check turn off of series regulator by shorting Q4 emitter to collector.	a. Output voltage remains high. b. Output voltage decreases.	a. Series regulator Q7 (or Q6) shorted. b. Remove short and proceed to Step 2.
2	Check turn on of Q4 by disconnecting collector of Q3.	a. Output voltage remains high. b. Output voltage decreases.	a. Q4 open. b. Reconnect lead and proceed to Step 3.
3	Check turn off of Q3 by disconnecting collector of Q1A.	a. Output voltage remains high. b. Output voltage decreases.	a. Q3 shorted. b, Check Q1A for short, Q1B for open. Check for open strap between A6 and A8. Check R10 for open.

Table 5-5. Low Output Voltage Troubleshooting

STEP	ACTION	RESPONSE	PROBABLE CAUSE
1	Check turn on of Q7 (and Q6, if included) by opening the emitter of Q4 .	a. Output voltage remains low. b. Output voltage increases.	a. Q7 (or Q6) open. b. Reconnect lead and proceed to Step 2.
2	Eliminate the current limit circuit as a source of trouble by disconnecting the anode of CR16.	a. Output voltage increases. b. Output voltage remains low.	a. Q10 shorted, R81 defective. b. Reconnect lead and proceed to Step 3.
3	Check turn off of Q4 by shorting Q3 emitter to collector.	a. Output voltage remains low. b. Output voltage increases.	a. Q4 shorted. b. Remove the short and proceed to Step 4.

Table 5-5. Output Voltage Troubleshooting (Continued)

STEP	ACTION	RESPONSE	PROBABLE CAUSE
4	Check turn on of Q3 by shorting Q1A emitter to collector	a. Output voltage remains low b. Output voltage increases	a. Q3 open b, Check Q1A for open, QlB for short. Check R10 for short or open strap between A7 and A6

5-58 REPAIR AND REPLACEMENT

5-59 Before servicing a printed wiring board, refer to Figure 5-11. Section VI of this manual contains a tabular list of the instruments replaceable parts. Before replacing a semiconductor device, refer to Table 5-6 which lists the special characteristics of selected semiconductors. If the device to be replaced is not listed in Table 5-6, the standard manufacturers part number listed in Section VI is applicable. After replacing a semiconductor, refer to Table 5-7 for checks and adjustments that may be necessary.

Table 5-6. Selected Semiconductor Characteristics

REFERENCE DESIGNATOR	CHARACTERISTICS	hp STOCK NO.	SUGGESTED REPLACEMENT
Q1	Matched differential amplifier. NPN Si. planar 70 (min.) h_{FE} i_c = lmA, V_{CE} = 5V, Ico = 0.01µA @ V_{cbo} = 5V,	1854-0229	2N291 G.E.
Q7	NPN Power h_{FE} = 35 (min.) @ Ic = 4A; V_{CE} = 4V.	1854-0225	2N3055 R. C,A,

Table 5-7. Checks and Adjustments After Replacement of Semiconductor Devices

REFERENCE	FUNCTION	CHECK	ADJUST
Q1	Constant voltage differential amplifier	Constant voltage (CV) line and load regulation. Zero volt output.	R6 or R8
Q3, Q4	Error amplifiers	CV load regulation. CV transient response.	R30
Q7 (Q6)	Series regulater	CV load regulation.	
Q8, Q9	Reference regulator	Reference circuit line regulation.	VR1, VR2, CR20
CR1, CR2	Limiting diodes	CV load regulation.	
CR8	Forward bias regulator	Voltage across diode 2.0 to 2.4 Volts.	

Table 5-7. Checks and Adjustments After Replacement of Semiconductor Devices (Continued)

REFERENCE	FUNCTION	CHECK	ADJUST
Q10, CR16 (CR21)		Current limit adjustment.	R81
CR22 thru CR29	Rectifier diodes	Voltage across appropriate filter capacitor.	
VR1	Positive reference voltage	+6.2V line and load regulation.	R46, VR1
VR2	Negative reference voltage	-6.2V line and load regulation.	R46, VR2

5-60 ADJUSTMENT AND CALIBRATION

5-61 Adjustment and calibration may be required after performance testing, troubleshooting, or repair and replacement. Perform only those adjustments that affect the operation of the faulty circuit and no others.

5-62 METER ZERO

5-63 Proceed as follows to zero meter:

a. Turn off instrument (after it has reached normal operating temperature) and allow 30 seconds for all capacitors to discharge.

b. Insert sharp pointed object (pen Point or awl) into the small hole at top of round black plastic disc located directly below meter face.

c. Rotate plastic disc clockwise (CW) until meter reads zero, then rotate ccw slightly in order to free adjustment screw from meter suspension, If pointer moves, repeat Steps b and c.

5-64 AMMETER TRACKING

5-65 To calibrate the ammeter, proceed as follows:

a. Connect test setup as shown on Figure 5-4.

b. Set RANGE switch to low voltage mode and METER switch to lowest current range.

c. Turn on supply and adjust VOLTAGE controls so that differential voltmeter indicates exactly 40Vdc.

d. Front panel meter should read 0.3 Amp for Model 6204B and 6205B supplies, or 0.1 Amp for Model 6206B supply. If it does not, adjust R72.

5-66 CONSTANT VOLTAGE PROGRAMMING CURRENT

5-67 Programming Accuracy. To calibrate the programming current, proceed as follows:

a. Connect an 8K, 0.1% resistor (18K resistor for Model 6206B supplies) between terminals -S and A6 on rear barrier strip.

b. Disconnect jumper between A7 and A8 (leaving A6 and A7 jumpered).

c. Connect decade resistance box in place of R13.

d. Connect differential voltmeter between +S and -S terminals on rear barrier strip.

e. Set RANGE switch to high voltage mode, METER switch to high voltage range, and turn on supply.

f. Adjust decade resistance box so that differential voltmeter reads 40 ± 0.4Vdc for Models 6204B and 6205B or 60 ± 0.6Vdc for Model 6206B supplies,

g. Replace decade resistance with resistor of appropriate value in R13 position.

5-68 Zero Output Voltage. To calibrate the zero Volt programming accuracy, proceed as follows:

a. Connect differential 1 voltmeter between +S and -S terminals.

b. Short out voltage controls by connecting jumper between terminals A6 and -S.

c. Turn on supply and observe reading on differential voltmeter.

d. If it is more positive than O Volts, shunt resistor R6 with a decade resistance box.

e. Adjust decade resistance until differential voltmeter reads zero, then shunt R6 with resistance value equal to that of the decade resistante.

f. If reading of Step c was more negative than 0 Volts, shunt resistor R8 with the decade resistance box.

g. Adjust decade resistance until differential voltmeter reads zero then shunt R8 with a resistance value equal to that of the decade box.

Excessive heat or pressure can lift the copper strip from the board. Avoid damage by using a low power soldering iron (50 watts maximum) and following these instructions. Copper that lifts off the board should be cemented in place with a quick drying acetate base cement having good electrical insulating properties.

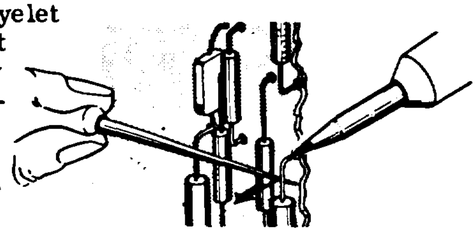
A break in the copper should be repaired by soldering a short length of tinned copper wire across the break.

Use only high quality rosin core solder when repairing etched circuit boards. NEVER USE PASTE FLUX. After soldering, clean off any excess flux and coat the repaired area with a high quality electrical varnish or lacquer.

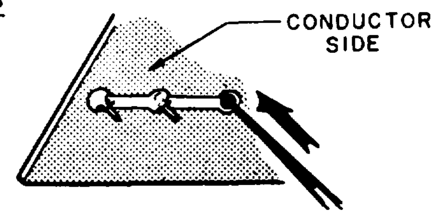
When replacing components with multiple mounting pins such as tube sockets, electrolytic capacitors, and potentiometers, it will be necessary to lift each pin slightly, working around the components several times until it is free.

WARNING: If the specific instructions outlined in the steps below regarding etched circuit boards without eyelets are not followed, extensive damage to the etched circuit board will result.

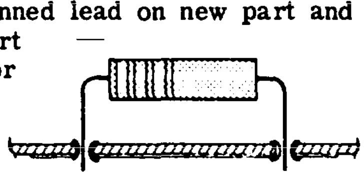
1. Apply heat sparingly to lead of component to be replaced. If lead of component passes through an eyelet in the circuit board, apply heat on component side of board. If lead of component does not pass through an eyelet, apply heat to conductor side of board.



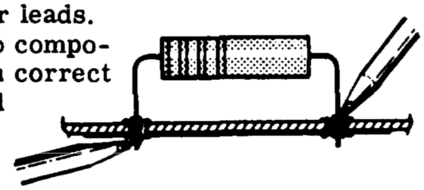
2. Reheat solder in vacant eyelet and quickly insert a small awl to clean inside of hole. If hole does not have an eyelet, insert awl or a #57 drill from conductor side of board.



3. Bend clean tinned lead on new part and carefully insert through eyelets or holes in board.

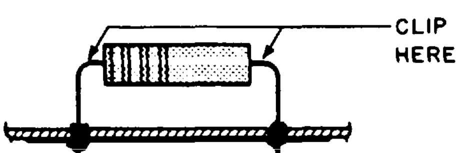


4. Hold part against board (avoid overheating) and solder leads. Apply heat to component leads on correct side of board as explained in step 1.

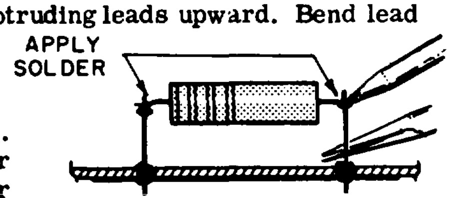


In the event that either the circuit board has been damaged or the conventional method is impractical, use method shown below. This is especially applicable for circuit boards without eyelets.

1. Clip lead as shown below.



2. Bend protruding leads upward. Bend lead of new component around protruding lead. Apply solder using a pair of long nose pliers as a heat sink.



This procedure is used in the field only as an alternate means of repair. It is not used within the factory.

Figure 5-11. Servicing Printed Wiring Boards

5-69 REFERENCE CIRCUIT ADJUSTMENTS

5-70 Line Regulation. To adjust the line regulation capabilities of the instrument proceed as follows:

a. Connect the differential voltmeter between +S (positive) and 31 (common).

b. Connect variable voltage transformer between supply and input power source.

c. Adjust line to 105Vac.

d. Connect decade resistance in place of R46.

e. Set range switch to high voltage mode and turn on supply.

f. Adjust decade resistance so that voltage indicated by differential voltmeter does not change more than 1.08 millivolts for 6204B and 6205B or .946mV for 6206B as input line voltage is varied from 105 to 125Vac.

g. Replace decade resistance with appropriate value resistor in R46 position.

5-71 CONSTANT VOLTAGE TRANSIENT RECOVERY TIME

5-72 To adjust the transient response, proceed as follows:

a. Connect test setup as shown in Figure 5-8.

b. Repeat Steps a through f as outlined in Paragraph 5-37.

c. Adjust R30 so that the transient response is as shown in Figure 5-9.

5-73 CURRENT LIMIT ADJUSTMENT

5-74 To adjust the current limit so that the supply can be used to furnish maximum rated output current, proceed as follows:

a. Connect test setup shown in Figure 5-5.

b. Short out load resistor (Ry).

c. Set RANGE switch to low voltage (high current) mode.

d. Turn on supply and rotate VOLTAGE controls fully clockwise (maximum).

e. Adjust R81 until differential volt meter indicates 3.5Vdc for Models 6204B and 6205B supplies or 3.6Vdc for Model 6206B supply.

SECTION VI
REPLACEABLE PARTS

6-1 INTRODUCTION

6-2 This section contains information for ordering replacement parts. Table 6-4 lists parts in alphanumeric order by reference designators and provides the following information:

a. Reference Designators. Refer to Table 6-1.

b. Description. Refer to Table 6-2 for abbreviations.

c. Total Quantity (TQ). Given only the first time the part number is listed except in instruments containing many sub-modular assemblies, in which case the TQ appears the first time the part number is listed in each assembly.

d. Manufacturer's Part Number or Type.

e. Manufacturer's Federal Supply Code Number. Refer to Table 6-3 for manufacturer's name and address.

f. Hewlett-Packard Part Number.

9. Recommended Spare Parts Quantity (RS) for complete maintenance of one instrument during one year of isolated service.

h. Parts not identified by a reference designator are listed at the end of Table 6-4 under Mechanical and/or Miscellaneous. The former consists of parts belonging to and grouped by individual assemblies; the latter consists of all parts not immediately associated with an assembly.

6-3 ORDERING INFORMATION

6-4 To order a replacement part, address order or inquiry to your local Hewlett-Packard sales office (see lists at rear of this manual for addresses). Specify the following information for each part: Model, complete serial number, and any Option or special modification (J) numbers of the instrument; Hewlett-Packard part number; circuit reference designator; and description. To order a part not listed in Table 6-4, give a complete description of the part, its function, and its location.

Table 6-1. Reference Designators

A	= assembly	E	= miscellaneous electronic part
B	= blower (fan)		
C	= capacitor	F	= fuse
CB	= circuit breaker	J	= jack, jumper
CR	= diode	K	= relay
DS	= device, signaling (lamp)	L	= inductor
		M	= meter

Table 6-1. Reference Designators (Continued)

P	= plug	v	= vacuum tube, neon bulb, photocell, etc.
Q	= transistor		
R	= resistor		
s	= switch	VR	= zener diode
T	= transformer	x	= socket
TB	= terminal block	z	= integrated circuit or network
TS	= thermal switch		

Table 6-2. Description Abbreviations

A	= ampere	mfr	. manufacturer
ac	= alternating current	mod.	= modular or modified
assy.	= assembly	mtg	= mounting
bd	= board	n	. nano . 10^{-9}
bkt	= bracket	NC	= normally closed
°C	. degree Centigrade	NO	= normally open
		NP	= nickel-plated
cd	= card	Ω	ohm
coef	= coefficient	obd	= order by description
comp	. composition		
CRT	= cathode-ray tube	OD	= outside diameter
CT	= center-tapped	p	= pico = 10^{-12}
dc	= direct current	P.C.	= printed circuit
DPDT	= double pole, double throw	pot.	= potentiometer
		p-p	. peak-to-peak
DPST	= double pole, single throw	ppm	= parts per million
elect	= electrolytic	pvr	= peak reverse voltage
encap	= encapsulated		
F	= farad	rect	= rectifier
°F	. degree Farenheit	rms	= root mean square
fxd	= fixed	Si	silicon
Ge	= germanium	SPDT	= single pole, double throw
H	= Henry		
Hz	= Hertz	SPST	= single pole, single throw
IC	= integrated circuit		
		SS	= small signal
ID	= inside diameter	T	= slow-blow
incnd	. incandescent	tan.	= tantulum
k	= kilo = 10^{3}	Ti	= titanium
m	= mini = 10-3	v	= volt
M	= mega . 10^{6}	var	= variable
p	= micro = 10^{-6}	WW	= wirewound
met.	= metal	w	= Watt

Table 6-3. Code List of Manufacturers

CODE NO.	MANUFACTURER	ADDRESS
00629	EBY Sales Co., Inc.	Jamaica, N.Y.
00656	Aerovox Corp.	New Bedford, Mass.
00853	Sangamo Electric Co. S. Carolina Div.	Pickens, S.C.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc. Semiconductor-Components Div.	Dallas, Texas
01686	RCL Electronics, Inc.	Manchester, N.H.
01930	Amerock Corp.	Rockford, Ill.
02107	Sparta Mfg. Co.	Dover, Ohio
02114	Ferroxcube Corp.	Saugerties, N.Y.
02606	Fenwal Laboratories	Morton Grove, Ill.
02660	Amphenol Corp.	Broadview, Ill.
02735	Radio Corp. of America, Solid State and Receiving Tube Div.	Somerville, N.J.
03508	G.E. Semiconductor Products Dept.	Syracuse, N.Y.
03797	Eldema Corp.	Compton, Calif.
03877	Transitron Electronic Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co. Inc.	Cedar Knolls, N.J.
04009	Arrow, Hart and Hegeman Electric Co.	Hartford, Conn.
04072	ADC Electronics, Inc.	Harbor City, Calif.
04213	Caddell & Burns Mfg. Co. Inc.	Mineola, N.Y.
04404	*Hewlett-Packard Co. Palo Alto Div.	Palo Alto, Calif.
04713	Motorola Semiconductor Prod. Inc.	Phoenix, Arizona
05277	Westinghouse Electric Corp. Semiconductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	Grand Junction, Colo.
05820	Wakefield Engr. Inc.	Wakefield, Mass.
06001	General Elect. Co. Electronic Capacitor & Battery Dept.	Irmo, S.C.
06004	Bassik Div. Stewart-Warner Corp.	Bridgeport, Conn.
06486	IRC Div. of TRW Inc. Semiconductor Plant	Lynn, Mass.
06540	Amatom Electronic Hardware Co. Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co.	Penacook, N.H.
06666	General Devices Co. Inc.	Indianapolis, Ind.
06751	Semcor Div. Components, Inc.	Phoenix, Arizona
06776	Robinson Nugent, Inc.	New Albany, Ind.
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07263	Fairchild Camera and Instrument Corp. Semiconductor Div.	Mountain View, Calif.
07387	Birtcher Corp., The	Los Angeles, Calif.
07397	Sylvania Electric Prod. Inc. Sylvania Electronic Systems Western Div.	Mountain View, Calif.
07716	IRC Div. of TRW Inc. Burlington Plant	Burlington, Iowa
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Raytheon Co. Components Div. Semiconductor Operation	Mountain View, Calif.
08484	Breeze Corporations, Inc.	Union, N.J.
08530	Reliance Mica Corp.	Brooklyn, N.Y.
08717	Sloan Company, The	Sun Valley, Calif.
08730	Vemaline Products Co. Inc.	Wyckoff, N.J.
08806	General Elect. Co. Miniature Lamp Dept.	Cleveland, Ohio
08863	Nylomatic Corp.	Norrisville, Pa.
08919	RCH Supply Co.	Vernon, Calif.
09021	Airco Speer Electronic Components	Bradford, Pa.
09182	*Hewlett-Packard Co. New Jersey Div.	Rockaway, N.J.
09213	General Elect. Co. Semiconductor Prod. Dept.	Buffalo, N.Y.
09214	General Elect. Co. Semiconductor Prod. Dept.	Auburn, N.Y.
09353	C & K Components Inc.	Newton, Mass.
09922	Burndy Corp.	Norwalk, Conn.
11115	Wagner Electric Corp. Tung-Sol Div.	Bloomfield, N.J.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of Cal. Inc.	So. Pasadena, Calif.
11502	IRC Div. of TRW Inc. Boone Plant	Boone, N.C.
11711	General Instrument Corp Rectifier Div.	Newark, N.J.
12136	Philadelphia Handle Co. Inc.	Camden, N.J.
12615	U.S. Terminals, Inc.	Cincinnati, Ohio
12617	Hamlin Inc.	Lake Mills, Wisconsin
12697	Clarostat Mfg. Co. Inc.	Dover, N.H.
13103	Thermalloy Co.	Dallas, Texas
14493	*Hewlett-Packard Co. Loveland Div.	Loveland, Colo.
14655	Cornell-Dubilier Electronics Div. Federal Pacific Electric Co.	Newark, N.J.
14936	General Instrument Corp. Semiconductor Prod. Group	Hicksville, N.Y.
15801	Fenwal Elect.	Framingham, Mass.
16299	Corning Glass Works, Electronic Components Div.	Raleigh, N.C.

*Use Code 28480 assigned to Hewlett-Packard Co., Palo Alto, California

Table 6-3. Code List of Manufacturers (Continued)

CODE NO.	MANUFACTURER	ADDRESS
16758	Delco Radio Div. of General Motors Corp.	Kokomo, Ind.
17545	Atlantic Semiconductors, Inc.	Asbury Park, N.J.
17803	Fairchild Camera and Instrument Corp Semiconductor Div. Transducer Plant	Mountain View, Calif.
17870	Daven Div. Thomas A. Edison Industries McGraw-Edison Co.	Orange, N.J.
18324	Signetics Corp.	Sunnyvale, Calif.
19315	Bendix Corp. The Navigation and Control Div.	Teterboro, N.J.
19701	Electra/Midland Corp.	Mineral Wells, Texas
21520	Fansteel Metallurgical Corp.	No. Chicago, Ill.
22229	Union Carbide Corp. Electronics Div.	Mountain View, Calif.
22753	UID Electronics Corp.	Hollywood, Fla.
23936	Pamotor, Inc.	Pampa, Texas
24446	General Electric Co.	Schenectady, N.Y.
24455	General Electric Co. Lamp Div. of Consumer Prod. Group	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	LTV Electrosystems Inc Memcor/Components Operations	Huntington, Ind.
26982	Dynacool Mfg. Co. Inc.	Saugerties, N.Y.
27014	National Semiconductor Corp.	Santa Clara, Calif.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
28520	Heyman Mfg. Co.	Kenilworth, N.J.
28875	IMC Magnetics Corp. New Hampshire Div.	Rochester, N.H.
31514	SAE Advance Packaging, Inc.	Santa Ana, Calif.
31827	Budwig Mfg. Co.	Ramona, Calif.
33173	G.E. Co. Tube Dept.	Owensboro, Ky.
35434	Lectrohm, Inc.	Chicago, Ill.
37942	P.R. Mallory & Co. Inc.	Indianapolis, Ind.
42190	Muter Co.	Chicago, Ill.
43334	New Departure-Hyatt Bearings Div. General Motors Corp.	Sandusky, Ohio
44655	Ohmite Manufacturing Co.	Skokie, Ill.
46384	Penn Engr. and Mfg. Corp.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
49956	Raytheon Co.	Lexington, Mass.
55026	Simpson Electric Co. Div. of American Gage and Machine Co.	Chicago, Ill.
56289	Sprague Electric Co.	North Adams, Mass.
58474	Superior Electric Co.	Bristol, Conn.
58849	Syntron Div. of FMC Corp.	Homer City, Pa.
59730	Thomas and Betts Co.	Philadelphia, Pa.
61637	Union Carbide Corp.	New York, N.Y.
63743	Ward Leonard Electric Co.	Mt. Vernon, N.Y.

CODE NO.	MANUFACTURER	ADDRESS
70563	Amperite Co. Inc.	Union City, N.J.
70901	Beemer Engrg. Co.	Fort Washington, Pa.
70903	Belden Corp.	Chicago, Ill.
71218	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionic Corp.	Cambridge, Mass.
71400	Bussmann Mfg. Div. of McGraw & Edison Co.	St. Louis, Mo.
71450	CTS Corp.	Elkhart, Ind.
71468	I. T. T. Cannon Electric Inc.	Los Angeles, Calif.
71590	Globe-Union Inc. Centralab Div.	Milwaukee, Wis.
71700	General Cable Corp. Cornish Wire Co. Div.	Williamstown, Mass.
71707	Coto Coil Co. Inc.	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co. and Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co. Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72699	General Instrument Corp.	Newark, N.J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72962	Elastic Stop Nut Div. of Amerace Esna Corp.	Union, N.J.
72982	Erie Technological Products Inc.	Erie, Pa.
73096	Hart Mfg. Co.	Hartford, Conn.
73138	Beckman Instruments Inc. Helipot Div.	Fullerton, Calif.
73168	Fenwal, Inc.	Ashland, Mass.
73293	Hughes Aircraft Co. Electron Dynamics Div.	Torrance, Calif.
73445	Amperex Electronic Corp.	Hicksville, N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73734	Federal Screw Products, Inc.	Chicago, Ill.
74193	Heinemann Electric Co.	Trenton, N.J.
74545	Hubbell Harvey Inc.	Bridgeport, Conn.
74868	Amphenol Corp. Amphenol RF Div.	Danbury, Conn.
74970	E. F. Johnson Co.	Waseca, Minn.
75042	IRC Div. of TRW, Inc.	Philadelphia, Pa.
75183	*Howard B. Jones Div. of Cinch Mfg. Corp.	New York, N.Y.
75376	Kurz and Kasch, Inc.	Dayton, Ohio
75382	Kilka Electric Corp.	Mt. Vernon, N.Y.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76381	Minnesota Mining and Mfg. Co.	St. Paul, Minn.
76385	Minor Rubber Co. Inc.	Bloomfield, N.J.
76487	James Millen Mfg. Co. Inc.	Malden, Mass.
76493	J.W. Miller Co.	Compton, Calif.

*Use Code 71785 assigned to Cinch Mfg. Co., Chicago, Ill.

Table 6-3. Code List of Manufacturers (Continued)

CODE NO.	MANUFACTURER	ADDRESS
76530	Cinch	City ot Industry, Calif.
76854	Oak Mfg. Co. Div. of Oak Electro/Netics Corp.	Crystal Lake, Ill.
77068	Bendix Corp., Electrodynamics Div.	No. Hollywood, Calif.
77122	Palnut Co.	Mountainside, N.J.
77147	Patton-MacGuyer Co.	Providence, R.I.
77221	Phaostron Instrument and Electronic Co.	South Pasadena, Calif.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine and Foundry Co. Potter and Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N.J.
77764	Resistance Products Co.	Harrisburg, Pa.
78189	Illinois Tool Works Inc. Shakeproof Div.	Elgin, Ill.
78452	Everlock Chicago, Inc.	Chicago, Ill.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78526	Stanwyck Winding Div. San Fernando Electric Mfg. Co. Inc.	Newburgh, N.Y.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78584	Stewart Stamping Corp.	Yonkers, N.Y.
79136	Waldes Kohinoor, Inc.	L.I.C., N.Y.
79307	Whitehead Metals Inc.	New York, N.Y.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Co.	Mt. Kisco, N.Y.
80031	Mepco Div. of Sessions Clock Co.	Morristown, N.J.
80294	Bourns, Inc.	Riverside, Calif.
81042	Howard Industries Div. of Msl Ind. Inc.	Racine, Wisc.
81073	Grayhill, Inc.	La Grange, Ill.
81483	International Rectifier Corp.	El Segundo, Calif.
81751	Columbus Electronics Corp.	Yonkers, N.Y.
82099	Goodyear Sundries & Mechanical Co. Inc.	New York, N.Y.
82142	Airco Speer Electronic Components	Du Bois, Pa.
82219	Sylvania Electric Products Inc. Electronic Tube Div. Receiving Tube Operations	Emporium, Pa.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals and Controls Inc. Control Products Group	Attleboro, Mass.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83058	Carr Fastener Co.	Cambridge, Mass.
83186	Victory Engineering Corp.	Springfield, N.J.
83298	Bendix Corp. Electric Power Div.	Eatontown, N.J.
83330	Herman H. Smith, Inc.	Brooklyn, N.Y.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Div. of Amerace Esna Corp.	Brookfield, Mass.

CODE NO.	MANUFACTURER	ADDRESS
83508	Grant Pulley and Hardware Co.	West Nyack, N.Y.
83594	Burroughs Corp. Electronic Components Div.	Plainfield, N.J.
83835	U.S. Radium Corp.	Morristown, N.J.
83877	Yardeny Laboratories, Inc.	New York, N.Y.
84171	Arco Electronics, Inc.	Great Neck, N.Y.
84411	TRW Capacitor Div.	Ogallala, Neb.
86684	RCA Corp. Electronic Components	Harrison, N.J.
86838	Rummel Fibre Co.	Newark, N.J.
87034	Marco & Oak Industries a Div. of Oak Electro/netics Corp.	Anaheim, Calif.
87216	Philco Corp. Lansdale Div.	Lansdale, Pa.
87585	Stockwell Rubber Co. Inc.	Philadelphia, Pa.
87929	Tower-Olschan Corp.	Bridgeport, Conn.
88140	Cutler-Hammer Inc. Power Distribution and Control Div. Lincoln Plant	Lincoln, Ill.
88245	Litton Precision Products Inc, USECO Div. Litton Industries	Van Nuys, Calif.
90634	Gulton Industries Inc.	Metuchen, N.J.
90763	United-Car Inc.	Chicago, Ill.
91345	Miller Dial and Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat, Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Neb.
91662	Elco Corp.	Willow Grove, Pa.
91929	Honeywell Inc. Div. Micro Switch	Freeport, Ill.
92825	Whitso, Inc.	Schiller Pk., Ill.
93332	Sylvania Electric Prod. Inc. Semi-conductor Prod. Div.	Woburn, Mass.
93410	Essex Wire Corp. Stemco Controls Div.	Mansfield, Ohio
94144	Raytheon Co. Components Div. Ind. Components Oper.	Quincy, Mass.
94154	Wagner Electric Corp. Tung-Sol Div.	Livingston, N.J.
94222	Southco Inc.	Lester, Pa.
95263	Leecraft Mfg. Co. Inc.	L.I.C., N.Y.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95712	Bendix Corp. Microwave Devices Div.	Franklin, Ind.
95987	Weckesser Co. Inc.	Chicago, Ill.
96791	Amphenol Corp. Amphenol Controls Div.	Janesville, Wis.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97702	IMC Magnetics Corp. Eastern Div.	Westbury, N.Y.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98410	ETC Inc.	Cleveland, Ohio
98978	International Electronic Research Corp.	Burbank, Calif.
99934	Renbrandt, Inc.	Boston, Mass.

REF. DESIG.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	hp PART NO.	RS
C1	FXD, ELECT 5µ 65VDC	2		09182	0180-1836	1
C2-4,6-8, 11,13,15, 17-19	NOT ASSIGNED	-	-	-	-	-
C5	FXD, FILM . 001µ 200VDC	2	192P10292	56289	0160-0153	1
C9	FXD, ELECT 4.7ΩF 35VDC	2	150D475X9035B2	56289	0180-0100	1
C10,12	FXD, ELECT 100µUF 50 VDC	4		09182	0180-1852	1
C14	FXD, ELECT 490µF 85 VDC	2		09182	0180-1888	1
C16	FXD, CERAMIC .05µF 400VDC	2	33C17A	56289	0150-0052	1
C20	FXD, ELECT 80µF 300VDC	2		09182	0180-1851	1
CR1,2	RECT. SI. 250MA 200PRV	8	1N485B	93332	1901-0033	6
CR3-5,9, 10,12-15, 18,19,21, 30-33	NOT ASSEIGNED	-	-	-	-	-
CR6	RECT. SI. 400MW 10PRV	2	1N4828	03508	1901-0461	2
CR7,8	RECY. SI. 400MW 10PRV	4	1N4830	03508	1901-0460	4
CR11	RECY. SI. 500MA 200 PRV	22	1N3253	02735	1901-0389	9
CR16	RECT. SI. 250MA 200PRV		1N485B	93332	1901-0033	
CR17	RECT. SI. 500MA 200PRV		1N3253	02735	1901-0389	
CR20	RECT. SI. 250MA 200PRV		1N485B	93332	1901-0033	
CR22-29,34	RECT. SI. 500MA 200PRV		1N3253	02735	1901-0389	
DS1	LAMP NEON	1		09182	2140-0244	1
F1	FUSE CARTRIDGE 2A 250V 3AG	1	312002	75915	2110-0002	5
Q1	SS NPN DIFF. AMP	2		09182	1854-0229	2
Q2,5,6	NOT ASSIGNED	-	-	-	-	-
Q3	SS PNP SI.	4		09182	1853-0099	4
Q4	SS PNP SI.	2		09182	1853-0041	2
Q7	POWER, NPN SI.	2		09182	1854-0225	2
Q8	SS PNP SI.			09182	1853-0099	
Q9,10	SS NPN SI.	4		09182	1854-0071	4
R1	FXD, WW 1KW ±5% 3W	2	242E1025	56289	0813-0001	1
R2	FXD, MET. FILM 6.2KW µ1% 1/8W	2	TYPE CEA T-O	07716	0698-5087	1
R3,4	FXD, MET. FILM 23KW µ1% 1/8W	4	TYPE CEA T-O	07716	0698-3269	1
R5	FXD, MET. FILM 1.5KW ±1% 1/8W	2	TYPE CEA T-O	07716	0757-0427	1
R6	FXD, COMP 360KW ±5% ½W	2	EB-3645	01121	0686-3645	1
R7,9,11 14-28, 32,35-40, 48,50,59 62-71, 74-79, 82-86	NOT ASSIGNED	-	-	-	-	-
R8	FXD, COMP 560KW ±5% 1/2W	2	EB-5645	01121	0686-5645	
R10	VAR. WW DUAL 10K-100	2		09182	2100-0997	1
R12	FXD, WW 1.3KW ±5% 3W	2	242E1325	56289	0811-1803	1
R13	FXD, COMP (SELECTED) ±5% 1/2W	2	TYPE EB (OBD)	01121		1
R29	FXD, COMP 5.1KW ±5% 1/2W	4	EB-5125	01121	0686-5125	1
R30	VAR. WW 5KW (MODIFY)	2	TYPE 110-F4	11236	2100-1824	1
R31	FXD, COMP NKW ±5% 1/2W	2	EB-1025	01121	0686-1025	1
R33	FXD, COMP 2.4KW ±5% 1/2W	2	EB-2425	01121	0686-2425	1

REF. DESIG.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	hp PART NO.	RS
R34	FXD, COMP 300Ω ±5% 1/2W	2	EB-3015	01121	0686-3015	1
R41	RXD, COMP 12KΩ ±5% 1/2W	2	EB-1235	01121	0686-1235	1
R42	FXD, COMP 6.8KΩ ±5% 1/2W	2	EB-6825	01121	0686-6825	1
R43	FXD, MET, FILM 470Ω ±1% 1/4W	2	TYPE CEB T-O	07716	0698-3506	1
R44	FXD, COMP 47KΩ ±5% 1/2W	2	EB-4735	01121	0686-4735	1
R45	FXD, COMP 5.1KΩ ±5% 1/2W		EB-5125	01121	0686-5125	
R46	FXD, COMP 100KΩ ±5% 1/2W	2	EB-1045	01121	0686-1045	1
R47	FXD, COMP 680Ω ±5% 1/2W	2	EB-6815	01121	0686-6815	1
R49	FXD, MET. OX 3KΩ ±5% 2W	2	TYPE C42S	16299	0698-3642	1
R51	FXD, COMP 20KΩ ±5% 1/2W	2	EB-2035	01121	0686-2035	1
R52	FXD, MET. FILM 1.21KΩ ±1% 1/8W	2	TYPE CEA T-O	07716	0757-0274	1
R53	FXD, COMP 470Ω ±5% 1/2W	2	EB-4715	01121	0686-4715	1
R54,55	FXD, WW 5Ω ±0.5% 1/2W	4	TYPE E-30	01686	0811-1920	1
R56	FXD, MET. FILM 1.69KΩ ±1% 1/8W	2	TYPE CEA T-O	07716	0698-4428	1
R57	FXD, MET. FILM 3.57KΩ ±1% 1/8W	2	TYPE CEA T-O	07716	0698-3496	1
R58	FXD, MET. FILM 196Ω ±1% 1/8W	2	TYPE CEA T-O	07716	0698-3440	1
R60	FXD, MET. FILM 4.81KΩ ±1% 1/4W	2	TYPE CEB T-O	07716	0698-5147	1
R61	FXD, MET. FILM 45KΩ ±1% 1/8W	2	TYPE CEA T-O	07716	0698-5091	1
R72	VAR. WW 250Ω (MODIFY)	2	TYPE 110-F4	11236	2100-0439	1
R73	FXD, MET. FILM 42.2Ω _1% 1/8W	2	TYPE CEA T-O	07716	0757-0316	1
R80	FXD, COMP 33KΩ ±5% 1/2W	1	EB-3335	01121	0686-3335	1
R81	VAR. WW 1KΩ	2	TYPE 110-F4	11236	2100-0391	1
R87	THERMISTOR 64Ω ±10%	2	LB16J1	02606	0837-0023	1
S1	SWITCH, PILOT LIGHT (RED)					
	PUSH ON/OFF SPDT	1	54-61681-26 A1H	87034	3101-0100	1
S2	ROTARY SWITCH CONCENTRIC SHAFTS	2		09182	3100-1913	1
T1	TRANSFORMER, POWER	1		09182	9100-1821	1
VR1	DIODE, ZENER 6.2V	2	1N821	06486	1902-0761	2
VR2	DIODE, ZENER 6-19V ±5% 400MW	2	1N753	04713	1902-0049	2
	MISCELLANEOUS					
	COVER, TOP	2		09182	5000-6061	
	CHASSIS, RIGHT	1		09182	5060-6118	
	CHASSIS, LEFT	1		09182	5060-6119	
	PANEL, FRONT	1		09182	06205-00001	
	BINDING POST (MAROON)	2		09182	1510-0040	1
	BINDING POST(BLACK)	4	DF21BC	58474	1510-0039	1
	KNOB, BLACK (WITH POINTER)	2		09182	0370-0107	1
	KNOB, RED	2		09182	0370-0101	1
	KNOB, BAR, RED)WITH POINTER)	2		09182	0370-0102	1
	KNOB, BLACK	2		09182	0370-0179	1
	METER 2 1/2" DUAL SCALE 0-50V 0-.75A	2		09182	1120-1230	1
	BEZEL, METER 1/6 MOD	2		09182	4040-0295	1
	SPRING, METER	8		09182	1460-0720	2
	GUARD, BARRIER STRIP	1		09182	5020-5541	
	CABLE CLAMP	1	T4-4	79307	1400-0330	
	STRAIN RELIEF BUSHING	1	SR-5P-1	28520	0400-0013	1
	LINE CORD PLUG PH151 7 1/2'	1	KH-4096	70903	8120-0050	1
	JUMPER, BARRIER STRIP	10	422-13-11 013	71785	0360-1143	2
	PLASTIC EXTRUDSION BARRIER STRIP	1		09182	4040-0067	
	BARRIER BLOCK	1		09182	0360-1273	1
	FUSEHOLDER	1	342014	75915	1400-0084	1

REF. DESIG.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	hp PART NO.	RS
	BRACKET, TRANSF. MFG	2		09182	06205-00002	
	BRACKET, HEAT SINK	2		09182	5000-6060	
	HEAT SINK, REAR	1		09182	0050-1035	
	RUBBER BUMPER (FEET)	4	MB50	87575	0403-0088	1
	PRINTED CIRCUIT BOARD	1		09182	06205-20020	
	RUBBER BUMPER, PRINTED CIRCUIT BOARD	3	4072	87575	0403-0086	1
	HEAT DISSIPATOR (Q7, Q4)	2	NF-207	05820	1205-0033	2
	MICA INSULATOR (Q7, Q4)	2	734	08530	0340-0174	2
	INSULATOR, TRANSISTOR PINS (Q7, Q40	4		09182	0340-0166	4
	INSULATOR (Q7,Q4)	4		09182	0340-0168	4
	END CAPS	2		09182	9220-1218	
	CARTON	1		09182	9211-0848	
	OPTION 07 10-TURN OUTPUT VOLTAGE CONTROL					
R10	VAR. WW 10KΩ ±5% (10 TURN)	2		09182	2100-1866	
	KNOB	2		09182	0370-0137	
	OPTION 13 10-TURN VOLTAGE CONTROL WITH DECADIAL					
R10	VAR. WW 10KΩ ±5% (10 TURN)	2		09182	2100-1866	
	DECADIAL	2	RD-411	07716	1140-0020	

PART NUMBER - NATIONAL STOCK NUMBER
CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
DF21BC	58474	5940-00-738-6269	150D475X9035B2	56289	5910-00-177-4300
0150-0052	28480	5910-00-797-4909	150D475X9035B2	56289	5910-00-752-4172
0160-0153	28480	5910-00-965-9728	1510-0039	28480	5940-00-738-6269
0180-0100	28480	5910-00-752-4172	1853-0041	28480	5961-00-931-8259
0180-1836	28480	5910-00-974-6135	1853-0099	28480	5961-00-450-4689
0180-1852	28480	5910-00-931-7060	1854-0071	28480	5961-00-137-4608
0180-1888	28480	5910-00-884-1194	1854-0087	28480	5961-00-824-7567
0370-0101	28480	5355-00-068-4557	1854-0225	28480	5961-00-072-0094
0370-0102	28480	5355-00-906-8933	1854-0229	28480	5961-00-867-9318
0370-0107	28480	5355-00-926-5508	1901-0033	28480	5961-00-821-0710
0686-1045	28480	5905-00-195-6761	1901-0460	28480	5961-00-867-9206
0686-2035	28480	5905-00-903-6304	1901-0461	28480	5961-00-937-3918
0686-3335	28480	5905-00-997-5436	1902-0049	28480	5961-00-911-9277
0686-4735	28480	5905-00-222-5571	1902-3002	28480	5961-00-252-1307
0686-5125	28480	5905-00-279-2019	192P10292	56289	5910-00-993-8305
0698-3440	28480	5905-00-828-0377	2N3417	03508	5961-00-937-3768
0698-3496	28480	5905-00-407-0106	2100-0281	28480	5905-00-918-7471
0698-3506	28480	5905-00-431-6844	2100-0439	28480	5905-00-851-3924
0698-5087	28480	5905-00-469-2837	2100-1824	28480	5905-00-892-9626
0757-0274	28480	5905-00-858-9105	2100-1866	28480	5905-00-110-0282
0757-0316	28480	5905-00-981-7475	2140-0244	28480	5240-00-951-3376
0757-0346	28480	5905-00-998-1906	242E1025	56289	5905-00-504-4892
0757-0427	28480	5905-00-917-0578	30D105G050BA2	56289	5910-00-691-1255
0757-0440	28480	5905-00-858-6795	30D105G050BA2	56289	5910-00-130-2712
0813-0001	28480	5905-00-932-0413	3101-0100	28480	5930-00-918-4381
1N4830	03508	5961-00-103-3950	3101-1248	28480	5930-00-476-9679
1140-0020	28480	5355-00-584-0840	312002	75915	5920-00-280-5062
1205-0033	28480	5999-00-871-9538	342014	75915	5920-00-881-4636
1400-0084	28480	5920-00-881-4636	734	08530	5970-00-840-5109
			8120-0050	28480	5625-00-052-4921

SECTION VII
CIRCUIT DIAGRAMS

This section contains the circuit diagrams necessary for the operation and maintenance of this power supply. Included are:

a. Component Location Diagram, Figure 7-1, which shows the physical location and reference designator of parts mounted on the printed wiring board.

b. Schematic Diagram, Figure 7-2, which illustrates the circuitry for the entire power supply. Voltages are given adjacent to test points, identified by encircled numbers on the schematic and printed wiring board.

APPENDIX A
REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).
TM 11-2019	Test Sets 1-49, 1-49-A, and 1-49-B and Resistance Bridges ZM-4A/U and ZM-4B/U.
TM 11-6625-203-12	Operator's and Organizational Maintenance: Multimeter AN/URM-105 AND AN/URM-105C (Including Multimeter, ME-77/u and ME-77C/U).
TM 11-6625-654-14	operators, Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools List) for Multimeter AN/USM-223.
TM 11-6625-822-12	Operator and Organizational Maintenance Manual; Signal Generator SG-321B/U.
TM 11-6625-2616-14	Operator's Organizational, Direct Support, and General Support Maintenance Manual; Digital Voltmeter AN/GSM-64A.
TM 11-6625-2658-14	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Oscilloscope AN/USM-281C (NSN 6625-OO-106-9622).
TM 11-6625-2724-12	Operator's and Organizational Maintenance Manual: Voltmeter, Electronic ME-202C/U (NSN 6625-00-972-4046),
TB 43-180	Calibration Requirements for the Maintenance of Army Materiel.

APPENDIX B

COMPONENTS OF END ITEM LISTING

ICOEIL

1 each Power Supply HP 6205B 6625-00-437-4861

BILL

Technical Manual TM 11-6625-2965-14&P

AAL

N/A

ES&ML

N/A

APPENDIX C

MAINTENANCE ALLOCATION

Section 1. INTRODUCTION

C -1. General

This appendix provides a summary of the maintenance operations for the PP-7548/U. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. ***Test.*** To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating conditions, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. ***Align.*** To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. ***Install.*** The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. ***Repair.*** The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

C-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn (s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. SubColumns of column 4 are as follows:

C - Operator/Crew
0- Organizational
F- Direct Support
H - General Support
D - Depot

e. Column 5, Tools and Equipment. Column 6 specifies by code, those common tool sets (not individual tools) and special tools, test and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

C-4. Tool and Test Equipment Requirement (sect III)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. *Nomenclature.* This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specified tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

C-5. Remarks (sect IV)

a. Reference Code. This code refers to the appropriate item in section II, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in section II.

SECTION II MAINTENANCE ALLOCATION CHART
FOR
POWER SUPPLY PP-7548/U

(1) GROUP NUMBER	(2) COMPONENT/ASSEMELY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
00	Power Supply PP-7548/U	Inspect		0.1					A
		Service		0.1				2	A
		Test		0.1				1	B
		Inspect				0.2		3	C
		Service				0.2		3	C
		Test				1.2		3-11	D
		Adjust				0.6		3-11	D
		Repair				1.3		3	D
		Overhaul					42	3-11	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
POWER SUPPLY PP-7548/U

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	0	MULTIMETER AR/URM-105	6625-00-581-2036	
2	0	TOOL KIT, ELECTRONIC EQUIPMENT TK-101/G	5180-00-064-5178	
3	H, D	TOOL KIT, ELECTRONIC EQUIPMENT TK-105/G	5180-00-610-8177	
4	H, D	GENERATOR, SIGNAL SG-321/U	6625-00-674-7097	
5	H, D	MULTIMETER AN/USM-223/U	6625-00-999-7465	
6	H, D	MULTIMETER, ELECTRONIC ME-260()/U	6625-00-965-1534	
7	H, D	OSCILLOSCOPE AN/USM-281	6625-00-106-9622	
8	H, D	RESISTANCE BRIDGE ZM-4()/U	6625-00-500-9370	
9	H, D	TRANSFORMER, VARIABLE CN-16/U	5950-00-235-2086	
10	H, D	VOLTMETER, DIGITAL AN/GSM()/64	6625-00-022-7894	
11	H, D	VOLTMETER, ELECTRONIC ME-202()/U	6625-00-709-0288	

REFERENCE CODE	REMARKS
A	Exterior
B	Operational
C	Interior
D	All

APPENDIX D
MANUAL BACKDATING CHANGES

Manual backdating changes describe changes necessary to adapt this manual to earlier instruments. To adapt the manual to serial numbers prior to 7L2301 inspect the following table for your serial number and then make the appropriate changes. For serial numbers 7L4450 and up check for inclusion of change sheet.

SERIAL		MAKE CHANGES
Prefix	Number	
7L	2300 - down	1

CHANGE 1:

In the replaceable parts table, make the following changes:

Delete Q10.

Delete R51.

Change R53 to fxd, comp 10Ω ±5% ½W, EB-1005, 01121, hp part No. 0686-1005.

Change R54 to fxd, ww 5.25Ω ±0.5% ½W, Type E-30, 01686, hp Part No, 0811-1921.

Change R81 to var. ww 100Ω, Type 110-F4, 11236, hp Part No. 2100-0281.

On the schematic remove transistor Q10 in current limit circuit and connect circuit as shown in Figure B-1.

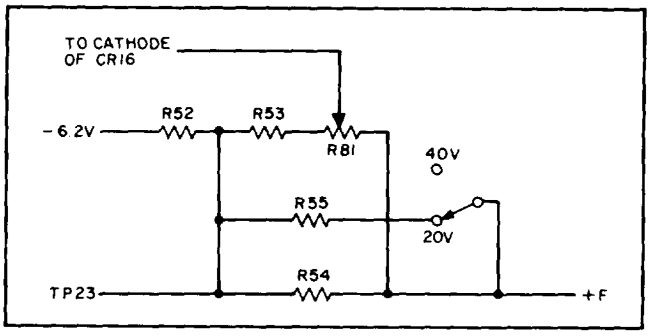


Figure B-1.

The circuit description Paragraph 4-19 should now read as follows:

4-19 Current limiting occurs when diode CR16 becomes forward biased. Its anode potential is determined by the voltage at the base of Q4. The cathode potential of CR16 is determined by the voltage drop acress resistors R53 and R81 which, in turn, are connected across the current sampling resistor(s). The cathode potential of CR16 is a function of the output current. As this current increases, the drop across the sampling network increases, and CR16 will start to conduct. Conduction of this diode clamps the base of Q4 to a potential which decreases the conduction of the series regulator, thus limiting the output current, Potentiometer R81 permits the cathode potential of CR16 to be varied and thus charges the current limiting threshold.

Paragraph 5-52, Step (e) should read:

"Adjust R81 until differential voltmeter indicates 2.55 Vdc . . . ."

Option 11, Overvoltage Protection "Crowbar"

DESCRIPTION:

This option is installed in DC Power Supplies, 6200B, 6201B, 6202B, 6203B, 6204B, and 6206B, and tested at the factory. It consists of a printed circuit board, screwdriver-type front panel potentiometer, and six wires that are soldered to the main power supply board.

The crowbar monitors the output voltage of the power supply and fires an SCR that effectively shorts the output when it exceeds the preset trip voltage. The trip voltage is determined by the setting of the CROWBAR ADJUST control on the front panel. The trip voltage range is as follows:

Model	6200B	6201B	6202B	6203B	6204B	6205B	6206B
Trip Voltage Range	2.5-44V	2.5-23V	2.5-44V	2.5-10V	2.5-44V	2.5-44V	2.5-65V

To prevent transients from falsely tripping the crowbar, the trip voltage must be set higher than the power supply output voltage by the following margin: 4% of the output voltage plus 2V. The margin represents the minimum crowbar trip setting for a given output voItage; the trip voltage can always be set higher than this margin.

OPERATION:

1. Turn the CROWBAR ADJUST fully clockwise to set the trip voltage to maximum.

2. Set the power supply VOLTAGE control for the desired crowbar trip voltage. To prevent false crowbar tripping, the trip voltage should exceed the desired output voltage by the following amount: 4% of the output voltage plus 2V.

3. Slowly turn the CROWBAR ADJUST ccw until the crowbar trips, output goes to 0V or a small positive voltage.

4. The crowbar will remain activated and the output shorted until the supply is turned off. To reset the crowbar, turn the supply off, then on.

5. If the CROWBAR must be completely disabled, remove the lead attached to the CROWBAR ADJUST potentiometer R5.

TABLE A-1. REPLACEABLE PARTS

REF. DESIG.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	hp PART NO.	RS
C1	FXD, ELECT 1µF 50VDC	2	30D105G050BA2	56289	0180-0108	1
C2	FXD, MICA 510µF 500VDC	2	RCM15E511J	04062	0140-0047	1
CR1-CR3	RECT. SI. 200MA 200PRV	6	1N485B	93332	1901-0033	6
CR4	SCR 7.4A 100PRV	2	C20B	03508	1884-0032	2
Q1,2	SS NPN SI.	4	2N3417	03508	1854-0087	4
R1	FXD, MET. FILM 10Ω ±1% 1/8W	2	TYPE CEA T-O	07716	0757-0346	1
R2	FXD, COMP 3KΩ ±5% 2W	2	TYPE C42S	16299	0698-3642	1
R3	FXD, MET. FILM 1.21LΩ ±1% 1/8W	2	TYPE CEA T-O	07716	0757-0274	1
R4	FXD, MET. FILM 7.5KΩ ±1% 1/8W	2	TYPE CEA T-O	07716	0757-0440	1
R5	VAR. WW 10KΩ ±5%	2		09182	2100-1854	1
R6	FXD, WW 1KΩ ±5% 3W	2	242E1025	56289	0813-0001	1
R7	FXD, COMP 22Ω ±5% 1/2W	2	EB-2205	01121	0686-2205	1
R8	FXD, MET. FILM 196Ω ±1% 1/8W	2	TYPE CEA T-O	07716	0698-3440	1
T1	TRANSFORMER, PULSE	1		09182	5080-7122	1
VR1	DIODE, ZENER 6.19V±5%	2	1N753	04713	1902-0049	2
VR2	DIODE, ZENER 2.37V±5%	2	1N4370	04713	1902-3002	2
	MISCELLANOEUS					
	PRINTED CIRCUIT BOARD (BLACK)	1		09182	06205-20021	
	P.C. BOARD (INCLUDES COMPONENTS)	1		09182	06205-60021	
	HEAT SINK	1		09182	06205-00003	
	INSULATOR (CR4)	2		09182	0340-0462	1
	MICA WASHER	2		09182	2190-0709	1

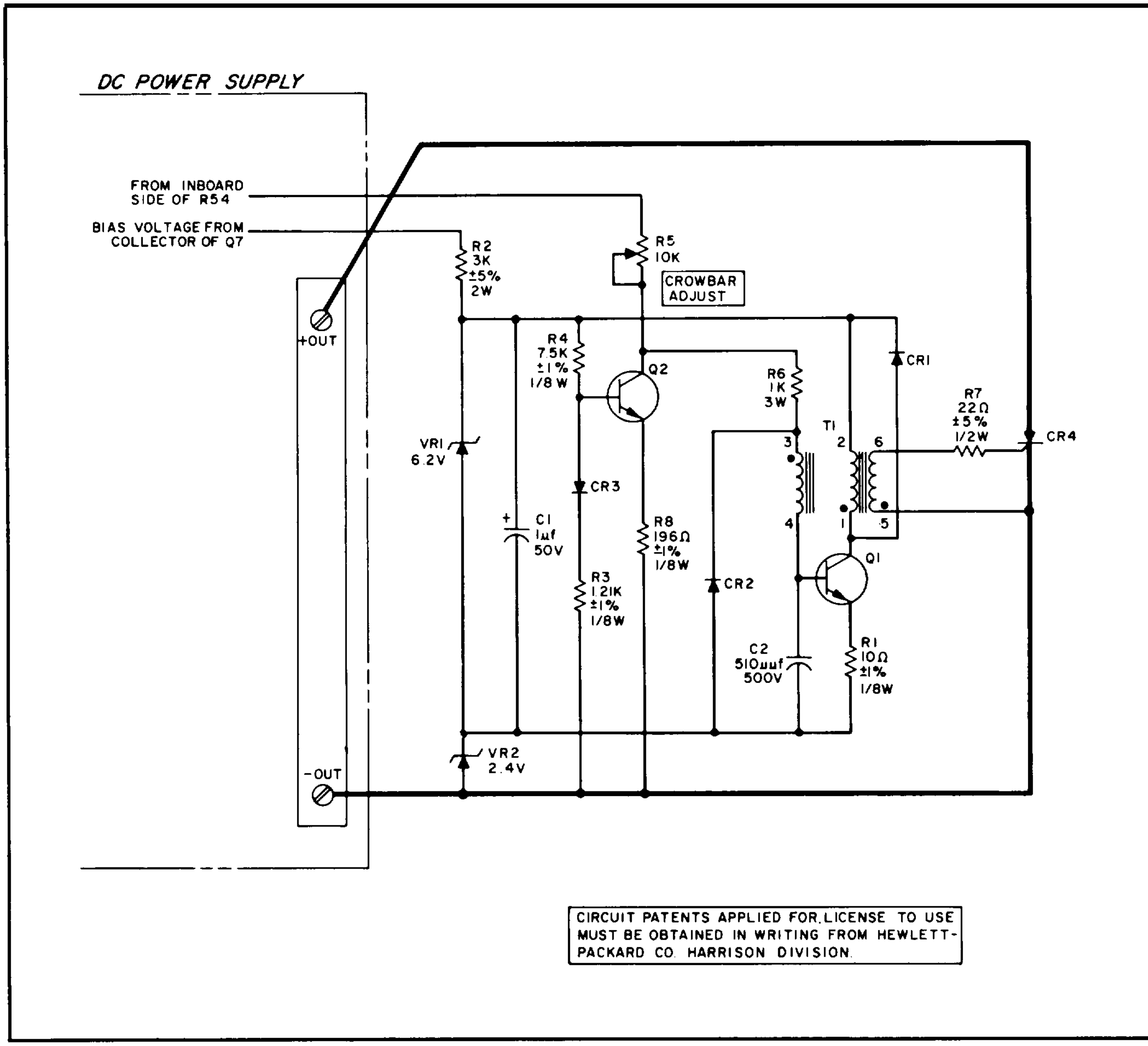


Figure A-1. Models 6200B, 6204B, and 6205B* Overvoltage Protection "Crowbar"

*For Model 6205B the above circuit is duplicated on each half of the assembled board, 06205-60021.

MANUAL CHANGES

Model 6205B DC Power Supply
Manual HP Part No. 06205-90002

Make all corrections in the manual according to errata below, then check the following table for your power supply serial number and enter any listed change(s) in the manual.

SERIAL		MAKE CHANGE S
Prefix	Number	
ALL		Errata
7L	5451 - 5900	1
7L	5901 - 6200	1,2
lC	6201 - 6300	1,2,3
1140A	6301 - up	1,2,3,4

ERRATA:

On Page 3-1, in Paragraph 3-2, delete step (b) and reletter following steps appropriately; change step (c) to read: "Set range switch (2) to desired operating mode. . . "; change step (d) to read: "Adjust coarse and fine voltage controls (3) until. . ."

On Page 5-4, in Paragraph 5-16, change steps (b) through (d) to read as follows:

b. Set METER switch to low current range and RANGE switch to high voltage mode.

c, Turn on supply and adjust VOLTAGE controls until front panel meter indicates exactly 300mA (0.5 ampere for Model 6206B supplies).

d. Differential voltmeter should read 1.5 ± 0.045Vdc.

CHANGE 1:

In the replaceable parts table, make the following change:

Terminal Strip: Add, HP Part No. 0360-0401.

CHANGE 2:

In the replaceable parts table, make the following changes:

S1: Change to HP Part No. 3101-1248.

In miscellaneous:

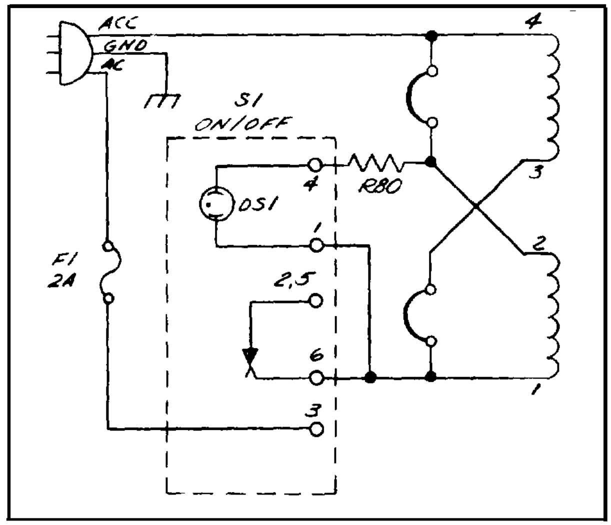
Panel, Front: Change to HP Part No. 06205-00004.

CHANGE 3:

In the replaceable parts table and on the schematic make the following changes:

Tl: Change to HP Part No. 9100-2611.

The primary wiring of the unit is now as shown below.



CHANGE 4:

The Serial Prefix of this unit has been changed to 1140A. This is the only change.

ERRATA :

in the instructions for auto-series operation in paragraph 3-33, change the third sentence to read:

"The value of Rx is this voltage divided by the voltage programming current of the slave supply (l/Kp, where K_p is the resistance programming coefficient for constant voltage operation). " The voltage programming current of the Model 6205B is 1/200 ohms per volt, or 5 milliamps.

On page A-1 under Description, add "6205B" to the first sentence. Also change the second sentence of the second paragraph to read, "The trip voltage is determined by the setting of the crowbar adjust control on the front panel (except in the Model 6205B, where it is accessible through a hole in the top cover). " Also on page A-1, change the last part of the third step under Operation to read ". . . output goes to O volts or a small positive voltage. "

On the schematic and in the parts list, change resistor R12 (for both dual supplies) to 1.4kΩ 5% 3W 30 ppm, HP Part No. 0811-1804.

DESCRIPTION	STANDARD	HP PART NO. OPTION A85	OPTION X95
Front Panel, Lettered	06205-00005	06205-60004	←
Chassis, Right Side	5060-7956	←	5060-6118
Chassis, Left Side	5060-7955	←	5060-6119
Cover, Top	5000-9424	←	5000-6061
Rack Kit (accessory)	14523A	14523A-A85	←
Heatsink	06205-60005	←	06205-60002

ERRATA:

In parts list, change HP Part No. of rubber bumper (qty. 4) to 0403-0002.

In Figure 5-4, change Rx value listed for Model 6206B to 3 ohms.

In Table 1-1, change the INTERNAL IMPEDANCE AS A CONSTANT VOLTAGE SOURCE (Output Impedance) specification to read as follows:
Output Impedance (Typical): Approximated by a 25 milliohm resistance in series with a 1 micro henry inductance.

The standard colors for this instrument are now mint gray (for front panel) and olive gray (for all other external surfaces). Option X95 designates use of the former color scheme of light gray and blue gray. Option A85 designates use of a light gray front panel with olive gray used for all other external surfaces. New part numbers shown above.

In Figure 3-9, delete the six references to TP23. These wires must be connected in the appropriate power supply directly to the end of R54 that is towards the rear of the supply. Another correction needed in this figure is that the wire from terminal A6 in Slave No. 1 in the two-unit example at the top of the figure should be connected to the rear of R54 in the master supply. Note: The range switches of the master and slave supplies must be set to the same range when operating in auto-parellel.

Add to the parts list the replacement lamp for illuminated switch 3101-1248, which is used in those supplies that include Change 2. The HP Part No. of the type A1H lamp is 2140-0244.

ERRATA:

Effective January 1, 1977, Option 007 (1O-turn voltage control) has been redesignated Option 009, and Option 013 (1 O-turn voltage control with decadial) has been redesignated Option 015. Make these changes wherever Option 007 or 013 is mentioned in the manual.

The front panel binding posts have been changed to a type with better designed insulation. Delete the two types of posts listed on page 6-6 of the parts list and add : black binding post, HP Part **No. 1510-**0114 (qty. 4); and red binding post HP Part No. 1510-0115 (qty. 2).

● The corrugated shipping carton for this model has been changed to HP Part No. 9211-2570. Two 9220-2703 floater pads are used.

The blue-gray meter bezel has been replaced by a black one, HP Part No. 4040-0414.

8-5-77

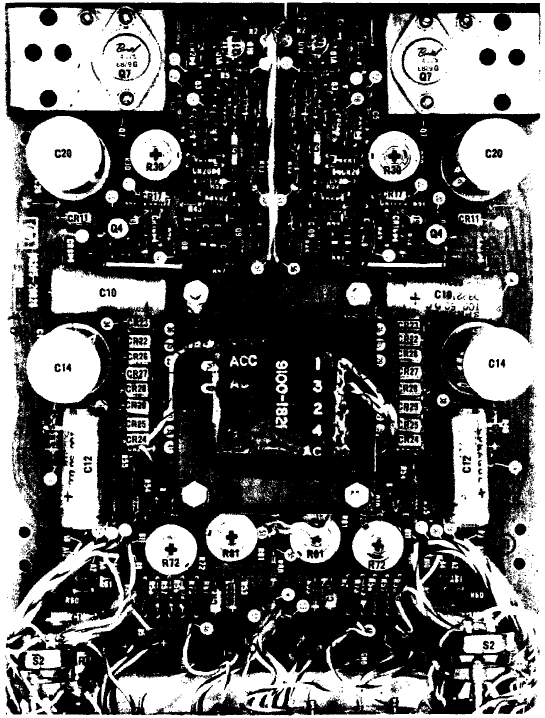
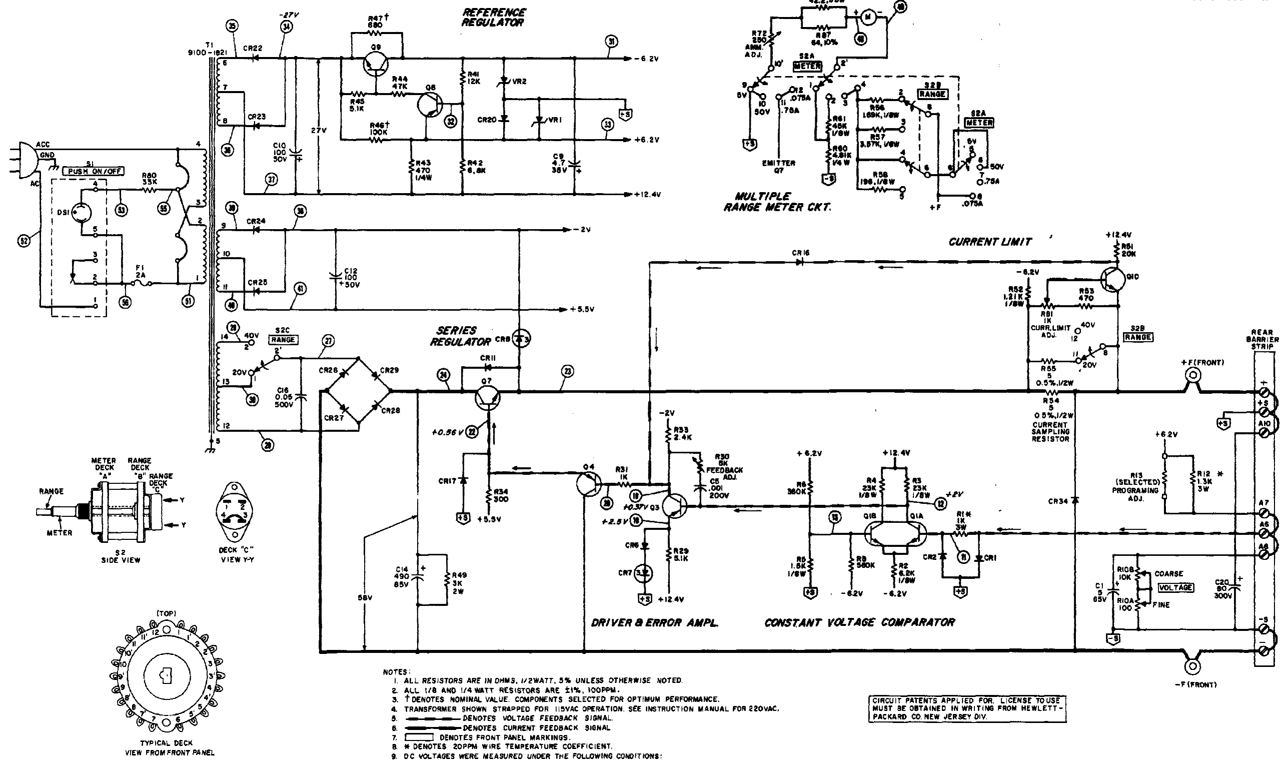


Figure 7-1. Component Location Diagram



NOTES:
1. ALL RESISTORS ARE IN OHMS, 1/2WATT, 5% UNLESS OTHERWISE NOTED.
2. ALL 1/8 AND 1/4 WATT RESISTORS ARE ±1%, 100PPM.
3. † DENOTES NOMINAL VALUE. COMPONENTS SELECTED FOR OPTIMUM PERFORMANCE.
4. TRANSFORMER SHOWN STRAPPED FOR 115VAC OPERATION. SEE INSTRUCTION MANUAL FOR 220VAC.
5. ▬ ▬ ▬ DENOTES VOLTAGE FEEDBACK SIGNAL.
6. ▬▬▬ DENOTES CURRENT FEEDBACK SIGNAL.
7. ▭ DENOTES FRONT PANEL MARKINGS.
8. * DENOTES 20PPM WIRE TEMPERATURE COEFFICIENT.
9. DC VOLTAGES WERE MEASURED UNDER THE FOLLOWING CONDITIONS:
   A. SIMPSON MODEL 269 OR EQUIVALENT.
   B. 115VAC INPUT.
   C. VOLTAGES REFERENCED TO +S UNLESS OTHERWISE NOTED.
   D. VOLTAGES ARE TYPICAL ±10% UNLESS OTHERWISE NOTED.
   E. ALL READINGS TAKEN IN CONSTANT VOLTAGE OPERATION AT MAXIMUM RATED OUTPUT WITH NO LOAD CONNECTED.
10. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE NOTED
11. CIRCUIT ABOVE IS ONE OF TWO IDENTICAL SECTIONS. EVERYTHING TO RIGHT OF TRANS. IS DUPLICATED.

CIRCUIT PATENTS APPLIED FOR. LICENSE TO USE MUST BE OBTAINED IN WRITING FROM HEWLETT-PACKARD CO. NEW JERSEY DIV.

Figure 7-2. Schematic Diagram, Model 6205B

EUROPE, NORTH AFRICA AND MIDDLE EAST

AUSTRIA
Hewlett-Packard Ges m b H
Handelska 52
P O box 7
A-1205 **Vienna**
Tel (0222) 35 16 21 to 27
Cable HEWPAK Vienna
Telex 75923 hewpak a

BELGIUM
Hewlett Packard Benelux S A / N V
Avenue de Col Vert 1
(Groenkraaglaan)
B-1170 **Brussels**
Tel (02) 672 22 40
Cable PALOBEN Brussels
Telex 23 494 paloben bru

CYPRUS
Kypronics
19 Gregorios & Xenopoulos Rd
P O Box 1152
CY **Nicosia**
Tel 45628 29
Cable KYPRONICS PANDEHIS
Telex 3018

CZECHOSLOVAKIA
Vyvojova a Provozni Zakladna
Vyzkumnych Ustavu v Bechovicich
CSSR-25097 **Bechovice u Prahy**
Tel 89 93 41
Telex 121333
Institute of Medical Bionics
Vyskumny Ustav Lekarskej Bioniky
Jedlova 6
CS-88346 **Bratislava-Kramare**
Tel 44-55/45-541

DDR
Entwicklungslabor der TU Dresden
Forschungsinstitut Meinsberg
DDR-7305
Waldheim/Meinsberg
Tel 37 667
Telex 112145
Export Contact AG Zuerich
Guenther Forgber
Schlegelstrasse 15
1040 **Berlin**
Tel 42-74-12
Telex 111889

DENMARK
Hewlett-Packard A/S
Datavej 52
DK-3460 **Birkerod**
Tel (02) 81 66 40
Cable HEWPACK AS
Telex 37409 hpas dk
Hewlett-Packard A/S
Navervej 1
DK-8600 **Silkeborg**
Tel (06) 82 71 66
Telex 37409 hpas dk
Cable HEWPACK AS

FINLAND
Hewlett-Packard OY
Nahkahousuntie 5
P O Box 6
SF-00211 **Helsinki** 21
Tel (90) 6923031
Cable HEWPACKOY Helsinki
Telex 12-1563 HEWPA SF

FRANCE
Hewlett Packard France
Quartier de Courtaboeuf
Boite Postale No. 6
F-91401 **Orsay Cedex**
Tel (1) 907 78 25
Cable HEWPACK Orsay
Telex 600048
Hewlett-Packard France
Agency Regionale
Le Saquin
Chemin des Mouilles
B P 162
F-69130 **Ecully**
Tel (78) 33 81 25
Cable HEWPACK Ecully
Telex 31 06 17

Hewlett-Packard France
Agence Regionale
Pericentre de la Cepiere
Chemin de la Cepiere 20
F-31300 **Toulouse-Le Mirail**
Tel (61) 40 11 12
Cable HEWPACK 51957
Telex 510957
Hewlett-Packard France
Agence Regionale
Aeroport principal de
Marseille-Marignane
F-13721 **Marignane**
Tel (91) 89 12 36
Cable HEWPACK MARGN
Telex 410770
Hewlett-Packard France
Agence Regionale
63 Avenue de Rochester
B P 1124
F-35014 **Rennes Cedex**
Tel (99) 36 33 21
Cable HEWPACK 74912
Telex 740912
Hewlett-Packard France
Agence Regionale
74 Allee de la Robertsau
F-67000 **Strasbourg**
Tel (88) 35 23 20 21
Telex 890141
Cable HEWPACK STRBG
Hewlett-Packard France
Agence Regionale
Centre Vauban
201 rue Colbert
Entree A2
F-59000 **Lille**
Tel (20) 51 44 14
Telex 820744
Hewlett-Packard France
Centre d' Affaires Paris-Nord
Batiment Ampere
Rue de La Commune de Paris
B P 300
F-93153 **Le Blanc Mesnil Cedex**
Tel (01) 931 88 50

GERMAN FEDERAL REPUBLIC
Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Bernerstrasse 117
Postfach 560 140
D-6000 **Frankfurt** 56
Tel (0611) 50 04-1
Cable HEWPACKSA Frankfurt
Telex 04 13249 hpffmd
Hewlett-Packard GmbH
Technisches Buero Boblingen
Herrenbergerstrasse 110
D-7030 **Boblingen**, Wurttemberg
Tel (07031) 667-1
Cable HEPAK Boblingen
Telex 07265739 bbn
Hewlett-Packard GmbH
Technisches Buero Dusseldorf
Emanuel-Leutze-Str 1 (Seestern)
D-4000 **Dusseldorf** 11
Tel (0211) 59711
Telex 085/86 533 hpdd d
Hewlett-Packard GmbH
Technisches Buero Hamburg
Wendenstrasse 23
D-2000 **Hamburg** 1
Tel (040) 24 13 93
Cable HEWPACKSA Hamburg
Telex 21 63 032 hphh d
Hewlett-Packard GmbH
Technisches Buero Hannover
Am Grossmarkt 6
D-3000 **Hannover** 91
Tel (0511) 46 60 01
Telex 092 3259

Hewlett Packard GmbH
Werk Groetzingen
Ohmstrasse 6
D-7500 **Karlsruhe** 41
Tel (0721) 69 40 06
Telex 07 825707
Hewlett-Packard GmbH
Technisches Buero Nuremberg
Neumeyer Str 90
D-8500 **Nuremberg**
Tel (0911) 56 30 83/85
Telex 0623 860
Hewlett-Packard GmbH
Technisches Buero Munchen
Unterhachinger Strasse 28
ISAR Center
D-8012 **Ottobrunn**
Tel (089) 601 30 61-7
Cable HEWPACKSA Munchen
Telex 0524985
Hewlett-Packard GmbH
Technisches Buero Berlin
Keith Strasse 2-4
D-1000 **Berlin** 30
Tel (030) 24 90 86
Telex 18 3405 hpbln d

GREECE
Kostas Karayannis
8 Omirou Street
GR-**Athens** 133
Tel 3237731
Cable RAKAR Athens
Telex 21 59 62 rkar gr
Analytical Only
"INTECO" G. Papathanassiou & Co
Marni 17
GR **Athens** 103
Tel 522 1915
Cable INTEKNIKA Athens
Telex 21 5329 INTE GR
Medical Only
Technomed Hellas Ltd
52 Skoufa Street
GR **Athens** 135
Tel 362 6972 363 3830
Cable ETALAK athens
Telex 21-4693 ETAL GR

HUNGARY
MTA
Muszerugyi es Meresttechnikai
Szolgalata
Lenin Krt 67
1391 **Budapest** VI
Tel 42 03 38
Telex 22 51 14

ICELAND
Medical Only
Elding Trading Company Inc
Hafnarhvoli - Tryggvatotu
IS-**Reykjavik**
Tel 1 58 20
Cable ELDING Reykjavik

IRAN
Hewlett Packard Iran Ltd
No 13 Fourteenth St
Miremad Avenue
P O Box 41/2419
IR-**Tehran**
Tel 851082-7
Telex 21 25 74 khrm ir

IRAQ
Hewlett-Packard Trading Co
4/1/8 Mansoor City
Baghdad
Tel 5517827
Telex 2455 hepairaq ik
Cable HEWPACDAD,
Baghdad Iraq

IRELAND
Hewlett-Packard Ltd
King Street Lane
GB-**Winnersh**,Wokingham
Berks, RG11 5AR
Tel (0734) 78 47 74
Telex 847178/848179

ITALY
Hewlett-Packard Italiana S p A
Via Amerigo Vespucci 2
Casella postale 3645
I-20100 **Milano**
Tel (2) 6251 (10 lines)
Cable HEWPACKIT Milano
Telex 32046
Hewlett Packard Italiana S p A
Via Pietro Maroncelli 40
(ang Via Visentin)
I-35100 **Padova**
Tel (49) 66 48 88
Telex 41612 Hewpackit
Medical only
Hewlett-Packard Italiana S p A
Via d Aghiardi 7
I-56100 **Pisa**
Tel (050) 2 32 04
Telex 32046 via Milano
Hewlett-Packard Italiana S p A
Via G Armellini 10
I-00143 **Roma**
Tel (06) 54 69 61
Telex 61514
Cable HEWPACKIT Roma
Hewlett-Packard Italiana S p A
Corso Giovanni Lanza 94
I-10133 **Torino**
Tel (011) 682245/659308
Medical/Calculators Only
Hewlett-Packard Italiana S p A
Via Principe Nicola 43 G/C
I-95126 **Catania**
Tel (095) 37 05 04
Hewlett-Packard Italiana S p A
Via Amerigo Vespucci 9
I-80142 **Napoli**
Tel (081) 33 77 11
Hewlett-Packard Italiana S p A
Via E Mass 9/B
I-40137 **Bologna**
Tel (051) 30 78 87

KUWAIT
Al-Khaldiya Trading & Contracting Co
P O Box 830 Safat
Kuwait
Tel 424910 411726
Telex 2481 areeg kt
Cable VISCOUNT

LUXEMBURG
Hewlett-Packard Benelux S A /N V
Avenue du Col-Vert, 1
(Groenkraaglaan)
B-1170 **Brussels**
Tel (02) 672 22 40
Cable PALOBEN Brussels
Telex 23 494

MOROCCO
Gerep
190 Blvd Brahim Roudani
Casablanca
Tel 25-16-76/25-90-99
Cable Gerep-Casa
Telex 23739

NETHERLANDS
Hewlett-Packard Benelux N V
Van Heuven Goedhartlaan 121
P O Box 667
NL-1134 **Amstelveen**
Tel (020) 47 20 21
Cable PALOBEN Amsterdam
Telex 13 216 hepa nl

NORWAY
Hewlett-Packard Norge A/S
Nesveien 13
Box 149
N-1344 **Haslum**
Tel (02) 53 83 60
Telex 16621 hpnas n

POLAND
Biuro Informacji Technicznej
Hewlett-Packard
Ul Stawki 2 6P
00-950 **Warszawa**
Tel 395962/395187
Telex 81 24 53 hepa pl
UNIPAN
Zaklad Doswiadczalny
Budowy Aparatury Naukowej
Ul Krasewa 5, Rady Narodowej 51/55
00-830 **Warszawa**
Tel 36190
Telex 81 46 48
Zaklady Naprawcze Sprzetu
Medycznego
Plac Komuny Paryskiej 6
90-007 **Lodz**
Tel 334-41 337-83

PORTUGAL
Telectra-Empresa Tecnica de
Equipamentos Electricos S a r l
Rua Rodrigo da Fonseca 103
P O Box 2531
P-**Lisbon** 1
Tel (19) 68 60 72
Cable TELECTRA Lisbon
Telex 12598
Medical only
Mundinter
Intercambio Mundial de Comércio
S a r l
Av A A de Aguiar 138
P O Box 2761
P **Lisbon**
Tel (19) 53 21 31-7
Cable INTERCAMBIO Lisbon

RUMANIA
Hewlett-Packard Reprezentanta
Bd N Balcescu 16
Bucharest
Tel 158023/138885
Telex 10440
I I R U C
Intreprinderea Pentru
Intretinerea
Si Repararea Utilajelor de Calcul
B-dul prof Dimitrie Pompei 6
Bucharest-Sectorul 2
Tel 12 64 30
Telex 11716

SAUDI ARABIA
Modern Electronic Establishment
King Abdul Aziz str (Head office)
P O Box 1228
Jeddah
Tel 31173-332201
Cable ELECTRA
P O Box 2728 (Service center)
Riyadh
Tel 62596-66232
Cable RAOUFCO

SPAIN
Hewlett-Packard Española S A
Jerez Calle 3
E **Madrid** 16
Tel (1) 458 26 00 (10 lines)
Telex 23515 hpe
Hewlett-Packard Española S A
Milanesado 21-23
E-**Barcelona** 17
Tel (3) 203 6200 (5 lines)
Telex 52603 hpbe e
Hewlett-Packard Española S A
Av Ramón y Cajal 1
Edificio Sevilla planta 9°
E-**Seville** 5
Tel 64 44 54/58
Hewlett-Packard Española S A
Edificio Albia II 7 B
E-**Bilbao** 1
Tel 23 83 06/23 82 06
Calculators Only
Hewlett Packard Española S A
Gran Via Fernando El Catolico, 67
E-**Valencia**-8
Tel 326 67 28/326 85 55

SWEDEN
Hewlett-Packard Sverige AB
Enighetsvagen 1-3
Fack
S-161 20 **Bromma** 20
Tel (08) 730 05 50
Cable MEASUREMENTS Stockholm
Telex 10721
Hewlett-Packard Sverige AB
Ostra Vintergatan 22
S-702 40 **Orebro**
Tel (019) 14 07 20
Hewlett-Packard Sverige AB
Frotallgatan 30
S-421 32 **Vastra Frolunda**
Tel (031) 49 09 50
Telex 10721 Via Bromma Office

SWITZERLAND
Hewlett-Packard (Schweiz) AG
Zurcherstrasse 20
P O Box 307
CH-8952 **Schlieren-Zurich**
Tel (01) 730 52 40/730 18 21
Cable HPAG CH
Telex 53933 hpag ch
Hewlett Packard (Schweiz) AG
Chateau Bloc 19
CH-1219 **Le Lignon-Geneva**
Tel (022) 96 03 22
Cable HEWPACKAG Geneva
Telex 27 333 hpag ch

SYRIA
Medical/Calculator only
Sawah & Co
Place Azme
B P 2308
SYR-**Damascus**
Tel 16367 19697 14268
Cable SAWAH Damascus

TURKEY
Telekom Engineering Bureau
P O Box 437
Beyoglu
TR-**Istanbul**
Tel 49 40 40
Cable TELEMATION Istanbul
Telex 23609
Medical only
E M A
Muhendislik Kollektif Sirketi
Adakale Sokak 41/6
TR-**Ankara**
Tel 175622
Analytical only
Yilmaz Ozyurek
Milli Mudafaa Cad No 16/6
Kizilay
TR-**Ankara**
Tel 25 03 09
Telex 42576 ozek tr

UNITED KINGDOM
Hewlett Packard Ltd
King Street Lane
GB-**Winnersh**, Wokingham
Berks RG11 5AR
Tel (0734) 78 47 74
Cable Hewpie London
Telex 847178/9
Hewlett-Packard Ltd
Trafalgar House,
Navigation Road
Altrincham
Cheshire WA14 1NU
Tel (061) 928 6422
Telex 668068
Hewlett-Packard Ltd
Lygon Court
Hereward Rise
Dudley Road
Halesowen
West Midlands B62 8SD
Tel (021) 550 9911
Telex 339105

Hewlett-Packard Ltd
Wedge House
799 London Road
GB-**Thornton Heath**
Surrey CR4 6XL
Tel (01) 684 0103 8
Telex 946825
Hewlett Packard Ltd
c/o Makro
South Service wholesale Centre
Wear Industrial Estate
Washington
GB-**New Town**, County Durham
Tel Washington 464001 ext 57 56
Hewlett-Packard Ltd
10 Wesley St
GB-**Castleford**
West Yorkshire WF10 1AE
Tel (09775) 50402
Telex 557355
Hewlett-Packard Ltd
1 Wallace Way
GB-**Hitchin**
Herts
Tel (0462) 52824/56704
Telex 825981
Hewlett-Packard Ltd
2C Avonbeg Industrial Estate
Long Mile Road
Dublin 12
Tel Dublin 509458
Telex 30439

USSR
Hewlett-Packard
Representative Office USSR
Pokrovsky Boulevard 4/17-KW 12
Moscow 101000
Tel 294-2024
Telex 7825 hewpak su

YUGOSLAVIA
Iskra-standard/Hewlett-Packard
Miklosiceva 38/VII
61000 **Ljubljana**
Tel 31 58 79 32 16 74
Telex 31583

SOCIALIST COUNTRIES NOT SHOWN PLEASE CONTACT:
Hewlett-Packard Ges m b H
P O Box 7
A-1205 **Vienna**, Austria
Tel (0222) 35 16 21 to 27
Cable HEWPAK Vienna
Telex 75923 hewpak a

MEDITERRANEAN AND MIDDLE EAST COUNTRIES NOT SHOWN PLEASE CONTACT:
Hewlett-Packard S A
Mediterranean and Middle
East Operations
35, Kolokotroni Street
Platia Kefallariou
GR-**Kifissia-Athens**, Greece
Tel 8080337/359 429
Telex 21-6588
Cable HEWPACKSA Athens

FOR OTHER AREAS NOT LISTED CONTACT
Hewlett-Packard S A
7, rue du Bois-du-Lan
P O Box
CH-1217 Meyrin 2 - **Geneva**
Switzerland
Tel (022) 82 70 00
Cable HEWPACKSA Geneva
Telex 2 24 86

UNITED STATES

ALABAMA
8290 Whitesburg Dr S E
P O Box 4207
Huntsville 35802
Tel (205) 881-4591
Medical Only
228 W Valley Ave
Room 220
Birmingham 35209
Tel (205) 942 2081-2

ARIZONA
2336 E Magnolia St
Phoenix 85034
Tel (602) 244 1361
2424 East Aragon Rd
Tucson 85706
Tel (602) 294 3148

***ARKANSAS**
Medical Service Only
P O Box 5646
Brady Station
Little Rock 72215
Tel (501) 376 1844

CALIFORNIA
1430 East Orangethorpe Ave
Fullerton 92631
Tel (714) 870 1000
3939 Lankershim Boulevard
North Hollywood 91604
Tel (213) 877 1282
TWX 910-499-2671
5400 West Rosecrans Blvd
P O Box 92105
World Way Postal Center
Los Angeles 90009
Tel (213) 970 7500
***Los Angeles**
Tel (213) 776 7500
3003 Scott Boulevard
Santa Clara 95050
Tel (408) 249 7000
TWX 910-338-0518
***Ridgecrest**
Tel (714) 446-6165
646 W North Market Blvd
Sacramento 95834
Tel (916) 929 7222
9606 Aero Drive
P O Box 23333
San Diego 92123
Tel (714) 279-3200

COLORADO
5600 South Ulster Parkway
Englewood 80110
Tel (303) 771-3455

CONNECTICUT
12 Lunar Drive
New Haven 06525
Tel (203) 389-6551
TWX 710-465-2029

FLORIDA
P O Box 24210
2806 W Oakland Park Blvd
Ft Lauderdale 33311
Tel (305) 731-2020
***Jacksonville**
Medical Service only
Tel (904) 398-0663
P O Box 13910
6177 Lake Ellenor Dr
Orlando 32809
Tel (305) 859-2900
P O Box 12826
Pensacola 32575
Tel (904) 476-8422

GEORGIA
P O Box 105005
Atlanta 30348
Tel (404) 955-1500
TWX 810 766-4890
Medical Service Only
***Augusta** 30903
Tel (404) 736-0592
P O Box 2103
Warner Robins 31098
Tel (912) 922-0449

HAWAII
2875 So King Street
Honolulu 96814
Tel (808) 955-4455
Telex 723 705

ILLINOIS
5201 Tollview Dr
Rolling meadows 60008
Tel (312) 255-9800
TWX 910-687 2260

INDIANA
7301 North Shadeland Ave
Indianapolis 46250
Tel (317) 842-1000
TWX 810 260-1797

IOWA
2415 Heinz Road
Iowa City 52240
Tel (319) 338-9466

KENTUCKY
Medical Only
Atkinson Square
3901 Atkinson Dr
Suite 407 Atkinson Square
Louisville 40218
Tel (502) 456-1573

LOUISIANA
P O Box 840
3229-39 Williams Boulevard
Kenner 70063
Tel (504) 443-6201

MARYLAND
6707 Whitestone Road
Baltimore 21207
Tel (301) 944-5400
TWX 710-862 9157
2 Choke Cherry Road
Rockville 20850
Tel (301) 948 6370
TWX 710-828-9684

MASSACHUSETTS
32 Hartwell Ave
Lexington 02173
Tel (617) 861-8960
TWX 710-326-6904

MICHIGAN
23855 Research Drive
Farmington Hills 48024
Tel (313) 476-6400
724 West Centre Ave
Kalamazoo 49002
Tel (606) 323-8362

MINNESOTA
2400 N Prior Ave
St. Paul 55113
Tel (612) 636-0700

MISSISSIPPI
***Jackson**
Medical Service only
Tel (601) 982-9363

MISSOURI
11131 Colorado Ave
Kansas City 64137
Tel (816) 763-8000
TWX 910-771-2087
1024 Executive Parkway
St. Louis 63141
Tel (314) 878-0200

NEBRASKA
Medical Only
7171 Mercy Road
Suite 110
Omaha 68106
Tel (402) 392-0948

NEW JERSEY
W 120 Century Rd
Paramus 07652
Tel (201) 265-5000
TWX 710 990-4951
Crystal Brook Professional
Building
Eatontown 07724
Tel (201) 542 1384

NEW MEXICO
P O Box 11634
Station E
11300 Lomas Blvd N E
Albuquerque 87123
Tel (505) 292 1330
TWX 910 989 1185
156 Wyatt Drive
Las Cruces 88001
Tel (505) 526-2484
TWX 910-9983-0550

NEW YORK
6 Automation Lane
Computer Park
Albany 12205
Tel (518) 458-1550
201 South Avenue
Poughkeepsie 12601
Tel (914) 454-7330
TWX 510-253-5981
650 Perinton Hill Office Park
Fairport 14450
Tel (716) 223-9950
5858 East Molloy Road
Syracuse 13211
Tel (315) 454-2486
TWX 710-541-0482
1 Crossways Park West
Woodbury 11797
Tel (516) 921-0300
TWX 710-990-4951

NORTH CAROLINA
P O Box 5188
1923 North Main Street
High Point 27262
Tel (919) 885-8101

OHIO
16500 Sprague Road
Cleveland 44130
Tel (216) 243 7300
TWX 810 423-9430
330 Progress Rd
Dayton 45449
Tel (513) 859-8202
1041 Kingsmill Parkway
Columbus 43229
Tel (614) 436 1041

OKLAHOMA
P O Box 32008
Oklahoma City 73132
Tel (405) 721-0200

OREGON
17890 SW Lower Boones
Ferry Road
Tualatin 97062
Tel (503) 620-3350

PENNSYLVANIA
111 Zeta Drive
Pittsburgh 15238
Tel (412) 782-0400
1021 8th Avenue
King of Prussia Industrial Park
King of Prussia 19406
Tel (215) 265 7000
TWX 510-660-2670

SOUTH CAROLINA
6941-0 N Trenholm Road
Columbia 29260
Tel (803) 782-6493

TENNESSEE
***Knoxville**
Medical Service only
Tel (615) 523-5022
3027 Vanguard Dr
Director's Plaza
Memphis 38131
Tel (901) 346-8370
Nashville
Medical Service only
Tel (615) 244-5448

TEXAS
P O Box 1270
201 E Arapaho Rd
Richardson 75080
Tel (214) 231-6101
10535 Harwin Dr
Houston 77036
Tel (713) 776-6400
205 Billy Mitchell Road
San Antonio 78226
Tel (512) 434-8241

UTAH
2160 South 3270 West Street
Salt Lake City 84119
Tel (801) 972-4711

VIRGINIA
P O Box 12778
No 7 Koger Exec Center
Suite 212
Norfolk 23502
Tel (804) 461-4025/9
P O Box 9669
2914 Hungary Springs Road
Richmond 23228
Tel (804) 285-3431

WASHINGTON
Bellefield Office Pk
1203-114th Ave S E
Bellevue 98004
Tel (206) 454-3971
TWX 910-443-2446

***WEST VIRGINIA**
Medical/Analytical Only
Charleston
Tel (304) 345-1640

WISCONSIN
9004 West Lincoln Ave
West Allis 53227
Tel (414) 541-0550

FOR U.S. AREAS NOT LISTED:
Contact the regional office nearest you: Atlanta, Georgia; North Hollywood, California; Rockville, Maryland; Rolling Meadows, Illinois. Their complete addresses are listed above.

*Service Only

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:

Active Army:

TSG (l)
USAARENBD (1)
USAINSCOM (2)
TRADOC (2)
DARCOM (1)
TECOM (2)
OS Maj Cmd (2)
USACC (2)
HISA Ft Monmouth (21)
Armies (1)
USASIGS (10)
Svc Colleges (1)
Ft Richardson (CERCOM Oft) (1)
Ft Carson (5)
Ft Gillem (10)
USMR (1)
USA ERDAA(l)
USAERDAW (1)
Army Dep (1) except:
LBAD (10)
SAAD (30)
TOAD (14)
SHAD (3)
USA Dep (1)
Sig Sec USA Dep (1)
Units org under fol TOE:
29-134 (1)
29-136 (1)
29-207 (2)
29-610 (2)

NG: None.
USAR: None.
For explanation of abbreviations used, see AR 310-50.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)
Commander
Stateside Army Depot
ATTN: AMSTA-US
Stateside, N.J. 07703

DATE 4 April 1978

PUBLICATION NUMBER	DATE	TITLE
TM 11-5840-340-14&P	23 Jan 74	Radar Set AN/PLC-76

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
E-5				For item 2, change the NSN to read: 5835-00-134-9186. REASON: Accuracy.
E-8		E-3		Identify the cover on the junction box (item no. 5). REASON: It is a separate item and is not called out on figure 19.
E-9				Add the cover of the junction box as an item in the listing for figure 19. REASON: Same as above.

SAMPLE

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:
SSG I. M. DeSpiritof 999-1776	SSG I. M. DeSpiritof

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FINDS," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG DOTTED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2965-14&P	25 Feb 80	

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

TEAR ALONG DOTTED LINE

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

____

____

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

Commander
US Army Communications and
Electronics Materiel Readiness Command
ATTN: DRSEL-ME-MQ
Fort Monmouth, New Jersey 07703

TEAR ALONG DOTTED LINE

FOLD BACK

REVERSE OF DA FORM 2028-2

THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'EIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

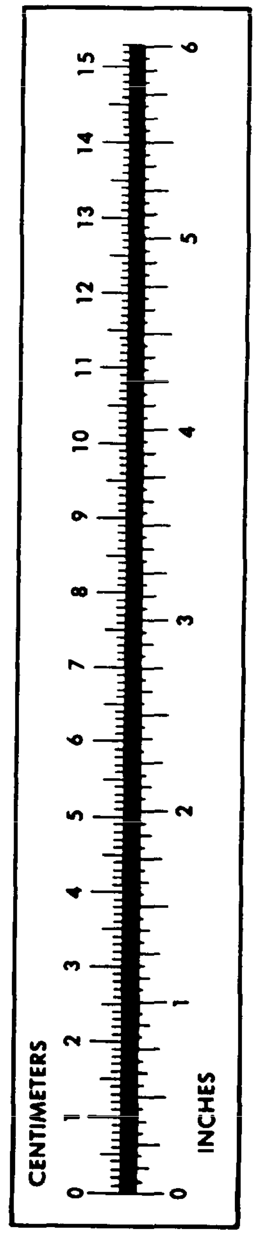
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
'ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
'lometers per Liter	Miles per Gallon	2.354
ometers per Hour	Miles per Hour	0.621



PIN: 044061-000