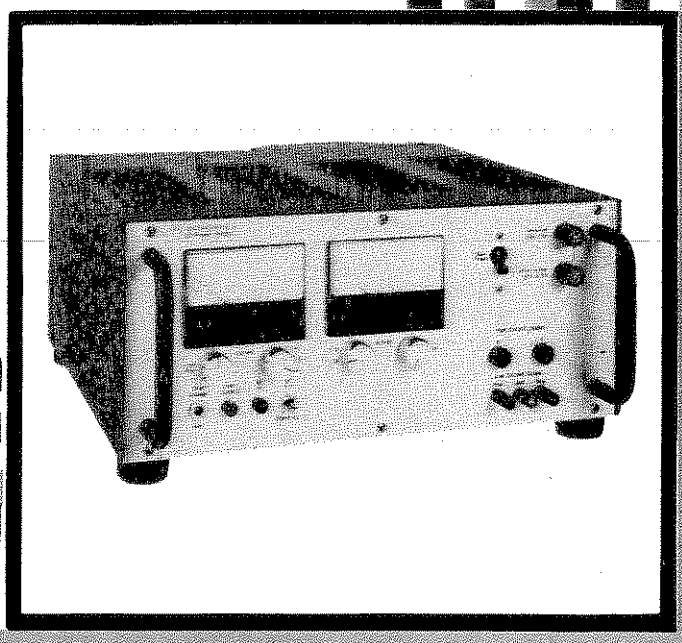
MOTOROLA
test equipment

DC POWER SUPPLY
0-40V, 0-40A



R-1011B

68P81069A94-O

MOTOROLA TEST EQUIPMENT PRODUCTS
LIMITED WARRANTY
(EXCLUDES EXPORT SHIPMENTS)

Motorola Test Equipment Products (herein the "product") that are manufactured or distributed by Motorola Communications Group Parts Department are warranted by Motorola for a period of one (1) year from date of shipment against defects in material and workmanship.

This express warranty is extended to the original purchaser only. In the event of a defect, malfunction, or failure during the period of warranty, Motorola, at its option, will either repair, or replace the product providing that Motorola receives written notice specifying the nature of the defect during the period of warranty, and the defective product is returned to Motorola at 1313 East Algonquin Road, Schaumburg, IL 60196 transportation prepaid. Proof of purchase and evidence of date of shipment (packing list or invoice) must accompany the return of the defective product. Transportation charges for the return of the product to Purchaser shall be prepaid by Motorola.

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(b) The seals on non-user serviceable components or modules are broken;

(c) The product has been subject to misuse, abuse, damage, accident, negligence, repair or alteration.

In no event shall Motorola be liable for any special, incidental, or consequential damages.

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EPS-30828-O

MOTOROLA INC.
Communications Group

R1011B
DC POWER SUPPLY

CONTENTS

technical writing services
1301 E. Algonquin Road, Schaumburg, Il. 60196

68P81069A94-O
11/25/81-PHI

SECTION *NUMBER*

SPECIFICATIONS

AC Line Input	R-1011B — Maximum Range: 108-132 V ac; 50-60 Hz R-1011B/220 — Maximum Range: 198-242 V ac; 50-60 Hz R-1011B/240 — Maximum Range: 216-264 V ac; 50-60 Hz Power Consumption: 1200 watts maximum with 600 watts output Line Current: 15A max @120 V, 7A max @240 V with 600 watts output
DC Output Ranges	Voltage: 0-20 V dc or 0-40 V dc Current: 0-5A, 0-20A or 0-40A* *30A continuous, 40A intermittent
Output Power Rating	600 watts, continuous 800 watts, intermittent
DC Load Regulation	±0.1% max. line + load ± .025% typical no load to full load
Ripple and Noise	Less than 20 mV rms
Meters	DC Voltage: Two scales; 0-20 and 0-40 DC Current: Three scales; 0-5, 0-20 and 0-40 Accuracy: ±5%
Temperature Range	Operating: 0° to +50° C Storage: −40° to +75° C
Physical Characteristics	Size: 16" (40.6 cm) W x 8" (20.3 cm) H x 20" (50.8 cm) D Weight: 63 lb. (29 kg)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

FOREWORD

1. SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMR's are added to the manuals as the engineering changes are incorporated into the equipment.

2. MODEL AND KIT IDENTIFICATION

Motorola equipments are specifically identified by an overall model number on the nameplate. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them. When a production or engineering change is incorporated, the applicable schematic diagrams are updated.

As diagrams are updated, information about the change is incorporated into a revision column. This revision column appears in the manual next to the parts list or, in some cases, on the diagram. It lists the reference number, part number, and description of the parts removed or replaced.

3. SERVICE

Motorola's National Service Organization offers one of the finest nation-wide installation and maintenance programs available to communication equipment users. This organization includes approximately 900 authorized Motorola Service Stations (MSS) located throughout the United States, each manned by one or more trained, FCC licensed technicians.

These MSS's are independently owned and operated and were selected by Motorola to service its customers. Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

The administrative staff of this organization consists of national, area and district service managers and district representatives, all of whom are Motorola employees with the objective to improve the service to our customers.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

National Service Manager
Motorola Communications and Electronics, Inc.
1303 E. Algonquin Road
Schaumburg, Illinois 60196

4. REPLACEMENT PARTS ORDERING

Motorola maintains a number of parts offices strategically-located throughout the United States. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Group products.

Orders for all parts *except* crystals, active filters, code plugs, channel elements, and "Vibrasender" ® and "Vibrasponder" ® resonant reeds should be sent to the nearest area parts center. Orders for instruction manuals should also be sent to the area parts center.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements, active filters, PROMs, code plugs, and reeds should be sent directly to the factory address listed on the following page. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the chassis model number in which the part is used.

Orders for active filters, PROMs, code plugs, *Vibrasender* and *Vibrasponder* resonant reeds should specify type number and frequency, should identify the owner/operator of the communications system in which these items are to be used; and should include any serial numbers stamped on the components being replaced.

5. ADDRESSES

5.1 GENERAL OFFICES

MOTOROLA Communications and Electronics Inc.
Communications Group Parts Dept.
1313 E. Algonquin Rd.,
Schaumburg, Illinois 60196
Phone: 312-576-3900

5.2 U.S. ORDERS

WESTERN AREA PARTS
1170 Chess Drive, Foster City,
San Mateo, California 94404
Phone: 415-349-3111
TWX: 910-375-3877

MIDWEST AREA PARTS
1313 E. Algonquin Road
Schaumburg, Ill. 60196
Phone: 312-576-7322
TWX: 910-693-0869

MID-ATLANTIC AREA PARTS
7230 Parkway Drive
Hanover, Maryland 20176
Phone: 301-796-8600
TWX: 710-862-1941

EAST CENTRAL AREA PARTS
12995 Snow Road,
Parma, Ohio 44130
Phone: 216-267-2210
TWX: 810-421-8845

EASTERN AREA PARTS
85 Harristown Road,
Glen Rock, New Jersey 07452
Phone: 201-447-4000
TWX: 710-988-5602

PACIFIC SOUTHWESTERN AREA PARTS
P.O. Box 85036
San Diego, California 92138
Phone: 714-578-2222
TWX: 910-335-1634

GULF STATES AREA PARTS
8550 Katy Freeway
Suite 128
Houston, Texas 77024
Phone: 713-932-8955

SOUTHWESTERN AREA PARTS
P.O. Box 34290
3320 Belt Line Road,
Dallas, Texas 75234
Phone: 214-241-2151
TWX: 910-860-5505

SOUTHEASTERN AREA PARTS
P.O. Box 368
Decatur, Georgia 30031
Phone: 504-981-9800
TWX: 810-766-0876

5.3 CANADIAN ORDERS

MOTOROLA LTD.
National Parts Department
3125 Steeles Avenue East
Willowdale, Ontario M2H 2H6
Phone: 416-499-1441
TWX: 610-492-2713
Telex: 065-25191

5.4 ALL COUNTRIES EXCEPT U.S. AND CANADA

MOTOROLA, INC. OR MOTOROLA AMERICAS, INC.
International Parts Dept.
1313 E. Algonquin Road
Schaumburg, Illinois 60196 U.S.A.
Phone: 312-576-6492
TWX: 910-693-0869
Telex: 722443 or 722424
Cable: MOTOL PARTS

5.5 FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT, ACTIVE FILTER, CODE PLUGS, PROMs, AND RESONANT REED ORDERS

ALL MAIL ORDERS
Motorola, Inc.
Component Products Sales & Service
P.O. Box 66191
O'Hare International Airport
Chicago, Ill. 60666

CORRESPONDENCE
Motorola, Inc.
Component Products Sales & Service
2553 N. Edgington Street
Franklin Park, Illinois 60131

1. DESCRIPTION

The R1011B DC Power Supply provides a highly filtered, voltage regulated and current limited power source for servicing all types of solid state communications equipment, from low power portable receivers to high power mobile transceivers. The output voltage of 0-40 V is available in two ranges: 0-20 V or 0-40 V; and is continuously adjustable in either range. The output current is available in three ranges: 0-5A, 0-20A, or 0-40A; and provides up to 30A continuously or up to 40A intermittently.

The low ripple content of the output eliminates the need for external filtering. A solid state, pulse-width modulated switching type voltage regulator maintains output voltage stability under sharply varying load conditions, such as where a high power transmitter is keyed-up. This excellent stability allows the power supply to be connected directly to the load equipment eliminating the need for power supply operation as a battery charger, with an automotive type battery. (This mode of operation is often required when using *other* high current power supplies.)

Adjustable current limiting is used with the constant voltage source. Sufficient current is provided to maintain the output voltage, as the load demand increases, up to the preset current limiting level, at which time, an overcurrent indicator lights and the output voltage drops preventing the current from rising above the preset limit.

Protection circuits enhance the power supply usefulness. RFI and EMI shielding permit reliable operation within the rf environment frequently encountered in the service shop. A transient overload protector circuit shuts-down power supply operation when high current transients are sensed at the output. Crowbar short circuit protection prevents damage to the output transistors from direct shorts across the output terminals. Overvoltage circuits protect both the power supply input and output against damage from sustained overvoltage operation. This allows intermittent operation at the full 40A output. Thermoswitches shut-down the power supply in event of sustained overload conditions.

Negatively- or positively-grounded equipment, or equipment using a floating ground may be operated from the power supply. Separate terminals are provided for the high and low current outputs.

2. PREPARATION FOR USE

2.1 EQUIPMENT LOCATION

Select a flat surface for mounting the power supply that is convenient to the ac power source. Make sure that the mounting surface is sturdy enough to support the power supply weight of 63 lb. Allow adequate space around the power supply to permit free airflow for cooling purposes.

2.2 POWER REQUIREMENTS

Before connecting power to the power supply, place the MAIN POWER switch in the OFF position. Plug the three-wire power cord into the power supply rear panel socket and into the ac power convenience outlet. It is recommended that a separately fused 15A outlet box be used for this power supply. Do not use the power supply until you are familiar with the usage of all operator's items and you have read the Operating Instructions provided in this instruction manual.

WARNING

Do not disconnect the third wire ground on this power cord. This could create an electrical shock hazard. If a two-wire to three-wire adapter is used, be sure that the third wire is connected to a good earth ground.

3. DESCRIPTION OF OPERATOR'S ITEMS

3.1 MAIN POWER OFF-ON SWITCH AND CIRCUIT BREAKER

This item is a combination input ac power OFF-ON switch and an overload circuit breaker. The circuit breaker automatically trips, turning off the power supply, whenever there is an excessive output load demand, a thermal hot spot, or an input or output overvoltage condition. The circuit breaker should be reset only after the faulty condition has been corrected.

3.2 AC ON POWER INDICATOR (GREEN)

Lights when the MAIN POWER switch is on and turns off if the circuit breaker trips.

3.3 DC ON-STANDBY SWITCH

DC ON position applies power to the OUTPUT jacks and binding posts. STANDBY position prevents power from being applied to the output and metering circuits by inhibiting the output voltage regulator.

3.4 VOLTAGE RANGE SWITCH

Selects one of two dc output voltage ranges: 20 V (0-20 V) or 40 V (0-40 V).

3.5 VOLTAGE ADJ CONTROL

Adjusts the output voltage within the range determined by the VOLTAGE range selection.

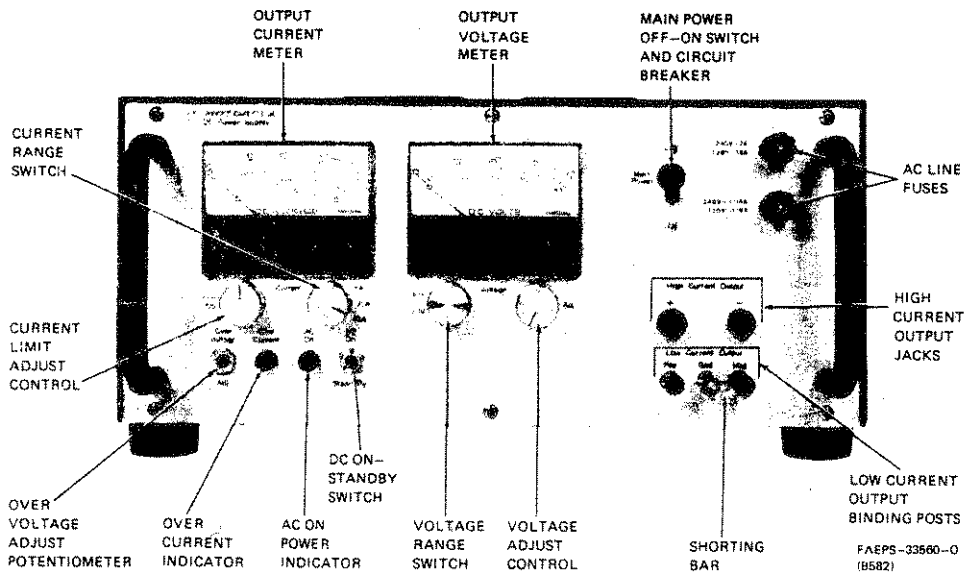


Figure 1. Identification of Operator's Items

3.6 DC VOLTS OUTPUT VOLTAGE METER

Monitors the power supply dc output voltage. The meter scale permits reading of two voltage ranges: 0-20 V or 0-40 V.

3.7 OVERVOLTAGE ADJ CONTROL

Sets the maximum voltage level that can be applied to the load, regardless of the VOLTAGE range switch selection and VOLTAGE ADJ control setting. The circuit breaker will trip, turning off the power supply, should the output voltage attempt to rise above this maximum preset level.

3.8 CURRENT RANGE SWITCH

Selects one of three output current ranges: 5A (0-5A), 20A (0-20A), or 40A (0-40A).

3.9 CURRENT LIMIT ADJ CONTROL

Adjusts the maximum output current that can be applied to the load within the range determined by the CURRENT range selection. If excess load current is drawn the OVERCURRENT indicator lights and the output voltage drops limiting the current to the preset level.

3.10 DC AMPERES OUTPUT CURRENT METER

Monitors the power supply dc output current. The three meter scales permit reading of three current ranges: 0-5A, 0-20A or 0-40A.

3.11 OVERCURRENT INDICATOR (AMBER)

Turns on when the load current drawn exceeds the setting of the CURRENT LIMIT ADJ control.

3.12 HIGH CURRENT OUTPUT + AND – JACKS

These jacks provide the power supply output for current levels above 5A. This is a floating output allowing either negatively- or positively-grounded equipment to be operated from the power supply. Heavy gauge cables terminated in 1/4 inch male banana plugs should be used for interconnection to these jacks.

3.13 LOW CURRENT OUTPUT BINDING POSTS

These binding posts provide the power supply output for current levels below 5A. The POS (RED) and NEG (BLK) binding posts provide a floating output. The GND (GRN) binding post is connected to earth (or safety) ground through the power supply chassis and the three-wire ac power cord. The floating output allows either negatively- or positively-grounded equipment to be operated from the power supply. The binding posts are the five-way type which can accommodate most dc power cables used in the service shop.

3.14 SHORTING BAR

The shorting bar allows the power supply output to be strapped according to the ground requirements of the load equipment, regardless of whether the HIGH or LOW CURRENT OUTPUT is used. For negatively-grounded equipment, connect the shorting bar between

the GND and NEG binding posts. For positively-grounded equipment, connect the shorting bar between the GND and POS binding posts. For equipment requiring a floating voltage, disconnect the shorting bar from all binding posts.

3.15 AC LINE FUSES

Fuse F1 protects the main power source in the power supply from damage due to internal failure or excessive power demand. Fuse F2 prevents damage to the auxiliary power source circuitry.

4. OPERATING INSTRUCTIONS

4.1 INTERCONNECTING EQUIPMENT

The power supply may be used to power either negatively- or positively-grounded equipment or equipment requiring a floating voltage source. Interconnect the equipment as follows:

Step 1. Determine the type of ground required for the equipment to be powered.

Step 2. For negatively-grounded equipment, connect the shorting bar between the GND and NEG binding posts. For positively-grounded equipment, connect the shorting bar between the GND and POS binding posts. From equipment requiring a floating voltage, disconnect the shorting bar from all binding posts.

CAUTION

When using the floating output, do not exceed a 100 V dc potential difference between the floating ground and the power supply GND (chassis) binding post. This condition could damage the power supply filter capacitors.

Step 3. If the equipment requires a load current of less than 5A, the LOW CURRENT OUTPUT binding posts should be used. Connect a suitable dc power cable to the POS and NEG binding posts and to the equipment, observing proper polarities.

Step 4. If the equipment requires a load current of more than 5A, the HIGH CURRENT OUTPUT jacks should be used. Connect a suitable dc power cable to the + and − jacks and to the equipment, observing proper polarities.

WARNING

For equipment operated with a grounded voltage, make sure that the power supply GND binding post and all other equipments are connected to the same earth (safety) ground point. This will prevent ground loops from being created and possibly cause an electrical shock hazard.

4.2 OPERATING PROCEDURE

This power supply is intended to be used as a constant voltage source. The output voltage is first preset to the desired level and then the current limiter is set to the maximum allowable limit. The power supply will deliver any current needed to maintain the preset voltage level up to the limiting current level. An overvoltage limit control prevents the output voltage from increasing above the preset safe operating level for the equipment being powered. Operate the power supply as follows:

Step 1. Connect load to output terminals per instructions in preceeding paragraph 4.1.

Step 2. Place DC ON-STANDBY switch in the STANDBY position. Set the OVERVOLTAGE ADJ potentiometer fully clockwise (maximum output voltage point).

Step 3. Turn on the power supply by placing the MAIN POWER switch in the ON position. The green AC ON power indicator should light.

Step 4. Place the 20 V-40 V VOLTAGE range switch in the proper position for the required output voltage. Set the VOLTAGE ADJ control fully counterclockwise (minimum output level).

Step 5. Place the 5A-20A-40A CURRENT range switch in the proper position for the anticipated load current demand. Set the CURRENT LIMIT ADJ control fully clockwise.

CAUTION

This adjustment temporarily defeats the power supply current limiting capability. The maximum current for the CURRENT range selected could be applied to the load.

If the maximum load current is known, an alternate adjustment procedure may be made as follows. Assume that the OVERCURRENT LIMIT ADJ control provides linear adjustment over its entire operating range. Set control to an approximately correct position. For example, if the CURRENT range switch is in the 20A position, then a mid-range setting of the OVERCURRENT LIMIT ADJ control would be approximately 10A.

Step 6. Place the DC ON-STANDBY switch in the DC ON position.

Step 7. Slowly turn the VOLTAGE ADJ control clockwise until the desired output voltage is obtained, as read on the dc volts meter. An output will not be observed until the control is turned slightly.

Step 8. Slowly turn the CURRENT LIMIT ADJ control counterclockwise until the OVERCURRENT indicator just lights. Turn control slightly clockwise. The

output current is now limited to about 10% more than the initial value.

Step 9. The power supply may now be used and operated for those applications not requiring output overvoltage protection. If overvoltage protection is needed, proceed as follows:

a. Disconnect load from output terminals.
b. With the OVERVOLTAGE ADJ potentiometer turned fully clockwise, turn the VOLTAGE ADJ control clockwise until the maximum permissible output voltage is read on the voltmeter.
c. Turn the OVERVOLTAGE ADJ control slowly counterclockwise until the circuit breaker trips.
d. Turn the VOLTAGE ADJ control counterclockwise at least 1/8 turn and connect the load to the output terminals.
e. Restart the power supply in the normal way.

5. THEORY OF OPERATION

5.1 INTRODUCTION AND OVERVIEW

The Motorola R1011B High Current Power Supply is a typical switching regulator design with special features to lessen its susceptibility to rf interference and to protect associated equipment. It consists of an input dc power source, an auxiliary power supply, a series switching circuit, an output filter, a voltage comparator and pulse generator and protection and metering circuits.

5.2 INPUT DC POWER SOURCE

The input dc power source (or main dc supply) consists of transformer T1 providing line isolation and voltage step-down, bridge rectifier CR7, and filter capacitors C1 thru C4. Bleeder resistors R6 and R7 stabilize the output voltage and supply an input reference voltage. L1 improves filtering and regulation, gives increased transformer and rectifier efficiency and isolates the input circuit from output transients. Filter capacitors C1-C4 are chosen to provide a low impedance to both 120 Hz and 20 kHz.

5.3 AUXILIARY POWER SUPPLY

The auxiliary power supply provides five regulated output voltages and an unregulated negative voltage for various control functions in the circuit. The regulated output voltages come from three terminal IC regulators or Zener diodes. Of special importance is the −18 volt regulated output voltage, used as a reference voltage for the main regulator circuit.

5.4 SERIES SWITCHING CIRCUIT

5.4.1 Pass transistors Q1-Q4, driven by driver transistors Q201-Q205, act as a switch to alternately connect or disconnect the output of the main DC supply to the output filter circuit. The pass transistors are either completely turned off or saturated; the average output voltage is proportional to the input voltage times the duty factor of the pulsed on time of the pass transistors. Commutating choke L2 provides the necessary series impedance to limit the current when the pass devices are turned on and to store energy to drive the output circuit during the period when the pass transistors are off. Commutating diode CR3 provides a current path for the output current when the pass transistors are off.

5.4.2 The input to L2 consists of a series of positive pulses whose amplitude is one or two volts less than the voltage across C1-C4. The output of L2, across C5 and C6, consists of well-filtered dc whose value is equal to the average value of the positive pulses. A circuit is provided to prevent turning on the series pass devices more than 95 percent of the time.

5.4.3 In order to understand the operation of the circuit it must be remembered that a transistor is a current operated device. Thus, when Q205 is turned on, its collector voltage drops almost to zero, but the voltage on the bases of Q201-Q204 remains almost constant. They are driven by *current* flowing thru R216-R219 in parallel with R226-R229. Resistors R206-R209 and R211-R214 are provided to help equalize the drive to the main pass transistors.

5.4.4 A plug and jack connection is provided at the input to Q205. If it is desirable for maintenance purposes to test the switching circuit without the main control circuit board it is possible to do so by connecting a pulse generator to the input cable at this point. The positive pulses should be about 3 volts amplitude, 50 microseconds maximum pulse width and no more than 90 percent duty factor. When the supply is in the STANDBY position, the input to Q205 is short-circuited.

5.4.5 Under certain failure mode conditions, such as the short circuiting of one of the capacitors (C1-C4), the output voltage could become higher than the input voltage. Diodes CR1 and CR2 prevent damaging reverse voltages from being applied across the pass transistors in such a case.

5.5 OUTPUT FILTER CIRCUIT

5.5.1 The commutating and smoothing functions of L2 and C5 have been discussed above. C6 improves filtering and also helps absorb transient voltages generated by L2 if the output current is suddenly changed.

5.5.2 Additional capacitive and inductive rf filtering is provided inside a shield box over the output terminals. Filtering is provided from each terminal to chassis ground and from terminal to terminal so as to minimize interference going either direction with either output terminal grounded or floating up to 100 volts above ground potential.

5.5.3 The output voltage for the metering circuit and control system is taken from the output terminals to avoid voltage drops in the internal wiring.

5.6 METERING CIRCUITS

5.6.1 The output voltage is indicated on a two scale voltmeter with a 10 milliampere full scale movement. The proper series resistors are switched in by the voltage range switch.

5.6.2 Current is measured in reference to the voltage drop across a precision 20 watt .01 ohm resistor in the negative return lead of the supply. The voltage drop across this resistor will be 0.4 volts at full (40 amp) output. The proper multiplying resistor is switched into the circuit by the current range switch. The ammeter uses the same movement as the voltmeter; the difference is in the scale calibration.

5.7 VOLTAGE COMPARATOR CIRCUIT

5.7.1 The power supply output voltage is applied to a voltage divider consisting of R104 in series with R105 or R105 and R106 in parallel. The resultant output voltage (0 to 12 volts) is applied to R103. The −18 volt regulated reference voltage is applied to R24, OUTPUT VOLTAGE ADJUST, and the output voltage, variable from 0 to −18 volts, is applied to R101, filtered by C101 and C102 and connected to R103 through R102. The resultant is a nominally zero voltage at the non- inverting input, pin 3, of voltage comparator U101. The inverting input terminal, pin 2, is referred to circuit ground through R107. This connection permits output voltage from almost zero to 40 volts with full regulator sensitivity. Inverse feedback around U101 is provided by R108, R109 and C104; the dc gain of U101 is much higher than the ac gain to provide maximum regulation with good ac stability. C102 also aids circuit stability and provides a soft turn on and minimum transient currents thru the pass devices when the output voltage is changed.

5.7.2 A slight positive bias is applied to the comparator input terminal through R162, assuring that the pass devices will start at minimum duty factor when turned on from standby. This feature results in a slight offset from zero in the voltage adjust control. Another circuit, to be discussed below, clamps the input to provide mimimum output in the event of a large surge of output current, thus protecting the pass devices.

5.8 PULSE GENERATOR CIRCUIT

Q101, a unijunction transistor, is used as a pulse generator to produce a positive pulse across R120. The width of the pulse is determined by the time constant R120-C105, the pulse repetition frequency (PRF) is determined by the time constant of C105 and the equivalent total series resistance of R117 and R118. The manual PRF control, R117, is adjusted so that the total duty factor of the pulse generator will not exceed 90%. The output of Q101, guaranteed to be a short positive pulse by the action of C106, R123, CR104 and CR105, is applied to the base of Q102.

5.9 MONOSTABLE MULTIVIBRATOR CIRCUIT

Q102 and Q103 comprise a monostable multivibrator. Q103 is normally fully ON because of the positive bias through R125. Q102 is normally OFF because of R124. Q102 is pulsed on by the positive trigger pulse from Q101. Cross coupling through C107 then turns Q103 OFF. The time constant R125-C107 determines the time the circuit stays in this condition. After the base of Q103 becomes positive again by current through R125, the circuit switches back to its original state, helped by cross coupling through C108 and R128. The output at the collector of Q103 is a positive pulse with sharp rise and fall times. The output is buffered by emitter-follower Q104.

5.10 PULSE WIDTH CONTROL CIRCUIT

5.10.1 The output of U101 is also connected to inverter-amplifier Q105 through R112 and CR103. When pin 6 of U101 is less than 0 volts, Q105 is non-conducting and the voltage on the collector of Q105, which is connected to the gate of Q106, is 18 volts. Q106 is turned fully OFF and has no effect on the circuit. This results in maximum pulse width or full output voltage.

5.10.2 If the reference voltage at the input (pin 3) of U101 starts going positive, the output at pin 6 of U101 starts going positive and Q105 will start conducting, lowering the gate voltage of Q106, the pulse width controller. Q106 in series with R126 is effectively a variable resistor in shunt with R125; as the combined resistance is lowered, the positive pulse at the output of Q103 and Q104 becomes narrower. Since the PRF stays the same, the duty factor is lowered and the output voltage decreased.

5.11 PROTECTIVE CIRCUITS

A number of circuits designed to protect the power supply and/or devices connected to it are incorporated in the control circuits. The supply is protected against input and output overvoltage, excess output current (continuous and transient) and excess dissipation. The circuits to accomplish these objectives are described below.

5.12 OUTPUT OVERVOLTAGE CIRCUIT

5.12.1 An overvoltage condition in the output circuit usually indicates a failure in the control circuit and demands immediate positive action to protect the equipment connected to the load.

5.12.2 A +18 volt regulated reference voltage is connected across R25, the OVERVOLTAGE ADJUST pot. A fraction of this voltage is applied to one terminal of the optical isolator U103 through R153. The

other terminal of the optical isolator is connected to output voltage divider R8-R9 through diode CR115. If this terminal becomes more positive than the terminal connected to R25 U103 will conduct, producing a positive output signal which will turn on SCR101. Once started, SCR101 will conduct until the supply is shut off. SCR101 supplies a positive output that turns on output clamp Q110, removing the drive from the pass transistors immediately lowering the output unless the pass transistors are shorted. SCR101 also turns on an output crowbar, SCR2, which short circuits the output, forcing it to zero even if the pass transistors are shorted. (If the pass transistors are shorted, damage also will occur to the associated base-emitter resistors.) At the same time, SCR101 also turns on Q5, the CIRCUIT BREAKER ACTUATOR, shutting off the main ac power in less than one second. The only limitation to how fast the output voltage will be reduced to zero is current limiting resistor R28 which limits the current through SCR2 to less than 300 amperes.

5.13 INPUT OVERVOLTAGE

Zener diode ZR1 is non-conducting unless the output from the main power supply exceeds 100 volts. At voltages higher than this, ZR1 conducts, turning on SCR101, and the sequence described above occurs, shutting off the supply.

5.14 THERMAL OVERLOAD

5.14.1 Thermal switch SW5 is normally closed, shorting the output of R11 to ground. If this switch gets too hot it will open, causing a positive potential at the gate of SCR101 and again shut off the supply. The switch monitors the temperature of the main pass transistors (Q1-Q4). The pass transistors will overheat as a result of high output currents, but especially at high output voltage and low line. They can also quickly overheat as a result of failure or blockage of the cooling air system.

5.14.2 Thermal switch (SW8) is mounted on the rear main chassis panel to monitor the temperature of the rear panel. If the panel temperature exceeds the thermostat switch point, the thermostat closes, turning on the fan. Under light load conditions the fan may not turn on because the panel temperature is below the thermostat switch point.

5.15 ADJUSTABLE CURRENT LIMITING SYSTEM

5.15.1 A voltage of 0.01 volt per ampere is developed across R10. In addition to driving the ammeter circuit, this voltage is applied to the input (pin 3) of U102 where it is compared with another negative voltage derived from the auxiliary power supply. The level of this reference voltage determined by the position of the current range switch and the setting of R16, the OVERCURRENT LIMIT ADJUST. This control can be adjusted for any setting from zero to slightly more than the upper limit of the selected current range.

5.15.2 The output of U102 (pin 6) is normally positive and Q108 and Q109 are non-conducting. If pin 3 becomes more negative than pin 2 the output of U102 will go negative, turning on both devices. Q109 will turn on DS3, the overcurrent indicator lamp, and Q108 will start lowering the reference voltage applied to U101, thus lowering the output voltage until the output current falls below the preset value. However, the time constants in the circuit, principally C102, prevent this from happening instantaneously.

5.16 TRANSIENT OVERCURRENT PROTECTOR

5.16.1 Certain conditions which may occur even in normal operation of the power supply can result in very high transient currents which may damage the pass devices before the normal overcurrent system can be activated. Two examples of this type of condition are a direct output short circuit or the charging of a large capacitor. The transient overcurrent protection circuit will protect the supply under these conditions.

5.16.2 If the current through R10 exceeds 60 amperes, the output of Q104 (pin 6) goes positive. CR114, which has been back-biased by the negative voltage on pin 6 of U104 now conducts and completely overrides the signal at the input of U101, causing the output of U101 to go fully positive. This instantaneously causes the pulse generator to go to a minimum duty cycle condition where the pass transistors can stand high currents for a short time.

5.16.3 The circuit is not stable in this condition and will tend to oscillate between the two current limiting modes as shown by the flickering of the overcurrent lamp; therefore, the circuit should not be allowed to work into a short circuit for any length of time.

6. MAINTENANCE

6.1 CASE REMOVAL AND REPLACEMENT

Step 1. Remove the three Phillips-head screws from the top of the front panel. These screws secure hidden case tabs to the rear of the front panel.

Step 2. Remove the three slotted-head screws securing the case top to the rear panel.

Step 3. Remove the eight slotted-head screws securing the case sides to the power supply chassis. (There are four screws on each side.)

Step 4. Lift case upward, out of the chassis.

Step 5. To replace the case, reverse Steps 1 through 4. Secure the case with *all* screws to maintain proper rf shielding.

6.2 ADJUSTMENT OF MANUAL PRF CONTROL

NOTE

This control has been set at the factory and normally should not require adjustment. Do not attempt to reset it without proper test equipment.

6.2.1 Test Equipment Required

a. Oscilloscope
b. Oscilloscope Probe

6.2.2 Procedure

Step 1. Remove the drive from the series pass transistors by disconnecting P4 from J101.

Step 2. Connect the scope probe to the center pin of J101.

Step 3. Turn on the supply and turn the output voltage control to mid range. The output of the power supply will be zero volts, but a positive pulse train will appear on the oscilloscope.

Step 4. Adjust manual PRF control R117 until there is a spacing of 7 to 9 microseconds between pulses.

Step 5. Remove scope probe and reconnect P4.

6.3 METER ZERO ADJUST

If the dc volts or dc amperes meter does not return to zero when ac power is turned off, the meter may require a mechanical zero adjustment. The adjustment screw is on the meter face. Make the adjustment only when the power supply is in its normal upright operating position, and the ac power is turned off.

6.4 AMMETER CALIBRATION

6.4.1 Introduction

Three principal factors can influence the ammeter calibration:

a. The condition of a connection to the .01 ohm current sensing resistor R10.
b. The condition of the ammeter itself.
c. The accuracy of the ammeter multiplying resistors, R17 through R20.

6.4.2 Test Equipment Required

a. 1 ohm load resistor: Motorola PK-756 or equivalent.
b. Voltmeter

6.4.3 Testing R10

Step 1. Connect a known 1 ohm load resistor of adequate rating to the output terminal of the supply. Connect the voltmeter across the terminals of the 1 ohm resistor.

Step 2. Turn on the supply and increase the output to 10 volts across the 1 ohm load resistor.

Step 3. Switch the supply to STANDBY, disconnect the voltmeter from the load resistor.

Step 4. Connect the positive terminal of the voltmeter to the positive terminal of the ammeter and the negative terminal to the side of R17 not connected to R18.

Step 5. Turn the STANDBY switch to DC ON. The voltmeter should read 0.10 volts, ±3%. If it reads higher than .103 volts, R10 is defective or the connections to R10 are not making good contact.

NOTE

If the steps in 6.4.3 have been correctly followed and the meter reads equally incorrectly on all ranges, the meter is probably defective. Remove the meter and check it in series with another 10 milliampere meter of known accuracy. Replace the meter if defective.

6.4.4 Replacement of R20

R20 is a factory test selected resistor connected in parallel with R19 to compensate for tolerances in the meter movement coil resistance; its greatest effect is on the 5 ampere current range. It normally should not require replacement unless the ammeter has been changed. The proper value for R20 can be checked or determined in the following manner:

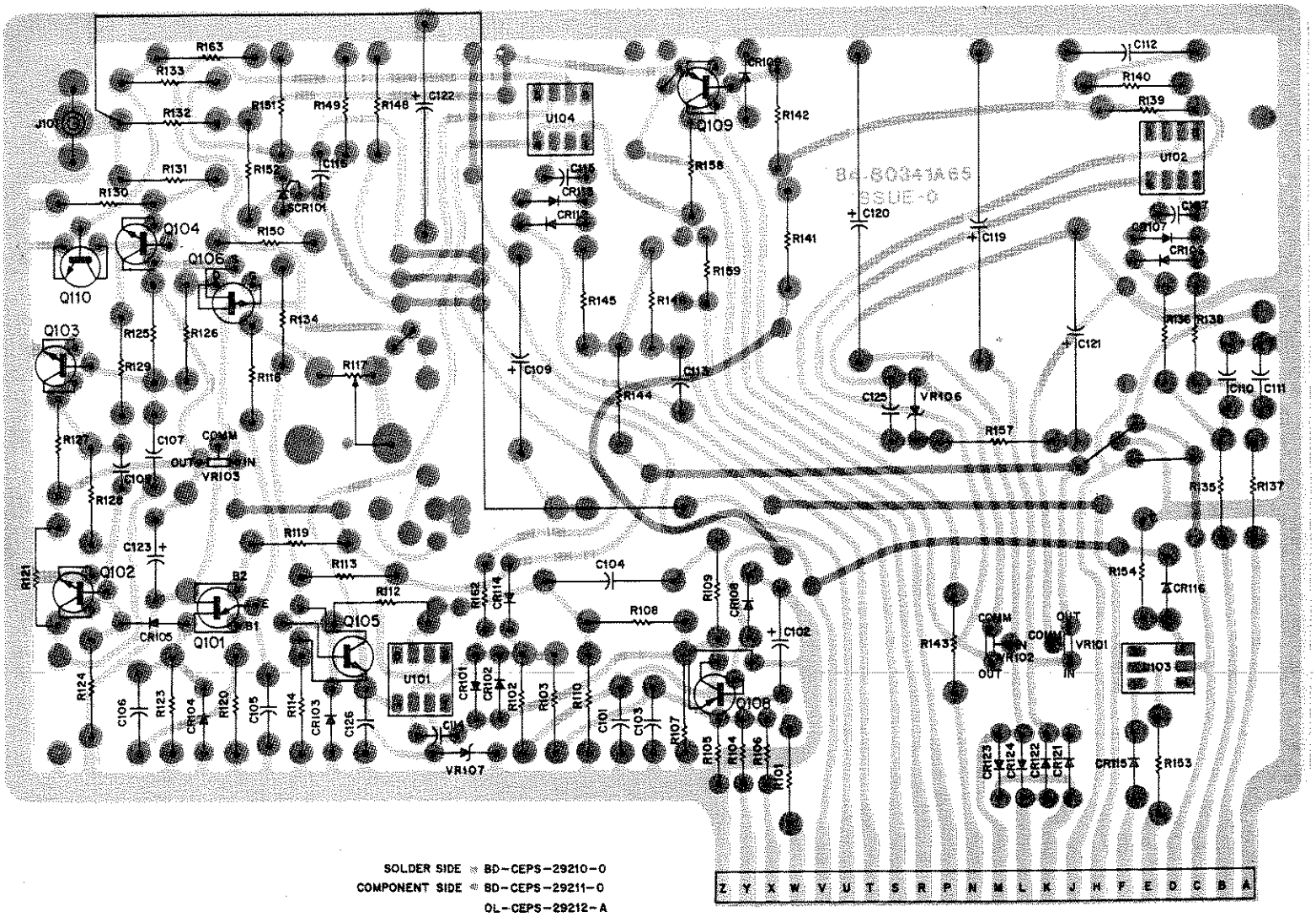
Step 1. Connect a suitable load across the output terminals of the power supply in series with a 0 to 5 amp dc ammeter. A typical value would be 2 ohms, 100 watts. The current range switch should be set at 5 amperes and the voltage range switch at 20 volts.

Step 2. Slowly increase the output voltage from 0 to 10 volts. The two current meters should track within 5%.

Step 3. If the two meters do not track, remove R20 and replace it with another value experimentally determined to give the correct meter reading. As a guide, measure the value of the resistor removed. If the ammeter originally read high, replace R20 with a higher resistance value; and conversely.

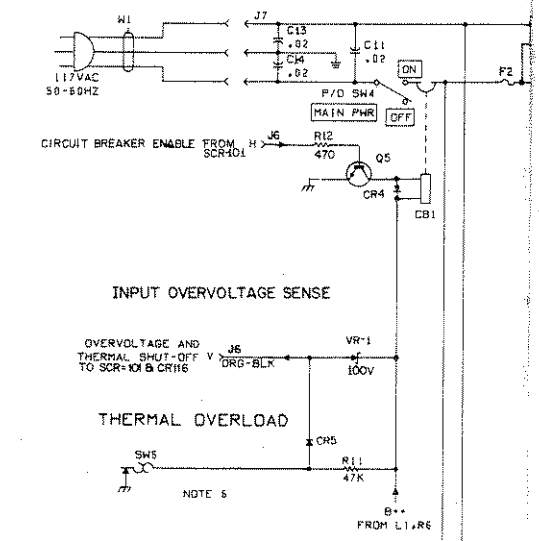
NOTE

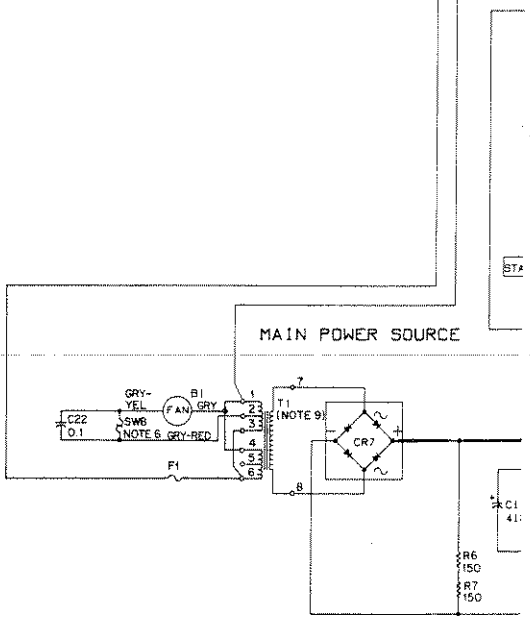
If an accurate 0-5 amp dc ammeter is not available, an accurate dc voltmeter measuring voltage across the load resistor may be used if the load resistance is also accurately known. The reading on the voltmeter will equal R_1 times the correct ammeter reading.

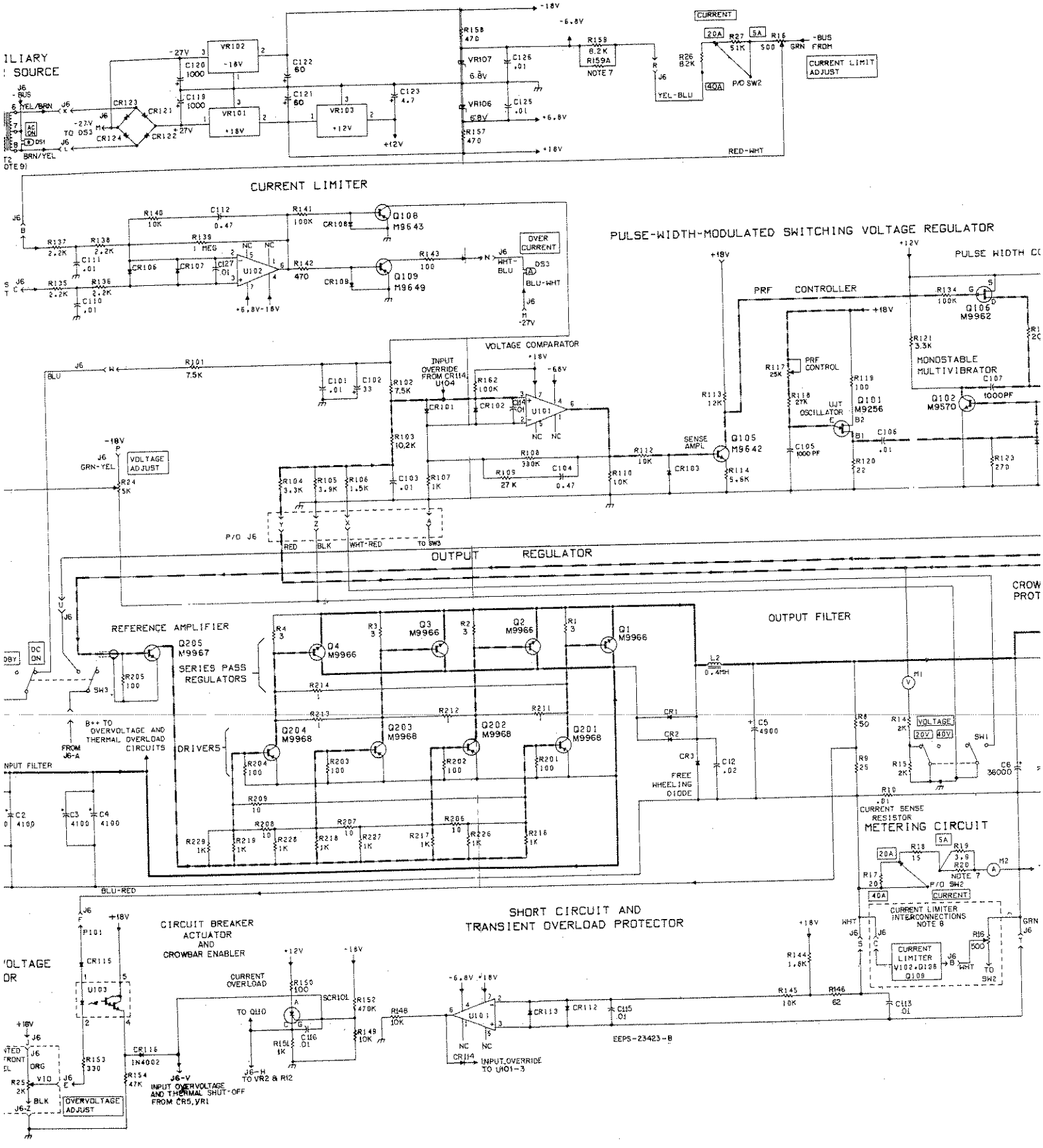


SHOWN FROM SOLDER SIDE

R1011B DC Power Supply
Schematic Diagram & Circui
Motorola No. PEPS-33602-C
(Sheet 1 of 3)
11/25/81-PHI







NOTES:

1. Unless otherwise indicated, resistors are in ohms and capacitors are in microfarads.
2. Descriptions enclosed within a rectangle are marked on equipment, such as 20 V.
3. ⏚ Represents earth ground.
   ⏚ Represents floating ground.
4. Integrated circuit pins not connected are indicated NC.
5. The following component referencing scheme is used:

0-99	Chassis-mounted parts: except for those parts on the overvoltage board.
100-199	Parts on control & regulator board.
200-299	Parts on driver board.

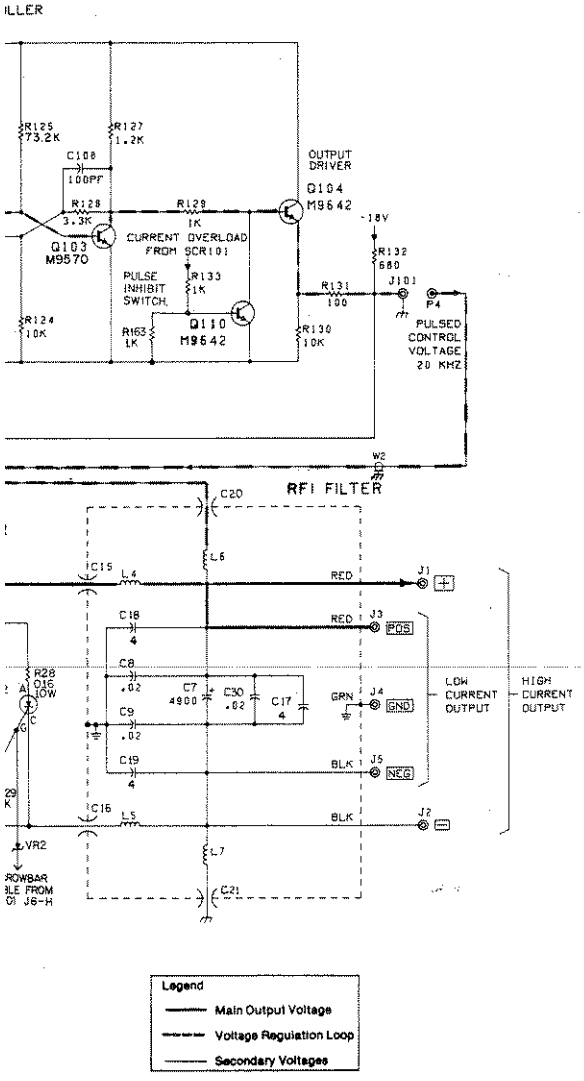
6. Thermoswitches locations are:

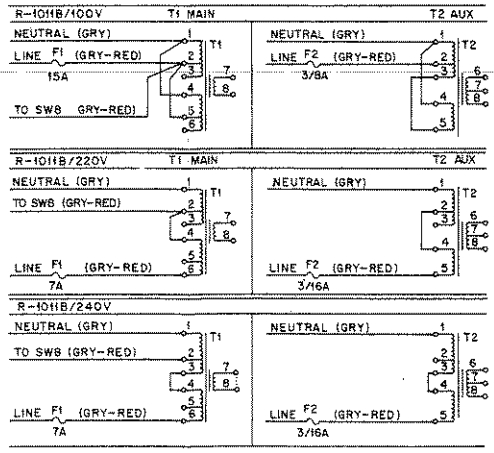
   SW5 Mounted on rear panel adjacent to Q3 and CR3
   SW8 Mounted on back panel between Q2 & Q3

7. Factory selected part value.
8. Current limiter interconnections are shown for functional signal flow purposes. Complete circuit is shown directly below the auxiliary power source.
9. Conversion of R-1011B to other input voltages:

   1. Remove all jumpers from both transformers.
   2. Reconnect transformer primaries as needed.
   3. Change fuses as necessary.
   4. Apply appropriate label to the back of power supply.

10. IF wired for 100 V Range input current might exceed 15A.





PARTS LIST SHOWN ON BACK OF THIS DIAGRAM
R1011B DC Power Supply
Schematic Diagram & Circuit Board Details
Motorola No. PEPS-33602-O
(Sheet 3 of 3)
11/25/81-**PHI**

parts list

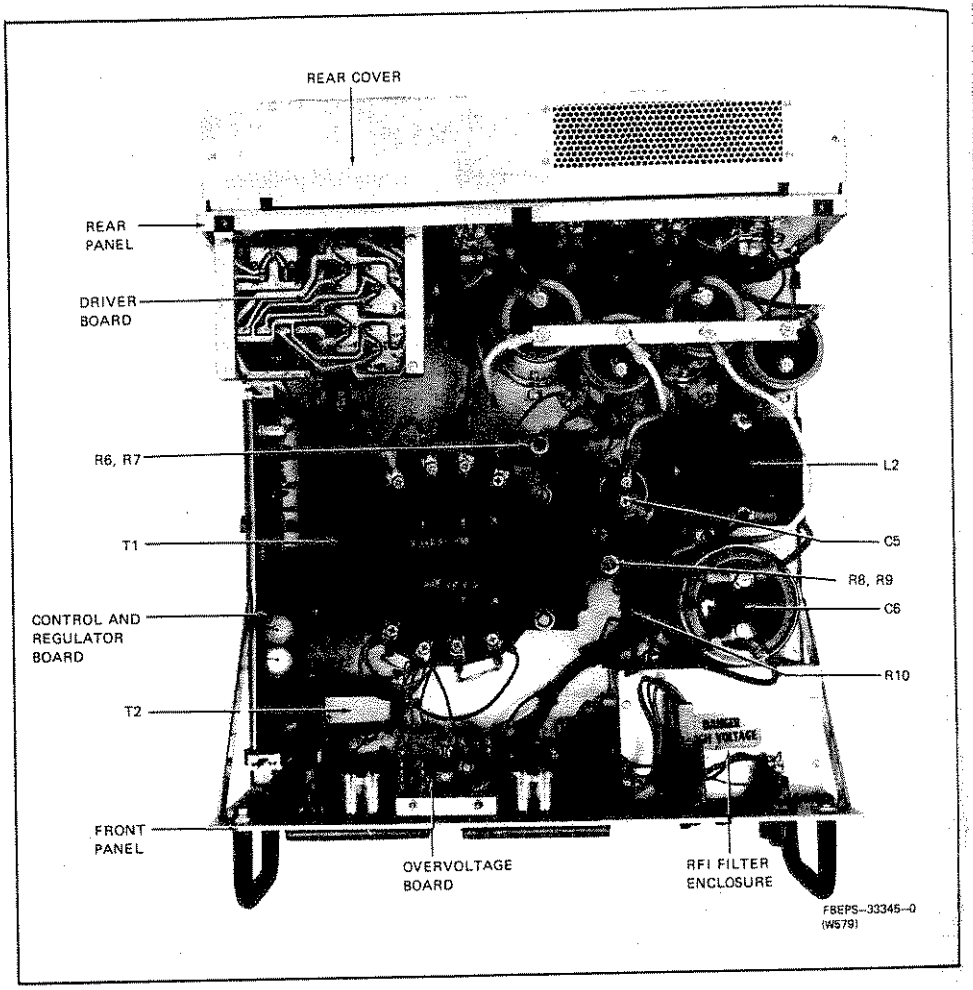
R1011B Power Supply — PL-5386-B

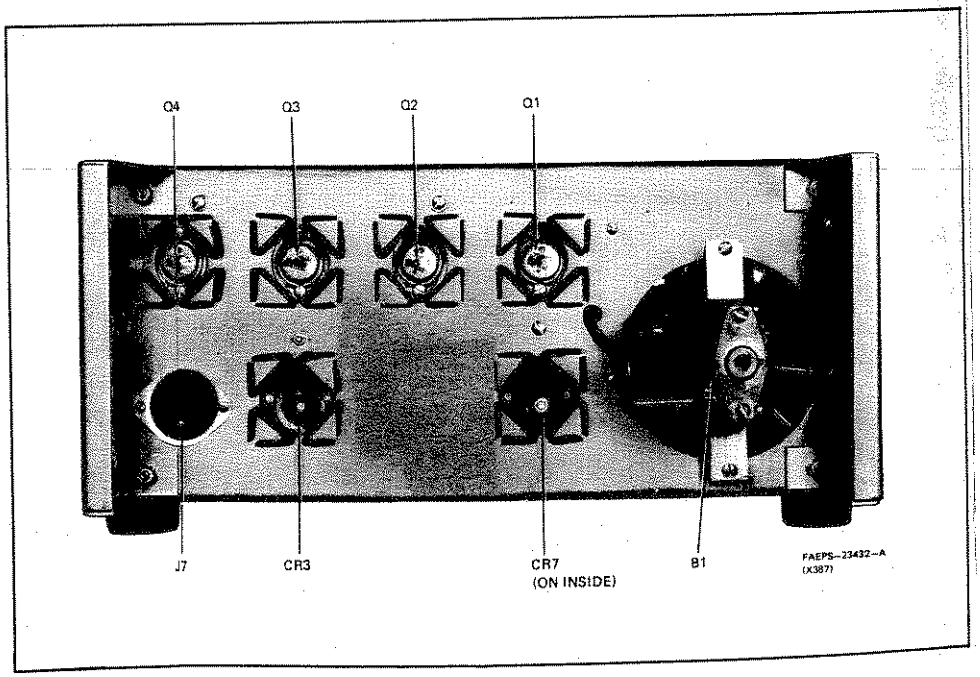
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		fan:
B1	59-80328A91	motor
		capacitor, fixed; uF: unless otherwise stated:
C1 thru 4	23-8320A27	4100; 100 V
C5, 7	23-80312A28	4900; 50 V
C6	23-80312A29	36,000; 75 V
C8, 9, 11 thru 14, 30	21-83596E29	0.02; 2000 V
C15, 16, 20, 21	21-84211B01	feedthru 0.01; 250 V
C17 thru 19	8-863550	4; 200 V
C22	8-82095G08	.1 mylar
C23	21-82428B11	.01 disc
C101, 103, 110 thru 116, 125 thru 127	21-801139	0.01
C102	23-84762H11	33; 15 V
C104, 112	8-82905G06	0.47; 50 V
C105	21-82537B38	1000 pF
C106	8-82095G14	.01 mylar
C107	21-82537B38	1000 pF
C108	21-840046	100 pF
C123	23-84762H01	4.7; 35 V
C119, 120	23-80319A67	1000; 35 V
C121, 122	23-82601A29	60; 50 V
		circuit breaker:
CB1	80-80326A68	0.05A; 400 ohms
		semiconductor device, diodes:
CR1, 2	48-82525G21	silicon
CR3	48-869963	silicon
CR4, 5, 108, 109, 115, 116, 121 thru 124	48-82466H13	silicon
CR7	48-84751H05	bridge rectifier
CR101 thru 107, 112 thru 114	48-82420C16	silicon
		indicator lamp:
DS1, 3	65-83358H06	type 327, 28 V, 0.04A
		fuse:
F1	65-139131	15A (100/120 V ac input)
F2	65-868957	3/8A (100/120 V ac input)
F1	65-80375A50	7A (220/240 V ac input)
F1	65-80375A55	3/16A (220/240 V ac input
		connector, receptacle:
J1	9-868661	jack; 40 amp; RED
J2	9-868662	jack; 40 amp; BLK
J3	46-863925	post binding; RED
J4	46-82921K01	post binding; GRN
J5	46-863924	post binding BLK
J6	9-80328A75	connector; 22 contact
J7	28-83258D01	socket; ac; male
		coil:
L2	25-80326A64	0.4H @ 20A
L4	24-80326A97	RFI
L5	24-80326A96	RFI
L6, 7	76-83960B01	ferrite bead
		meter:
M1	72-83379K03	voltage
M2	72-83379K04	current
		transistor:
Q1 thru Q4	48-869966	silicon, NPN
Q5, 205	48-869967	silicon, NPN
Q101	48-869256	unijunction
Q102, 103	48-869570	silicon, NPN
Q104, 105, 110	48-869642	silicon, NPN
Q106, 107	48-869962	FET
Q108	48-869643	silicon, PNP
Q109	48-869649	silicon, PNP
Q201 thru Q204	48-869968	silicon, PNP
		resistor, fixed: ± 5%; 1/2 W: unless otherwise stated:
R1 thru 4	17-82350A01	wirewound: 3; 1 W
R6, 7	17-80326A54	wirewound: 150; 25 W
R8	17-80326A53	wirewound: 50; 25 W
R9	17-80326A50	wirewound: 25; 25 W
R10	17-80312A34	wirewound: 0.01; 20 W
R11, 154,	6-125A89	47k
R12, 142, 157, 158	6-125A41	470
R14, 15	6-80327A88	2k; ± 1%
R16	18-80320A68	var: 500
R17	6-80327A87	20; ± 1%

R1011B DC Power Supply
Electrical Parts Lists and
Parts Location Photographs
Motorola No. PEPS-33603-O
11/25/81-PHI

MOTOROLA PART NO.	DESCRIPTION
6-80327A85	15; ± 1%
17-837834	wirewound: 3.9
	Factory Selected
18-80328A61	var: 5k
18-80328A66	var: 2k
6-80327A92	8.2k; ± 1%
6-80327A93	51k; ± 1%
17-82177B26	wirewound: 0.16; 10 W
6-125A49	1k
6-83175C89	7.5k; ± 1%; 1/4 W
6-83175C93	10.2k; ± 1%; 1/4 W
6-125C73	10k
6-80327A89	3.3k; ± 1%
6-80327A90	3.9k; ± 1%
6-80327A94	1.5k; ± 1%
6-125B12	390k
6-125A83	27k
6-125A75	12k
6-125A67	5.6k
18-83083G24	var: 25k
6-125A83	27k
6-125A25	100
6-125A09	22
6-125A61	3.3k
6-125A35	270
6-84640C80	73.2k; ± 1%; 1/4 W
6-125A32	200
6-125A51	1.2k
6-125A61	3.3k
6-125A45	680
6-125A97	100k
6-125A57	2.2k
6-125B22	1 meg
6-125A97	100k
6-125A55	1.8k
6-125A20	62; ± 5%
6-125B14	470k
6-125A37	330
6-80327A92	8.25k; ± 1%; 1/4 W
6-125C01	10; ± 10%
6-125D70	1; ± 10%
17-82177B21	wirewound: 1k; 5 W
	silicon controlled rectifier:
48-84973C01	silicon
48-84755H01	silicon
	switch:
40-80312A42	rotary
40-80312A43	rotary
40-83378K01	toggle p/o CB1
80-80332A62	thermostat
80-80332A60	thermostat
	transformer:
25-80374A86	power (main)
25-80374A83	power (auxiliary)
	integrated circuit:
51-84320A13	operational amplifier
51-84621K43	optical coupler
	voltage regulator:
51-84621K38	+ 18 V
51-84621K39	− 18 V
51-84621K40	+ 12 V
48-84390A01	Zener diode; 6.8 V
	cable:
30-80328A71	power; 3 cond.; with plug
	Zener diode regulator:
48-83461E06	100 V
48-83461E03	3.3 V

im performance, diodes, transistors, and integrated circuits must
orola part numbers.





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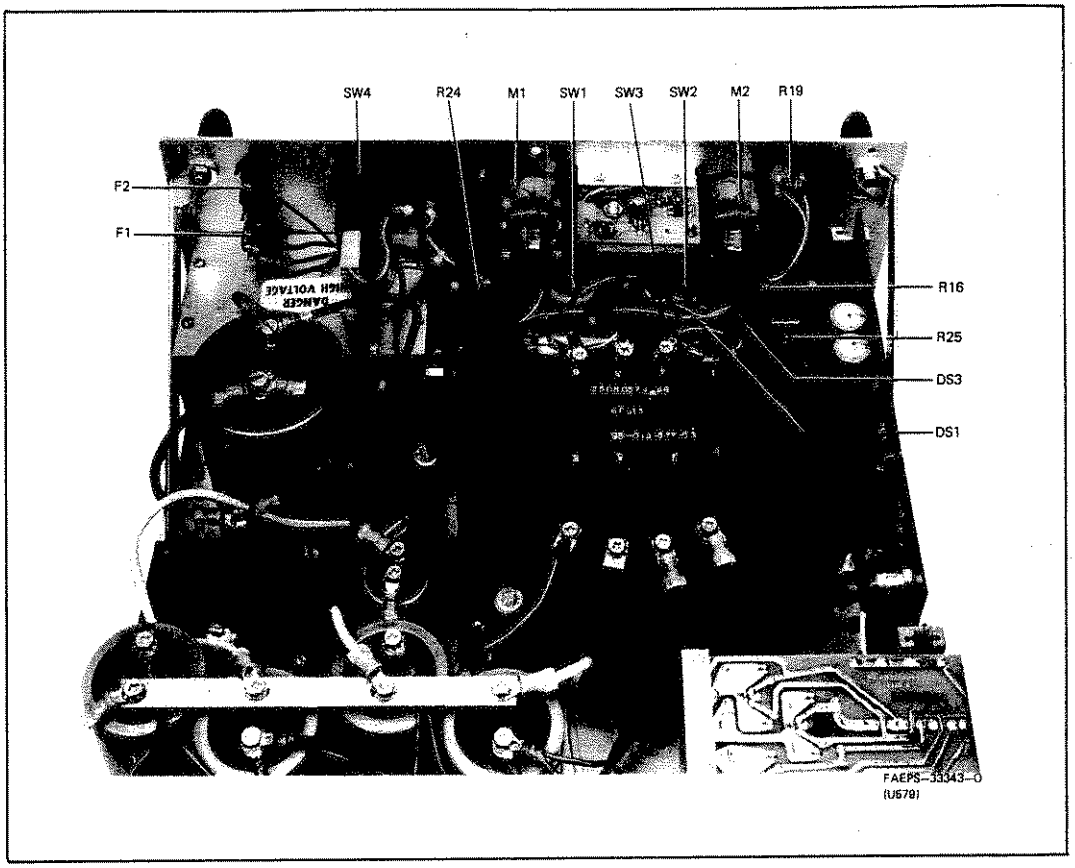

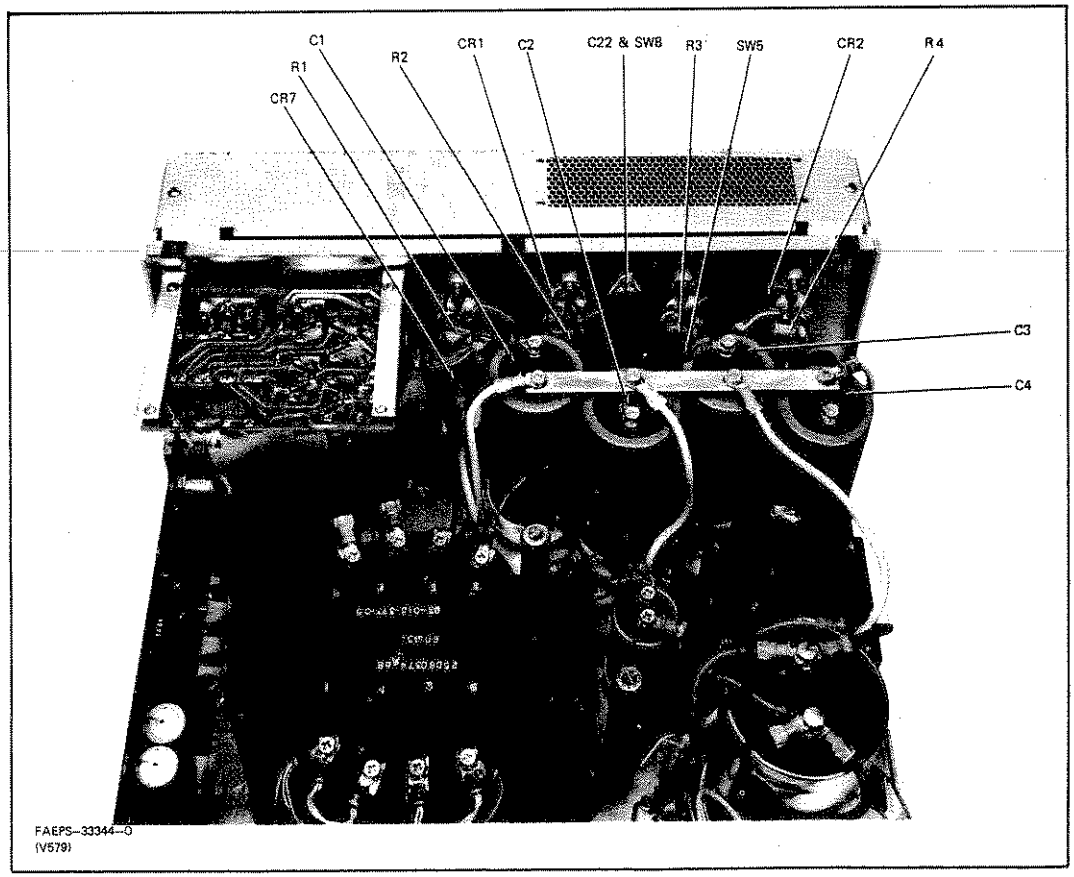

MOTOROLA
COMMUNICATIONS PARTS DIVISION

INSTRUCTION MANUAL REVISION

SMR-5744 4/3/90

GENERAL:

This Instruction manual revision outlines changes that have occurred since the printing of the manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

Model: R-1011B, DC Power Supply 0-40V, 0-40A.
Manual # 68-81069A94-0

REVISION DETAILS:

Changes to Parts List # PL-5386-C

Delete: 51-84621K43, U103 opto-coupler
Add: 51-80348A81, U103

Delete: 76-83960B01, L7 ferrite bead
Add: 76-84069B02, L7

MOTOROLA INC.
Test Equipment Products
1313 E. Algonquin Rd.
Schaumburg, Illinois 60196

SERVICE MANUAL REPRODUCTION

The attached manual is for non-current Motorola Equipment. In order to continue to supply this service literature certain steps may have been taken. These may have included the the following:

1) removal of cover
2) alternate binding or packaging method
3) size reduction of some foldouts, e.g. schematics
4) the division of extremely long schematics (over 17") into two or more sheets.
5) photographs and screens reproduced from printed material (as opposed to original screened negatives)
6) the elimination of colors other than black

We feel that these steps have only minor effect on the readability and utility of basic service information and will allow us to continue to supply this literature at a reasonable cost.

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MOTOROLA INC.

instruction manual revision

Supersedes SMR-4701

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81069A94-O DC Power Supply Instruction Manual

REVISION DETAILS:

Replace PEPS-33602-O Sheets 1, 2, and 3 of 3 with the attached revised diagrams, PEPS-33602-A, Sheets 1 and 2 of 2.
Replace PEPS-33603-O with PEPS-33603-A.

ATTACHMENTS:

R-1011B DC Power Supply Schematic Diagram and Circuit Board Detail Sheets 1 and 2 of 2.....PEPS-33602-A

R-1011B DC Power Supply Electrical Parts Lists and Parts Location Photographs.....PEPS-33603-A

MOTOROLA, INC.

SMR4701

INSTRUCTION MANUAL REVISION

This revision supercedes SMR4374, SMR4416, SMR4470, and SMR4694.

GENERAL

This revision outlines changes that may have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED

68-81069A94-0 DC POWER SUPPLY
0-40V, 0-40A
Model R1011B

REVISION DETAILS

R1011B DC POWER SUPPLY
Schematic diagram & circuit boards details
Motorola No. PEPS-33602-0 and PEPS-33603-0

A.(sheet 1 of 3)

1.) Jumper from J101 to card edge contact "U" is omitted.
2.) P.C. Board conductor from U103, pin 5 to card edge contact "D" is cut.
3.) C109 is omitted.

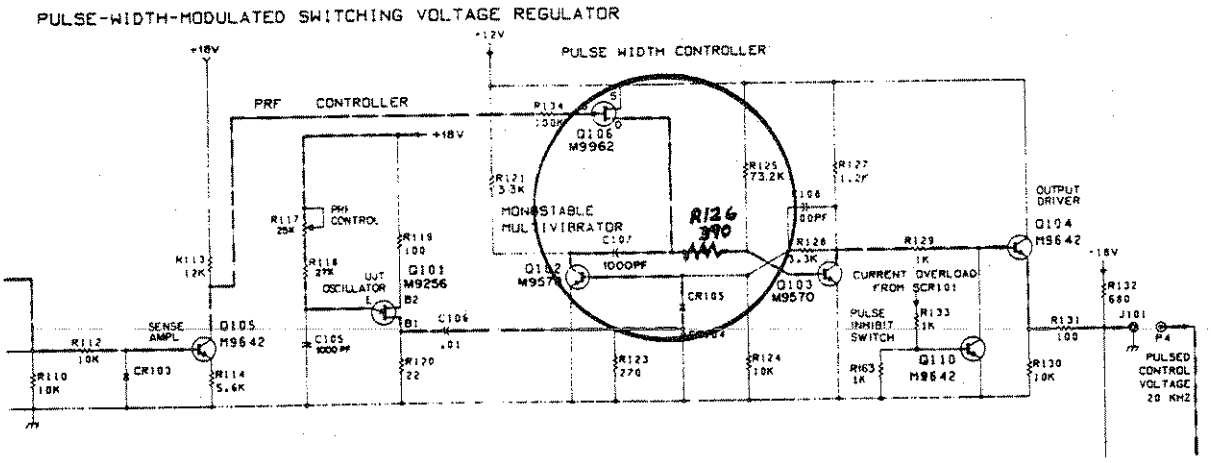
B.(sheet 3 of 3)

1.) Connection of switch SW3 to J6-A is omitted and reconnected directly to Q205 emitter.
2.) Connection of switch SW3 to J6-U is omitted and reconnected directly to Q205 base.
3.) R109 is changed to 15k ohm, 1/2W, 5%, Motorola P/N 06-125A77.

C.(sheets 1 & 3 of 3)
1.) Transistors Q1-Q4 are changed to M9715's (P/N 48-869715).
2.) Zener diode VR1 is changed to 91-volts (P/N 48-83461E16).
3.) A capacitor, 0.1ufd, 10%, (P/N 08-82096J18) is added from the cathode of SCR101 to ground.

Early R1011B power supplies used M9966's for Q1-Q4.
Any replacement of these 4 transistors must use the same Motorola part number; never mix M9966's with M9715's. Using M9715's for Q1-Q4 requires that zener diode VR1 be changed to 91-volts (P/N 48-83461E16).
All R1011AA power supplies must use M9966's for Q1-Q4.

D.(sheets 1 & 3 of3)
1.) Capacitor C114 is changed to 0.1ufd disc (P/N 21-82372C09).
2.) Resistor R126 is changed to 390ohms, 1/2W, 5% (P/N 06-125A39).
3.) Capacitor C103 is changed to 0.001ufd disc (P/N 21-82428B48).
4.) Change connection on capacitor C107 as shown in partial schematic below.



E.(sheets 2 & 3 of 3)
1.) Diode CR5 located on the overvoltage broad has been replaced by a 56k ohm, 1/4W, 5% resistor (P/N 06-124A91).

F.(sheets 1 & 3 of 3)
1.) Resistor R159 located on the control board has been changed to 9.09k ohm, 1/8W, 1% (P/N 06-10621C87).

parts list

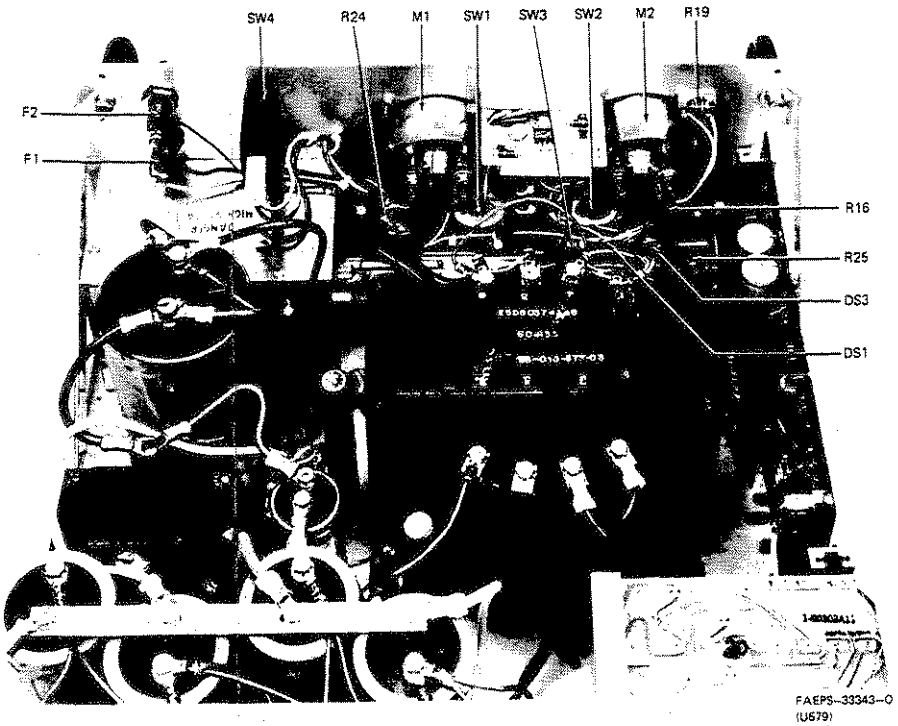
R-1011B DC Power Supply — PL-5386-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		fan:
B1	59-80328A91	motor, ac: 115 V
		capacitor, fixed; uF:
C1 thru 4	23-80320A27	4100; 100 V
C5	23-80312A28	4900; 50 V
C6	23-80312A29	36000; 75 V
C7	23-80312A28	4900; 50 V
C8, 9	21-83596E29	.02 +80-20%; 2000 V
C11 thru 14	21-83596E29	.02; 2000 V
C15, 16	21-84211B01	.01 feed-thru; 250 V
C17 thru 19	8-863550	4 ±10%; 200 V
C20, 21	21-84211B01	.01 feed-thru; 250 V
C22	8-82095G08	0.1 ±10%; 400 V
C23	21-82428B11	.01 +70-30%; 100 V
C30	21-83596E29	.02 +80-20%; 2000 V
		capacitor, fixed; uF:
C101	21-82428B35	.01 +80-20%; 500 V
C102	23-84762H11	33 ±20%; 15 V
C103	21-82428B48	.001 ±10%; 100 V
C104	8-82905G06	0.47 ±10%; 50 V
C105	21-82537B38	1000 pF ±3%; 100 V
C106	8-82905G14	.01 ±10%; 100 V
C107	21-82537B38	1000 pF ±3%; 100 V
C108	21-840046	100 pF ±10%; 500 V
C110, 111	21-82428B35	.01 +80-20%; 500 V
C112	8-82905G06	0.47 ±10%; 50 V
C113	21-82428B35	.01 +80-20%; 500 V
C114	21-82372C09	0.1 +80-20%; 25 V
C115, 116	21-82428B11	.01 +70-30%; 100 V
C117	8-82906J18	0.1 ±10%; 250 V
C119, 120	23-80319A67	1000; 35 V
C121, 122	23-82601A29	60 +150-60%; 50 V
C123	23-84762H01	4.7 ±10%; 35 V
C125, 126	21-82428B35	.01 +80-20%; 500 V
C127	21-82428B11	.01 +70-30%; 100 V
		diode: (see note)
CR1, 2	48-82525G20	silicon
CR3	48-869963	silicon
CR4	48-82466H13	silicon
CR7	48-84751H05	bridge, rectifier
CR101 thru 107	48-82420C16	silicon
CR108, 109	48-82466H13	silicon
CR112 thru 114	48-82420C16	silicon
CR115, 116	48-82466H13	silicon
CR121 thru 124	48-82466H13	silicon
		circuit breaker:
CB1	80-80326A68	relay, .05 amp. 400 ohms
		indicator lamp:
DS1, 3	65-83358H06	type 327, 28 V
		fuse:
F1	65-139131	15 amp; 250 V ac
F2	64-868957	3/8 amp; 120 V ac
		connector, receptacle:
J1	9-868661	female jack: RED
J2	9-868662	female jack: BLK
J3	46-863925	POST, binding: RED
J4	46-82921K01	POST, binding: GRN
J5	46-863924	POST, binding: BLK
J6	9-80328A75	female; 22-contact
J7	28-83258D01	male; ac socket
J101	9-84231B02	female, single contact
		coil, rf:
L2	25-80326A64	0.4H @20 amp.
L4	24-80326A97	RF1
L5	24-80326A96	RF1
L6, 7	76-83960B01	ferrite bead
		meter:
M1	72-80324A43	voltage
M2	72-80324A44	current
		connector:
P4	28-82365D02	PLUG, single contact (phono)
		transistor: (see note)
Q1 thru 4	48-869715	NPN; type M9715
Q5	48-869967	NPN; type M9967
Q101	48-869256	PNP; type M9256
Q102, 103	48-869570	NPN; type M9570
Q104, 105	48-869642	NPN; type M9642
Q106	48-869962	field effect
Q108	48-869643	PNP; type M9643
Q109	48-869649	PNP; type M9649
Q110	48-869642	NPN; type M9642
Q201 thru 204	48-869968	PNP; type M9968
Q205	48-869967	NPN; type M9967

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		resistor, fixed; ±5%; 1/4 W: unless otherwise stated
R1 thru 4	17-82350A01	3; 1 W
R6, 7	17-80326A54	150; 25 W
R8	17-80326A53	50; 25 W
R9	17-80326A50	25; 25 W
R10	17-80312A34	.01; 20 W
R11	6-125A89	47k ±10%; 1/2 W
R12	6-125C41	470 ±10%; 1/2 W
R13	6-124A91	56k; 1/4 W
R14, 15	6-80327A88	2k ±1%; 1/2 W
R16	18-80320A68	variable; 500 W
R17	6-80327A86	20 ±1%; 1/2 W
R18	6-80327A85	15 ±1%; 1/2 W
R19	17-837834	3.9 W.W.
R20	—	factory selected
R24	18-80328A61	variable; 5k ±10%
R25	18-80328A66	variable; 2k
R26	6-80327A92	8.2k ±1%; 1/2 W
R27	6-80327A93	51.1k ±1%; 1/2 W
R28	17-82177B26	0.16; ±10%; 10 W
R29	6-125C49	1k ±10%; 1/2 W
R101, 102	6-83175C89	7.5k ±1%
R103	6-83175C93	10.2k ±1%
R104	6-80327A89	3.32k ±1%; 1/2 W
R105	6-80727A90	3.92k ±1%; 1/2 W
R106	6-80727A94	1.5k ±1%; 1/2 W
R107	6-125A49	1k; 1/2 W
R108	6-125B12	390k; 1/2 W
R109	6-125A77	15k; 1/2 W
R110	6-125A73	10k; 1/2 W
R112	6-125A73	10k; 1/2 W
R113	6-125A75	12k; 1/2 W
R114	6-125A67	5.6k; 1/2 W
R117	18-83452F17	variable: 50k ±10%; 1/2 W
R118	6-125A83	27k
R119	6-125A25	100; 1/2 W
R120	6-125A09	22; 1/2 W
R121	6-125A61	3.3k; 1/2 W
R123	6-125A35	270; 1/2 W
R124	6-125A73	10k; 1/2 W
R125	6-84640C70	73.2k ±1%; 1/8 W
R126	6-125A39	390; 1/2 W
R127	6-125A51	1.2k; 1/2 W
R128	6-125A61	3.3k; 1/2 W
R129	6-125A49	1k; 1/2 W
R130	6-125A73	10k; 1/2 W
R131	6-125A25	100; 1/2 W
R132	6-125A45	680; 1/2 W
R133	6-125A49	1k; 1/2 W
R134	6-125A97	100k; 1/2 W
R135 thru 138	6-125A57	2.2k; 1/2 W
R139	6-125B22	1 meg; 1/2 W
R140	6-125A73	10k; 1/2 W
R141	6-125A97	100k; 1/2 W
R142	6-125A41	470; 1/2 W
R143	6-125A25	100; 1/2 W
R144	6-125A55	1.8k; 1/2 W
R145	6-125A73	10k; 1/2 W
R146	6-125A20	62; 1/2 W
R148, 149	6-125A73	10k; 1/2 W
R150	6-125A25	100; 1/2 W
R151	6-125A49	1k; 1/2 W
R152	6-125B14	470k; 1/2 W
R153	6-125A37	330; 1/2 W
R154	6-125A89	47k; 1/2 W
R157	6-126A41	470; 1/2 W
R158	6-125A41	470; 1/2 W
R159	6-10621C87	9.09k ±1%; 1/4 W
R162	6-124A97	100k
R163	6-125A49	1k; 1/2 W
R201 thru 205	6-125C25	100
R206 thru 209	6-125C01	10 ±10%
R211 thru 214	6-125D70	1 ±10%
R216 thru 219	17-82177B21	1k; 5 W
R226 thru 229	17-82177B21	1k; 5 W
		controlled rectifier: (see note)
SCR2	48-84973C01	silicon
SCR101	48-84755H01	silicon
		switch:
SW1	40-80312A42	rotary
SW2	40-80312A43	rotary
SW3	40-83378K01	toggle
SW4	—	p/o CB1
SW5	80-80332A62	thermostat
SW8	80-80332A60	thermostat
		transformer:
T1	25-80374A86	POWER (main)
T2	25-80374A83	POWER (auxiliary)
		integrated circuit: (see note)
U101, 102	51-84320A13	operational amplifier
U103	51-84621K43	optical coupler
U104	51-84320A13	operational amplifier

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		voltage regulator: (see note)
VR1	48-83461E16	Zener type; 91 V
VR2	48-83461E03	Zener type; 3.3 V
VR101	51-84621K38	+18 V
VR102	51-84621K39	-18 V
VR103	51-84621K40	+12 V
VR106, 107	48-84390A01	Zener type; 6.8 V
		cable:
W1	30-80328A71	power: 3-conductor with plug
W2	30-859004	CABLE, coaxial; RG316 (P4)
		mechanical parts
	2-1376	NUT; 3/8-32 × 1/2 × 3/32"
	2-2878	NUT; 1/4-20 × 7/16 × 3/16"; 10 used
	2-129892	NUT; 8-32 × 5/16 × 1/8 × 5/32"; 35 used
	2-131435	NUT; 4-40 × 1/4 × 3/32"; 5 used
	2-132616	NUT; 6-32 × 1/4 × 3/32 × 1/8"; 14 used
	2-80325A82	NUT, spring: 11 used
	2-80326A93	NUT.
	2-7003	NUT; 8-32 × 5/16 × 1/8"; 2 used
	2-7019	NUT; 4-40 × 1/4 × 3/32"; 2 used
	2-131865	NUT; 1/4-28 × 3/8 × 3/32"; 6 used
	3-1209	SCREW, machine; 10-32 × 1/2"; 4 used
	3-6990	SCREW, machine; 1/4-20 × 3/4"; 4 used
	3-7229	SCREW, machine; 6-32 × 3/8"; 2 used
	3-7364	SCREW, machine; 6-32 × 1/4"; 2 used
	3-7365	SCREW, machine; 8-32 × 3/4"; 5 used
	3-9661	SCREW, machine; 8-32 × 3/8"; 23 used
	3-115341	SCREW, machine; 8-32 × 1"
	3-121856	SCREW, machine; 1/4-20 × 1/2"; 6 used
	3-122330	SCREW, machine; 6-32 × 3/8"; 4 used
	3-134268	SCREW, lock; 4-40 × 7/16"; 4 used
	3-136253	SCREW, lock; 6-32 × 5/8"; 8 used
	3-136581	SCREW, lock; 10-32 × 3/8"; 18 used
	3-138804	SCREW, lock; 4-40 × 5/16"; 17 used
	3-139539	SCREW, machine; 6-32 × 5/16"; 2 used
	3-410095	SCREW, machine; 1/4-20 × 5/8"; 8 used
	3-80315A47	SCREW, 8-32 × 3/8"; 3 used
	3-7164	SCREW, machine; 6-32 × 1/4"; 6 used
	3-1930	SCREW, machine; 4-40 × 3/8"; 6 used
	3-10129A07	SCREW, machine; 4-40 × 3/8"
	3-7178	SCREW, machine; 6-32 × 5/16"; 2 used
	4-1792	WASHER, flat; .281 × .625 × .090"; 4 used
	4-7564	WASHER, flat; .391 × .750 × .067"
	4-7650	LOCKWASHER, #6 internal; 9 used
	4-7651	LOCKWASHER; #8 internal; 2 used
	4-7655	LOCKWASHER; 3/8 internal
	4-7658	LOCKWASHER; #10 internal; 24 used
	4-114583	LOCKWASHER; #4 split; 4 used
	4-400449	LOCKWASHER; 1/4" split; 17 used
	4-80326A95	WASHER
	4-80338A51	WASHER
	4-844093	WASHER, shoulder; 4 used
	4-7657	LOCKWASHER; #8 external
	4-7670	LOCKWASHER, 1/4" internal; 5 used
	4-7698	LOCKWASHER, 3/8" internal; 6 used
	4-8210	WASHER, flat; .391 × .562 × .016
	4-9788	LOCKWASHER, 5/16" internal; 3 used
	4-80312A13	WASHER, shoulder; 2 used
	7-80312A03	BRACKET, panel support; 2 used
	7-80326A69	HEAT SINK; 4 used
	7-80326A70	HEAT SINK
	7-80326A72	HEAT SINK
	7-80326A77	BRACKET; 2 used
	7-83724K01	BRACKET, mounting; 2 used
	7-80328A78	BRACKET, mounting; 2 used
	7-80326A75	HEAT SINK; 5 used
	7-80326A92	BRACKET
	7-80332A87	BRACKET
	9-82083C02	SOCKET, fuse; 2 used
	29-3025	LUG, soldering; 2 used
	29-5247	LUG, soldering
	29-132678	LUG, soldering; 3 used
	29-867966	LUG, 8 used
	29-867967	LUG, 30 used
	29-80326A56	TERMINAL, lug
	29-867965	LUG; 9 used
	29-80330A70	TERMINAL, 16 used
	9-82684G02	SOCKET, light and jewel (GRN)
	9-82684G04	SOCKET, light and jewel (AMBER)
	29-5247	LUG, soldering
	29-867966	LUG, 5 used
	36-84675F03	KNOB; 4 used
	29-859118	LUG, faston; 4 used
	39-10184A53	CONTACT, receptacle; 2 used
	14-83820M02	INSULATOR, thermostat
	26-80375A69	HEAT SINK, U clip
	26-84275L01	HEAT SINK
	37-807834	GROMMET
	37-80328A97	GROMMET
	42-80348A39	CLIP; 2 used
	42-82465C01	CLAMP, capacitor mounting
	42-83415C01	CLIP, capacitor mounting
	43-847528	BUSHING, spacer; 2 used
	43-80326A94	SPACER, bushing insulator
	43-84475K01	STANDOFF, threaded; 4 used
	47-80329A35	BAR BUSS
	75-80322A01	FEET, rubber; 4 used
	42-80313A70	TIE WRAP
	54-83042H67	LABEL
	43-84654B02	BUSHING, threaded; 4 used
	47-80375A70	ROD, threaded; 2 used
	47-80348B38	BAR
	55-80312A22	HANDLE (BRN); 2 used
	64-80374A80	PANEL, front
	15-80326A79	HOUSING, shielded
	14-859051	INSULATOR, lug; 4 used
	14-83799G01	INSULATOR, terminal, male; 2 used
	42-80313A70	TIE WRAP; 4"; 57 used
	54-83042H67	LABEL
	64-80326A80	PLATE
	54-83379A01	LABEL, high voltage
	9-82673A01	SOCKET, transistor; 4 used
	2-7003	NUT, 8-32 × 5/16 × 1/8"; 2 used
	7-80394A03	BRACKET, mounting
	14-83799G02	INSULATOR, terminal, female; 2 used
	39-10184A52	CONTACT, plug; 2 used
	49-80328A92	BLADE, fan
	13-80329A21	GRILLE
	15-80328A86	COVER, fan

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



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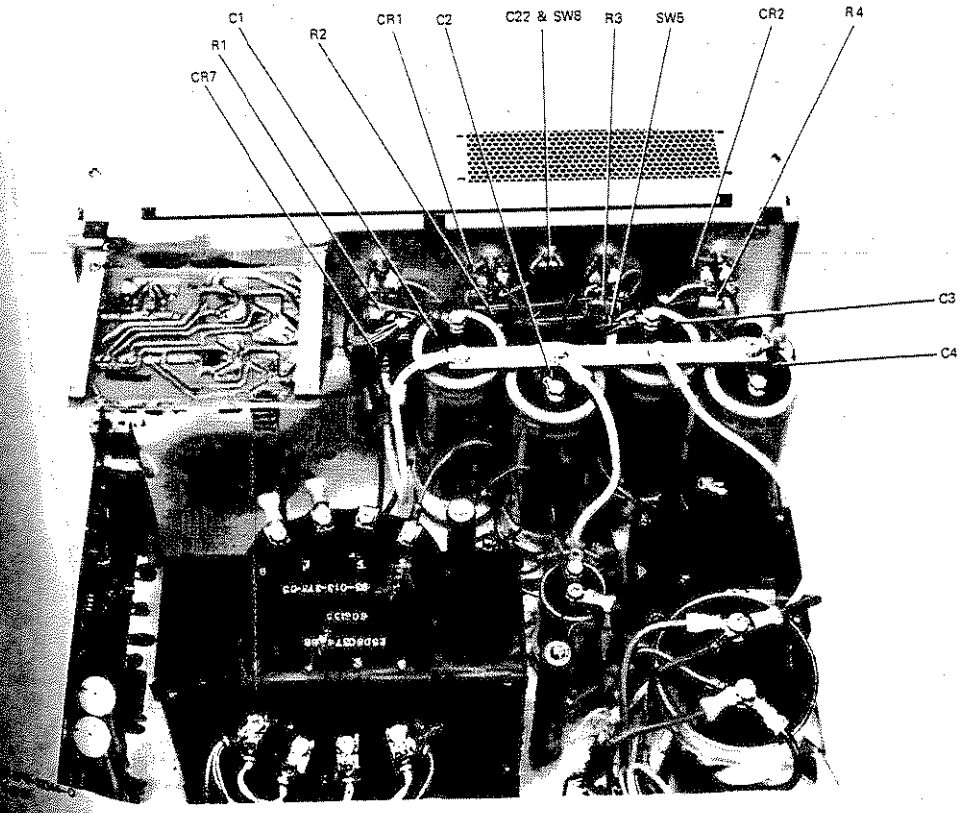
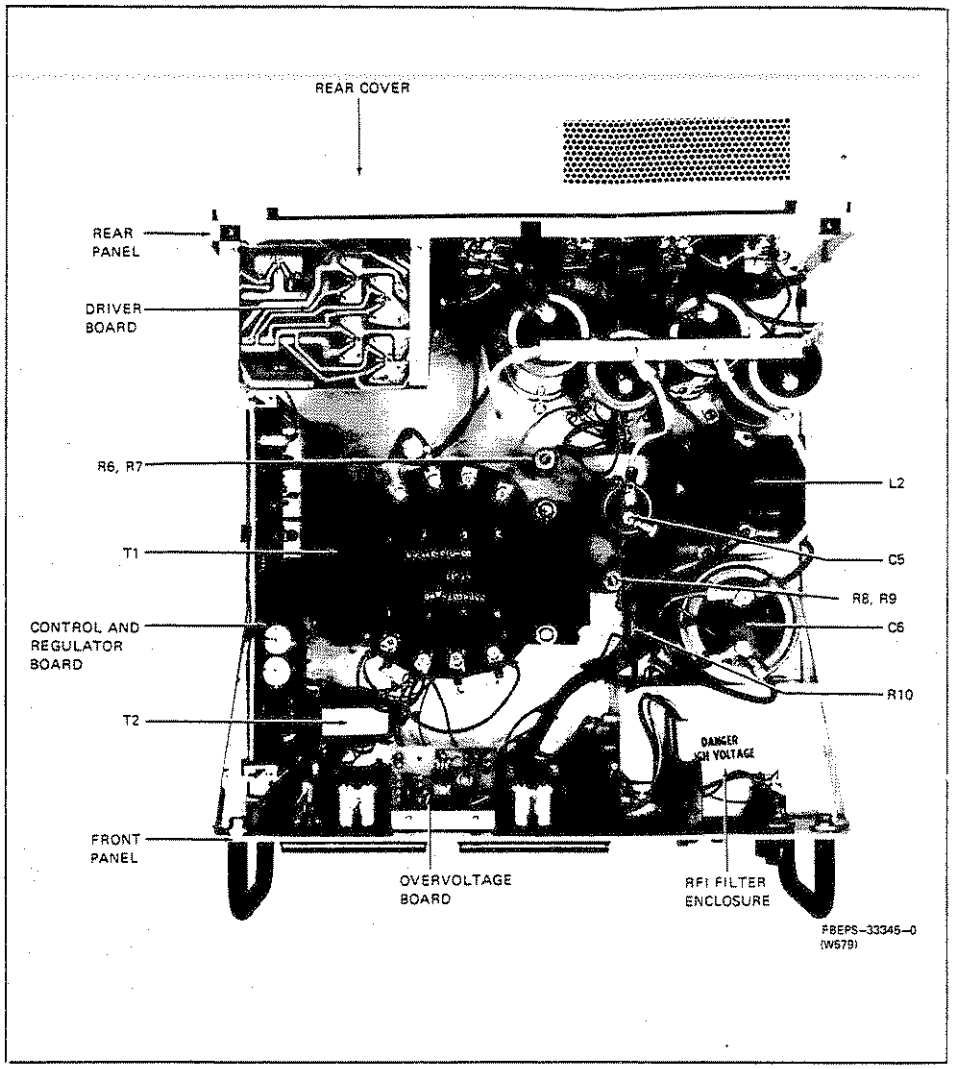
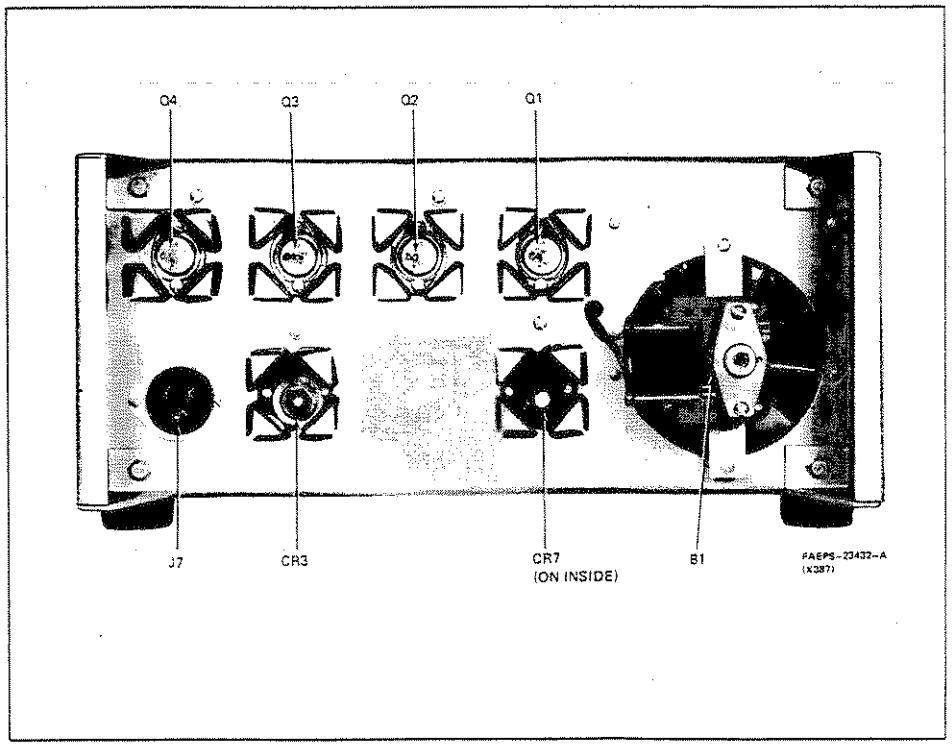
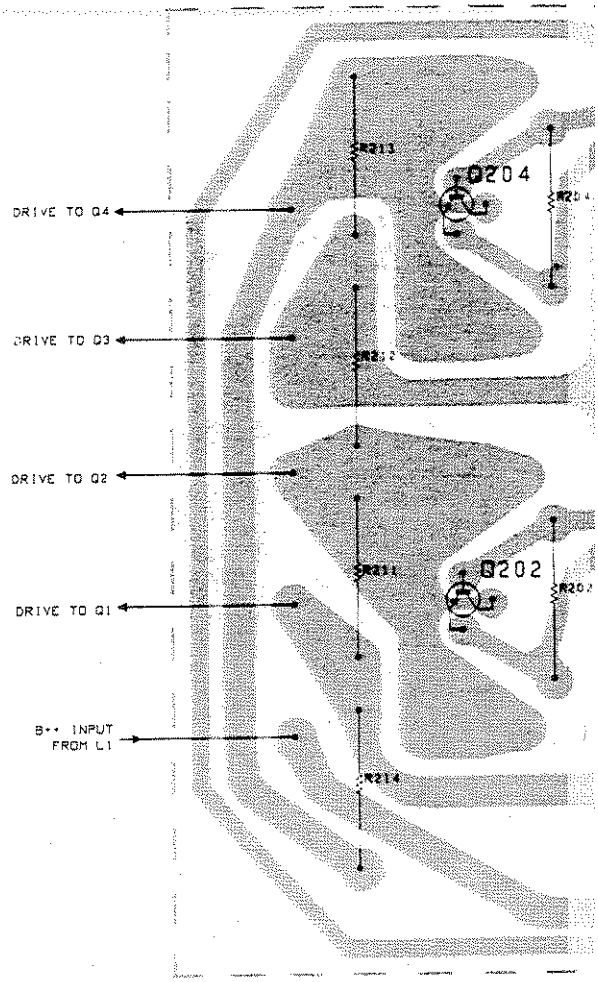
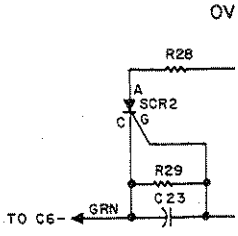


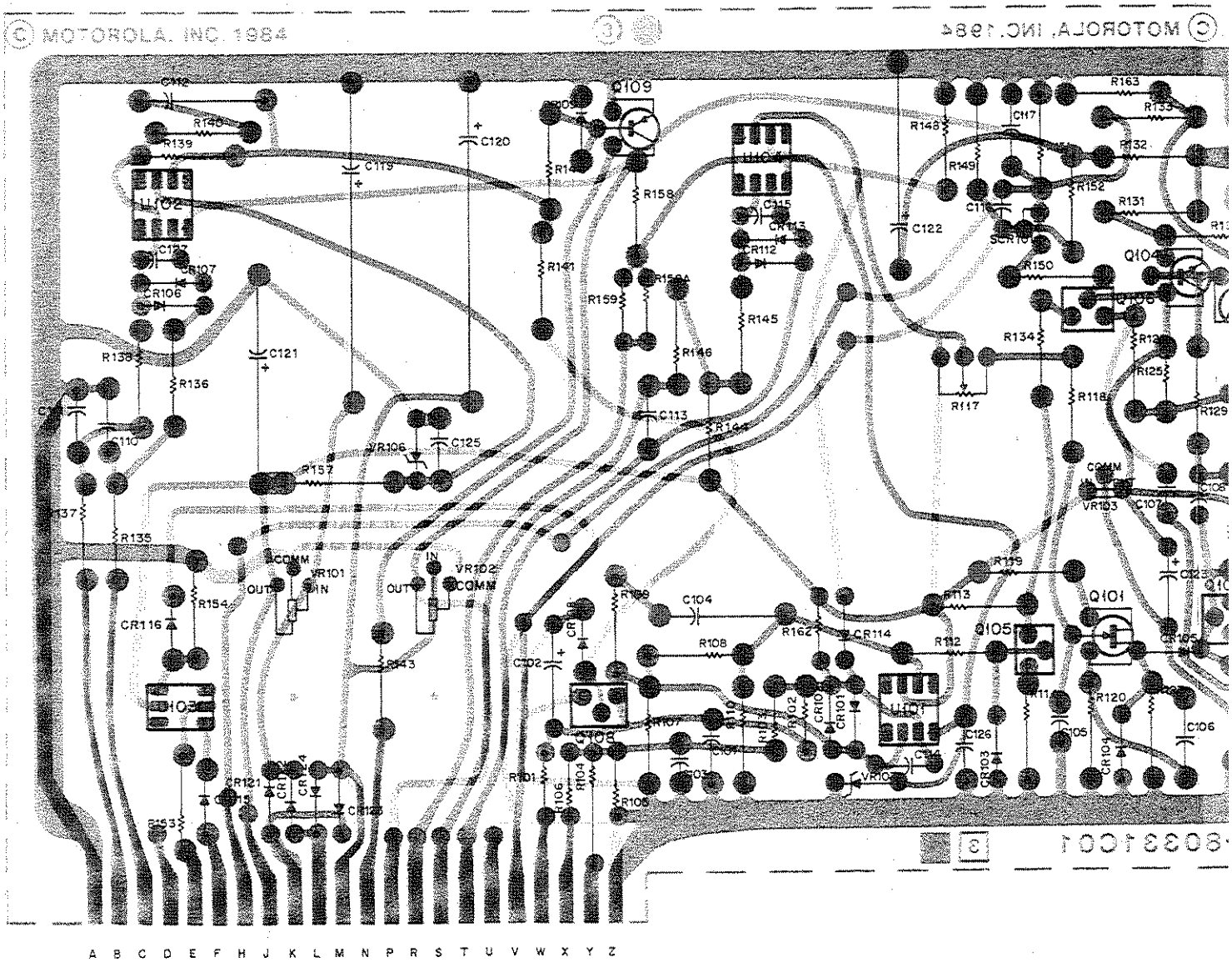








R1011B DC Power Supply
Schematic Diagram & Circuit Board Details
Motorola No. PEPS-33602-A
(Sheet 1 of 2)
1/10/86-PHI



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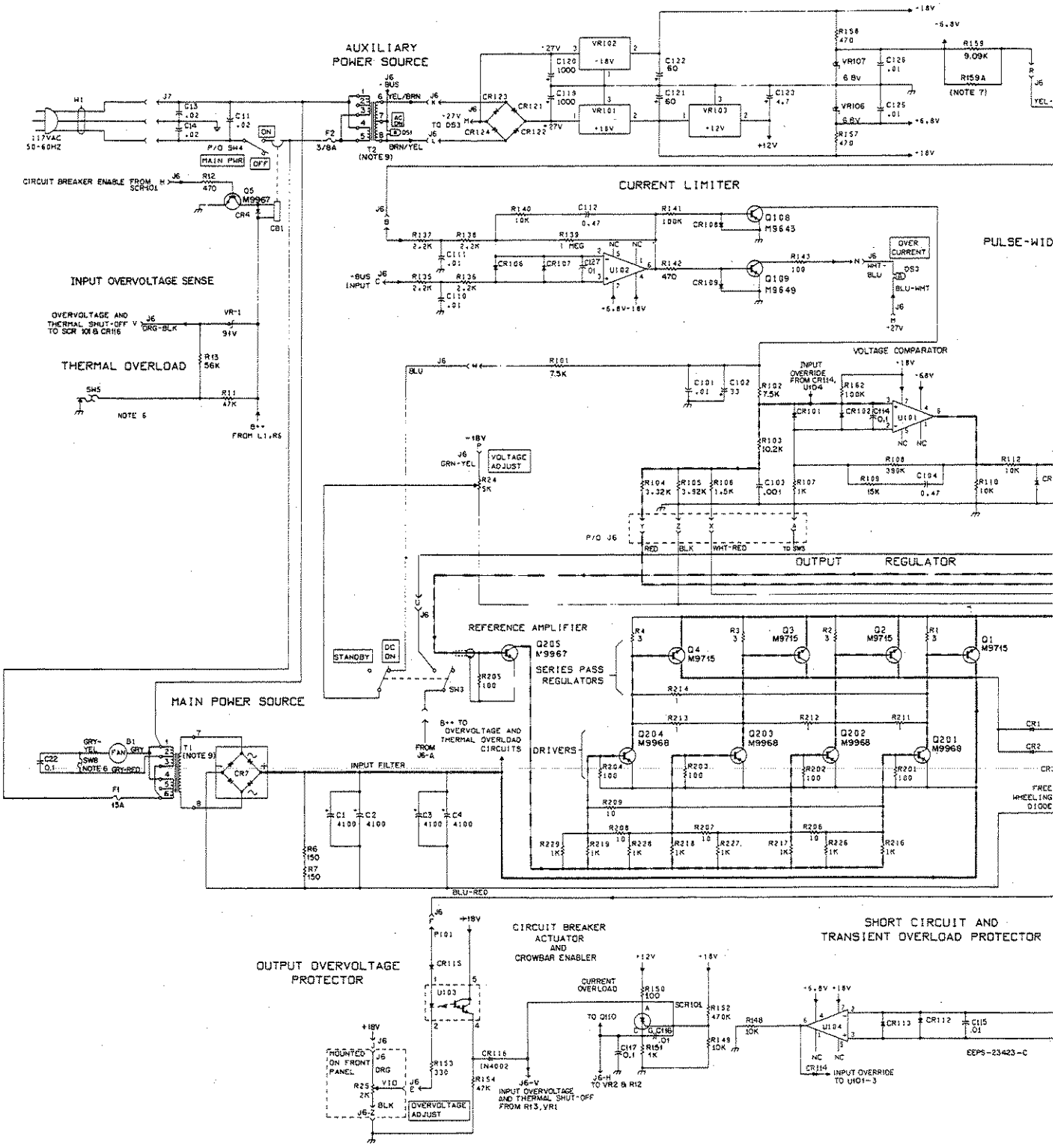
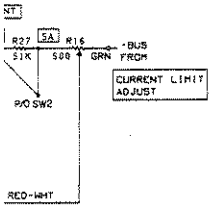
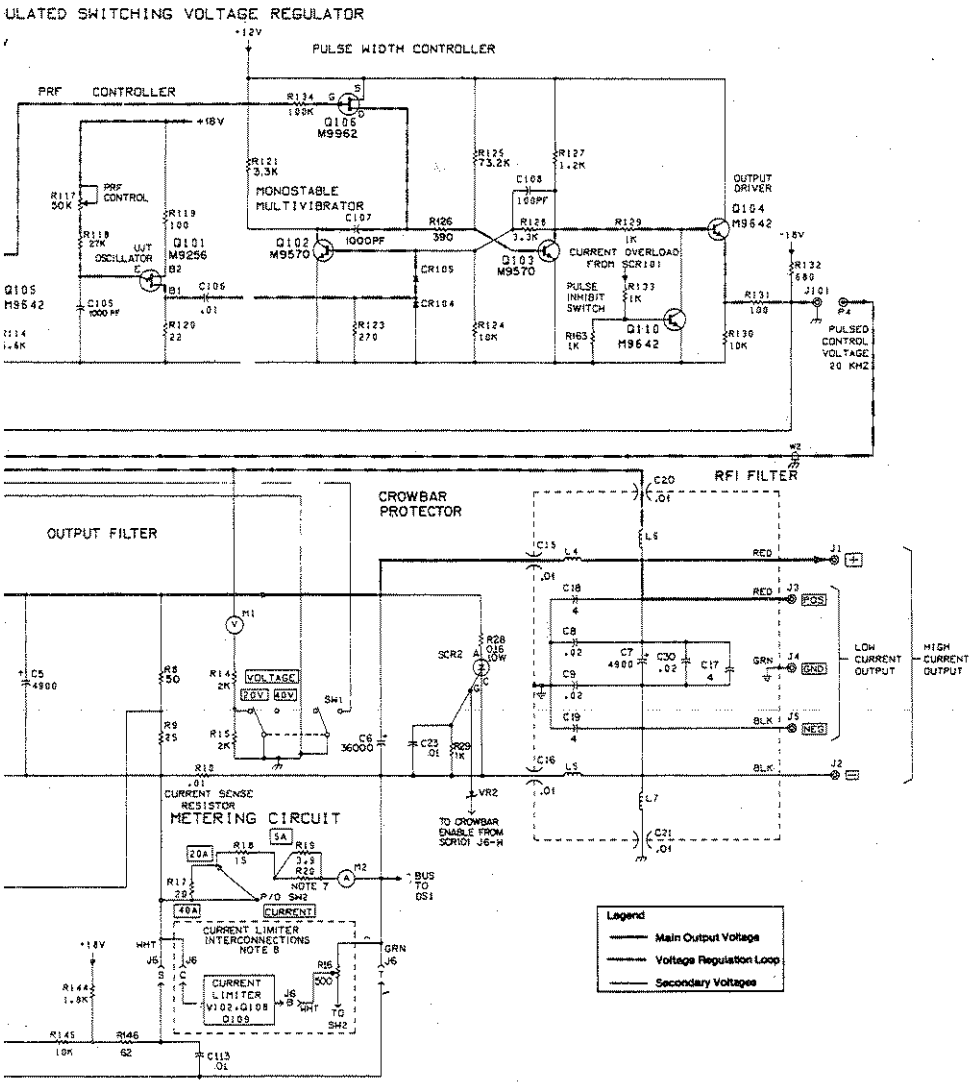
SOLDER SIDE BD-CEPS-41782-O SHOWN FROM COMPONENT SIDE
OL-CEPS-41783-O

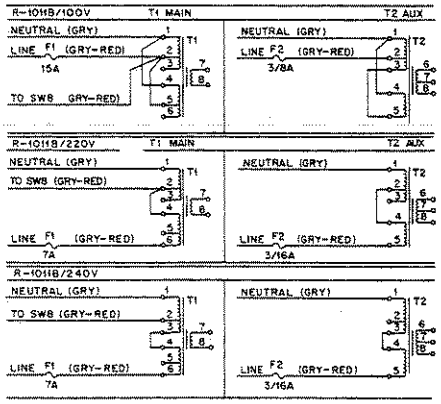






NOTES:

1. Unless otherwise indicated, resistors are in ohms and capacitors are in microfarads.
2. Descriptions enclosed within a rectangle are marked on equipment, such as 20 V.
3. ⏚ Represents earth ground.
   ⏚ Represents floating ground.
4. Integrated circuit pins not connected are indicated NC.
5. The following component referencing scheme is used:
   - 0-99 Chassis-mounted parts: except for those parts on the overvoltage board.
   - 100-199 Parts on control & regulator board.
   - 200-299 Parts on driver board.
6. Thermoswitches locations are:
   - SW5 Mounted on rear panel adjacent to Q3 and CR3
   - SW8 Mounted on back panel between Q2 & Q3
7. Factory selected part value.
8. Current limiter interconnections are shown for functional signal flow purposes. Complete circuit is shown directly below the auxiliary power source.
9. Conversion of R-1011B to other input voltages:
   1. Remove all jumpers from both transformers.
   2. Reconnect transformer primaries as needed.
   3. Change fuses as necessary.
   4. Apply appropriate label to the back of power supply.
10. IF wired for 100 V Range input current might exceed 15A.



R1011B DC Power Supply
Schematic Diagram & Circuit Board Details
Motorola No. PEPS-33602-A
(Sheet 2 of 2)
1/10/86 PHI