

Model 244
MOBIL/COMM DC POWER SUPPLY
INSTRUCTION MANUAL

(STOCK NO. 2490-678)

The Hickok Electrical Instrument Company

10514 DUPONT AVENUE • CLEVELAND, OHIO 44108 • (216) 541-8080 • TWX: 810-421-8288

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SECTION I GENERAL INFORMATION



Figure 1-1. Hickok Model 244 Mobil/Comm DC Power Supply

DESCRIPTION

The Hickok Model 244 Mobil/Comm Power Supply is a compact, state-of-the-art, precision instrument, designed to supply filtered, regulated, direct current, applicable to servicing automotive-type electronic equipment, specifically personal communications transceivers such as Citizen Band units.

Model 244 incorporates features of particular value to the communication equipment technician. The voltage output is variable from 10 to 14.5 Vdc with a calibrated meter designation for 13.8 Vdc. The current output is capable of supplying 0 to 3 amperes. Both voltage and current are metered. "Foldback" current limiting makes the Model 244 absolutely burn-out proof. Even a dead short across any output terminals will cause no damage. There are no circuit breakers to reset, or fuses to replace. After the short circuit is removed, the unit will return to normal operation. During shorted or high current conditions, the "foldback" current limit circuit reduces available current to approximately 1.4 amperes and the **OVERLOAD** indicator lamp lights. Three 5-way output binding-post terminals are provided on the front panel, +, -, and ground. Depending on the application, the unit may be operated up to 500 volts off ground potential.

SPECIFICATIONS

Output:	
Voltage:	10.5 — 14.5 Vdc
Current:	0 — 3.0 Adc
Regulation:	
Line:	10.5 — 13.8 volts less than or equal to 0.1% for $\pm 10\%$ change in line
Load:	10.5 — 13.8 volts less than or equal to 0.5% no load to full load
Recovery Time:	200 μ s
Ripple and Noise:	Less than or equal to 10mVrms 0-3 A
Ambient Operating Temperature:	0 to 40°C continuous duty
Metering:	Single dual-function meter
Voltage:	10.5 to 14.5 Vdc calibrated $\pm 2\%$ of full scale
Current:	0 to 3 Adc calibrated $\pm 3\%$ of full scale
Power Requirements:	105-115/210-230 Vac 50-400Hz, 100 watts (see schematic for conversion to 230 Vac
Dimensions:	8-1/2" w X 4" h X 6" d (not including handle)
Weight:	11 pounds
Handle:	Continuously variable handle acts as tilt stand

CONTROLS AND INDICATORS DESCRIPTION

Refer to Figure 1-2

	Item Number	
ON-OFF Switch	1	Front-panel-mounted, two-position, slide switch applies power to unit.
POWER Indicator Lamp	2	Front-panel-mounted red LED illuminates, indicating that ON-OFF switch is in ON position and unit is connected to power source.
OUTPUT VOLTAGE Control	3	Front-panel-mounted, continuously variable, rotary control varies the output voltage level from 10.5 volts to 14.5 volts.
Meter Switch	4	Front-panel-mounted, two-position slide switch labeled VOLTS AMPS selects the quantity to be displayed on the output meter. In the VOLTS position, the meter will display on the upper meter scale the output voltage level. In the AMPS position, the meter will display on the lower meter scale the output current level.
OVERLOAD Indicator Lamp	5	Front-panel-mounted red LED illuminates to indicate a low-resistance overload condition which causes the foldback current limiting circuit to control the output current level.
Output Meter	6	Front-panel-mounted, dual-scale, dual-function meter, which displays either the output voltage or output current depending on the function selected by the Meter Switch (Item 4).
Output Connectors	7	Three 5-way binding-post terminals, labeled +, - and GND , provide access to the outputs of the power supply. Connector labeled + will always be positive with respect to the connector labeled -. Connector labeled GND is connected to the chassis and third-wire ground.

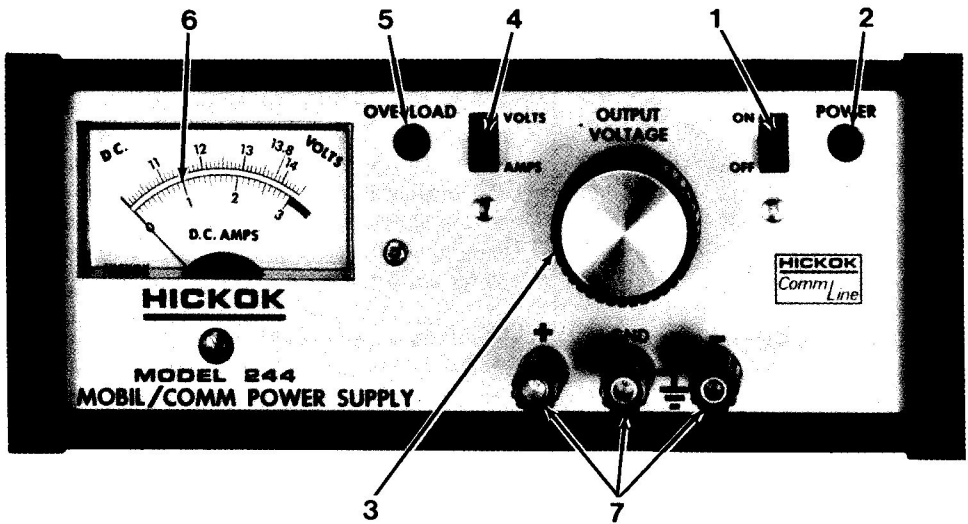


Figure 1-2. Front Panel of Model 244 Mobil/Comm Power Supply

SECTION II OPERATION

GENERAL

This section describes the operation of the Hickok Model 244 Mobil/Comm Power Supply in a step-by-step procedure.

PRELIMINARY OPERATION

After removing the unit from its shipping carton and inspecting for visible damage, proceed to the following set-up steps:

1. Connect ac power cord to appropriate power source.
2. Set the **ON-OFF** switch to the **ON** position.
3. Check that the **POWER** lamp illuminates.
4. Set the Meter Switch to the **VOLTS** position.
5. Turn the **OUTPUT VOLTAGE** control from fully counterclockwise to fully clockwise while observing the meter deflection. Check that the meter needle varies the full arc of the dc volts scale.
6. With no connection to the output terminals, set the Meter Switch to the **AMPS** position. Check that the meter needle indicates zero on the dc amps scale.
7. If all the preceding steps could be performed, the unit is operating properly and you may proceed to **OPERATION**. If any of the preceding steps could not be performed, a malfunction is indicated. Refer to **MAINTENANCE** or **CALIBRATION** section of this manual.

OPERATION

CAUTION

*The foldback current-limiting circuit of the Model 244 will reduce current output to approximately 1.4 amperes if a short or low resistance circuit is connected to the outputs, thus protecting the Model 244. However, current will continue to be supplied at 1.4 amperes to the unit under test. To avoid possible additional damage to a unit under test with a shorted or low resistance power input, always disconnect the power supply if the **OVERLOAD** indicator light illuminates. Correct the malfunction before reconnecting the power supply.*

Using Model 244 to Power Automotive Radio Equipment

1. Set **ON-OFF** switch to **ON** position.
2. Set Meter Switch to **VOLTS** position.
3. Adjust the **OUTPUT VOLTAGE** control to produce the appropriate voltage level reading on the meter. CB transceivers are to be operated at 13.8 Vdc.
4. Observing the proper polarity, connect the unit under test to the + positive and - negative output terminals of the Model 244.

CAUTION

*If the **OVERLOAD** indicator lamp lights when unit is connected, immediately disconnect the power supply and locate the malfunction causing the overload condition. Failure to do so may cause additional damage to the unit under test.*

5. To monitor current load, set Meter Switch to **AMPS** position.

Using Model 244 With Output Referenced to Ground

In applications requiring the normally floating output to be referenced to ground, such as noise elimination, proceed as follows:

1. After completing all steps in Using Model 244 to Power Automotive Radio Equipment, connect a clip lead with banana plug to the **GND** terminal.
2. Connect **GND** clip lead to same point as - power lead.
3. Alternately, connect clip lead to chassis of unit under test or + lead connect point. One of these three connection points should eliminate noise from unit under test.

SECTION III APPLICATIONS

TESTING CITIZEN BAND TRANSCEIVERS

The Model 244 is ideally suited for CB servicing because it allows the operator to accurately adjust the output voltage from 10.5 to 14.5 Vdc. This range of output voltage adjustment can simulate worse-case conditions that can occur in battery operated devices such as CB transceivers and other radio equipment. For example, some radios exhibit a malfunction when the terminal voltage of the battery is low (10.5 Vdc) or high (14.5 Vdc) in comparison with the nominal 13.8 Vdc terminal voltage. The FCC requires that CB radios must not deliver more than 4.0 watts of power to the antenna when operating from a 13.8 Vdc power source. The output voltage of the Model 244 can be easily adjusted to within 2% of 13.8 Vdc.

When the meter switch is set to **AMPS**, the meter will monitor the average current delivered to the load. This feature is useful in determining the efficiency of the CB transmitter and also spotting increased load current demands with temperature and time that are peculiar to some malfunctioning circuits.

SECTION IV

THEORY OF OPERATION

GENERAL

The Model 244 has a rugged series pass regulator to vary the output voltage, incorporating a foldback current limiting network for protection.

REGULATOR

A filtered, but unregulated, dc voltage is applied to the input (collector) of the series pass transistor, Q101. The operational amplifier, Z101, compares a zener reference voltage (CR106) with a voltage which is proportional to the output voltage. When the output voltage differs from the reference voltage, the operational amplifier provides an error signal to the series pass transistor. This error signal either adds or subtracts from the normal drive required by the pass transistor, depending on whether the output voltage should increase or decrease. In either case the output voltage cannot differ by more than 50mv from its preset voltage unless the regulator is in the overload condition.

OVERLOAD CONDITION

In this condition, the load demands more current than the regulator can supply. In this particular supply, the load current is limited to 3 amperes.

OVERLOAD PROTECTION

Overload protection is in the form of foldback current limiting. Foldback is a method for reducing the power dissipation of the series pass transistor.

Foldback is accomplished as follows:

The current limiting transistor, Q103, senses the voltage developed across the load-current-sense resistor, R103. In the overload condition, Q103 directs drive current (produced by the operational amplifier) away from the pass transistor. Reducing the drive to the pass transistor limits the current supplied to the load. The voltage required across the sense resistor to initiate current limiting is equal to $V_{be} + V_b$ where V_{be} is the forward base emitter voltage of the current limiting transistor and V_b is a bucking voltage derived from a resistive divider, R105 and R116. The voltage developed across the sense resistor is directly proportional to the load current. The bucking voltage is directly proportional to the output voltage. If the voltage across the sense resistor is equal to $V_{be} + V_b$, current limiting begins. If the resistance of the load is low enough to cause the output voltage to fall, the bucking voltage will also fall. Therefore, the current through the pass transistor will be

limited to something less than three amperes. During a short circuit condition, the current will be limited to about 1.4 amperes thus limiting the power dissipation of the pass transistor to a safe value.

METERING

The meter, M1, can measure output voltage by setting the meter function switch, S102, to volts. In this mode the meter follows a suppressed scale for greater accuracy. A zener reference voltage (CR106) functions as a suppressed metering reference. The voltage divider of R110, R113 and R118 sets the threshold voltage at which the meter begins to read on scale. In the current mode, the meter follows a standard scale from zero to 3 amperes. S102 places the meter, in series with R102 and the meter calibration (current) resistor R101, across the current-sense resistor R103. The meter effectively responds to a voltage developed across R103 which is proportional to the load current.

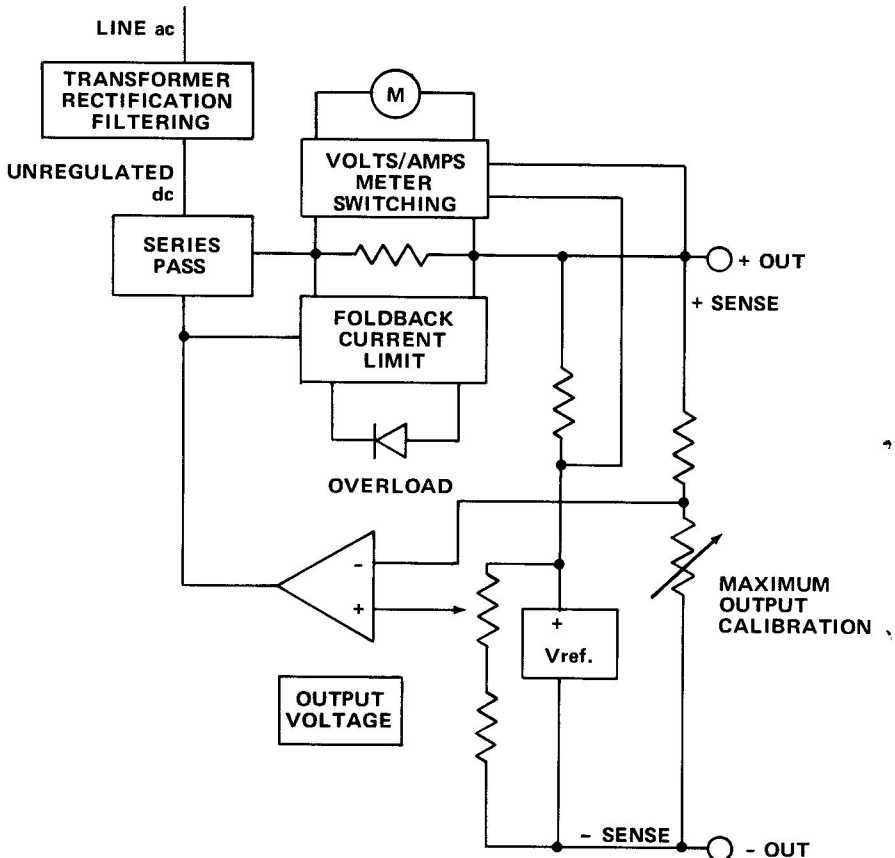


Figure 4-1. Block Diagram Model 244 Mobil/Comm Power Supply

SECTION V MAINTENANCE

GENERAL

Hickok Model 244 Mobil/Comm Power Supply is an all solid-state device which uses no "use-up or wear-out" components. There is, however, an internal 3AG 1.5A Slo-Blo fuse for protection of the unit against internal short circuits. If, when the **ON-OFF** switch is activated, the **POWER** lamp does not light, the fuse may have failed. To locate and replace the fuse, follow the procedure below:

NOTE

A fuse failure may be symptomatic of a more serious circuit malfunction. Check for a cause of the fuse failure before replacing the fuse. Never replace the fuse with one of larger capacity.

1. Place **ON-OFF** switch in **OFF** position.
2. Disconnect line power by pulling the plug.
3. Remove 8 screws from 4 corner brackets (2 screws each).
4. Remove corner brackets.
5. Lift off top cover.
6. Locate fuse in right-rear corner of circuit board.
7. With ohmmeter, check continuity of fuse.
8. If fuse is open, check for burned or shorted components or circuit board.
9. After repair of faulty component, or if no reason for the fuse failure is apparent, replace fuse with 3AG 1.5A Slo-Blo.
10. Reconnect line cord and activate power switch. If fuse fails again, more extensive troubleshooting and repair is required.

SECTION VI CALIBRATION

GENERAL

Hickok Model 244 Mobil/Comm Power Supply is factory calibrated to insure maximum accuracy. There may be times, because of component aging, repair, or replacement, that it becomes necessary to recalibrate the unit to factory specifications. The calibration procedure is described below.

NOTE

The following calibration procedures must be performed only by qualified service personnel with the appropriate equipment.

Equipment Required

1. Multimeter Hickok 334 or equivalent.
2. 4.7 ohm $\pm 1\%$, 50 watt power resistor, Dale RH-50 or equivalent.
3. 3 to 5 ohm variable load with 3.2 ampere capacity Ohmite # 0141 rheostat in series with Ohmite Type 0400L, 3 ohm, 50 watt power resistor or equivalent.

PRELIMINARY

1. Disconnect line power by pulling the plug.
2. Remove 8 screws from 4 corner brackets (2 screws each).
3. Remove corner brackets and lift off cover.

NOTE

Refer to component location drawings in rear of manual for all adjustments.

4. Adjust R102, R118, and R115 to midrange position. Adjust R105 to full clockwise position.
5. Set Meter Switch to **VOLTS** position.
6. Set multimeter to 20 Vdc range and connect leads to + and - output jacks of Model 244.

7. Mechanically zero the panel meter of Model 244 by turning adjustment screw on meter face.

CAUTION

With line cord connected, hazardous line-voltage levels are present around the transformer, fuse, power switch and some printed-circuit foils on the left side of the main circuit board. Exercise care to avoid dangerous electrical shock or damaging short circuits.

8. Connect line cord and set **ON-OFF** switch to the **ON** position.

Maximum Output Voltage Adjustment

1. Turn **OUTPUT VOLTAGE** control to the full clockwise position.
2. Monitor the output voltage reading on the multimeter while adjusting R115 for 14.5 ± 0.1 Vdc.

Panel Meter Voltage Calibration

1. Monitor output voltage reading on multimeter while adjusting **OUTPUT VOLTAGE** control to produce a multimeter reading of 13.80 ± 0.02 Vdc.
2. Adjust the meter voltage calibration trimmer R118 to make the panel meter read 13.8 Vdc. Remove multimeter.

Panel Meter Current Calibration

1. Connect $4.7\Omega \pm 1\%$, 50 watt resistor across the + and - output jacks of Model 244.
2. Set Meter Switch to **AMPS**.
3. Use multimeter to measure output voltage at binding posts; verify that the voltage is 13.72 to 13.82 Vdc. If voltage drops below this range, unit cannot be calibrated and requires repair.
4. Adjust meter current calibration trimmer R101 to make the panel meter read 3.0 amperes dc.

Foldback Current-Limiting Calibration

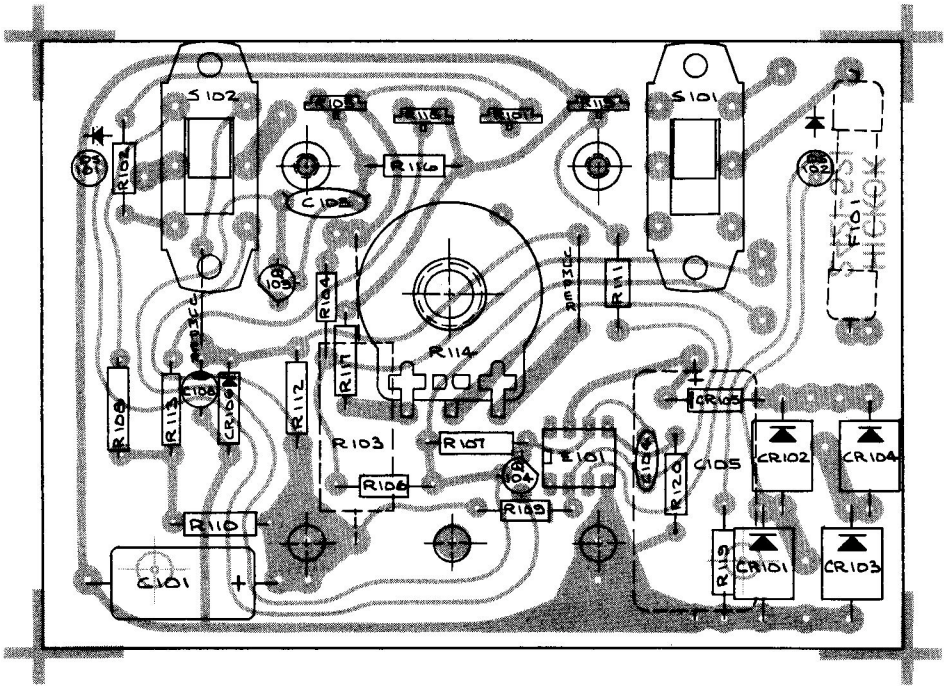
1. Verify that the Meter Switch is set to the **AMPS** position.
2. Adjust **OUTPUT VOLTAGE** control to a reading of 13 ± 0.1 Vdc on the multimeter.
3. Connect the 3 to 5 ohm variable load across the + and - output jacks of Model 244.
4. Monitor the panel meter and adjust the variable load to produce a reading of 3.0 amperes. Allow 5-minute warm-up time before proceeding.
5. Adjust current-limit calibration trimmer R105 until the **OVERLOAD** lamp just illuminates, then back off on the adjustment until the lamp just goes out.
6. The Model 244 is now calibrated and may be assembled to operating condition.

SECTION VII PARTS LIST

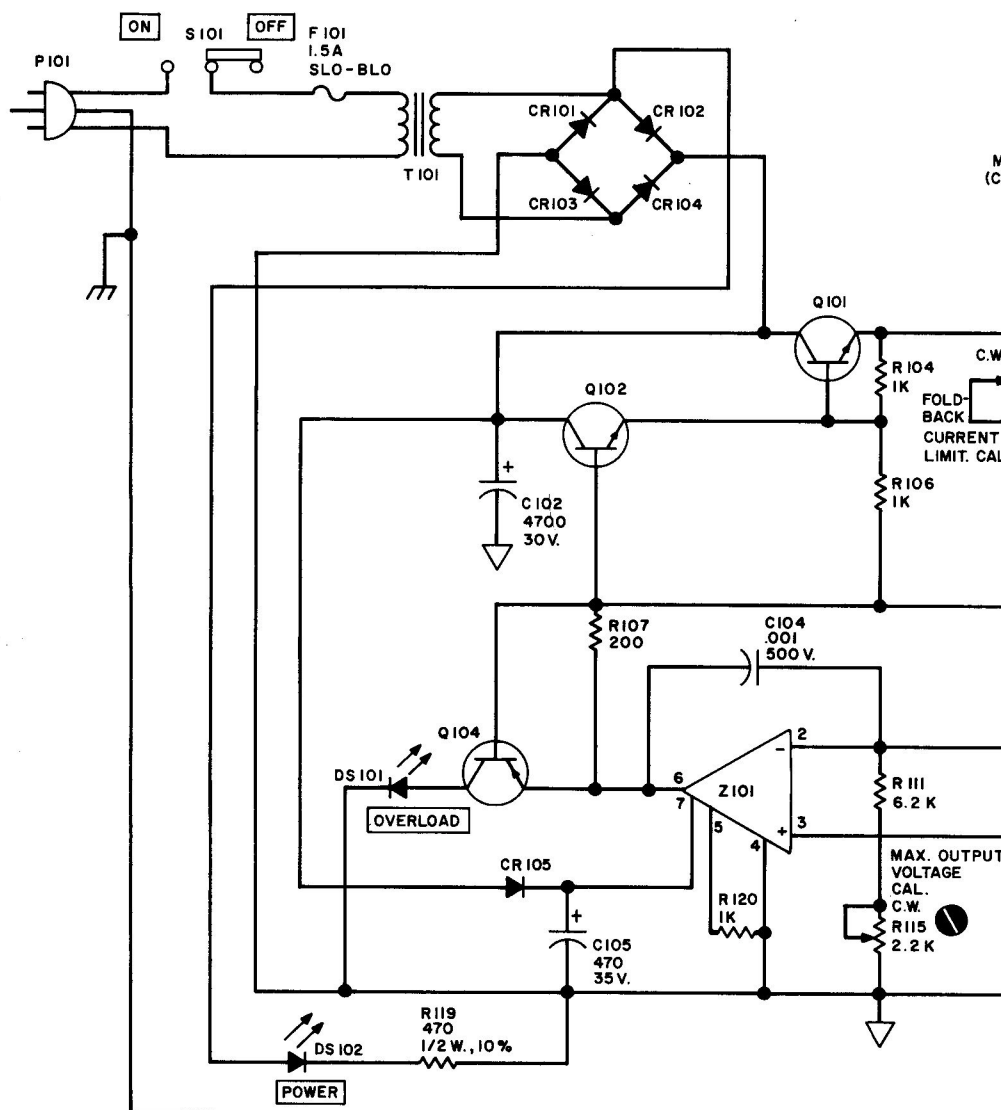
When ordering parts be sure to give the reference designation, description, and the Hickok part number as listed in the following table. Unless otherwise indicated in the DESCRIPTION column, parts listed are applicable to all models. Also include the model and serial number of the equipment. There is a minimum billing charge of \$20.00 for all parts orders.

REF. DESIG.	NOTES	DESCRIPTION	HICKOK PART NO.
C101		CAPACITOR, FIXED, ELECTROLYTIC: 150 uf, 25 volts	3085-450
C102		CAPACITOR, FIXED: 4700 uf, +100% -0%, . . . 30 volts	3085-545
C103		CAPACITOR, FIXED, CERAMIC: 0.1 uf, 20%, 25 volts, disc type	3110-333
C104		CAPACITOR, FIXED, CERAMIC: 1000 pf, . . . 500 volts, disc type	3111-522
C105		CAPACITOR, FIXED, ALUMINUM ELECTRO- . LYTIC: 470 uf, +100% -10%, 35 volts	3085-505
C106		CAPACITOR, FIXED, ELECTROLYTIC: bead tantalum, 10 uf, 10%, 25 volts	3085-504
CR101 thru CR104 CR105		SEMICONDUCTOR DEVICE: diode, 3 amp, . . . 50 volts, type 1N4139	3870-324
CR106		SEMICONDUCTOR DEVICE: silicon diode, . . . 5 volt PIV, 1 amp, type 1N4001	3870-229
		SEMICONDUCTOR DEVICE: zener diode, . . . 6.2 v, $\pm 5\%$, 400 mw, type 1N5731B	3870-302
DS101		LAMP: LED, type LSL-3L, red diffused	12270-129
DS102		Same as DS101	
F101		FUSE: 1.5 amp, SLO-BLO, 3 AG pigtail type, 125 volt	6900-83
J101		BINDING POST: black	2360-106
J102		BINDING POST: red	2360-107
J103		BINDING POST: green	2360-129
M101		METER: 0-1 ma	13450-28
P101		CORD: line, 6 foot long, grey	3675-49
Q101		TRANSISTOR: 2N3055	20861-257
Q102		TRANSISTOR: NPN, medium power, NSD104	20861-387
Q103		TRANSISTOR: 2N3565	20861-99
Q104		TRANSISTOR: 2N5138	20861-221
R101		RESISTOR, VARIABLE: 1000 ohms, 20%, . . . vertical mount	16925-782
R102		RESISTOR, FIXED, DEPOSITED CARBON: . . . 1K ohms, 5%, 1/4 watt	18470-102
R103		RESISTOR, FIXED, WIRE WOUND: 0.47 ohms, 10%, 7 watt	18575-746
R104		Same as R102	
R105		Same as R101	
R106		Same as R102	

REF. DESIG.	NOTES	DESCRIPTION	HICKOK PART NO.
R107		RESISTOR, DEPOSITED, CARBON: 200 ohms, 5%, 1/4 watt	18470-201
R108		RESISTOR, FIXED, METAL FILM: 2.61K ohms, 1%, 1/8 watt	18554-230
R109		RESISTOR, FIXED, DEPOSITED CARBON: . . . 10K ohms, 5%, 1/4 watt	18470-103
R110		RESISTOR, FIXED, DEPOSITED CARBON: . . . 220 ohms, 5%, 1/4 watt	18470-221
R111		RESISTOR, FIXED, DEPOSITED CARBON: . . . 6.2K ohms, 5%, 1/4 watt	18470-622
R112		RESISTOR, DEPOSITED CARBON: 2K ohms, 5%, 1/4 watt	18470-202
R113		RESISTOR, FIXED, DEPOSITED CARBON: . . . 270 ohms, 5%, 1/4 watt	18470-271
R114		RESISTOR, VARIABLE: 10K ohms, 1/4" . . . bushing length, molded shaft 3/4" FMS	16925-891
R115		RESISTOR, VARIABLE: 2.2K ohms, 20%, vertical mount	16925-815
R116		RESISTOR, FIXED, DEPOSITED CARBON: . . . 9.1K ohms, 5%, 1/4 watt	18470-912
R117		RESISTOR, DEPOSITED CARBON: 20K ohms, 5%, 1/4 watt	18470-203
R118		RESISTOR, VARIABLE: 100 ohms, 20%, . . . vertical mount	16925-780
R119		RESISTOR, FIXED, COMPOSITION: 470 ohms, 10%, 1/2 watt	18411-472
R120		Same as R102	
S101		SWITCH: slide, dpdt	19911-159
S102		Same as S101	
T101		TRANSFORMER: power	20800-480
Z101		INTEGRATED CIRCUIT: LM741CN	9800-57

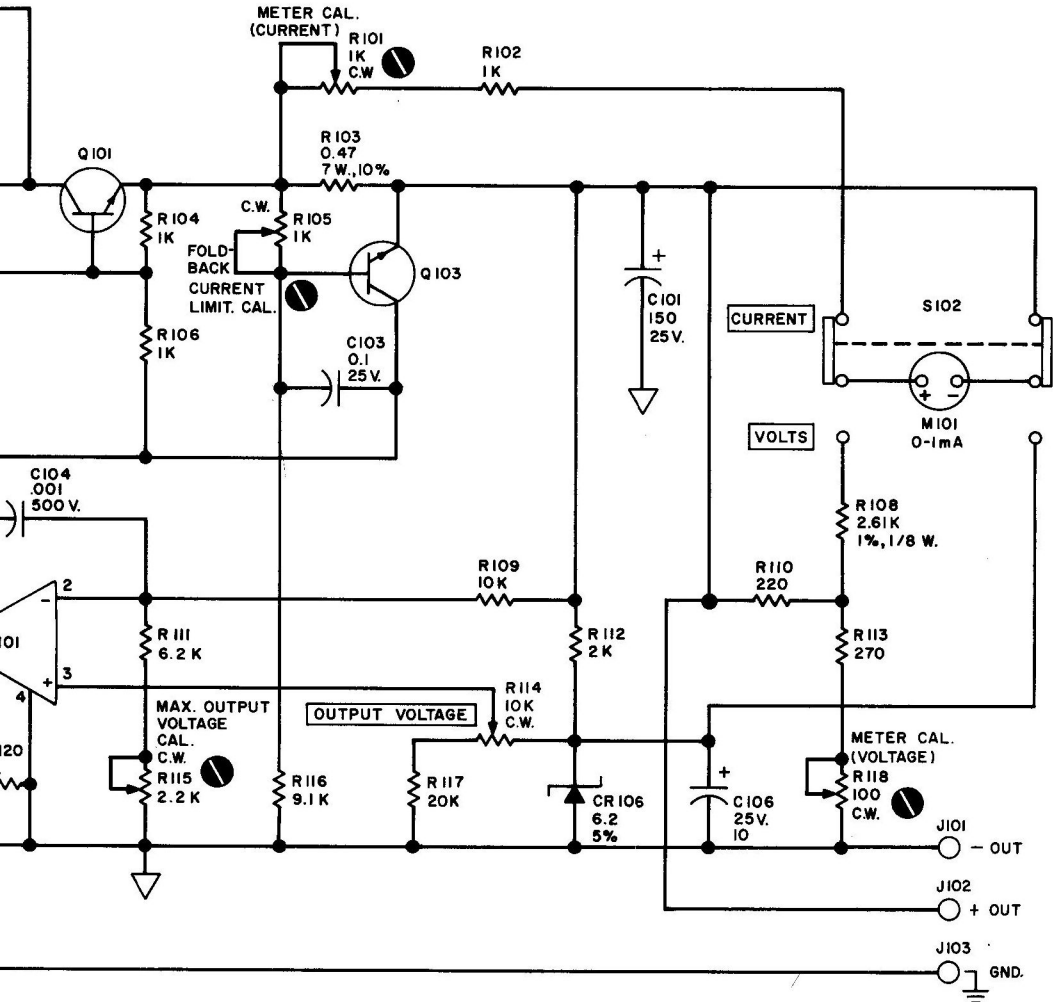


PC BOARD MODEL 244
DC POWER SUPPLY

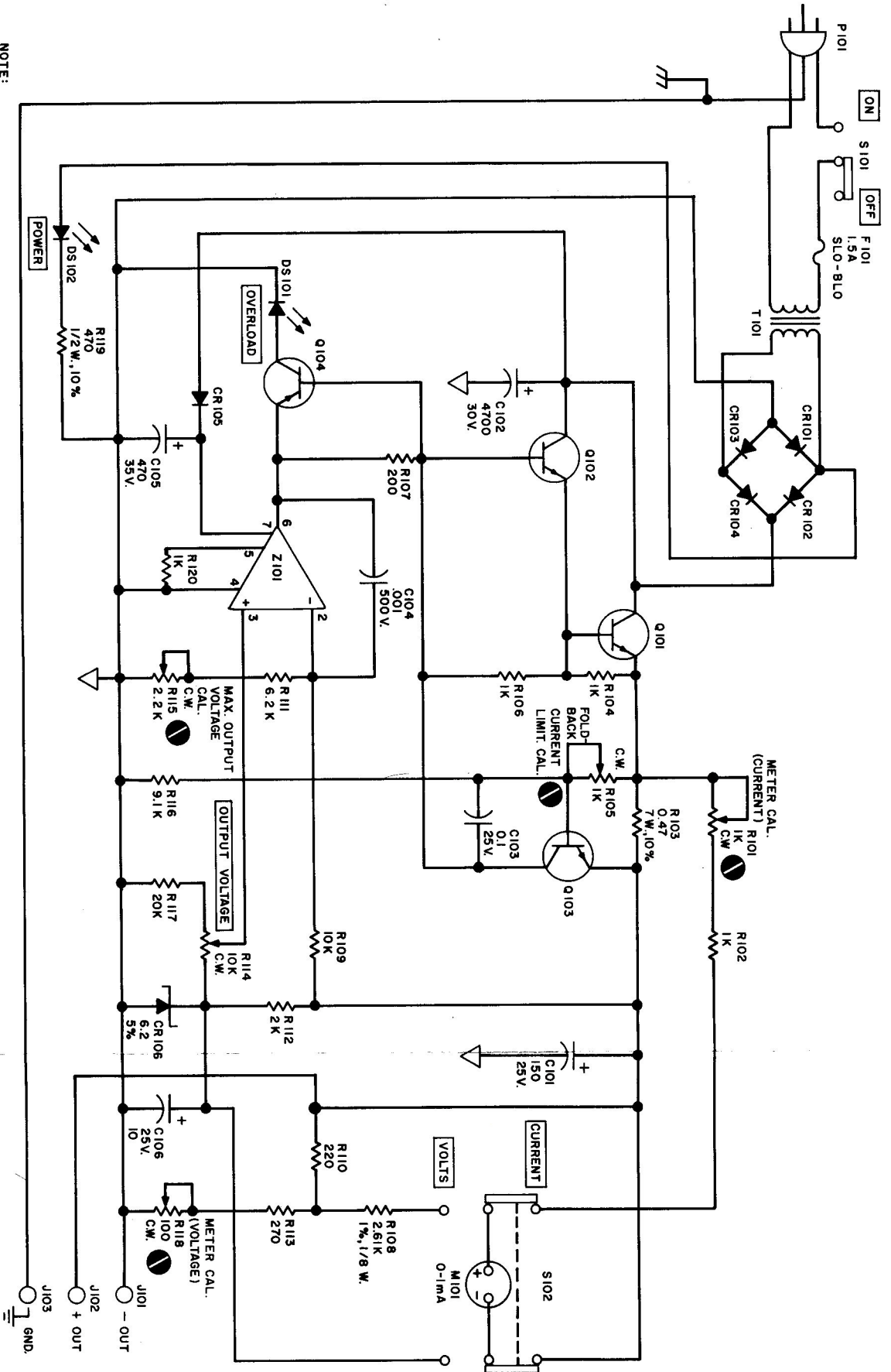


NOTE:

- 1) ALL RESISTORS ARE 1/4 WATT, 5% TOLERANCE UNLESS OTHERWISE SPECIFIED.
- 2) ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
- 3) INDICATES FRONT PANEL NOMENCLATURE.



SCHEMATIC MODEL 244
DC POWER SUPPLY
 Drawing Number 900-322W



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