MOTOROLA INC.
Communications
Sector

BATTERY CHARGER POWER SUPPLY

MODEL TPN1185A (500 WATT, 60 Hz)

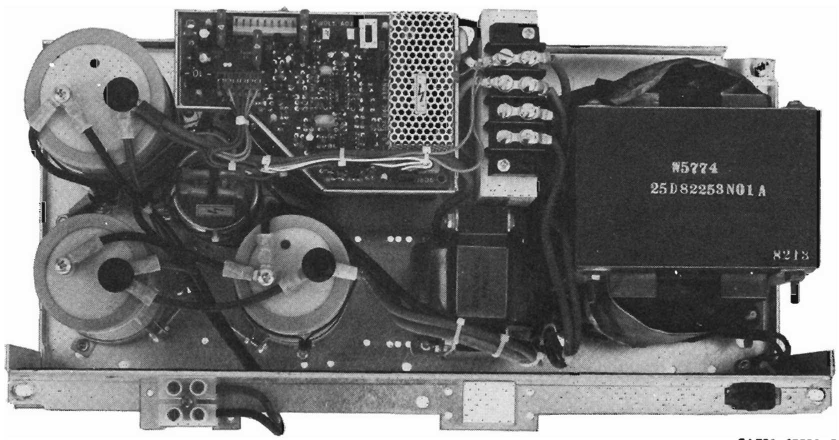

Figure 1. Model TPN1185A Battery Charger Power Supply

Model Complement of TPN1185A Battery Charger Power Supply (500 Watt, 60 Hz)

Kit	Description
TPN6137C	Battery Charger Circuit Board
TRN5153A	Battery Charger Power Supply Hardware Kit
TRN5336A	Power Supply Hardware Kit
TRN9752A	Power Supply Support Bracket Kit

1. DESCRIPTION

The Model TPN1185A Battery Charger Power Supply is a factory installed accessory that is available for various models of Motorola base and repeater stations.

The Power Supply permits the station to operate from 120 volt, 60 Hz ac power normally, but provides continued operation from external 12-volt batteries (emergency power) if the ac power should fail. When ac power is present, the power supply also operates as a battery charger to recharge the batteries.

The Power Supply provides an output signal ($\overline{\text{AC FAIL}}$) whenever a line voltage failure is sensed. The power supply then switches the station to battery power. The $\overline{\text{AC FAIL}}$ signal is normally high. It goes low when a line voltage failure is detected. The output signal may be used to enable an audible alarm or provide a visual indication, depending upon the type of station in which the power supply is installed. In some cases, the signal is routed to station control, for monitoring.

The Power Supply also provides an output ($\overline{\text{OVERVOLTAGE ALARM}}$) that occurs if the charger output voltage rises to a level which might result in damage to

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PERFORMANCE SPECIFICATIONS

Operating Temperature	-30° to +80°
Input Voltage	96 V to 132 V ac, 60 Hz

UNFUSED OUTPUT

Output Voltage	13.25 V Lead Acid 14.25 V NiCad and also if any battery is *not* connected 14.25 V Lead Acid Equalize 15.25 V NiCad Equalize
Output Power (rated)	482 Watts (34A at 14.25 V)
Load Transient	Shall not drop below 11.5 V for a 1.5 to 32.5A load.

FUSED OUTPUTS

Main	13.8 V at 4A
Auxiliary	13.8 V at 10A

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

the external batteries. The overvoltage alarm output signal is normally high. It goes low when an overvoltage condition is sensed. In the event of an overvoltage alarm, contact a serviceman immediately.

The $\overline{\text{OVERVOLTAGE ALARM}}$ signal is used within the supply to disconnect (open) the power transformer secondary winding from the high current A+ output. This is accomplished by energizing relay K650 when an overvoltage condition is detected. The overvoltage sensing circuitry resets after approximately 15 seconds and will re-activate at this rate as long as the overvoltage condition persists.

The power supply/battery charger is of the controlled ferroresonant design. The supply provides high current A+ at 14.25 V and two 13.8 V dc outputs to power any continuous or intermittent duty radio. Current limiting, short circuit, and over-voltage protection are also provided.

The batteries used as the external emergency source can be of either the nickel-cadmium or lead-acid type. An automotive type battery is not recommended as a permanent emergency dc supply.

A two-position switch, S650, on the battery charger board determines the charging rate of the batteries. The EQUALIZE position increases the charging voltage to restore the batteries after emergency use or where the condition of the battery dictates. In the other position (float), a voltage is supplied to the batteries sufficient to maintain them in a fully charged state.

2. THEORY OF OPERATION

(Refer to the functional block diagram attached at the end of this section.)

2.1 TRN5336A STANDARD POWER SUPPLY

The TRN5336A Standard Power Supply performs the conversion of ac line power to dc radio power. Refer to the schematic diagram attached at the end of this section. The supply consists of rectification and filtering circuits. The secondary voltage of ferroresonant transformer T601 is rectified by CR601 and CR602. Ground connection for the diodes is provided through the heat sink to the chassis. Output filtering is provided by C602, C603, L601, and C604.

2.2 TRN6137C BATTERY CHARGER BOARD

Line and load regulation is controlled by the TRN6137C Battery Charger Board. Refer to schematic diagram attached at the end of this section. Regulation is accomplished by controlling the saturation of ferroresonant transformer T601 via a control inductor, L650. This inductor is switched across the resonant winding on the transformer as the output voltage reaches a preset level. Potentiometer R662 (VOLT. ADJ.) permits output voltage adjustment. Switching and timing circuitry for the control inductor is described in the following paragraphs.

2.2.1 Clock Generator

Q665 and Q650 derive a line frequency related clocking signal for timing and triggering purposes.

2.2.2 +10 Volt Reference Source

Zener diode VR650 and diodes CR669 and CR670 establish a +10 volt reference source used by the activity detector, stabilizer, and control voltage generator circuits.

2.2.3 Monostable Switch

U650D converts the clock signal into a monostable pulse which drives the ramp generator.

2.2.4 Ramp Generator

Q651 generates a ramp voltage in conjunction with C653.

2.2.5 Control Voltage Generator

U650A compares a reference voltage with the output voltage and generates a control voltage with gain to the pulse width modulator.

2.2.6 Pulse Width Modulator

U650C compares the control voltage with the ramp and generates a pulse whose width is determined by how early in the ramp cycle the control voltage equals the ramp voltage.

2.2.7 Stabilizer

U650B keeps the monostable switch (U650D) from changing state for approximately 1/2 cycle to eliminate triggering errors due to line and load transients.

2.2.8 Power Switch

The SCR Q656 and TRIAC Q657 work together to switch the control inductor L650 in and out of the resonant winding on the power transformer. The diode bridge between the SCR and TRIAC allows the TRIAC to be triggered every half cycle.

2.2.9 Overvoltage Protection

Overvoltage comparator U651A compares the voltage appearing at the arm of R662 with a fixed voltage developed across a voltage divider consisting of R678, R683, and R655. Any increase or decrease A+ in voltage is reflected at the arm of R662 and applied to U651A-3. If the voltage at U651A-3 rises above the fixed voltage applied to U651A-2, the output at U651A-1 goes high. This action begins charging capacitor C659. If the A+ voltage remains high, C659 will charge to a level above the reference applied to U651B-6. This causes U651B-7 to go high, which in turn, turns on Q654 and Q653. Once Q654 is turned on, the overvoltage protection relay K650 is energized which removes the transformer secondary center tap return path. At the same time that relay K650 is energized, Q663 turns on and begins to charge C676 through R700. When C676 charges to a high enough voltage to turn on Q664, C569 is discharged. This will drive U651B-5 low and reset the overvoltage detection circuit. If the overvoltage conditions persists, the detection and reset process will continue to repeat itself every 15 seconds. Q653 will remain turned on to provide the overvoltage alarm output at J603-5 until both ac power and battery dc power is disconnected. Zener diode VR651 provides additional protection by forcing the overvoltage circuits to energize in the event that overvoltage sensing through R662 fails.

2.2.10 Line Fail Sense

Q658 and Q659 generate a "line fail" signal when a loss of clock signal is detected. Q658 senses failure at the ac line and Q659 generates the output signal $\overline{\text{AC FAIL}}$.

2.2.11 Power Up Reset

Q662 and Q661 use the line fail sense signal from Q658 to generate a power up reset input to the pulse width modulator, U650C, each time power is turned on. The power up reset signal is applied to the control voltage input (U650C-9) of the pulse width modulator and enables quick power up.

3. BATTERY CONNECTION AND INSTALLATION

3.1 GENERAL

Installation of the station with this option is standard except for the connection of the 12-volt battery (10 cells nickel-cadmium, 6 cells lead-acid).

Locate the battery in a secure place, and as close to the station as possible. The cable length must be kept as short as practical, because of the voltage drop in the battery cable. A substantial voltage drop can be developed across this low resistance due to the high currents drawn from the battery while transmitting.

Select a battery location that has an unobstructed air circulation, preferably a cool dry place with ample width aisles to permit easy access to all cells for installation, taking readings, adding water and cleaning. The battery must not be placed near radiators, boilers, or other heat-producing devices.

Capacity of a battery should be carefully determined before its purchase. Factors that influence the capacity are the busy hour load, the protection time desired, the final cell voltage limit and the minimum operating temperatures. For more information contact your Motorola Area Systems Engineer.

Connection of the battery terminals made during installation is extremely important to its service life. If connections are carefully made with clean, acid-free surfaces and kept tight by periodic checking, they will give trouble-free service over the life of the battery.

CAUTION
Do not attach batteries before setting the float voltage.

3.2 FLOAT VOLTAGE ADJUSTMENT

Adjustment of the float voltage of the power supply is required at the time the battery is installed. The float voltage is the A+ output voltage of the power supply which will keep a battery fully charged when connected across the A+ output terminals. The float voltage adjustment varies with the type of battery being installed and with the ambient temperature. Refer to paragraph 3, A+ Level Adjustments, and to the battery manufacturer's literature for adjustment of the float voltage.

Give the battery a freshening or boost charge when it is received. Do this in accordance with the manufacturer's instructions.

3.3 BATTERY CABLE INSTALLATION

Connect the battery cable from the junction box to the battery as follows:

Step 1. Remove fuse F610 from the battery cable to prevent accidental short circuiting during installation.

CAUTION
Observe proper polarity on battery connections.

Step 2. Connect the battery cable plug (P605) to J605 on the junction box, and route the battery cable to the battery connection points.

Step 3. Connect the red wire of the battery cable to the position (+) terminal of the battery.

Step 4. Connect the black wire of the battery cable to the negative (-) terminal of the battery.

Step 5. Check to assure proper polarity of the cable leads, and then reinstall fuse F601, removed in Step 1.

NOTE
If power is to be removed from the station for any reason after the initial installation, the most convenient method is to remove the in-line fuse (F610) from the battery cable.

3.4 A+ VOLTAGE LEVEL ADJUSTMENT

The A+ output is factory adjusted for nickel-cadmium batteries at 14.25 volts. Refer to the schematic diagram attached at the end of this section. If adjustment is necessary, set output voltage control (VOLT. ADJ.), R662, on the station power supply for the desired float voltage as follows:

Step 1. Disconnect the batteries (if connected) and set float-EQUALIZE switch S650 to the float position.

Step 2. Connect a dc voltmeter with 3% accuracy (or better) between terminals TB601 + and TB601 — on the power supply. Allow the power supply to warm up under PTT load for at least 10 minutes.

CAUTION
Refer to battery manufacturer's specifications for precise voltage setting required for charging the type of emergency battery to be used. If this information is unavailable, set the charging voltage for the type of battery as specified in Step 3.

Step 3. Set the VOLT. ADJ. control R662 to provide a charging voltage: (a) as specified by the battery manufacturer; (b) of 14.25 volts if batteries are not to be connected at this time; (c) of 14.25 volts for nickel-cadmium batteries, or; (d) of 13.25 volts for lead-acid batteries.

4. MAINTENANCE

4.1 INTRODUCTION

Maintenance and repairs of this power supply demand a thorough understanding of its operation. Refer to the power supply Theory of Operation for this information.

4.2 TEST EQUIPMENT REQUIRED

The following test equipment is necessary for efficient, accurate servicing in the event that maintenance is required.

- 3-1/2 digit DVM
- DC current meter (0-50 amperes)
- Load resistor (variable from 0 ohm to 15 ohms, and capable of carrying 50 amperes)
- Variable voltage ac line transformer (0-130 volts)
- Oscilloscope
- Variable power supply
- Bench service cord consisting of:

Qty.	Part No.	Description
1	15-83183N01	Housing
2	39-83145N01	Contact
1	39-83145N02	Contact
1	30-865903	Cord

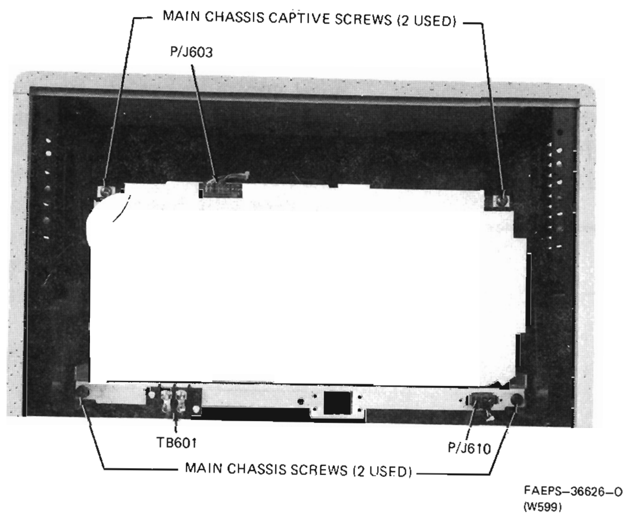


Figure 2. Power Supply Mounting Hardware and External Connections

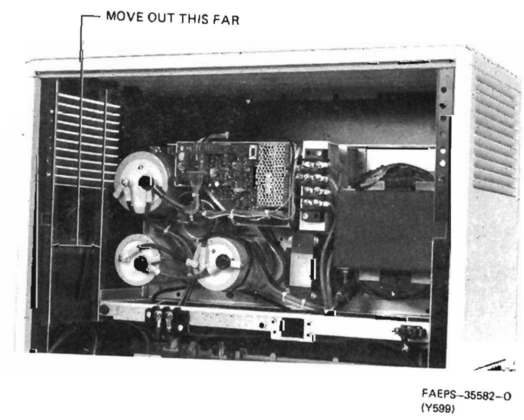


Figure 3. Power Supply Chassis Travel Distance

4.3 POWER SUPPLY REMOVAL

WARNING

The power supply is unexpectedly heavy, balances sharply to the right, and is awkward to hold. Follow the removal instructions carefully.

Step 1. Refer to Figure 2. Disconnect P610 from J610 on the power supply chassis. Disconnect P603 from J603 on the battery charger circuit board. Remove the two wires from the + and - terminals of TB601 on the power supply chassis. Note the color coding of the wires and the polarity of the terminals. If necessary, tag the wires for ease of identification.

Step 2. Refer to Figure 2. Remove main chassis screws and loosen main chassis captive screws.

Step 3. Slide power supply chassis toward you until chassis is flush with cabinet as shown in Figure 3.

WARNING
DO NOT ALLOW CHASSIS TO SLIDE FREELY BEYOND FRONT OF CABINET. CABINET RAIL SUPPORT ENDS ABRUPTLY.

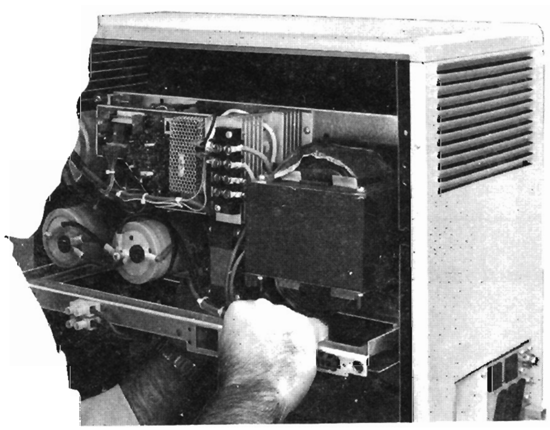


Figure 4. Properly Gripped Chassis

Step 4. Grip the main chassis with the right hand as shown in Figure 4. Find a comfortable grip around the flattened parts of the metal. Adjacent parts have sharp edges.

Step 5. Plant your feet firmly with good balance to receive a heavy weight.

Step 6. Slide the power supply toward you. Slightly tilt the chassis toward you and reach the left hand under the bottom to balance the chassis on the cabinet rails. Press the chassis firmly against the rails or the chassis will suddenly slide out of the cabinet. See Figure 5.

Step 7. Reposition the left hand from balancing the chassis to a firm grip.

Step 8. Brace your body to receive a heavy weight, and lift the power supply chassis free of the cabinet.

4.4 BATTERY MAINTENANCE

The battery or batteries used for emergency power require certain routine maintenance procedures to assure long trouble-free operation. Persons servicing the batteries should refer to the manufacturer's recommendations for routine maintenance. In addition, certain maintenance procedures are appropriate following each interval of emergency power operation.

Routine battery maintenance procedures for the two most common battery types are given (nickel-cadmium and lead-acid). The importance of keeping good battery maintenance records cannot be over-emphasized. A chart or table is needed, listing all voltage readings, temperature and hydrometer readings (where applicable), versus the dates on which the readings were taken. To be most effective, the battery report charts should be kept at the battery location for ready reference.

4.4.1 Nickel-Cadmium Batteries

Perform the following routine maintenance procedures at six-month intervals.

Step 1. Clean the battery and inspect it for damage.

Step 2. Measure cell voltages and enter the voltage readings on your maintenance report.

Most maintenance schedules require voltage readings of every cell each time maintenance is performed. If a difference of .05 volt or more exists between any two cells, apply an "equalizing charge" to the battery for 48 hours or until three consecutive cell measurements show no change (readings to be taken at 1/2-hour intervals). The terminal voltage of the battery should then read 15.25 ±0.2 volts.

Step 3. Add water as required to keep the electrolyte solution in each cell above minimum. Use *distilled water only*. Check the battery manufacturer's service literature for instructions on filling.

CAUTION
Do not use any tool on a nickel-cadmium battery which may have been used with lead-acid batteries. To do so may destroy the nickel-cadmium battery due to chemical contamination by electrolyte or other foreign matter from the lead-acid battery existing on the tool in question.

If frequent replacement of water is required, the charging rate may be too high. In this case, check the A+ voltage with float-EQUALIZE switch S650 in the float position. The A+ voltage reading should agree with the manufacturer's recommended voltage setting for the type of emergency battery being used. If the manufacturer's recommendations are not available, set the A+ voltage to 14.25 volts. Under certain conditions, the battery may require water even though the charging voltage is correct. In this case, the charging voltage should be reduced until infrequent addition of water is required.

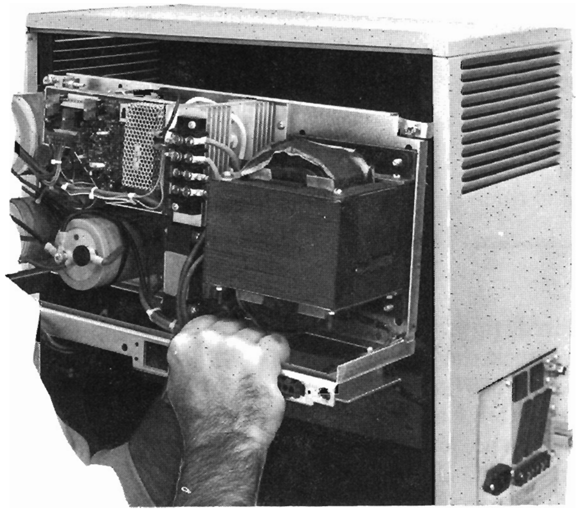


Figure 5. Power Supply Removed From Cabinet

4.4.2 Lead-Acid Batteries

Perform the routine maintenance procedures monthly.

Step 1. Clean the battery and inspect it for damage.

Step 2. Measure cell voltages and enter the voltage readings on your maintenance report. Most maintenance schedules require voltage readings of every cell each time maintenance is performed. If a difference of .05 volt or more exists between any two cells, apply an "equalizing charge" to the battery for the number of hours recommended by the manufacturer.

Step 3. Take specific gravity readings with a hydrometer calibrated for the type of electrolyte used.

Step 4. Observe the necessary precautions to see that the readings are accurate, that no chemical contamination of the cells occurs, and to prevent bodily injury from contact with the electrolyte.

Step 5. After taking a reading, always return the electrolyte in the hydrometer syringe to the cell from which it came. (Failure to do so will decrease the specific gravity of the cell when water is added to fill up the cell.)

Step 6. For an accurate comparison with "standard" specific gravity readings, as published in manufacturer's specifications, a correction factor must be applied to all readings to normalize them with the standard values, when taken at temperatures other than 77° Fahrenheit. However, if the battery temperature tends to be the same each time specific gravity readings are taken, a trend toward a change in specific gravity will be apparent without having to apply the correction factor to the readings.

The correction factor is easily applied, due to a linear relationship between changes in temperature and specific gravity above and below 77°F. For each three degrees above 77°F, add .001 (known as "1 point") to the "standard" value of specific gravity. Conversely, for each three degrees below 77°F, subtract 1 point.

Step 7. Take a specific gravity reading of the "pilot cell" monthly. It is not necessary to continually check the specific gravity of all cells, because any gradual changes usually occur simultaneously in all cells. One cell is therefore chosen and designated the "pilot cell," and the monthly routine specific gravity readings are always taken from this one cell. (Be sure to indicate on the maintenance chart which cell is the pilot cell.)

Take specific gravity readings of all the battery cells every three months, and record them on the maintenance chart.

Step 8. Add water as required to keep the electrolyte solution in each cell up to a minimum level. In some batteries, the electrolyte level should be between the high-and low-level marks on the inside of each cell. If the cells have no such markers, check the manufacturer's literature. Use *distilled water only*.

CAUTION

Do not use any tool on a lead-acid battery which may have been used with nickel-cadmium batteries. To do so may destroy the lead-acid battery, due to chemical contamination by electrolyte or other foreign matter from the nickel-cadmium battery existing on the surface of the tool in question.

If frequent replacement of water is required, the charging rate may be too high. In this case, check the A+ voltage with the float-EQUALIZE switch S650 in the float position. The A+ voltage reading should agree with the manufacturer's recommended voltage setting for the type of emergency battery being used. If the manufacturer's recommendations are not available, set the A+ voltage to 13.25 volts. Under certain high ambient temperature conditions, the battery may require frequent water replacement even though the correct charging voltage is maintained. In this case, the specified 13.25 volts may be reduced until infrequent water replacement is achieved.

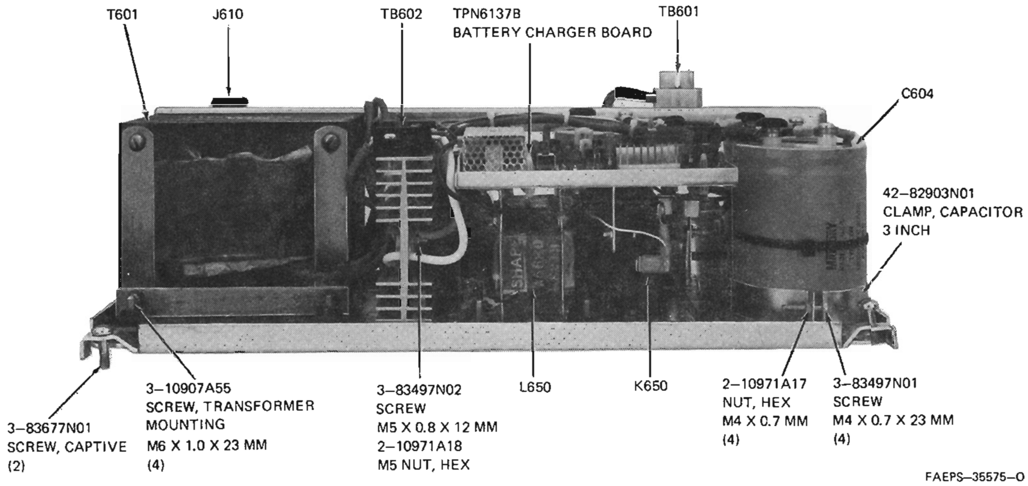
Step 9. Equalize charging of a lead-acid battery should be performed under any one of the following conditions:

- following each known use (or discharge) of the battery,
- if the specific gravity of the pilot cell or any other cell is more than ten-thousandths (10 points) below its full-charge value,
- if the difference in voltage between any two cells is .05 volt or more,
- as part of each monthly routine maintenance procedure independent of any of the previous conditions stated.

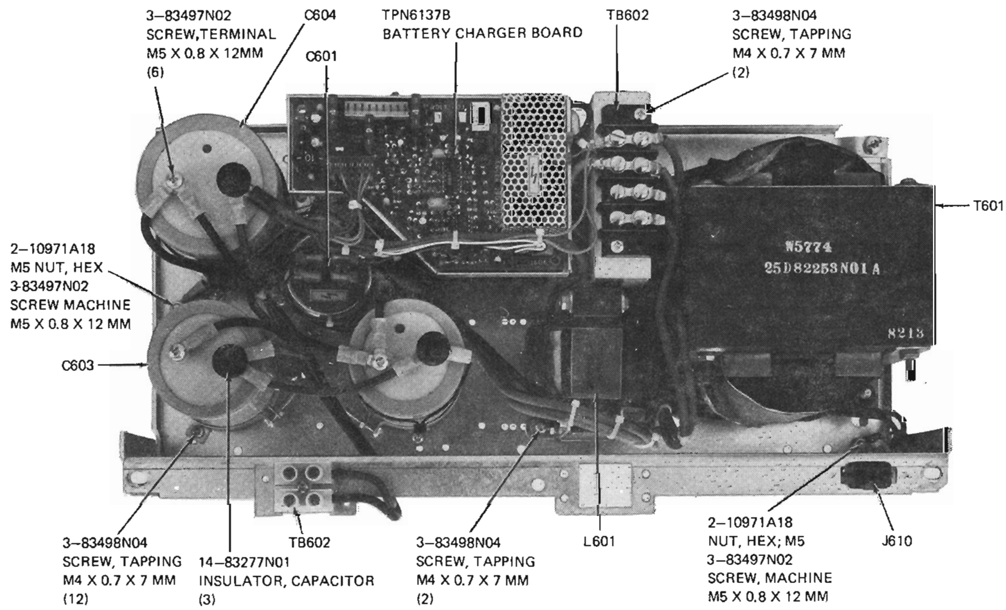
Equalize charging should continue for: (a) the number of hours specified by the battery manufacturer, which will vary according to temperature, charging voltage and the manufacturer's recommendations or; (b) until three successive readings of cell voltage and specific gravity show *no change* (readings to be taken at 1/2-hour intervals).

4.5 TROUBLESHOOTING

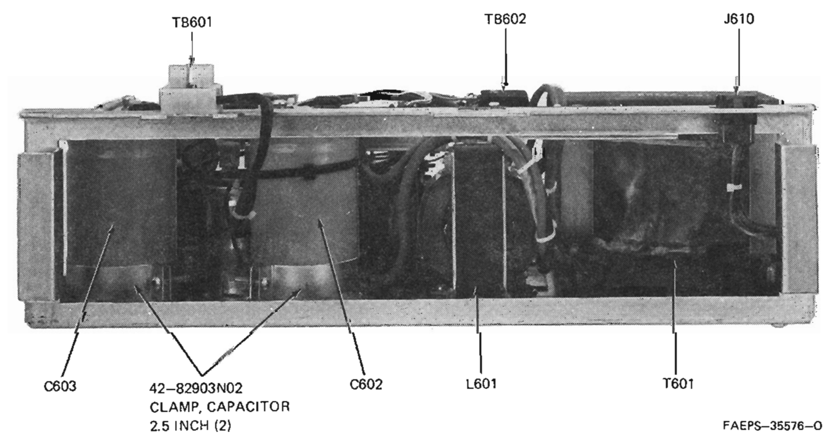
Symptom	Action
A. No Output Voltage	1. Check primary line connection to supply. 2. Check for transformer secondary voltage at TB602. 3. Check for continuity through relay.
B. Relay pulls in when power is applied.	1. Check RELAY DRIVER transistor (Q654). 2. Check OVERVOLTAGE COMPARATOR for proper levels. 3. Check for trigger pulses at pin 8, U650C a) If no trigger is present, check for proper signals from RAMP GEN. back to CLOCK GEN. If proper signals are present, check voltages at STABILIZER and CONTROL VOLTAGE GEN. b) If correct trigger pulses are present, check power switching circuitry (Q656 through Q657).
C. A+ output voltage too high and cannot adjust.	Check for trigger pulses at pin 8, U650C. 1. If no trigger present, check for proper signals from RAMP GEN. back to CLOCK GEN. If proper signals are present, check voltages at STABILIZER and CONTROL VOLTAGE GEN. 2. If correct trigger pulses are present, check power switching circuitry (Q656 through Q657).
D. A+ output voltage too low.	1. Check for trigger pulses at pin 8, U650C. a) If no trigger present, check for proper signals from RAMP GEN. back to CLOCK GEN. If proper signals are present, check voltages at STABILIZER and CONTROL VOLTAGE GEN. b) If correct trigger pulses are present, check power switching circuitry (Q656 through Q657). 2. Check power diodes CR601, CR602.



TOP VIEW

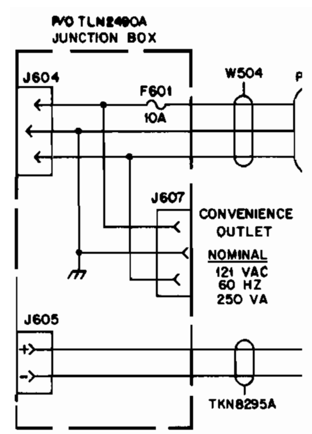


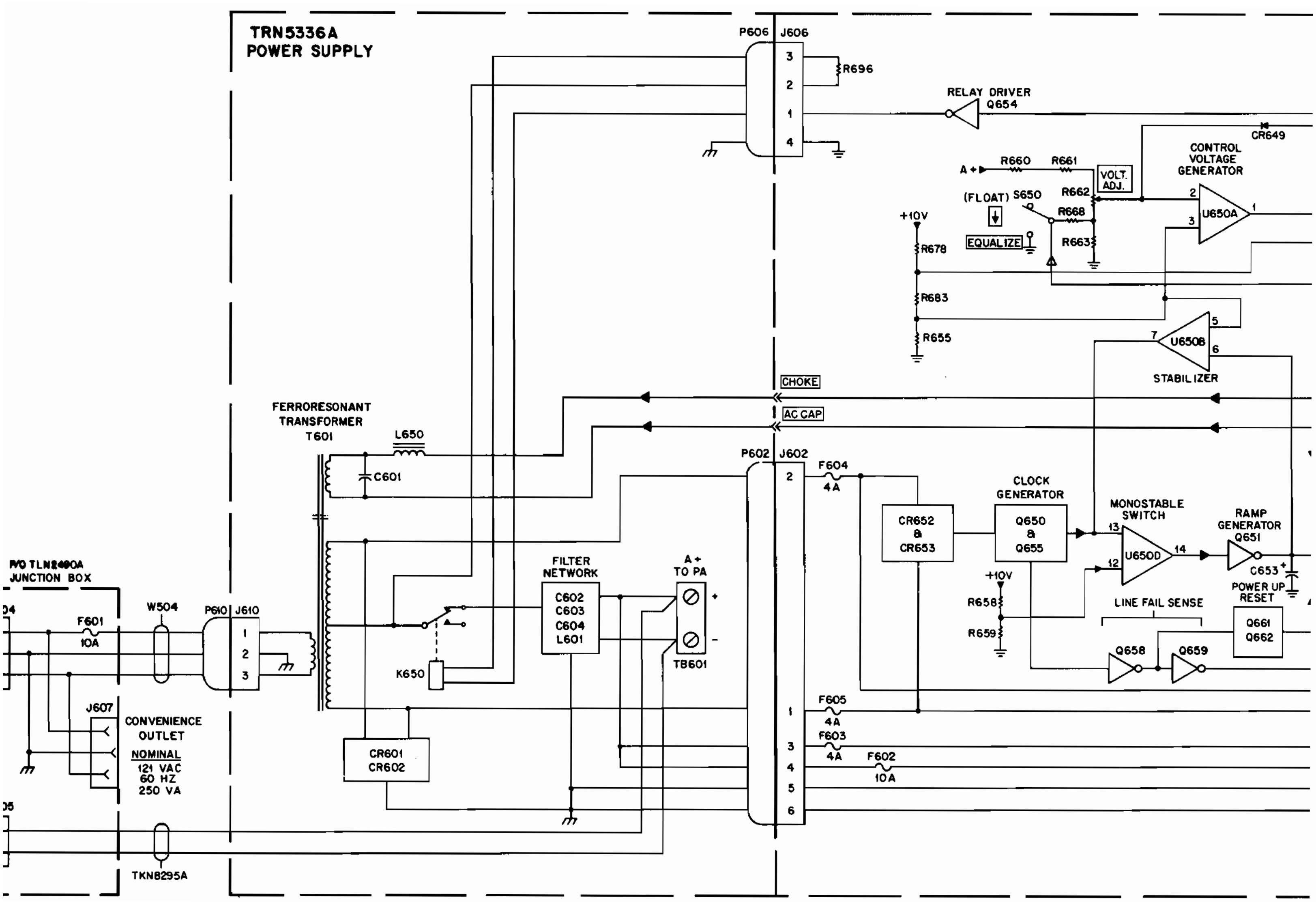
FRONT VIEW

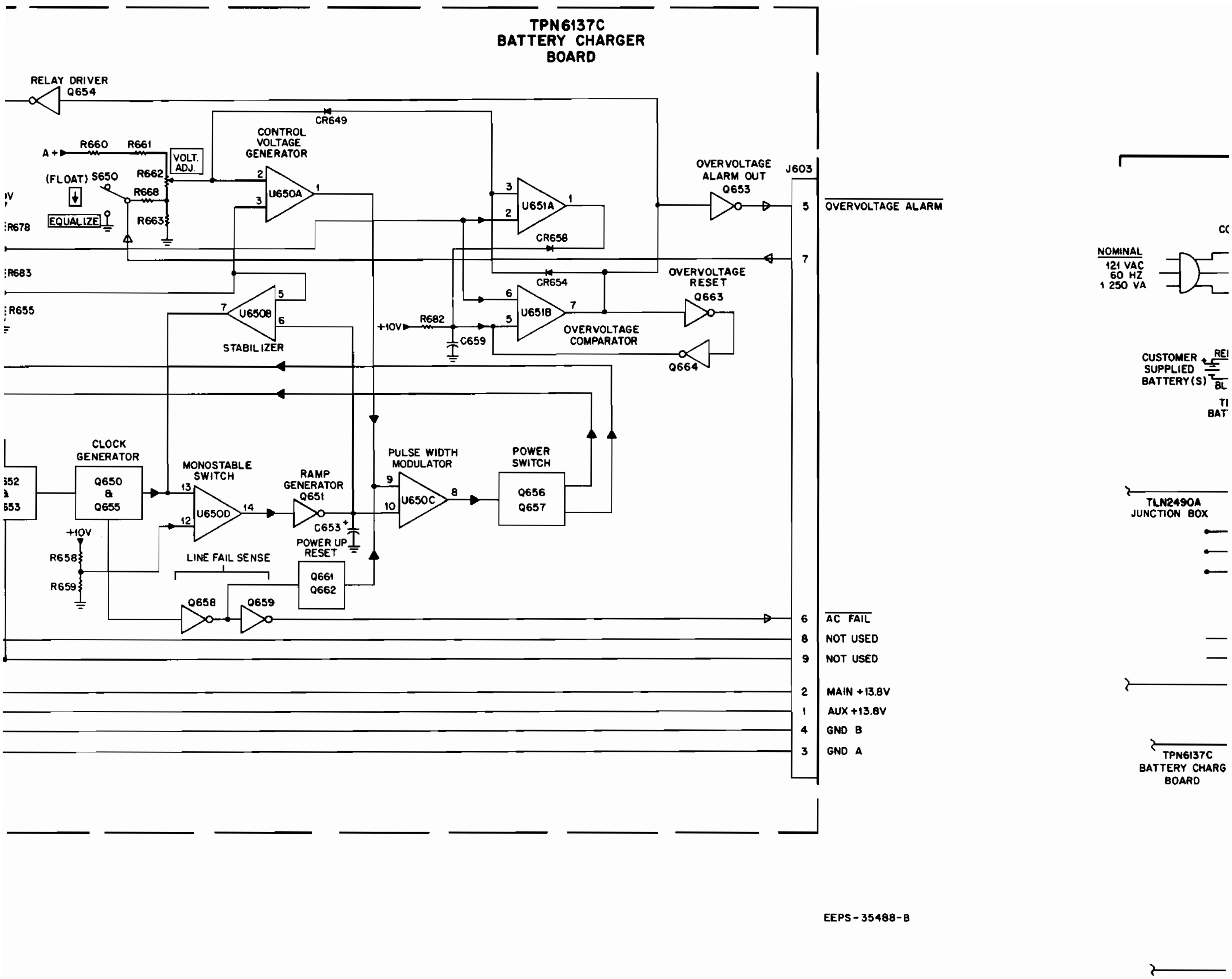


BOTTOM VIEW

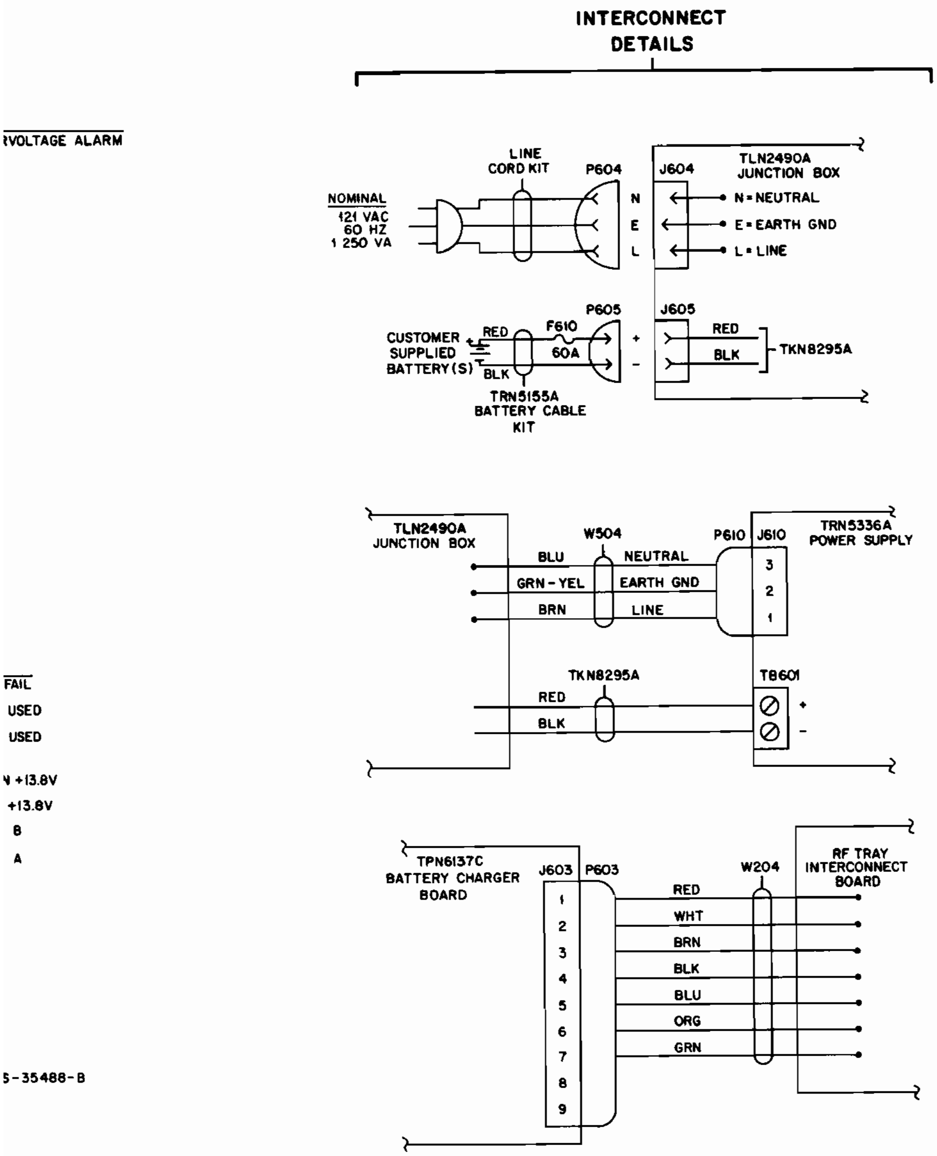
Figure 6. Mechanical Parts Location Detail


P/O TLN2490A
JUNCTION BOX
J604
F601
10A
W504
J607
CONVENIENCE
OUTLET
NOMINAL
121 VAC
60 HZ
250 VA
J605
TKN8295A

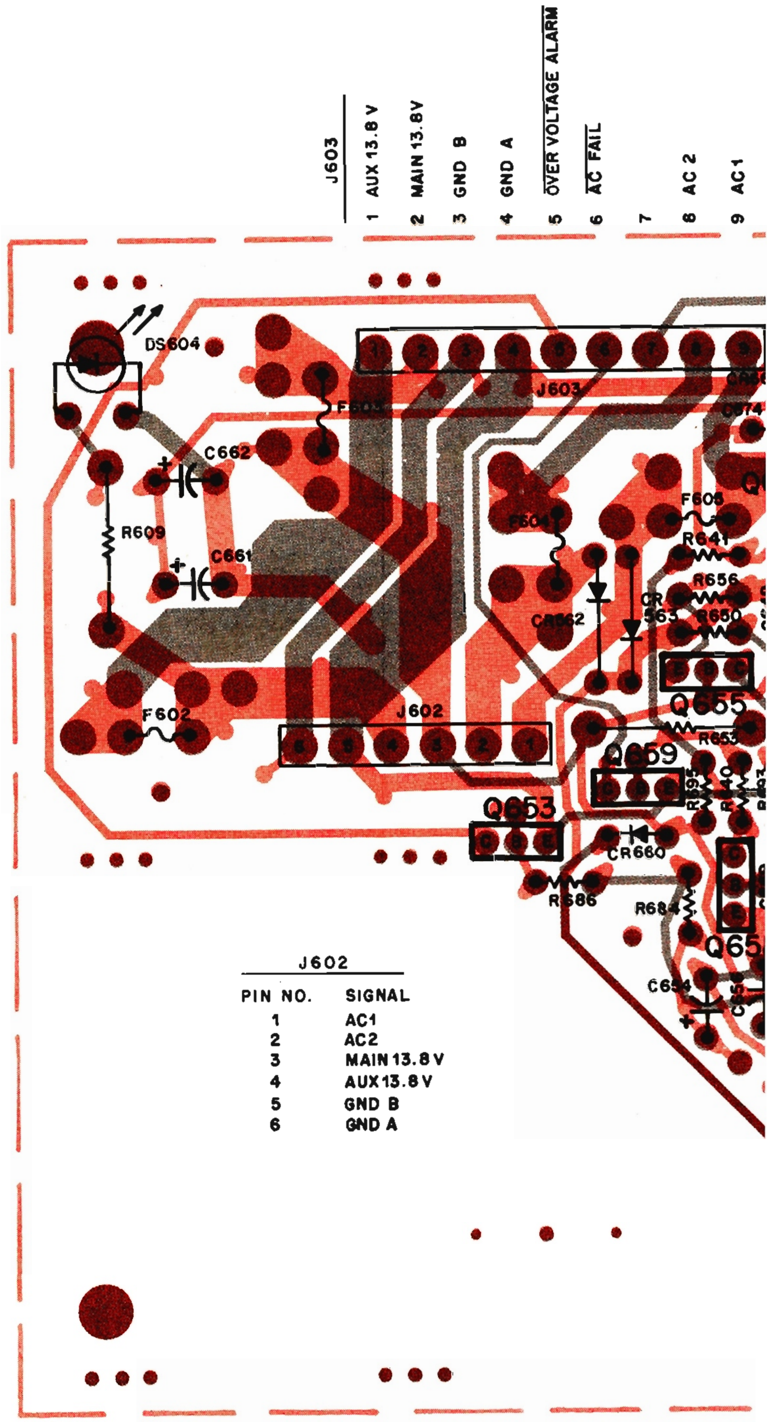

TRN5336A
POWER SUPPLY
P606
J606
R696
RELAY DRIVER
Q654
CR649
CONTROL
VOLTAGE
GENERATOR
A+
R660
R661
VOLT.
ADJ.
(FLOAT)
S650
R662
U650A
R668
+10V
EQUALIZE
R663
R678
R683
R655
U650B
STABILIZER
CHOKE
AC CAP
FERRORESONANT
TRANSFORMER
T601
L650
C601
P602
J602
F604
4A
CR652
&
CR653
CLOCK
GENERATOR
Q650
&
Q655
MONOSTABLE
SWITCH
U650D
RAMP
GENERATOR
Q651
C653
POWER UP
RESET
LINE FAIL SENSE
Q661
Q662
Q658
Q659
R658
R659
FILTER
NETWORK
C602
C603
C604
L601
A+
TO PA
TB601
K650
P/O TLN2490A
JUNCTION BOX
W504
P610
J610
F601
10A
J607
CONVENIENCE
OUTLET
NOMINAL
121 VAC
60 HZ
250 VA
CR601
CR602
F605
4A
F603
4A
F602
10A
TKN8295A


TPN6137C
BATTERY CHARGER
BOARD
RELAY DRIVER
Q654
CR649
CONTROL
VOLTAGE
GENERATOR
A+
R660
R661
VOLT.
ADJ.
(FLOAT)
S650
R662
R668
EQUALIZE
R663
U650A
U651A
CR658
CR654
R678
R683
R655
U650B
STABILIZER
U651B
+10V
R682
C659
OVERVOLTAGE
ALARM OUT
Q653
OVERVOLTAGE
RESET
Q663
OVERVOLTAGE
COMPARATOR
Q664
J603
OVERVOLTAGE ALARM
CLOCK
GENERATOR
Q650
&
Q655
MONOSTABLE
SWITCH
U650D
RAMP
GENERATOR
Q651
C653
POWER UP
RESET
Q661
Q662
PULSE WIDTH
MODULATOR
U650C
POWER
SWITCH
Q656
Q657
R658
R659
LINE FAIL SENSE
Q658
Q659
AC FAIL
NOT USED
NOT USED
MAIN +13.8V
AUX +13.8V
GND B
GND A
NOMINAL
121 VAC
60 HZ
1 250 VA
CUSTOMER
SUPPLIED
BATTERY(S)
TLN2490A
JUNCTION BOX
TPN6137C
BATTERY CHARG
BOARD

EEPS-35488-B



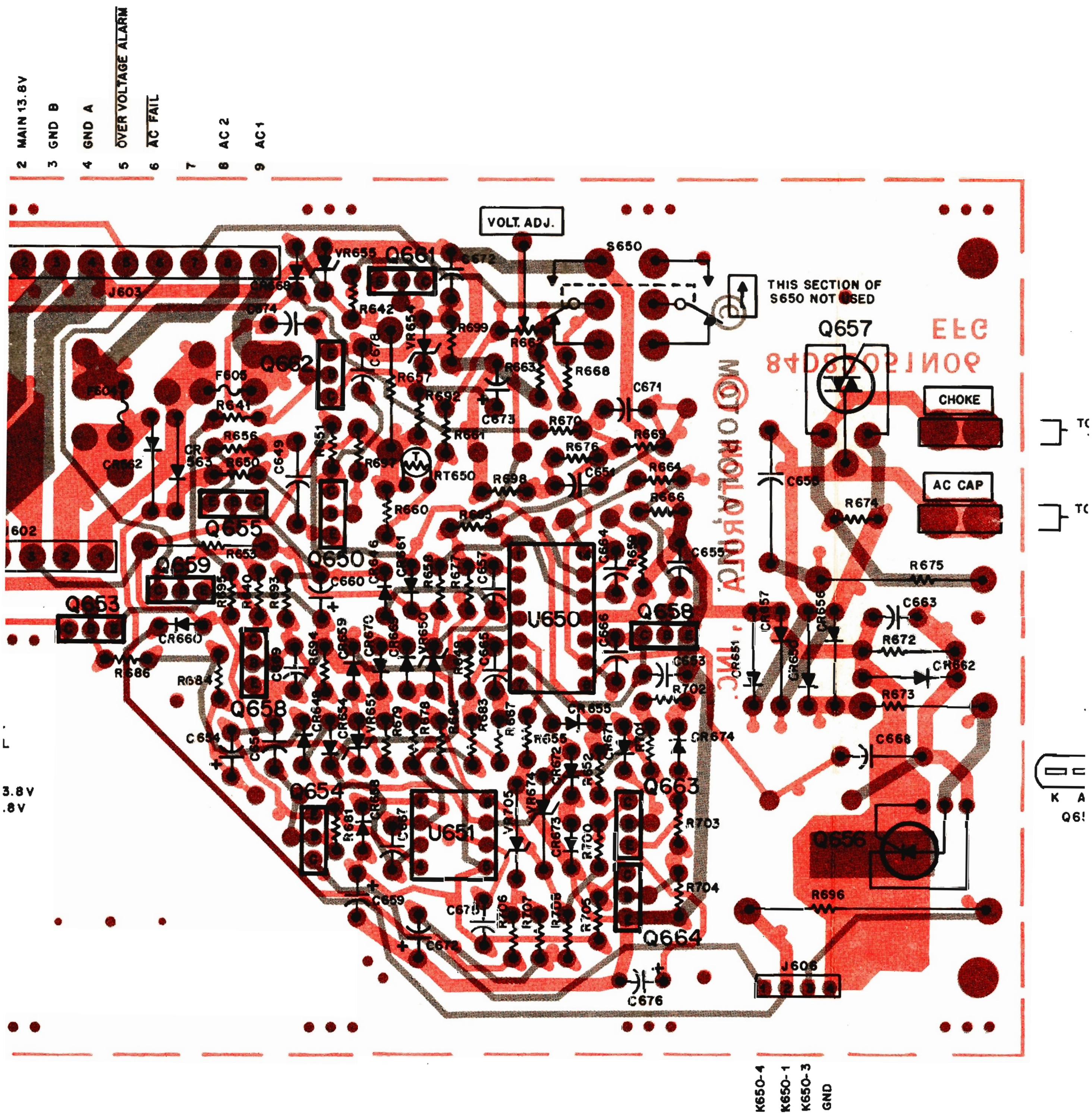
INTERCONNECT
DETAILS
ɫVOLTAGE ALARM
LINE
CORD KIT
P604
J604
TLN2490A
JUNCTION BOX
NOMINAL
121 VAC
60 HZ
1 250 VA
N
E
L
N = NEUTRAL
E = EARTH GND
L = LINE
P605
J605
CUSTOMER
SUPPLIED
BATTERY(S)
RED
BLK
F610
60A
+
-
RED
BLK
TKN8295A
TRN5155A
BATTERY CABLE
KIT
TLN2490A
JUNCTION BOX
W504
P610
J610
TRN5336A
POWER SUPPLY
BLU
NEUTRAL
GRN-YEL
EARTH GND
BRN
LINE
3
2
1
TKN8295A
TB601
RED
BLK
+
-
FAIL
USED
USED
N +13.8V
+13.8V
B
A
TPN6137C
BATTERY CHARGER
BOARD
J603
P603
W204
RF TRAY
INTERCONNECT
BOARD
RED
WHT
BRN
BLK
BLU
ORG
GRN
1
2
3
4
5
6
7
8
9
5-35488-B



J602

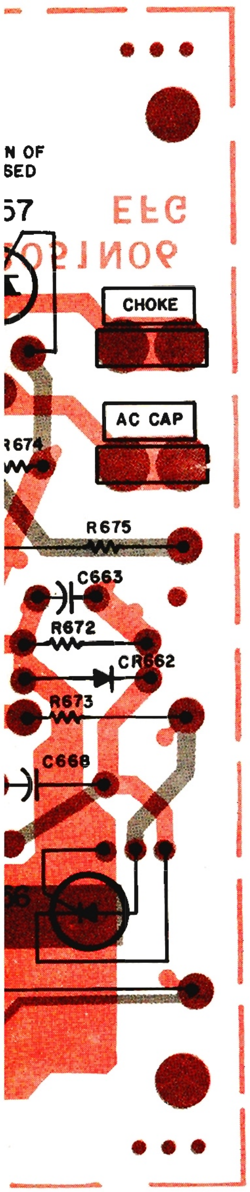
PIN NO.	SIGNAL
1	AC1
2	AC2
3	MAIN 13.8 V
4	AUX 13.8 V
5	GND B
6	GND A

COMPON
SOL



COMPONENT SIDE BD-CEPS-44790-O
SOLDER SIDE BD-CEPS-44791-O
OL-CEPS-44792-A

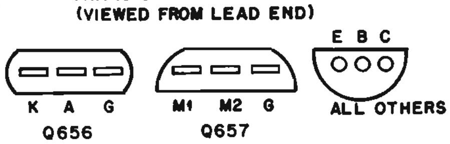
SHOWN FROM COMPONENT SIDE



TO L650 ON TRN5336A

TO C601 ON TRN5336A

TRANSISTOR BASE DETAILS (VIEWED FROM LEAD END)



IT SIDE

parts list

TPN6137C Battery Charger Circuit Board PL-10681-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ±20%; 25 V: unless otherwise stated
C649	8-84637L18	0.12 ±10%; 100 V
C651	8-11017A09	.015 ±5%; 50 V
C653	8-11017A10	.018 ±5%; 50 V
C654	23-11019A40	47
C655	8-82860N01	.047 ±10%; 250 V
C656, 657, 658	21-11014H32	20 pF ±5%; 100 V
C659	23-11019A40	47
C660	23-11019A11	2.2; 50 V
C661, 662	23-11019A48	220; 10 V
C663 thru 667	21-11014H32	20 pF ±5%; 100 V
C668	21-83596E20	.01; 1000 V
C669	21-11014H32	20 pF ±5%; 100 V
C670		NOT USED
C671	8-11051A15	0.22 ±5%; 63 V
C672	21-11014H32	20 pF ±5%; 100 V
C673	23-11019A46	100
C674, 675	21-11014H32	20 pF ±5%; 100 V
C676	23-11019A40	47
C677	23-84665F15	330 +50-10%
C678	8-11044A13	0.056 ±5%; 63 V
		diode: (see note)
CR646 thru 648	48-83654H01	silicon
CR650, 651	48-82466H18	silicon
CR652, 653	48-82466H13	silicon
CR654, 655	48-83654H01	silicon
CR656, 657	48-82466H18	silicon
CR658, 659	48-83654H01	silicon
CR660	48-82466H18	silicon
CR661, 662	48-83654H01	silicon
CR668 thru 674	48-83654H01	silicon
		light emitting diode: (see note)
DS604	48-84404E04	green
		fuse:
F602	65-139767	10 amp; 32 V
F603, 604, 605	65-82859N01	4 amp; 32 V
		connector, plug:
J602	28-82984N06	male; 6-contact
J603	28-82984N14	male; 9-contact
J606	28-83143M05	male; 4-contact
		transistor: (see note)
Q650	48-869649	PNP; type M9649
Q651	48-869642	NPN; type M9642
Q653	48-869642	NPN; type M9642
Q654	48-869648	NPN; type M9648
Q655	48-869643	PNP; type M9643
Q656	48-82604N01	silicon controller rectifier
Q657	48-82965F02	TRIAC; 15 amp; 800 V
Q658	48-869642	NPN; type M9642
Q659	48-869528	NPN; type M9528
Q661 thru 664	48-869642	NPN; type M9642
		resistor, fixed: ±5%; 1/4 W: unless otherwise stated
R609	6-11045A51	1.2k; 1/2 W
R640, 641	6-11009E49	1k
R642	6-11045A33	220; 1/2 W
R648	6-11009E89	47k
R650	6-11009E56	2k
R651	6-11009E63	3.9k
R652	6-11009E60	3k
R653	6-11045A31	180; 1/2 W
R655	6-84640C25	2.1k ±0.5%
R656	6-11009E56	2k
R657	6-11045A35	270; 1/2 W
R658	6-11009F12	390k
R659	6-11009F08	270k
R660	6-11009E49	1k
R661	6-11009E67	5.6k
R662	18-82374N10	variable; 1k; ±20%; 0.2 W
R663	6-11009E61	3.3k
R664	6-11009E63	3.9k
R665	6-11009E85	33k
R666	6-11009E53	1.5k
R667	6-11009F10	330k
R668	6-11009E83	27k
R669	6-11009E89	47k
R670	6-11009E55	1.8k
R672	6-11009A49	1k
R673	6-11045A59	2.7k; 1/2 W
R674	6-11009E29	150
R675	6-126A49	1k; 1 W
R676	6-11009E65	4.7k
R677	6-11009E89	47k
R678	6-11009E55	1.8k
R679	6-11009E44	620
R680	6-11045A45	680; 1/2 W
R681	6-11009E53	1.5k
R682	6-11009E95	82k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R683	6-11009E35	270
R684	6-11009E56	2k
R686	6-11009E73	10k
R692	6-11009E56	2k
R693	6-11009E65	4.7k
R694	6-11009E53	1.5k
R695	6-11009E65	4.7k
R696	17-82177B02	32; 5 W
R697	6-11009E49	1k
R698	6-11009E81	22k
R699	6-11009E89	47k
R700	6-11009F08	270k
R701	6-11009F22	1 meg.
R702	6-11009E27	120
R703	6-11009F06	220k
R704	6-11009E87	39k
R705	6-11009E89	47k
R706	6-11045A39	390; 1/2 W
R707	6-11045A37	330; 1/2 W
R708	6-11009E33	220
R709	6-11009F06	10k
		thermistor:
RT650	6-82769A08	2.02k @ 25°C
		switch:
S650	40-83204B02	slide, dpdt
		integrated circuit: (see note)
U650	51-83222M39	quad operational amplifier
U651	51-83222M56	dual operational amplifier
		voltage regulator:
VR650	48-82256C56	Zener; 8.8 V
VR651	48-82256C25	Zener; 12 V
VR654, 655	48-83461E36	Zener; 6.2 V
VR674	48-82256C56	Zener; 8.8 V
VR675	48-82256C58	Zener; 39 V
	mechanical parts	
	2-10971A16	NUT: M3 × 0.5
	3-83497N04	SCREW, machine: M3 × 0.5 × 8
	4-7683	LOCKWASHER, #4 internal
	14-83820M02	INSULATOR, transistor
	15-84576N01	SHROUD, fuse terminal; 4 used
	26-84275L01	HEAT SINK
	29-82906N01	TERMINAL, blade fuse; 8 used
	29-10231A10	TERMINAL, mounting faston; 2 used

TRN5153A Battery Charger P.S. Hardware Kit PL-8018-F

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		relay:
K650	80-83013N01	1 form "C"; coil res, 70 ohms
		coil:
L650	25-82419N05	choke, 65 mh
		connector, plug:
P606	15-83901N01	housing, 4 position
		resistor, fixed:
R709	6-11009A73	10k ±5%; 1/4 W
	mechanical parts	
	2-10971A17	NUT, machine: M4 × 0.7 hex
	3-83497N03	SCREW, machine: M5 × 0.8 × 25mm; 4 used
	3-83497N02	SCREW, machine: M5 × 0.8 × 12mm
	3-83497N05	SCREW, machine: M4 × 0.7 × 10mm
	3-83498N04	SCREW, tapping: M4 × 0.7 × 7mm; 4 used
	3-83498N06	SCREW, tapping: M4 × 0.7 × 16mm; 2 used
	4-7651	LOCKWASHER: #8 internal; 4 used
	5-82904N02	GROMMET, transformer; 4 used
	7-83364N02	BRACKET, charger board
	15-83901N01	COVER, battery: option, board
	29-82907N07	TERMINAL, ring; 3 used
	29-83113N03	TERMINAL, right angle; 2 used
	29-83883C02	LUG, crimp
	39-82717M01	CONTACT, receptacle; 4 used
	2-10971A18	NUT, machine: M5 × 0.8 hex
	4-7658	LOCKWASHER: #10 internal
	4-7673	LOCKWASHER, split: #10 internal
	14-83986N01	INSULATOR
	29-82907N05	TERMINAL, ring: 10 ga.; 2 used
	43-82980N01	STANDOFF; 6 used
	42-102176A02	STRAP, tie: nylon; 8 used
	54-83971N01	LABEL

TRN5336A Power Supply Hardware Kit (500 W) PL-8020-H

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C601	8-82682N01	20 uF ±6%; 330 V
C602,603	23-82681N01	64,000 uF +75-7%; 20 V
C604	23-82681N02	120,000 uF +75-10%; 20 V
		diode: (see note)
CR601,602	48-82732C09	silicon
		coil:
L601	25-82686N01	choke; 420 uH
		connector, receptacle:
P602	9-83360N01	female; 6 contact
		transformer:
T601	25-82253N01	power: 500 W; 60 Hz
		terminal, board:
TB601	31-83576K02	2-terminals
	mechanical parts	
	2-10971A17	NUT, machine: M4 × 0.7 hex; 5 used
	2-10971A18	NUT, machine: M5 × 0.8 hex; 2 used
	2-10971A19	NUT, machine: M6 × 1; 2 used
	3-10908A55	SCREW, machine: M6 × 1 × 25mm; 4 used
	3-83497N01	SCREW, machine: M4 × 0.7 × 23mm; 4 used
	3-83497N02	SCREW, machine: M5 × 0.8 × 12mm; 8 used
	3-83498N04	SCREW, tapping: M4 × 0.7 × 7mm; 18 used
	3-83498N06	SCREW, tapping: M4 × 0.7 × 16mm; 3 used
	3-83678N02	SCREW, tapping; M4 × 0.7 × 18mm
	4-7651	LOCKWASHER, #8 internal; 8 used
	4-119331	LOCKWASHER, 1/4" split; 2 used
	4-83423R01	WASHER, flat rectangular, 1/4"; 2 used
	4-135873	WASHER, flat: 0.281 × 0.75 × .06; 2 used
	4-83423R01	WASHER, flat rectangular; 1/4"; 2 used
	4-83499N01	WASHER, insulator; 3 used
	4-7658	LOCKWASHER, #10 internal; 15 used
	5-82904N01	GROMMET; 4 used
	14-83277N01	INSULATOR, lug; 3 used
	14-84088N01	INSULATOR, cap terminals; 2 used
	14-84548A01	INSULATOR, washer; 2 used
	26-82902N01	HEAT SINK
	29-82607B06	TERMINAL, ring; 3 used
	29-82607B09	LUG, ring tongue; 2 used
	29-82607B05	LUG, ring tongue; 2 used
	29-82607B06	LUG, ring tongue; 2 used
	29-82907N05	TERMINAL, ring (YEL); 8 used
	29-82907N07	TERMINAL, ring; (RED); 2 used
	29-83137N01	TERMINAL, splice; 2 used
	39-83146N01	CONTACT, socket
	42-10217A02	STRAP, tie; .091 × 3.62; 16 used
	42-10217A33	STRAP, tie: 0.19 × 15; 3 used
	42-82903N01	CLAMP, cap; 2"
	42-82903N02	CLAMP, cap: 2 1/2"; 2 used
	42-82903N03	CLAMP, cap; 3"
	54-83971N01	LABEL; 2 used
	54-84046N01	LABEL
	75-83056P01	PAD, snap-on
	31-811350	TERMINAL, board; 4 terminal

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

TRN5155A External Battery Cable Kit PL-8059-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		fuse:
F610	65-82846N01	60 amp; 300 V
		connector, plug:
P605		assembly, connector; includes:
	15-83502N01	HOUSING, single contact; 2 used
	39-83503N02	CONTACT, battery; 2 used
	mechanical parts	
	3-138490	SCREW, tapping: 8-18 x 1 1/4"; 2 used
	9-82842N01	BLOCK, fuse
	29-847817	LUG, ring tongue; 2 used
	42-10217A02	STRAP, tie; 3 used

PL-8020-H

I

TKN8295A Internal Battery Cable Kit
TKN8845A Internal Battery Cable Kit (DC Only)

PL-8017-E

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, receptacle:
J605		assembly connector, includes:
	15-83502N01	HOUSING, single contact; 2 used
	39-83503N02	CONTACT, battery; 2 used
		mechanical parts
	7-83504N01	BRACKET, male mounting
	7-83505N01	BRACKET, female mounting
	2-10971A18	NUT, machine: M5 x 0.8; 2 used
	3-83497N02	SCREW, machine: M5 x 0.8 x 12 mm; 2 used
	4-7658	WASHER, lock: #10 internal; 2 used
	42-10217A02	STRAP, tie: .091 x 3.62; 3 used

x; 5 used
x; 2 used
sed
x 25mm;

x 23mm;

x 12mm;

x 7mm;

x 16mm;

x 18mm
8 used
used
/4"; 2 used
x .06;

1/4"; 2 used

; 15 used

2 used

ed
sed

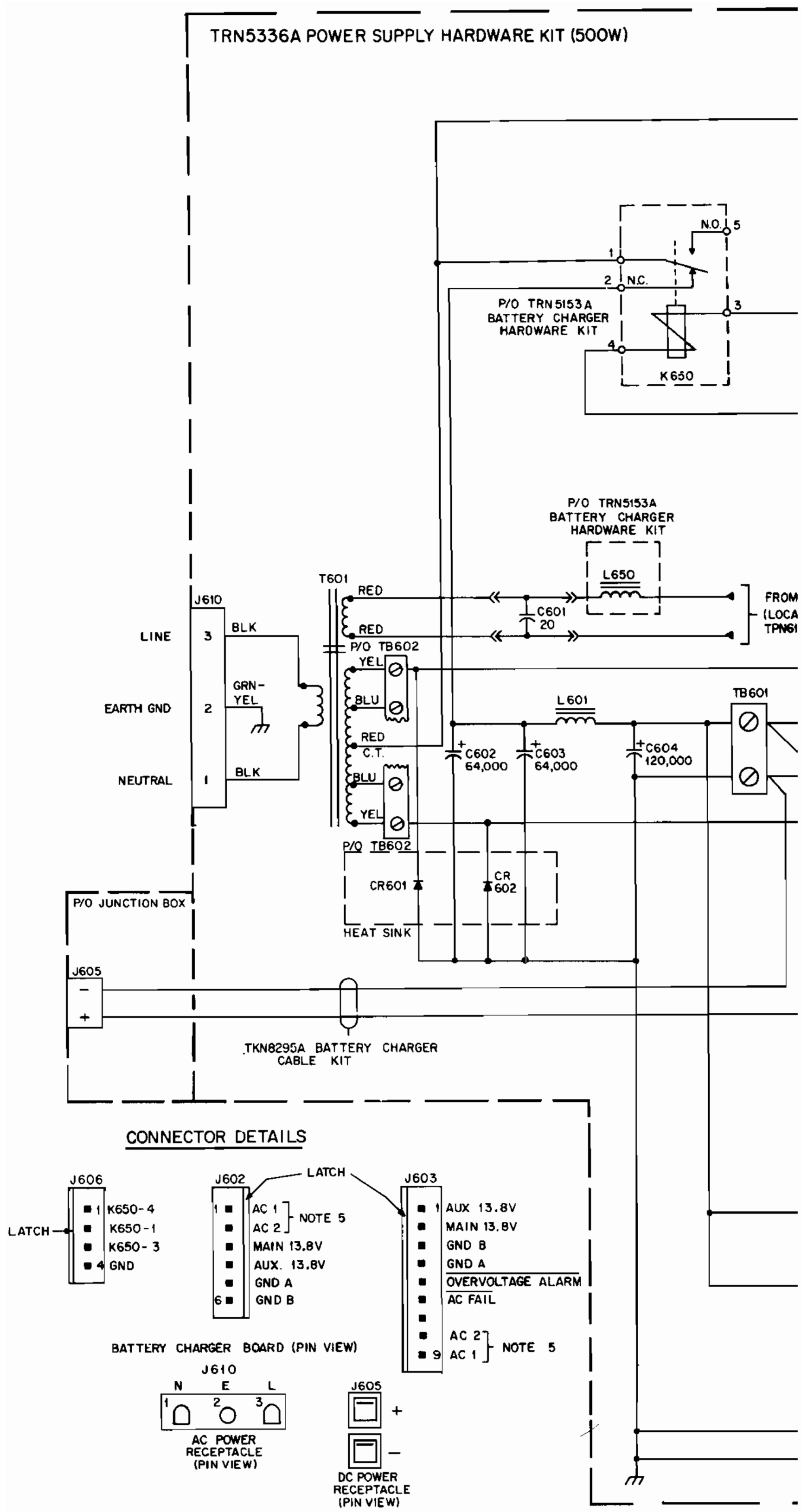
used
ed

al
d circuits must

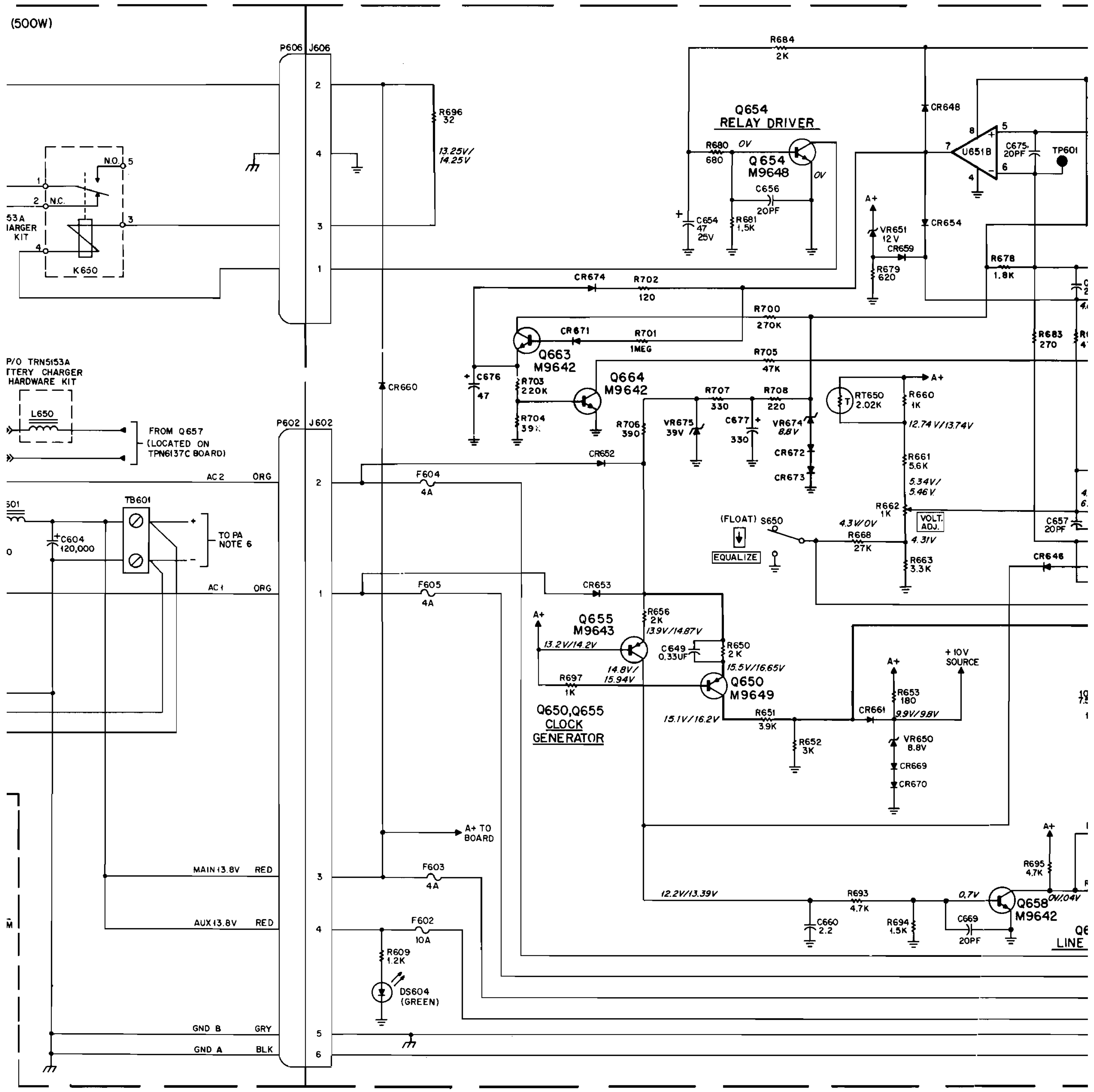
PL-8059-C

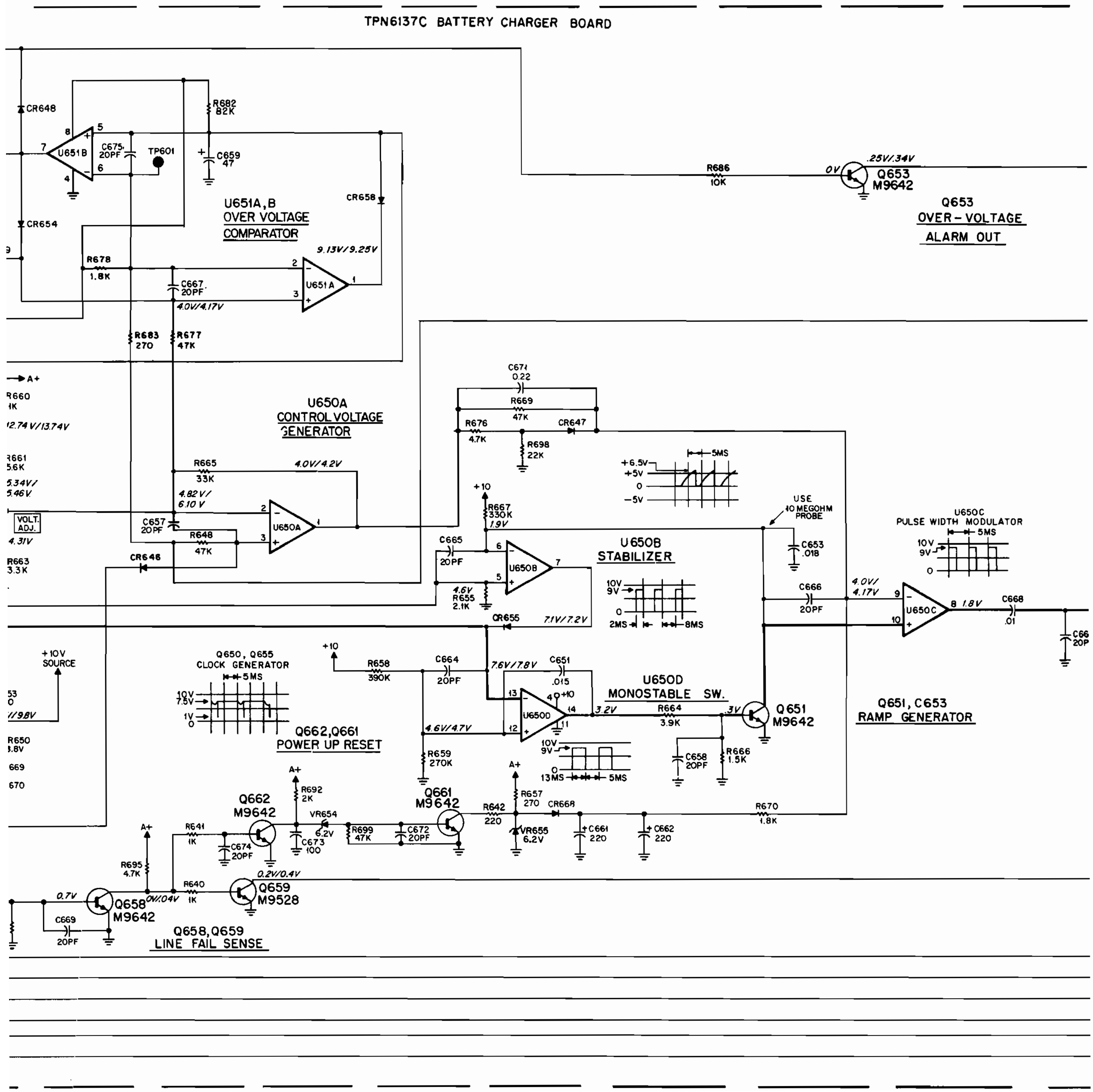
es:
2 used

"; 2 used

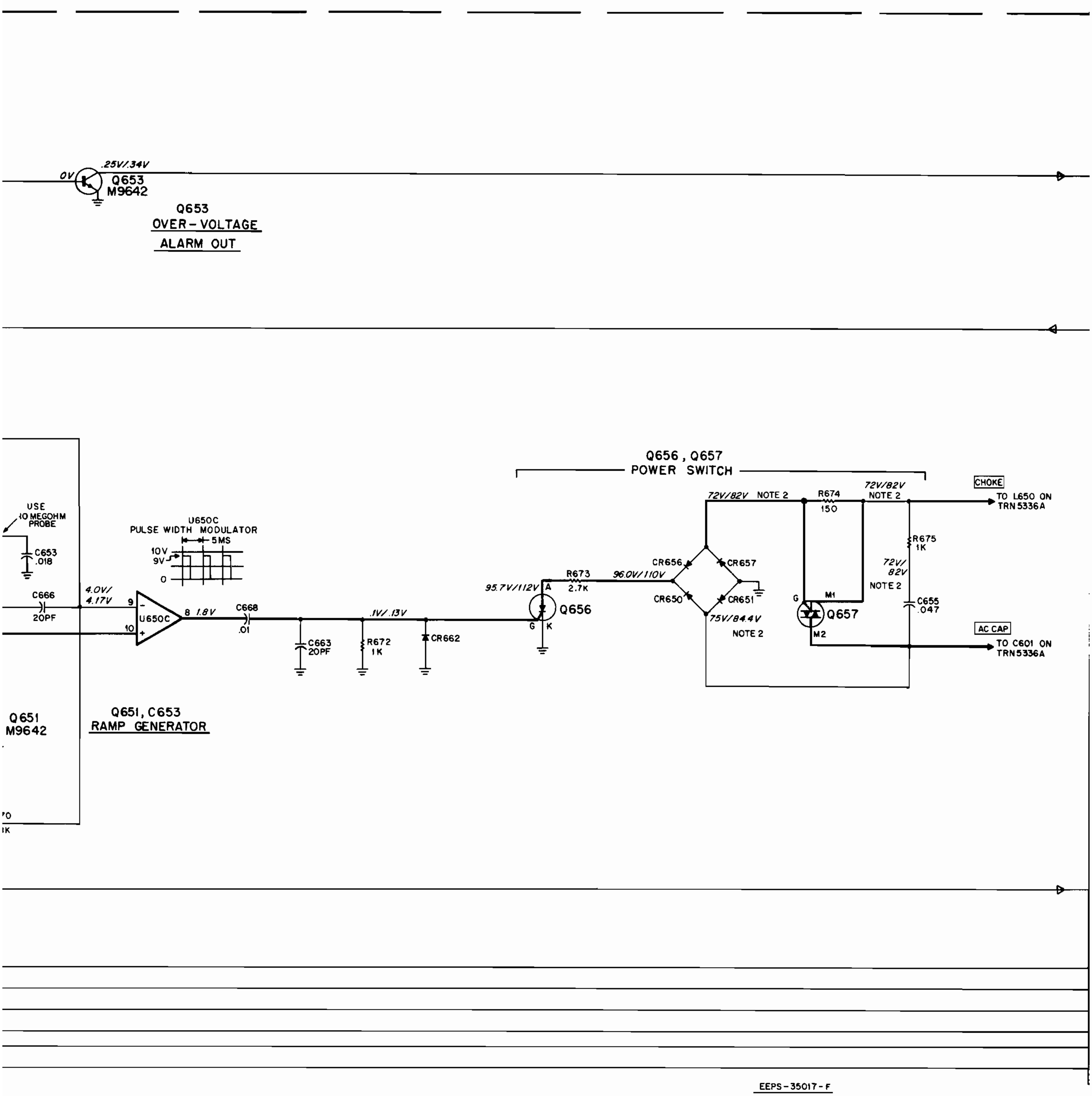


TRN5336A POWER SUPPLY HARDWARE KIT (500W)
P/O TRN5153A BATTERY CHARGER HARDWARE KIT
K650
N.O.
N.C.
L650
FROM (LOCA TPN61
T601
J610
LINE
EARTH GND
NEUTRAL
BLK
GRN-YEL
RED
YEL
BLU
C.T.
P/O TB602
C601 20
L601
TB601
C602 64,000
C603 64,000
C604 120,000
CR601
CR 602
HEAT SINK
P/O JUNCTION BOX
J605
TKN8295A BATTERY CHARGER CABLE KIT
CONNECTOR DETAILS
J606
LATCH
K650-4
K650-1
K650-3
GND
J602
AC 1
AC 2
NOTE 5
MAIN 13.8V
AUX. 13.8V
GND A
GND B
J603
AUX 13.8V
MAIN 13.8V
GND B
GND A
OVERVOLTAGE ALARM
AC FAIL
AC 2
AC 1
NOTE 5
BATTERY CHARGER BOARD (PIN VIEW)
N E L
AC POWER RECEPTACLE (PIN VIEW)
DC POWER RECEPTACLE (PIN VIEW)

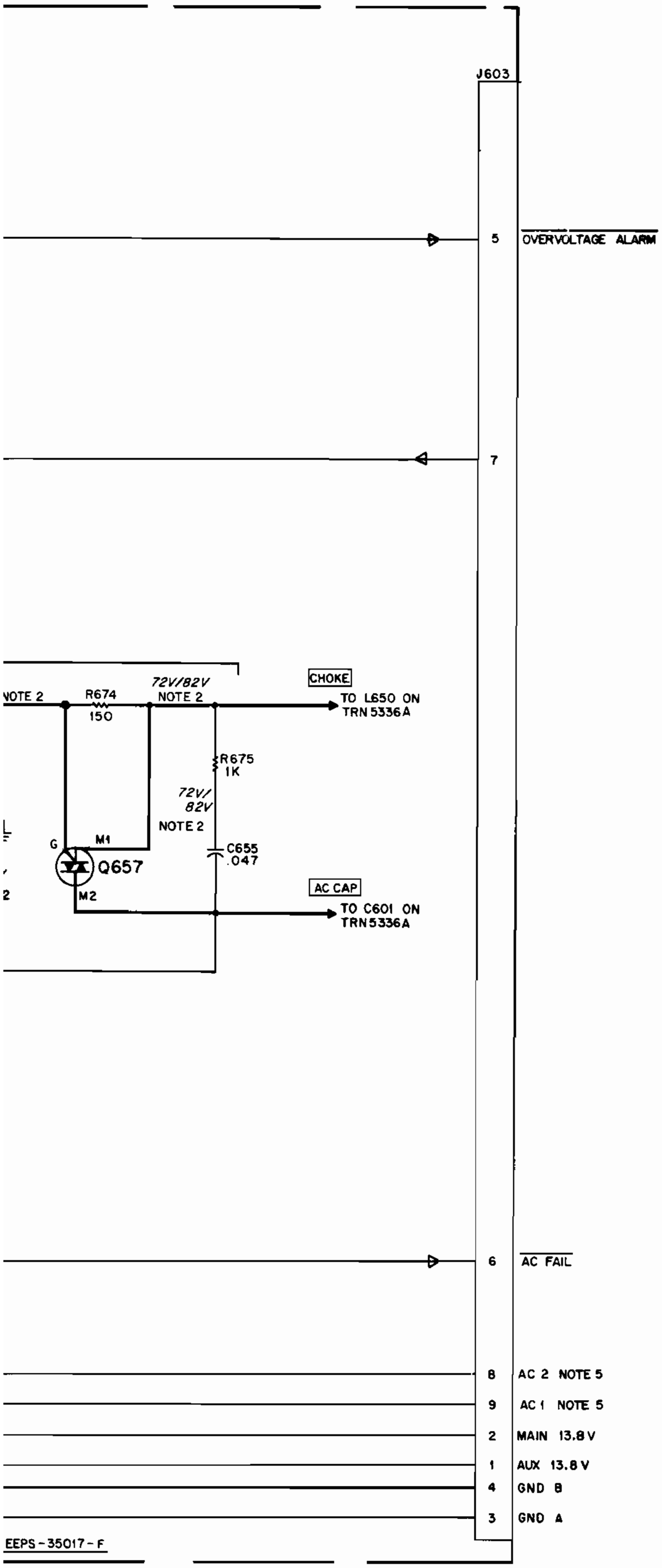

(500W)
P606 J606
R696 32
13.25V/ 14.25V
N.O. 5
N.C.
K650
53A
IARGER
KIT
P/O TRN5153A
TTERY CHARGER
HARDWARE KIT
L650
FROM Q657
(LOCATED ON
TPN6137C BOARD)
P602 J602
AC2 ORG
AC1 ORG
F604 4A
F605 4A
TB601
C604 120,000
TO PA
NOTE 6
CR660
A+ TO
BOARD
MAIN 13.8V RED
AUX 13.8V RED
F603 4A
F602 10A
R609 1.2K
DS604 (GREEN)
GND B GRY
GND A BLK
R684 2K
Q654
RELAY DRIVER
R680 680
0V
Q654
M9648
C656 20PF
C654 47 25V
R681 1.5K
CR648
U651B
C675 20PF
TP601
CR654
VR651 12V
CR659
R679 620
R678 1.8K
CR674
R702 120
R700 270K
CR671
R701 1MEG
Q663
M9642
C676 47
R703 220K
R704 39K
Q664
M9642
R705 47K
R707 330
R708 220
RT650 2.02K
R660 1K
12.74V/13.74V
R706 390
VR675 39V
C677 330
VR674 8.8V
CR672
CR673
CR652
R661 5.6K
5.34V/ 5.46V
R662 1K
VOLT. ADJ.
R683 270
C657 20PF
(FLOAT) S650
EQUALIZE
4.3V/0V
R668 27K
4.31V
R663 3.3K
CR646
CR653
Q655
M9643
R656 2K
13.9V/14.87V
13.2V/14.2V
C649 0.33UF
R650 2K
15.5V/16.65V
14.8V/ 15.94V
R697 1K
Q650
M9649
Q650,Q655
CLOCK
GENERATOR
15.1V/16.2V
R651 3.9K
R652 3K
CR661
R653 180
9.9V/9.8V
+10V SOURCE
VR650 8.8V
CR669
CR670
R695 4.7K
12.2V/13.39V
R693 4.7K
0.7V
Q658
M9642
0V/.04V
C660 2.2
R694 1.5K
C669 20PF
LINE



TPN6137C BATTERY CHARGER BOARD
CR648
R682 82K
U651B
C675 20PF
TP601
C659 47
U651A,B OVER VOLTAGE COMPARATOR
CR658
CR654
R678 1.8K
C667 20PF
U651A
9.13V/9.25V
4.0V/4.17V
R683 270
R677 47K
R686 10K
0V
.25V/.34V
Q653 M9642
Q653 OVER-VOLTAGE ALARM OUT
A+
R660 1K
12.74V/13.74V
R661 5.6K
5.34V/ 5.46V
VOLT. ADJ.
4.31V
R663 3.3K
U650A CONTROL VOLTAGE GENERATOR
R665 33K
4.0V/4.2V
4.82V/ 6.10V
C657 20PF
R648 47K
U650A
CR646
C671 0.22
R669 47K
R676 4.7K
CR647
R698 22K
+6.5V
+5V
0
−5V
5MS
+10
R667 330K
1.9V
USE 10 MEGOHM PROBE
C653 .018
C665 20PF
U650B
U650B STABILIZER
4.6V
R655 2.1K
10V 9V 0
2MS 8MS
CR655
7.1V/7.2V
C666 20PF
U650C PULSE WIDTH MODULATOR
5MS
10V 9V 0
4.0V/ 4.17V
U650C
1.8V
C668 .01
C66 20P
+10V SOURCE
Q650, Q655 CLOCK GENERATOR
5MS
10V 7.5V
1V 0
+10
R658 390K
C664 20PF
7.6V/7.8V
C651 .015
U650D MONOSTABLE SW.
U650D
3.2V
R664 3.9K
.3V
Q651 M9642
Q651, C653 RAMP GENERATOR
Q662,Q661 POWER UP RESET
4.6V/4.7V
R659 270K
10V 9V 0
13MS 5MS
C658 20PF
R666 1.5K
A+
R692 2K
Q662 M9642
VR654 6.2V
C673 100
R699 47K
C672 20PF
Q661 M9642
R642 220
A+
R657 270
CR668
VR655 6.2V
C661 220
C662 220
R670 1.8K
A+
R641 1K
C674 20PF
R695 4.7K
R640 1K
0.2V/0.4V
Q659 M9528
0.7V
Q658 M9642
0V/.04V
C669 20PF
Q658,Q659 LINE FAIL SENSE



.25V/.34V
0V
Q653
M9642
Q653
OVER-VOLTAGE
ALARM OUT
Q656, Q657
POWER SWITCH
USE
10 MEGOHM
PROBE
C653
.018
C666
20PF
4.0V/
4.17V
U650C
PULSE WIDTH MODULATOR
5MS
10V
9V
0
U650C
8 1.8V
C668
.01
C663
20PF
R672
1K
.1V/.13V
CR662
95.7V/112V
Q656
R673
2.7K
96.0V/110V
CR656
CR657
CR650
CR651
72V/82V NOTE 2
75V/84.4V
NOTE 2
R674
150
72V/82V
NOTE 2
Q657
R675
1K
72V/
82V
NOTE 2
C655
.047
CHOKE
TO L650 ON
TRN5336A
AC CAP
TO C601 ON
TRN5336A
Q651
M9642
Q651, C653
RAMP GENERATOR
EEPS-35017-F



NOTES:

1. Unless specified otherwise, all capacitor values are in microfarads and resistor values in ohms.
2. Waveform is non-sinusoidal. Voltage in recorded rms.
3. Voltages measured with DVM, with 1 meg ohm or greater input impedance.
4. Voltages measured correspond to SW650 = float position/equalize position, 120 V ac line, 2A load current, with output voltage set to 13.2 V in the float position by R662. Voltage measured @ TB601.
5. Used in MSR 2000 stations only.
6. The + and — wires from TB601 connect to TB801 on MSR 2000 stations and directly to the power amplifier on MSF 5000 stations.