MOTOROLA INC.

MT1000®
VEHICULAR ADAPTER
INSTRUCTION MANUAL

CONTENTS

RELATED PUBLICATIONS AVAILABLE SEPARATELY

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Instruction Manual
68P81062C75-O

SPECIFICATIONS

CAPACITY:	One MT1000, HT600, MTX-800,* MTX-900, HT800 , or HT600E radio.	
DIMENSIONS (LxHxW):	265.5x158.5x83mm (10.43"x6.24"x3.26")	
WEIGHT:		
(without portable radio)	1.70kg (3.76lbs)	
NOMINAL INPUT VOLTAGE:	13.8Vdc (11Vdc min.-16Vdc max.) negative ground	
CURRENT DRAIN:	CHARGED BATTERY	DISCHARGED BATTERY
Radio OFF:	200mA	600mA
Radio ON:	300mA	750mA
Transmit:	1.2A	1.2A
CHARGE RATE:	Three hours (Rapid Charge) and Sixteen hours (Standard Charge) Batteries	
ANTENNA INPUT IMPEDANCE:	50 Ohms	
AUDIO OUTPUT:	500mW with Internal Speaker	
(at less than 5% distortion)	12W with External Speaker**	

* MTX-800 radios have no external rf hookup.

Specifications subject to change without notice.

** Optional

MODEL NUMBER	DESCRIPTION
NTN1048A	Basic Package
NTN1050A	Enhanced Package

			ITEM NO.	DESCRIPTION
X			NTN5612A	Charging Console (Basic)
	X		NTN5613A	Charging Console (Enhanced)
X	X		NSN6054A	12-Watt Speaker
X	X		NTN5489A	Speaker Adapter
X	X		HMN1035A	Palm Mobile Microphone
X	X		HMN1037A	DTMF Palm Microphone
X	X		HMN1056A	Mini Mobile Microphone
A	A		TAD6111A	Antenna, 1/4 Wave Rooftop (136-144 MHz)
A	A		TAD6112A	Antenna, 1/4 Wave Rooftop (144-152 MHz)
A	A		TAD6113A	Antenna, 1/4 Wave Rooftop (152-162 MHz)
A	A		TAD6114A	Antenna, 1/4 Wave Rooftop (162-174 MHz)
A	A		RAE4012ARB	Antenna, 5dB Gain Rooftop (406-420 MHz)
A	A		RAE4014ARB	Antenna, 5dB Gain Rooftop (445-470 MHz)
A	A		RAE4015ARB	Antenna, 5dB Gain Rooftop (470-494 MHz)
A	A		RAE4016ARB	Antenna, 5dB Gain Rooftop (494-512 MHz)

KEY X = ITEM INCLUDED

A = ALTERNATE ITEM SUPPLIED; CHOICE DEPENDS UPON FREQUENCY

MAEPF-20088-O

DESCRIPTION

1. GENERAL

The Basic Motorola Mobile Radio Adapter (MVA) is a vehicular mounted unit used to adapt MT1000™, HT600™, MTX-800™ (no external rf hookup), MTX-900™, MTX-800™, HT800™, or HT600E™ Handie-Talkie™ portable FM two-way radios for mobile operation. The vehicular adapter system consists of a console, an external 12-watt speaker/amplifier, a hand-held mobile microphone, a rooftop antenna, mounting hardware, and cables.

When the radio is inserted into the console pocket for vehicular operation, the resulting combination acts as a mobile radio, with the following functions occurring automatically:

- The vehicular adapter's external antenna is connected to the radio, and the radio's internal antenna is disconnected.
- The vehicular adapter's mobile microphone is connected to the radio, and the radio's internal microphone is disconnected.
- The console's charging circuits are connected to the radio to charge the radio's battery.
- The radio's audio output is connected to the external 12-watt speaker/amplifier, and the radio's internal speaker is disconnected.

2. CONSOLE

The NTN5612A (Basic) console is the vehicular adapter's central unit. The Basic console includes three LEDs on the front control panel, palm microphone, 12-watt external speaker, mounting hardware, and power cables. When the MT1000 or MTX-900 radio is loaded into place, the MVA overrides the portable's volume control. All MVA consoles have a key lock located below the radio pocket.

When the radio is loaded in the console, the combined radio/console operates as a mobile two-way radio. The radio must have a battery attached when it is inserted into the console; this battery will be automatically charged when the radio is inserted. A key lock is provided on the console to minimize theft when the vehicle is left unattended. Appropriate mounting hardware is provided with the console to facilitate mounting at any suitable location.

3. EXTERNAL 12-WATT SPEAKER

The NSN6054A 12-watt speaker provides 12-watts of audio ouput power for use in high noise level environments. The audio level of the speaker can be adjusted from the console's panel.

4. MOBILE MICROPHONE

Three different types of mobile microphones are available for the MVA: the HMN1056A compact microphone, the HMN1035A palm microphone, and the HMN1037A DTMF palm microphone.

The microphones are palm-type, weatherproof, cartridge microphones, with transistorized preamplifiers as an integral part of the cartridge. Each microphone is equipped with a push-to-talk (PTT) switch on the side, has a coiled cord, and an 8-pin connector which plugs into a jack on the left side of the console. Mounting hardware is provided as part of the console package.

5. ROOFTOP ANTENNA

To enable the vehicular adapter to function as a mobile vehicular radio, an external rooftop antenna must be ordered from C&E Parts. This antenna is cut to correspond to the frequency band of the radio used with the vehicular adapter. Refer to the MODEL CHART for specific antenna model numbers and frequencies.

INSTALLATION

1. INSTALLATION PLANNING

a. General

Before starting the installation, determine the location of the console, microphone, and 12-watt speaker. Also, check the mounting penetrations required. On most vehicles, it is necessary to penetrate the firewall to reach the battery. Check the opposite side of the firewall for cable clearance before drilling holes, and protect the cable where it passes through the firewall by using the supplied grommets or other similar protective measures. Because of the wide variations in vehicle design, these instructions may be modified to suit each particular installation requirement.

A properly installed MVA will minimize service calls and equipment downtime. Consider the following guidelines when planning the installation:

- DO use all mounting holes provided.
- DO use lockwashers where provided
- DO ensure that unit cables are not placed under stress, are not weathered, and are not subjected to damage due to engine heat.
- DO follow proper A+ and A- connections.
- DO tape all splices securely.
- DON'T attach the units to any part of the vehicle that is not rigid or is subject to excessive vibration.
- DON'T install units in areas where rain or snow can easily get into them, such as next to a vehicle window which may be left open.
- DON'T dress cables over sharp edges that could cause wear or tearing of cable insulation.
- DON'T install the units in locations where they might interfere with the vehicle operator or operating controls.
- DON'T install the units where they will be difficult for the operator to reach.

WARNING

For vehicles with electronic anti-skid braking systems, refer to the "Anti-Skid Braking Precautions" section of this manual.

b. Console Location

NOTE

If possible, avoid mounting the console in a vertical position. This will minimize the danger of foreign substances being dropped or spilled into the console pocket.

The console should be mounted to provide 12-inches of clearance in front of the console for inserting and removing the radio. A 4-inch clearance at the rear and left side of the console is necessary for connection of power, microphone, antenna, and speaker cables; a 2.5 inch clearance is required above the vents on the top of the console. Consider accessibility to the controls by the operator When possible, mount the console on the floor near the center of the vehicle.

c. Microphone Bracket Location

When possible, mount the microphone bracket on the dash near the left side of the console. The location should be within easy reach of the operator, and it should be convenient to remove and replace the microphone without interfering with any of the vehicle controls.

CAUTION

Do not attach the microphone mounting bracket to the housing of the sole.

d. Speaker Location

Select a location for the speaker that will be neither dangerous to the operator nor damaging to the speaker. A trunnion bracket is provided for mounting the speaker. The speaker is normally hung under the dash near the right side of the console; however, the trunnion bracket permits mounting the speaker against a wall or other vertical surface, if desired.

e. Antenna Location

Complete antenna installation instructions are supplied with each antenna ordered. Refer to those instructions for all information pertaining to the antenna. Also, refer to the SAFETY INFORMATION paragraph in the **FOREWORD** of this manual for additional information.

f. Battery Connections

Determine the best cable route from the rear of the console to the vehicle battery through the engine firewall. The best route should include the shortest path to the battery terminals, yet provide the cable with protection from engine heat. Be sure the supplied grommet or similar protective measure is used wherever a cable must pass through a hole in a metal panel, such as a firewall. The power cables must be routed in a way that protects them from being pinched or crushed. For best results, connect the positive and negative leads directly to the battery terminals.

2. CONSOLE INSTALLATION

Referring to Figure 1, install the console using the following procedure, or modify the procedure as necessary to conform to the vehicle type:

a. Using the trunnion bracket as a template, drill the mounting holes, and mount the bracket with the hardware supplied. If the trunnion bracket is to be mounted on the floor or vehicle console, bend the tabs on the bracket to conform to the shape of the floor or vehicle console (see Figure 1).

b. Position the console onto the trunnion bracket so that the knurled fittings of the console and trunnion bracket mesh together.

c. Place the lockwashers on the Allen-head screws, then insert the screws through the trunnion bracket and screw them into the console. Since the console will have to be removed later to connect the cables, do not tighten the screws at this time.

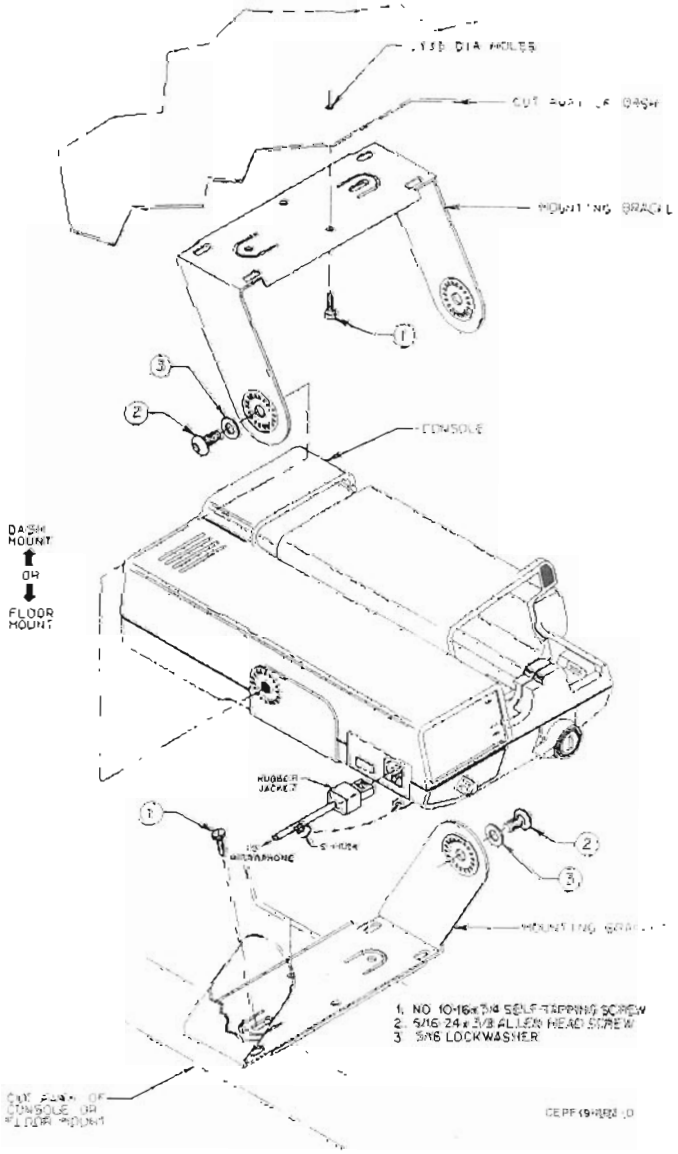


Figure 1. Console Installation Detail

3. MICROPHONE BRACKET INSTALLATION

Referring to Figure 1, crimp the S-hook (supplied with the mounting hardware) to the microphone cable approximately 1.5 inches to 2 inches from the connector end. When hooked to the baseplate, this prevents inadvertent damage to the cable connections when using the microphone. Care should be taken to prevent cutting into the cable jacket when installing the S-hook.

Referring to Figure 2, use the microphone mounting bracket as a template and drill two 1/8-inch holes. Attach the microphone bracket to the mounting surface with the two self-tapping screws provided. Be sure to leave sufficient room above the bracket for insertion and removal of the microphone.

When connecting the DTMF palm microphone to the MVA, press the "1" tone and tune the microphone's adjustable DTMF level to 60% of the radio's system deviation (i.e. 3kHz on a radio with 5kHz maximum system deviation or 1.5kHz for MTX-900 radio).

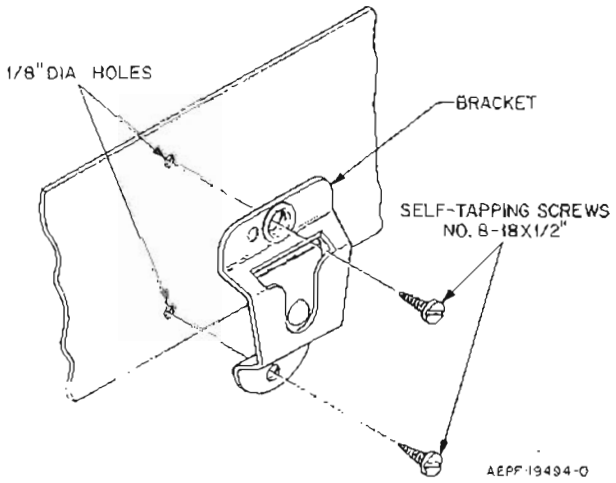


Figure 2. Microphone Bracket Installation Detail

4. 12-WATT SPEAKER INSTALLATION

The 12-watt speaker includes a trunnion bracket, a hanger bracket, and a wall-mount bracket, permitting the speaker to be mounted in a variety of ways.

- The trunnion bracket is used to permanently mount the speaker on the dashboard or accessible firewall areas, while permitting the speaker to be tilted to a desired angle.

- The hanger bracket permits temporary mounting, such as on an automobile window. The speaker must be removed from the trunnion bracket to use the hanger bracket.

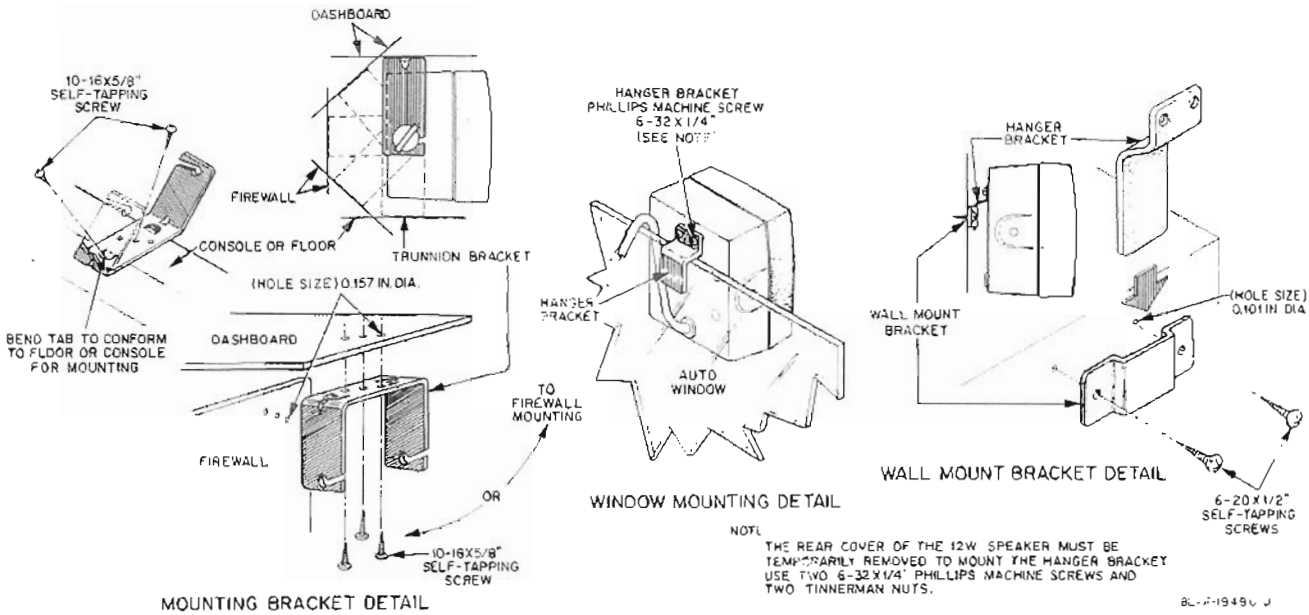


Figure 3. 12-Watt Speaker Installation Detail

- The wall-mount bracket can be used for permanent mounting if the trunnion bracket is too large to fit in the desired area. In this case, the trunnion bracket is removed, and the speaker is attached to the wall-mount bracket by the hanger bracket.

  Referring to Figure 3 for installation information, perform the following procedure:

a. Using the trunnion bracket as a template, drill the necessary mounting holes and secure the bracket with the self-tapping screws provided.

b. Position the 12-watt speaker onto the trunnion bracket, and secure it using the wing screws provided.

5. ANTENNA INSTALLATION

Install the antenna and antenna cable as outlined in the installation instructions supplied with the antenna. Pertinent information on frequency matching, and mounting details are also provided with each antenna.

NOTE

The rf jack, on the MVA console is a mini-UHF jack, and must be mated with either a mini-UHF plug (P3) or a UHF-to-mini-UHF adapter (Motorola part number 5880367B22).

6. CONSOLE CABLING

Refer to Figures 4 and 5 before routing or connecting any console cable. As shown in Figure 5, the console is used with a negative ground system only. The console should be cabled using the following procedure:

CAUTION

Remove the 5-ampere fuse from the power cable (red wire) before proceeding.

NOTE

Due to space restrictions, it may be necessary to remove the console before making connections to the connectors at the back of the console. If this is the case, make the connections and re-mount the console before replacing the 5-amp fuse.

a. Route the main power cable through the firewall and into the battery compartment. Use an existing opening or, if necessary, drill a 3/4-inch hole through the firewall. Insert the grommet provided with the mounting kit into the hole to prevent damage to the power cable.

b. Connect the black lead to the chassis of the vehicle.

CAUTION

It is not good practice to connect the black lead to the negative (-) battery terminal; the MVA could be damaged if there were a malfunction in the vehicle's electrical system.

c. Connect the red lead to the positive (+) battery terminal. Ensure that the plug and jack in the wire are connected firmly together.

d. Connect the yellow lead to the switched side of the ignition circuit.

e. Dress the cable so that it does not obstruct any vehicle controls or touch any hot or moving parts of the engine.

f. Connect power cable jack J7 to console plug P7. Attach the strain-relief hook to the console.

g. Connect speaker cable plug P6 to console jack J6, applying three in. lb. of torque to each screw. Attach the strain-relief hook to the console.

h. Connect external antenna cable plug.

i. Connect microphone cable plug P4 to console jack J4. Attach the strain-relief hook to the console.

j. Make certain that no radio is installed in the console, then replace the 5-amp fuse.

7. ANTI-SKID BRAKING PRECAUTIONS

a. General

The following transmitter installation suggestions and test procedures are recommended for vehicles with electronic anti-skid braking systems.

b. Installation Suggestions

Determine the location of the braking modulator box in the vehicle. This box is located in the trunk of Chrysler Corporation cars, and either in the trunk or under the dash in General Motors and Ford Corporation automobiles. A service manual may be helpful in finding the location of the braking modulator box.

Install the MVA console in accordance with the following recommended guidelines:

- If the braking modulator box is mounted in the right side of the vehicle, mount the console on the left side to give as much space as possible between the box and the console. If the box is mounted on the left side of the vehicle, mount the console on the right side.
- Use the shortest practical length of Motorola coaxial cable.
- Mount the antenna on the side of the car trunk opposite from the braking modulator box
- Route all cables along the side of the vehicle opposite from the braking modulator box.
- **DO NOT** operate the transmitter while the vehicle is in motion with the trunk lid open.

c. Test Procedure

This test is divided to cover several different types of interference. Disturbance of the electronic anti-skid device can usually be detected in several different ways in the vehicle's braking system: by the lights, by any irregular audible sounds, or by any change in the performance of the braking system itself.

NOTE

During procedure steps (1) through (6), however, none of the above conditions should be observed.

(1) With the car gear selector in NEUTRAL or PARK, your foot off the brake pedal, and the engine running at a fast idle, key (turn the carrier on and off) the transmitter with and without modulation. Refer to the note above.

(2) Repeat step (1) with your foot gently pressing the brake pedal. Refer to the note above.)

(3) When performing this step, allow at least two car lengths of clear area in front of the vehicle while it is stationary. Press your foot on the brake pedal with just enough pressure to keep the vehicle from moving. Put the car in a forward gear with the engine running at a fast idle, then key the transmitter with and without modulation.

WARNING

Disruption of the anti-skid braking system may cause the vehicle to move forward in addition to the lights and audible sounds mentioned above.

(4) Drive at a moderate speed (15-25 mph) with your foot off the brake pedal, and have an assistant key the transmitter with and without modulation. Refer to the above warning.

(5) Repeat step (4) with your foot lightly on the brake pedal to turn off the brake lights. Refer to the above warning.

WARNING

Severe disruption of the electronic anti-skid braking system may cause loss of control of the vehicle in steps (6), (7), and (8).

(6) Increase the vehicle speed to 25-30 mph. Decelerate slowly and come to a stop. As you are doing this, have an assistant key the transmitter with and without modulation. Refer to the above warning.

(7) While making abrupt stops from 20 mph, have an assistant key the transmitter with and without modulation. Refer to the above warning.

(8) If no interference or disruption is noticed, repeat step (7), making abrupt stops from 30 mph. Refer to the above warning.

If no malfunctions are observed in performing the above steps, it can be assumed that no apparent problem exists and the car can be released to the customer.

If any of the above steps results in a brake malfunction, contact the car manufacturer's service department as soon as possible, and remove the radio from the vehicle. **DO NOT** complete the installation.

8. INSTALLATION CHECKOUT

a. General

After completing the installation of the vehicular adapter, check all electrical wiring for tight connections. Also, check all mechanical parts for tight and secure mounting

Check for proper operation of the console, microphone, speaker, and radio as described in the operating instructions, Motorola publication 68P81061C35.

NOTE

If alternator or other vehicular noise is present in the received signal or in the transmission, refer to "Reducing Noise Interference in Mobile Two-Way Radios." Motorola publication 68P81109E33. This publication may be ordered separately from Motorola Communications Sector National Parts Department.

THEORY OF OPERATION

1. GENERAL

The MVA is compatible with HT600, MTX900, MT1000, HT800 and HT600E FM two-way radios. The resulting combination of the console and portable radio gives the same or better performance as a standard mobile system. The MTX 800 radio can also be placed in the MVA; however, the MTX800 does not have the ability to port external rf.

Connection between the radio battery and the console is made through the charger contact block (mounted on the printed circuit board) in the rear of the radio pocket. The contacts on this block and the associated circuitry automatically charge the portable radio battery.

Connection between the console and the portable radio functions is made through the portable radio control top universal contacts. When the portable radio is inserted into the console pocket and pushed in, the radio universal contacts are automatically engaged by the MVA pogo pins, and all basic portable radio functions are available to the console

On the basic model MVA (NTN5612A) , all basic portable radio controls remain with the radio except for the volume control when the 12W speaker option is used.

The mobile microphone and antenna are also automatically connected to the portable radio when it is inserted into the console pocket.

2. CIRCUIT DESCRIPTION

a. General (Refer to the schematic diagram)

The console is powered directly from the vehicle battery and through the vehicle ignition switch. The console consists of battery charging, PAC• RT interface, switching regulation, microphone and audio PA interface capabilities.

b. Ignition and PAC• RT Interface

Turning the ignition switch on causes the car ignition voltage to be supplied at J7 pin 2. If a radio is in the MVA, ground will be present at J5 pin 5. This ground will provide a biasing path which turns Q22 on. When Q22 is on, Q24 is turned on and switches the relay (K1). The relay supplies the MVA with power for all circuitry.

When the PAC • RT switch (S1) is turned off, J6 pin 9 is grounded and the PAC • RT is disabled. When the PAC • RT switch is on and a radio is in the MVA, Q23 is saturated, J6 pin 9 is low, and the PAC • RT is still disabled. When the radio is removed from the MVA and the PAC • RT switch is on, Q23 is off and J6 pin 9 is high, and the PAC •RT is enabled.

c. Switching Regulator

Due to the variation of the vehicle's battery voltage of 13.8V±20%, the switching regulator is required to step up the vehicle's voltage to the constant 16.5V±5% required by the charging circuit to provide a constant rate of charge. The switching regulator operates at 40KHz and the input voltage is stepped up to 16.5V. The output capacitors (C8 to C10) reduce the ripple voltage to less than 100mV for an 800mA load at 25° C.

d. Current Regulator

The charger is receptive to two different charge rates: A three hour fast charge (0.4C) and a sixteen hour slow charge (0.1C). Features for dead battery operation during transmit (PTT), with constant 800mA charge rate and extra 70mA charging if the radio is on, is incorporated.

The charging current is controlled by a current regulator with negative feedback. The current regulator is comprised of transistor circuits Q2 thru Q6, U11,U12, a differential amplifier (U3C), and single input amplifier (U3D). Under normal conditions, Q5 and U12-C are in saturation (ON) giving a rapid charge rate of 0.4°C. When the radio is loaded, the momentary increase in charging current through R19 (1Ω) results in an increase in differential amplifier output (pin 8) and input to the single input amplifier (pin 13). Its output drops and the base drive of Q2 and Q3 is reduced. Therefore, the charging current drops and maintains a constant charge rate according to the sensing resistors of the battery.

Diodes CR3, CR4, transistor Q4 and resistor R15 provide for a constant current input of transistor Q5, turning on Q5, independent of battery terminal voltage and charge rate. Together with Q6, this constant current source can be switched off for trickle-charging by switching off Q6, Q4, and Q5. With Q5 turned off, R16 ,R154 and R153 are added in the charging path.

The following chart lists the three different battery capacities, RC's, and rapid charging current and trickle charging current.

BATTERY CAPACITY	RC Ω	CHARGING CURRENT (mA) RAPID WITH RADIO ON	OFF	CHARGING CURRENT (mA) TRICKLE WITH RADIO ON	OFF
500	5.6K	320	250	130	62
900	3.3K	430	360	160	90
950	3.3K	430	360	160	90

At dead battery operation, the console provides a constant 800mA to the radio for transmitting. Pressing the PTT switch causes Q27 to turn off, and U12 pins 7 and 8, to go low. This switches off U12C and the charging current is no longer controlled by RC, but is controlled by R36 instead.

e. Battery Sense Detect

With no battery in the charger, the voltage at U3-B pin 6 is approximately 9.6V, holding the output of U3-B pin 7 low. When the radio is loaded in the console, U12-C conducts. Voltage at U3-B pin 6 drops to approximately 1.4V. This drop in voltage results in a high output at U3-B pin 7 turning on Q12 and charging LED CR28.

f. Temperature Window and Bistable Multivibrator

Comparators U4-B, U4-C, and U4-D sense the RT line and set the cold and hot sides of the temperature window respectively. The cold side temperature is below 8° C while the hot side temperature is above 41°C. If the temperature rises above 60°C, the output of U4-B goes low cutting off charging completely.

Temperature sensing is through a thermistor (RT), and its resistance is converted to voltage and compared with preset voltages of each comparator.

During normal operation (8°C to 41°C), the output at U4-D pin 14 is high turning on Q5 and the charging rate is 0.4C. If the temperature falls below 8°C the output at U4-D pin 14 is low, turning off Q6,Q4, and Q5, charging at 0.1C.

As the battery charges, the temperature of the battery increases causing RT resistance drops. As the temperature increases and exceeds 41°C, the output of U4-C goes from high to low, causing the output of U4-A to go low and turning off Q6, Q4, and Q5; the MVA is now in slow charge (0.1°C). Once the battery temperature goes above 41°, the rate of charging will latch at 0.1C with the help of Q30, Q31, Q32 and associated circuitry. This prevents a fully charged battery going back to rapid charge as its temperature drops. The sudden low output at U4-A results in a low output at U5-C pin 2 changing the LEDs (CR28 &CR29) from red to green indicating complete state of charge. This charging rate will continue as long as the temperature of the battery remains below 60°C. If the battery temperature exceeds 60 degrees the output of U4-B goes low, and the pass transistor (Q2) turns off and all charging stops. U4-B going low also results in the enabling of the oscillator and the LEDs will flash.

Due to the linearity of RC with charging current, resistor R96 is added to compensate for 900mAH and 950mAH battery capacity. Resistors R98 and R100 provide an extra 70mA charging current (rapid and slow) when the radio is on.

g. Oscillator

The oscillator circuit turns the green and yellow LEDs on and off (flashing) indicating that a problem (shorted or open cells, shorted terminals) is detected with the battery or the contacts when the output of the short circuit detector circuit, U5-C pin 13, or the battery open circuit detector, U5-D pin 14, goes low. This pulls pin 7 of U5-B lower than pin 6, and the output of the oscillator U5-B pin1 changes from high to low. Hence, C38 discharges through R80 and R81 until the voltage falls below the output at pin 7 of U5-B and toggles the O/P again. The output of the oscillator flips back and forth and turns the green and yellow LEDs on and off. If a problem occurs during the charge complete cycle, only the yellow LED will flash.

h. Battery (O/C) Open Circuit Detector

During normal operation, pin 9 of U5-D is higher than pin 8 of U5-D unless an open circuited battery is detected (RC present but no charging current). The low impedance of RC causes the differential operational amplifier output to go low, pulling pin 9 of U5-D lower than pin 8 of U5-D and, thereby, pulling the output low. This low output turns the oscillator on, triggering the green and yellow LEDs which causes them to flash.

i. Shorted Cells and Short Circuit Detect

This circuit compares the voltage at the battery terminals with a preset reference voltage of 4.0V. As long as the terminal voltage goes low, the charging

current is cut off completely thru U8-D. This circuit also activates the oscillator that flashes the green and yellow LEDs.

Capacitor C37 (100uF) is used to hold the output high when the console is powered on and is also used to time the response of the short circuit detect.

j. Dynamic Voltage Clamp

As long as the voltage at the battery terminals remains below 15V, the output of U3-A is held high. When the battery voltage exceeds 15V, the voltage at pin 2 U3-A is greater than the voltage at pin 3 U3-A. This causes the output of U3-A to go low and reduces the base drive for Q2, thus limiting the terminal voltage to 15V. This prevents over voltage loads and protects the radio from high voltage damage.

k. Radio ON/OFF Sensing Circuitry

The MVA contains sensing circuitry detecting whether the radio is on or off. When the radio is on, the MVA supplies an extra 70 mA of charging current to the battery to compensate for the current drawn by the radio in the standby mode. When the radio is on, B+ voltage (J5 pin 3) and Busy (J5 pin 3) go high. When the busy line goes high, the output of U13-A will go high. Option B+ and/or the output of U13-A pull U12 pins 3 and 4 low. This causes U12 pins 1 and 2 to go high and supply bias to U11 pin 13. This switches R98 into the circuit and modifies the charging current to supply the extra 70 mA.

l. Microphone and Audio PA Interface

An external microphone and audio amplifier are connected to the MVA through Telco and DB-25 connectors, respectively. Audio path selection is made by adjusting switches S1 and S2 (white switches located on back of console). The MVA is shipped standard with the 12W PA, and both S1 and S2 should be in the down position. For MT1000 and MTX radios, the volume control is remoted to the MVA. For HT600 radios, either the radio or MVA volume control can be used. For best results, the HT600 radio should be adjusted to 3/4 maximum volume when placed into the console. All volume adjustments should be made using the MVA volume control. The chart below shows other methods for routing audio.

METHOD	S1 POSITION	S2 POSITION
12 W AUDIO	DOWN	DOWN
RADIO AUDIO	UP	UP

Receive audio from the radio (J5 pin 8 and 2) passes through volume pot R109 and attenuator resistors R110, R111 and R142 to the 12 watt audio PA (J6 pins 20 and 21). The 12 W squelch is controlled via transistors Q20 and Q21. When the radio unsquelches, Q20 turns on and Q21 turns off. This causes the PA squelch line to go high (J6 pin 5).

The microphone receives its bias voltage from the MVA's 12 volt regulator through R127 and R128 to J4 pin 5. The microphone signal comes from J4 pin 5 through C103 and R126 to the radio via J5 pin 1.

current is cut off completely thru U8-D. This circuit also activates the oscillator that flashes the green and yellow LEDs.

Capacitor C37 (100uF) is used to hold the output high when the console is powered on and is also used to time the response of the short circuit detect.

j. Dynamic Voltage Clamp

As long as the voltage at the battery terminals remains below 15V, the output of U3-A is held high. When the battery voltage exceeds 15V, the voltage at pin 2 U3-A is greater than the voltage at pin 3 U3-A. This causes the output of U3-A to go low and reduces the base drive for Q2, thus limiting the terminal voltage to 15V. This prevents over voltage loads and protects the radio from high voltage damage.

k. Radio ON/OFF Sensing Circuitry

The MVA contains sensing circuitry detecting whether the radio is on or off. When the radio is on, the MVA supplies an extra 70 mA of charging current to the battery to compensate for the current drawn by the radio in the standby mode. When the radio is on, B+ voltage (J5 pin 3) and Busy (J5 pin 3) go high. When the busy line goes high, the output of U13-A will go high. Option B+ and/or the output of U13-A pull U12 pins 3 and 4 low. This causes U12 pins 1 and 2 to go high and supply bias to U11 pin 13. This switches R98 into the circuit and modifies the charging current to supply the extra 70 mA.

l. Microphone and Audio PA Interface

An external microphone and audio amplifier are connected to the MVA through Telco and DB-25 connectors, respectively. Audio path selection is made by adjusting switches S1 and S2 (white switches located on back of console). The MVA is shipped standard with the 12W PA, and both S1 and S2 should be in the down position. For MT1000 and MTX radios, the volume control is remoted to the MVA. For HT600 radios, either the radio or MVA volume control can be used. For best results, the HT600 radio should be adjusted to 3/4 maximum volume when placed into the console. All volume adjustments should be made using the MVA volume control. The chart below shows other methods for routing audio.

METHOD	S1 POSITION	S2 POSITION
12 W AUDIO	DOWN	DOWN
RADIO AUDIO	UP	UP

Receive audio from the radio (J5 pin 8 and 2) passes through volume pot R109 and attenuator resistors R110, R111 and R142 to the 12 watt audio PA (J6 pins 20 and 21). The 12 W squelch is controlled via transistors Q20 and Q21. When the radio unsquelches, Q20 turns on and Q21 turns off. This causes the PA squelch line to go high (J6 pin 5).

The microphone receives its bias voltage from the MVA's 12 volt regulator through R127 and R128 to J4 pin 5. The microphone signal comes from J4 pin 5 through C103 and R126 to the radio via J5 pin 1.

MAINTENANCE

1. PREVENTIVE MAINTENANCE

a. Periodic Inspections

Slow degradation of equipment performance, if left uncorrected, can lead to costly equipment downtime and repair. Preventive maintenance (PM) differs from corrective maintenance in that minor equipment operating deficiencies can be corrected before breakdown occurs. Periodic and systematic PM inspection schedules should be set up to keep the equipment operational and failure free. The frequency of PM schedules will be determined by the environment in which the equipment is being used.

The periodic inspections should include:

- Visual inspection of cables for frayed or oxidized leads.
- Ensuring that battery connections are free from oxidation or corrosion.
- Checking the external rooftop antenna for clean and rust-free mounting.
- Checking for tight connection of the console-to-antenna cable connectors.
- Checking the system ground lead (black) for clean and proper electrical contact.
- Checking all jack and plug connections for tightness and good electrical pin contact. Pins should be visually checked for wear.
- Checking for loose components. Checking component assemblies and mechanical assemblies for tight and secure installation. The majority of MVA failures is directly related to poor installation.
- Inspecting all mounting brackets and associated mounting screws for secure and tight mounting.
- Checking for overheated or discolored components.
- Checking for proper (13.8Vdc) vehicular alternator charging. Vehicular voltage can vary from as low as 12.9Vdc to as high as 18Vdc without being evident to the operator; however, it can affect MVA operation.

b. Cleaning Procedures

In areas of high dust or salt conditions, periodically check the mechanical operation of the console's battery contacts. If contact movement requires excessive effort, clean any dust or salt deposits from the moving parts as described below. Cleaning may be accomplished by performing the following procedure:

(1) Remove the console from the vehicle and place it rightside-up on a flat working surface. The working surface should offer protection from scratching to the console's surfaces.

(2) Referring to the "Disassembly/Reassembly Procedures" (paragraph d) in the "CORRECTIVE MAINTENANCE" section of this manual, disassemble the unit for cleaning.

(3) Clean the external surfaces of the console using the recommended cleaning agent. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of excessive dust, grease, and/or grime.

The only recommended agent for cleaning the internal and external plastic MVA surfaces is a 0.5% solution of a mild dishwashing detergent in water (one teaspoon of detergent per gallon of water).

CAUTION

The effects of certain chemicals and their vapors can be harmful to some types of plastics. Aerosol sprays, tuner cleaners, and other such chemicals should be avoided.

(4) The internal circuit boards and components should ordinarily be cleaned when the console must be disassembled for servicing or repair. The only factory recommended liquid for cleaning the circuit boards and their components is *isopropyl alcohol* (70% by volume).

NOTE

When the MVA is used under adverse marine conditions, the circuit board must be cleaned of salt deposits at least twice a year.

Isopropyl alcohol may be applied with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked-on materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the console.

Alcohol is a high-wetting liquid and can carry contamination into unwanted places if an excessive quantity is used. Make sure that the controls are not soaked with the liquid. Upon completion of the cleaning process, use a soft, absorbent, lintless cloth to dry the area.

NOTE

Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material from previous usage.

(5) Reassemble the console, reversing the disassembly procedure.

2. CORRECTIVE MAINTENANCE

a. Introduction

Efficient corrective maintenance requires an orderly and logical troubleshooting procedure for localizing malfunctions in the MVA's internal or external circuits. Troubleshooting and repair will be greatly simplified by becoming familiar with the overall MVA and radio operation.

This section provides detailed information required to isolate malfunctions to the MVA's internal or external circuits. The troubleshooting chart at the end of this section provides information on possible circuit failures, related symptoms, and suspected malfunctioning stages.

Generally it may be assumed that, if the MVA is totally inoperative, the vehicle's battery is completely discharged, the fuse is blown, or the power lead is opened. However, if the MVA is partially operative, it may be assumed that the batteries are serviceable and that one or more internal or external functional MVA circuits are defective or marginal. Using diagrams, the troubleshooting chart, the voltage table, and deductive reasoning, the defective circuit may readily be found.

To further aid in analyzing the symptoms and possible causes of the malfunction, check: rf power output using an in-line wattmeter, audio deviation, and current drain. Once the general problem area of the MVA is identified, careful use of a dc voltmeter, ohmmeter, and/or oscilloscope should help isolate the problem to a defective component.

b. Test Equipment and Service Aids

The "RECOMMENDED TEST EQUIPMENT" chart lists the test equipment recommended to properly service the MVA. Refer to the service manual for the associated radio for the recommended radio test equipment. For field servicing, the vehicle's battery is an adequate power source. Battery-operated test equipment is recommended when available.

RECOMMENDED TEST EQUIPMENT

MODEL NO.	NAME	CHARACTERISTICS	APPLICATION
R-2001, R-2002, or R-2200	Service Monitor	-----	Audio circuit, testing,frequency/ deviation, power output.
S-1347	DC Power Supply	0-20Vdc, 0-5 Amps; current limited	Power supply for bench testing
S-1053	AC Voltmeter	1mV to 300mV RMS, -72dB to +52dB; 10MΩ input impedance	Audio voltage measurements
R-1028	Solid-state Oscilloscope	-----	Waveform measurements
R-1001	Digital Multimeter	High input impedance	DC voltage, resistance measurements

See your Motorola sales representative for aid in ordering test equipment. The sales representative will analyze your requirements and help you select the latest available equipment and service aids to suit your individual needs.

(1) MAV-PACK 3 (VID-952)

The VID-952 Motorola Video Visual Package (MAV-PACK) is a video tape training program on leadless component repair techniques. This VHS format video cassette and supplemental literature describe the removal and replacement of leadless components using the following specialized equipment:

- RRX-4033 Laurier Hot Gas Bonder
- RPX-4234A Regulator and Hardware Kit
- 0180386A62 Heated Tweezers
- RSX-1002 Desoldering Station
- RSX-1008 Weller Soldering Station

This MAV-PACK is strongly recommended for technicians who intend to service this and other Motorola products using leadless components. This VHS videotape is in standard half-inch format. This MAV-PACK, as well as others, is available from:

Motorola C&E, Inc.
National Service Training Center
1300 N. Plum Grove Road
Schaumburg, Illinois 60195

c. Troubleshooting

Refer to the troubleshooting and voltage charts at the back of this section to isolate a malfunction to a defective circuit. Follow the flow through the chart, check each observation, and answer each question. As an aid in understanding the operation and functioning of a particular circuit, refer to the appropriate paragraphs in the "THEORY OF OPERATION" section of this manual.

If a circuit board must be tested, it may be necessary to remove it from the chassis and test it outside of the enclosure. In this case, leave all wires connected to the board, and use care to protect the board from being accidentally shorted out. Use heat sinks with insulators on transistor Q2 while the board is removed from the chassis.

d. Console Disassembly

NOTE

The Universal Connector pins can be individually replaced without disassembling the console. Grasp the pin with a pair of tweezers and pull it out towards the rear of the console.

(a) Unlock the MVA, remove the radio from the pocket and disconnect all cables (including the microphone). Remove the key from the lock and place the console on a flat surface.

(b) Referring to Figure 4, insert a small flat-bladed screwdriver into the two top housing catches at the rear of the housing. Disengage these catches one at a time while applying pressure to separate the top and bottom housings. These catches can only be reached from the underside of the console.

(c) Lift the top housing from the rear of the MVA so the front hooks in the bottom housing near the volume knob can slide out of their mating slots. Set the top housing to the side away from the pocket since there is still a flex circuit connection to the top housing.

(d) With thumb and forefinger, grasp the top edges of connector J3 (white), and lift up to disconnect the LED circuit flex. The connector will move upward about 1/8," but does not separate from the PCB fully. The flex circuit can now be pulled out of the connector.

(e) Position the pocket housing at its highest position. Unsnap the front two guide pins of the pocket housing from the guideways by bending the left guideway and pushing the pocket housing upwards.

(f) Repeat Step (e) for the rear guide pins.

(g) Unhook the two helical springs from the baseplate catches.

NOTE

Whenever the pocket is removed from the assembly (steps e thru g) , it is recommended that all four cam shafts (mate to the pins on the pocket) on the bottom housing be wiped clean to remove any foreign material. To accomplish this, use a dry cotton swab.

(h) Pull the volume pot knob out of its shaft.

(i) Disconnect the universal connector flex from its connector (J5) using the same procedure as explained in Step (d).

(j) Unsnap the power transistor clip.

(k) Referring to Figure 5, and using the small screwdriver,unsnap the five snap catches holding the main PCB. The board should be pulled directly upwards to allow the microphone connector to slide from its mating grooves. The main PCB is still attached to the bottom housing by the ribbon cable connected to the volume pot board. The main board can be flipped forward to access the underside without removing the volume pot board.

(l) To remove the volume pot board, unsnap it from the bottom housing by lifting the totwo catches.

(m) Referring to Figure 6, and using a small screwdriver, unsnap the six catches that hold the baseplate and the bottom housing together.

(n) Lift the plastic bottom housing away from the baseplate.

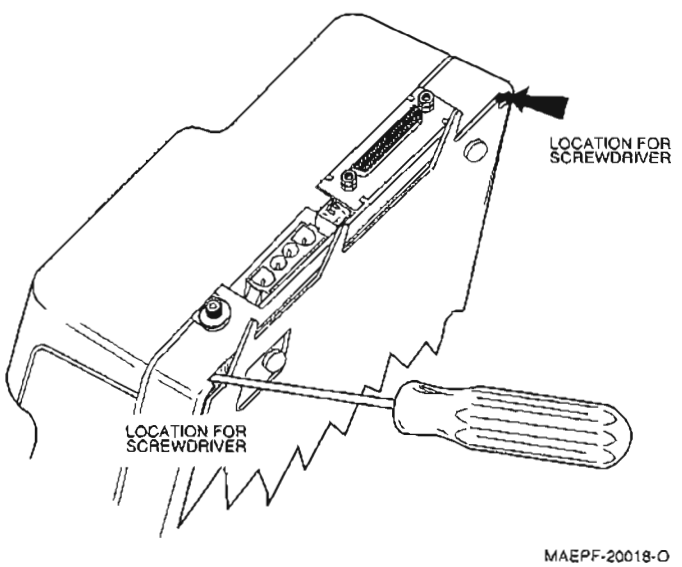


Figure 4. Disengaging the Two Catches

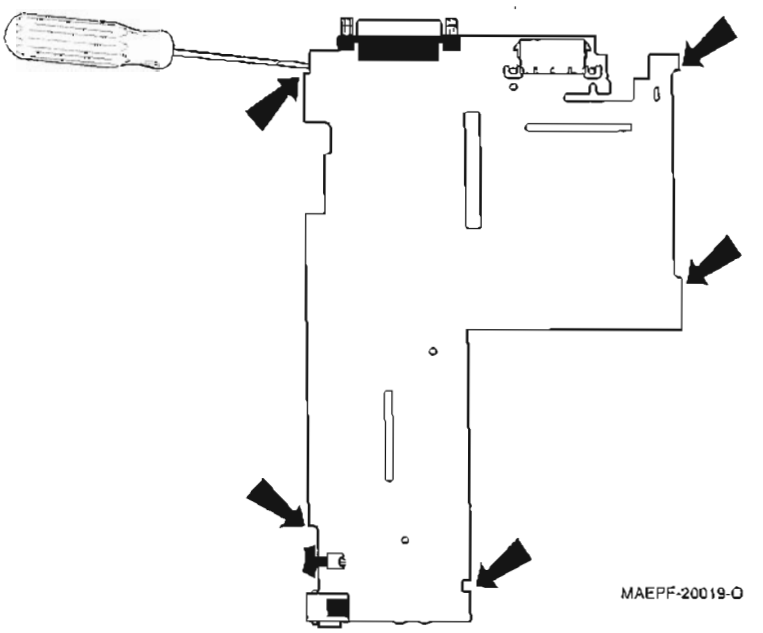


Figure 5. Top View of PCB

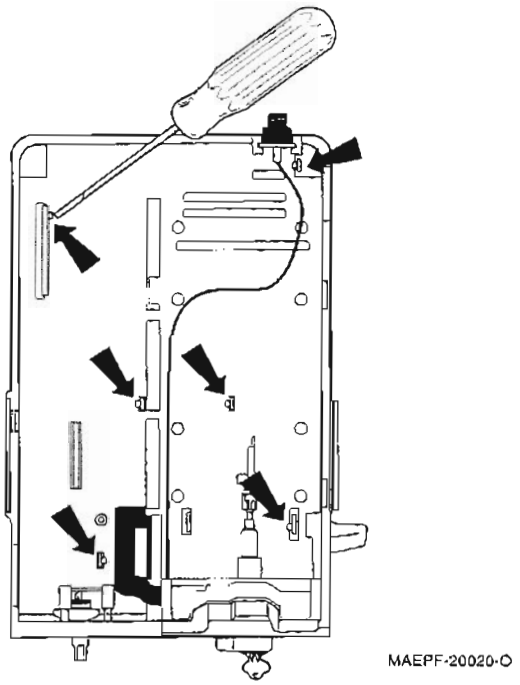


Figure 6. Top View of Bottom Housing

(o) The universal connector housing can only be removed after the bottom housing is removed from the baseplate. Locate the two snap features (about 1/2" on either side of the contact pins). Using the small screwdriver, push the snaps down and slide the connector housing and lock bracket toward the rear of the console. The bracket will only slide about 1/2" back and then the connector housing can be lifted out of the bracket. Unsnap the universal connector header and flex assembly from the connector housing.

CAUTION

Be careful not to damage any of the components on the flex circuit on the bottom housing snaps as it is pulled out.

(p) To remove the lock assembly, slide the bracket toward the rear, out of the slots in the housing. Note the position of the torsion spring so it can be reassembled correctly. Lift up on the rear end of the rod and unsnap it from the bottom housing. The lock assembly can then slide out through the front of the housing.

e. Console Reassembly

Reassemble the console by reversing the disassembly procedure. Be careful to completely snap all of the snaps that hold the bottom housing to the baseplate and the main PCB to the bottom housing.

f. Safe Handling of CMOS Devices

Complementary metal-oxide semiconductor (CMOS) devices are used in the MVA. While the attributes of CMOS are many, their characteristics make them susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair. The following handling precautions are mandatory for CMOS circuits, and are especially important in low humidity conditions.

(1) All CMOS devices must be stored or transported in conductive material so that all exposed leads are shorted together. CMOS devices must not be inserted into conventional plastic "snow" or plastic trays of the type that are used for storage or transportation of other semiconductor devices.

(2) All CMOS devices must be placed on a grounded bench surface and the technicians must ground themselves prior to handling the devices. This is done most effectively by having the technician wear a conductive wrist strap in series with a 100k-ohm resistor to ground.

(3) Do not wear nylon clothing while handling CMOS circuits.

(4) Do not insert or remove CMOS devices with power applied. Check all power supplies to be used for testing CMOS devices, and be certain that there are no voltage transients present.

(5) When straightening CMOS device leads, provide ground straps for the apparatus used.

(6) Use a grounded soldering iron.

(7) All power must be turned off in a system before printed circuit boards containing CMOS devices are inserted, removed, or soldered.

g. Parts Replacement and Substitution

When defective parts or components must be replaced, identical parts should be used. If the identical replacement part is not locally available, check the electrical and exploded view parts lists for the correct Motorola part number. Order the part from the nearest Motorola Communications Parts office as listed under "Replacement Parts Ordering" on the inside back cover of this manual.

If, for any reason, substitutions must be made, reinstall the exact replacement part as soon as possible to ensure optimum performance. The substituted part must have identical electrical characteristics and must have equal or higher voltage and current ratings.

If it is necessary to replace any of the transistors that mate against the heat sink fins on the chassis, be

sure to form the new transistor's leads like those of the original part so that the transistor lies flat against the insulator when clamped by the transistor clip against the heat sink fins.

h. Soldering

CAUTION

Leadless component technology requires the use of specialized equipment and procedures for repair and servicing of the SVA. If you are not totally familiar with leadless component repair techniques, it is strongly recommended that you either defer maintenance to qualified service personnel and service shops, or take the recommended video-taped component repair training program, MAV-PACK 3 (VID-952). This is of paramount importance as irreparable damage to the SVA can result from service by unauthorized persons. Unauthorized attempts to remove or repair parts may void any existing warranties or extended performance agreements with the manufacturer.

Special care must be taken to be as certain as possible that a suspected component is actually at fault. This special care will eliminate unnecessary unsoldering and removal of parts, which could damage or weaken other components or the printed circuit board itself.

(1) Rigid Circuit Boards

The MVA uses bonded multi-layer printed circuit boards. Since the inner layers are not accessible, some special considerations are required when soldering and unsoldering components. The printed through holes may interconnect multiple layers of the printed circuit. Therefore, care should be exercised to avoid pulling the plated circuit out of the hole. Closely examine your work for shorts due to solder bridges.

(2) Flexible Circuits

The flexible circuits are made from a different material than the rigid boards, and different techniques must be used when soldering. Excessive prolonged heat on the flexible circuit can damage the material. Avoid excessive heat and excessive bending. For parts replacement, use the ST-1087 Temperature-Controlled Solder Station with a 600 or 700 degree tip, and use small diameter solder such as ST-633. The smaller size solder will melt faster and require less heat being applied to the circuit.

POWER DISTRIBUTION TABLE

	Q24	J7			CR1	U2	U9	Q2		
IGNITION NO RADIO IN MVA	B 13.8V	PIN 1 13.8V	PIN 2 13.8V	PIN 4 0V	CATH 0V	PIN 1 —	PIN 3 —	B —	E	C
IGNITION ON RADIO IN MVA	11.8V	13.8V	13.8V	0V	13.8V	12V	5V	13.5V	16.8V	16.2V

CHARGER SECTION VOLTAGE MEASUREMENTS

	Q6	U3C
RAPID CHARGE (RED LED)	C 0.2V	PIN 8 6.02V
TRICKLE CHARGE (COMPLETE)	13V	9.2V

	Q20	Q21
12W SPEAKER SQUELCHED	C HI	C LO
12W SPEAKER UNSQUELCHED	LO	HI

	U12	
RADIO ON	PIN 3	PIN 4
	0V	LO
RADIO OFF	5V	HI

	Q27	
PTT SW. PRESSED	C	
	4.30V	HI
PTT SW. PRESSED	0.2V	LO

LED CIRCUITRY SECTION VOLTAGE MEASUREMENTS

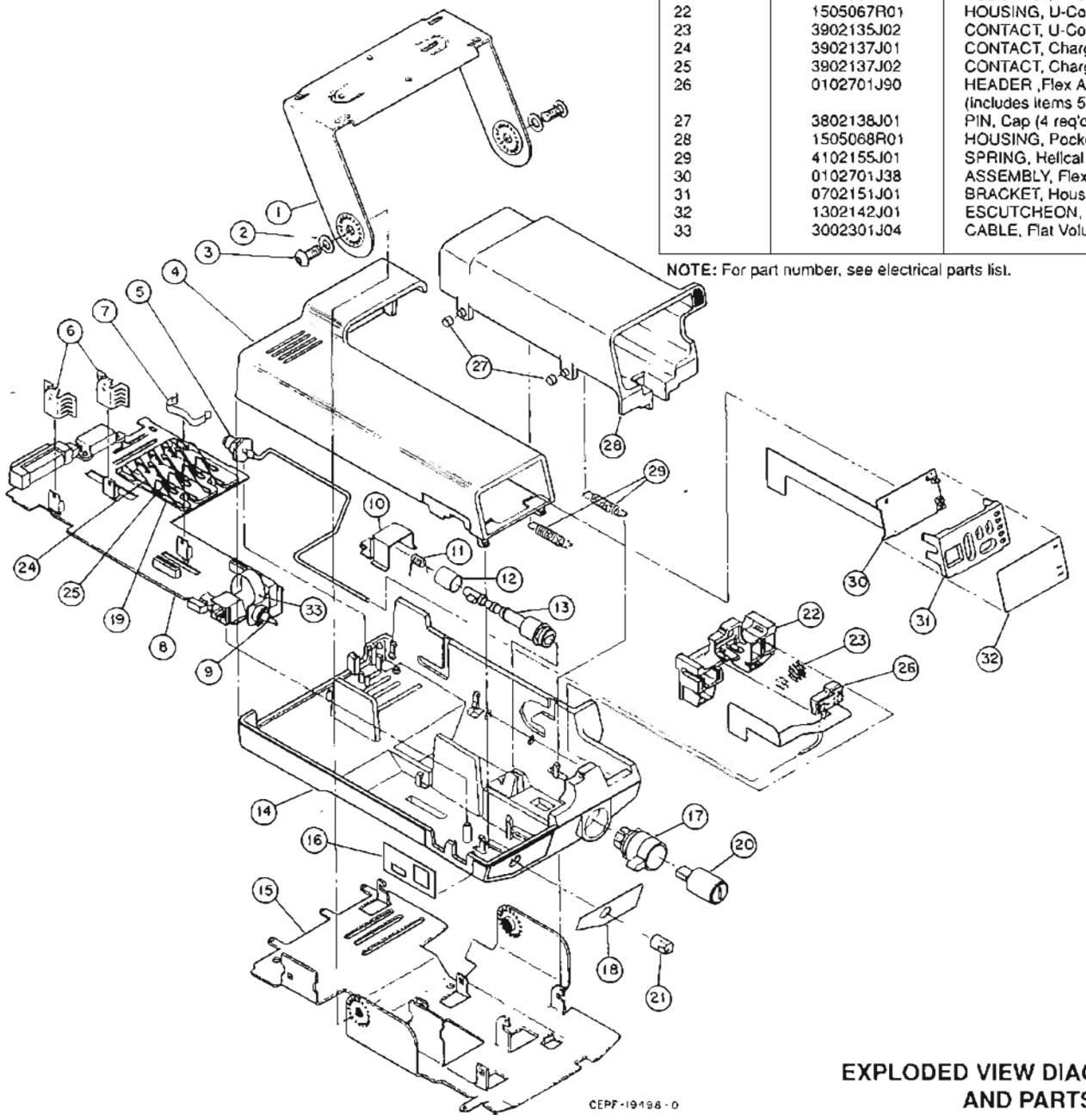
		U4		U5	Q11	Q12
RED LED ON GREEN LED OFF	RAPID CHARGE BATTERIES, RAPID CHARGING TRICKLE CHARGE BATTERIES, STANDARD CHARGING	PIN 1 HI	PIN 14 HI	PIN 2 HI	C HI	C LO
RED LED OFF GREEN LED ON	RAPID CHARGE BATTERY COMPLETE	LO	HI OR LO	LO	LO	HI

EXPLODED VIEW PARTS LIST

TPLF-3816-O

ITEM NUMBER	MOTOROLA PART NUMBER	DESCRIPTION
1	0102703J05	BRACKET, Trunnion (includes items 2&3)
2	0400114169	LOCKWASHER (2 req'd)
3	0383265G05	SCREW, Hex Socket (2 req'd)
4	1505066R01	HOUSING, Top
5	3002173J01	CABLE, Miniature UHF Assembly
6	2602328J01	CLIP, Heatsink (2 req'd)
7	4205200R01	CLIP, Power Transistor
8	0102701J42	ASSEMBLY, Main PCB (includes items 6,9,19,24,25 &33)
9	See Note	POT, Volume (R109)
10	0705097R01	BRACKET, Keylock
11	4102146J01	SPRING, Keylock
12	3702133J01	SLEEVE, Friction
13	4705099R01	ROD, Vibration
14	1505069R01	HOUSING, Bottom
15	6402139J01	BASEPLATE
16	1302141J01	ESCUTCHEON, Side
17	3605096R01	KNOB, Keylock
18	1302140J01	ESCUTCHEON, Bottom
19	1502136J01	HOUSING, Charging Contact
20	5502147J01	KEYLOCK
21	0105951N79	ASSEMBLY, Knob Volume
22	1505067R01	HOUSING, U-Connect
23	3902135J02	CONTACT, U-Connect (13 req'd)
24	3902137J01	CONTACT, Charging (8 req'd)
25	3902137J02	CONTACT, Charging (4 req'd)
26	0102701J90	HEADER ,Flex Assembly (includes items 5 &23
27	3802138J01	PIN, Cap (4 req'd)
28	1505068R01	HOUSING, Pocket
29	4102155J01	SPRING, Helical Ext. (2 req'd)
30	0102701J38	ASSEMBLY, Flex Dislay
31	0702151J01	BRACKET, Housing Top
32	1302142J01	ESCUTCHEON, Top
33	3002301J04	CABLE, Flat Volume

NOTE: For part number, see electrical parts list.



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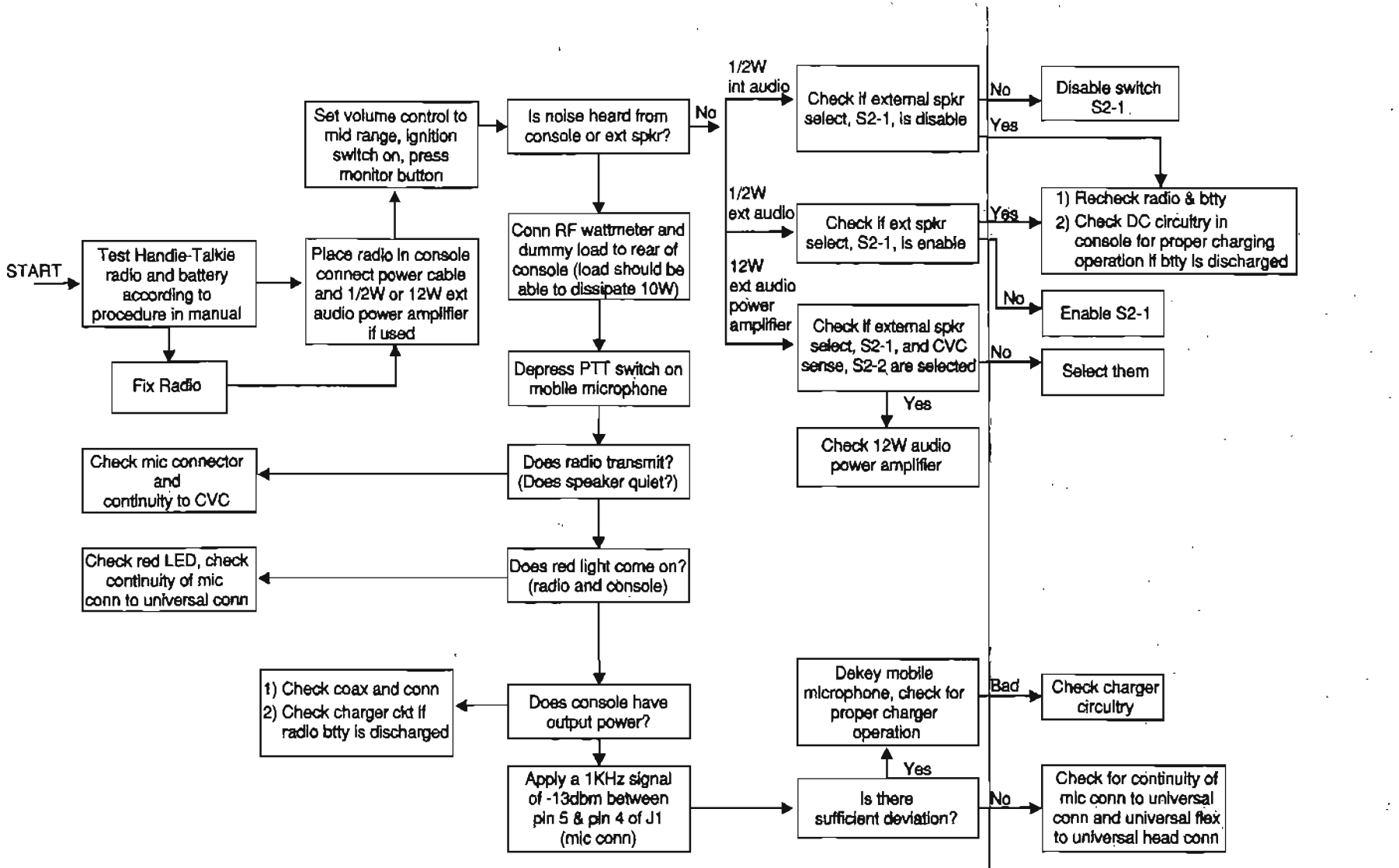
EXPLODED VIEW DIAGRAM AND PARTS LIST



TROUBLESHOOTING CHART

ELECTRICAL PARTS LIST

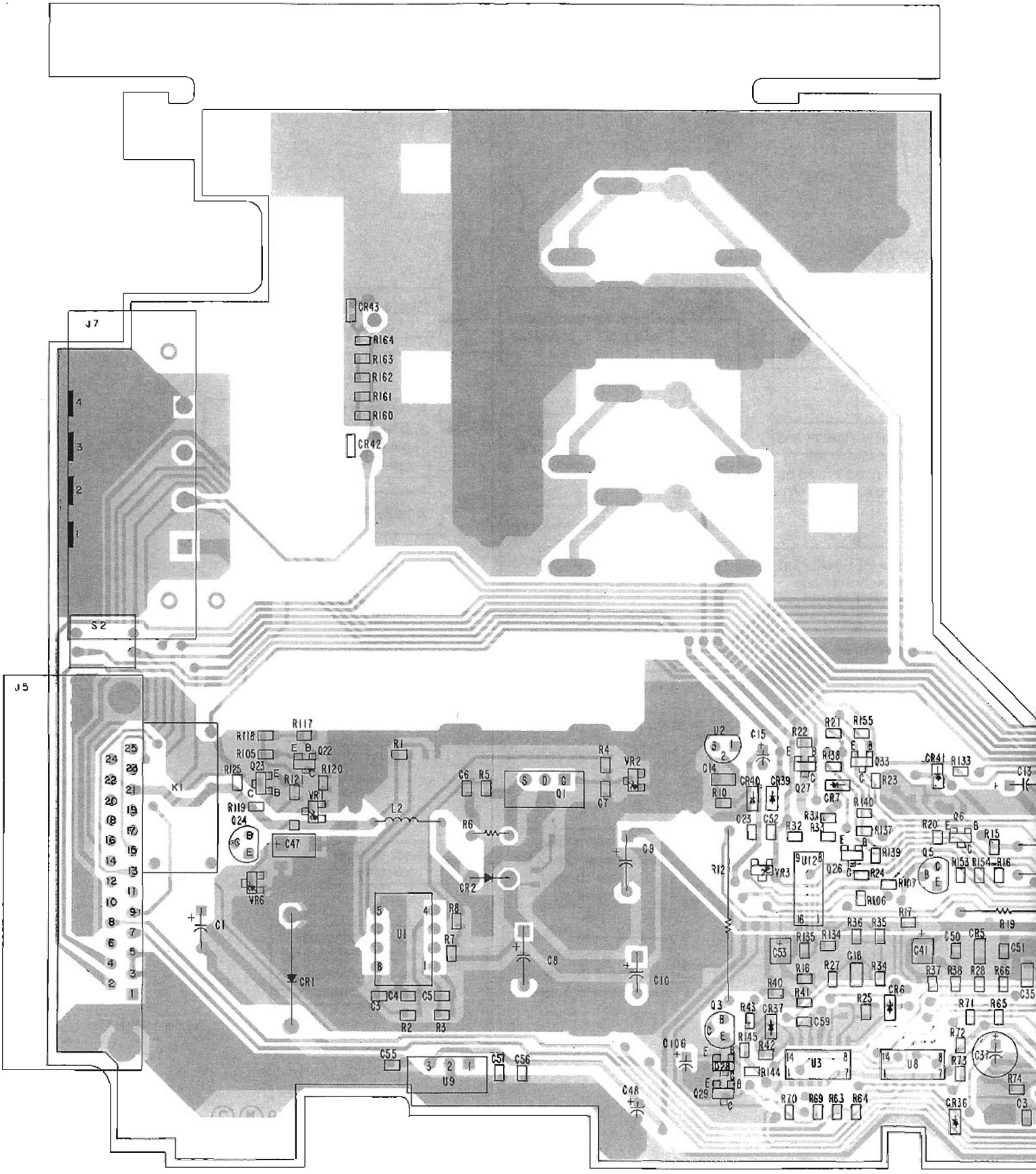
TPLF-3815-O

REFERENCE SYMBOL	MOTOROLA PART NUMBER	DESCRIPTION
		CAPACITOR, Fixed:
C1	2360561M71	470±20%;50V
C2	----------	Not Used
C3	2160521G37	0.1uF +80 -20%; 25V
C4	2113741A29	2200pF± 5%; 25V
C5	2113741A49	15nF± 5%; 25V
C6	2160521A11	680pF± 5%; 25V
C7	2113741A21	1000pF±10%; 25V
C8, 9	2302159J03	1500uF±20%; 25V
C10	2302159J02	560uF±20%; 35V
C11, 12	----------	Not Used
C13	2360561M70	470uF±20%; 35V
C14	2362998D59	1uF±10%; 20V Tant.
C15	2369561M23	22uF±20%; 16V
C16	2113740A67	330pF±5%; 50V
C17	----------	Not Used
C18	2160521H39	0.15uF+80-20%; 25V
C19 thru 22	----------	Not Used
C23, 24	2113740A67	330pF±5%
C25	2362998D74	4.7uF±10%; 16V
C26 thru 30	----------	Not Used
C31	2113740A53	82pF±5%; 50V
C32	2362998D74	4.7uF±10%; 16V
C33, 34	----------	Not Used
C35	2362998D59	1uF±10%; 20V
C36	----------	Not Used
C37	2360561M44	100uF±20%;16V
C38	2362998D74	4.7uF±10%; 16V
C39, 40	----------	Not Used
C41	2362998D74	4.7uF±10%; 16V
C42 thru 46	----------	Not Used
C47	2305600P22	2.2uF; Tant.
C48	2360561M23	22uF±20%; 16V
C49	----------	Not Used
C50	2113740A67	330pF±5%; 50V
C51, 52	2113740A53	82pF±5%; 50V
C53	2362998D74	4.7uF±10%; 16V
C54	2360561M23	22uF±20%; 16V
C55, 56	2113741A45	.01uF
C57 thru 61	2113740A67	330pF±5%; 50V
C100	2113741A45	.01uF
C101	2113740A53	82pF±5%; 50V
C102	----------	Not Used
C103	2362998D59	1uF±10%; 20V
C104, 105	2362998D74	4.7uF±10%; 16V
C106	2360561M23	22uF±20%; 16V
		DIODE: See Note
CR1	4880236E07	Transient Suppressor, MR2525L
CR2	4802197J07	Fast Recovery, MUR405
CR3,4	4805746G16	Tape and Reel, IN5391
CR5 thru 7	4805494Q04	Rectifier
CR26	4805494Q04	Rectifier
CR27	4805005R01	Hot Carrier, BAT49
CR28	4880051M01	LED, Red
CR29	4880051M02	LED, Green
CR30	4880051M01	LED, Red
CR31	----------	Not Used
CR32	4805494Q04	Rectifier
CR33	----------	Not Used
CR34 thru 37	4805494Q04	Rectifier
CR38	----------	Not Used
CR39 thru 41	4805494Q04	Rectifier
CR42, 43	4805729G29	LED, Green
		JACK:
J1, 2	----------	Not Used
J3	0902178J01	Connector, ZIFLOK
J4	0902167J01	Connector, Modular
J5	0902178J01	Connector, ZIFLOK
J6	0950113D01	Connector, DB25
J7	0902176J01	Connector, Modular
		RELAY:
K1	8002161J01	9 V
		INDUCTOR:
L1	2405452C08	Choke
L2	2502162J01	100uH
L3	2482723H27	Choke
L4 thru 10	2405452C08	Choke
		TRANSISTOR, See Note
Q1	4802197J08	MOSFET, IRF521
Q2	4805708G09	PNP, TIP32A
Q3	4805474G42	NPN, 945P
Q4	4805474G41	PNP, LP733
Q5	4805474G43	NPN, MPS650
Q6	4805128M62	NPN, SMBT-1001
Q7 thru 9	----------	Not Used
Q10	4805128M67	PNP, MMBT-3906
Q11,12	4805128M62	NPN, SMBT-1001
Q13	4805128M67	PNP, MMBT-390
Q14 thru 19	----------	Not Used
Q20,21	4805128M62	NPN, SMBT-1001
Q22	4805128M67	PNP, MMBT-3906
Q23	4805128M62	NPN, SMBT-1001
Q24	4805474G42	NPN, 945P
Q25 thru 27	4805128M62	NPN, SMBT-1001
Q28	4805128M67	PNP, MMBT-3906
Q29, 30	4805128M62	NPN, SMBT-1001
Q31	4805128M67	PNP, MMBT-3906
Q32,33	4805128M62	NPN, SMBT-1001
		RESISTOR, Fixed: Q±5%; 1/8W unless stated
R1	0660078A01	10
R2	0660076E78	16k ±1%
R3	0660076B01	100k
R4	0660076A33	220
R5	0660078A53	1.5k
R6	1760471A03	0.47; 2W
R7	0660076E69	6.8k±1%
R8	0660076E51	1.2k±1%
R9	----------	Not Used
R10	0660076A01	10
R11	0660076A56	2k
R12	1760471A01	430;2W
R13	0660076A65	4.7k
R14	0660075L49	1k;1/2W
R15,16	0660076A01	10
R17	0660076E95	82k
R18	0660076F25	1Meg ±1%
R19	1702166J01	1±1%;2W
R20	0660076A53	1.5k
R21,22	0660076A73	10k
R23	0660076A65	4.7k
R24	0660076A37	330
R25	----------	Not Used
R26	0660076E95	82k
R27	0660076F25	1Meg ±1%
R28	0660076A73	10k
R29,30	----------	Not Used
R31	0660076A56	2k
R32	0660076A73	10k
R33	0660076A89	47k
R34	0660076A65	4.7k
R35	0660076E69	6.8k±1%
R36	0660076A42	510
R37,38	0660076F01	100k±1%
R39	----------	Not Used
R40	0660076F03	120k±1%
R41	0660076A78	13k
R42	0660076A81	22k
R43	0660076A89	47k
R44	----------	Not Used
R45,46	0660076E77	15k±1%
R47	0660076E81	22k±1%
R48	0660076B25	1Meg
R49	0660076A73	10k
R50	0660076E78	16k ±1%
R51	0660076E66	5.1k±1%
R52	0660076B25	1Meg
R53	0660076E80	20k ±1%
R54	0660076E61	3.3k±1%
R55	0660076B25	1Meg
R56 thru 58	0660076A73	10k
R59	0660076B01	100k
R60	0660076B08	200k
R61	0660076A73	10k
R62	----------	Not Used
R63	0660076A85	33k
R64	0660076A89	47k
R65	0660076B25	1Meg

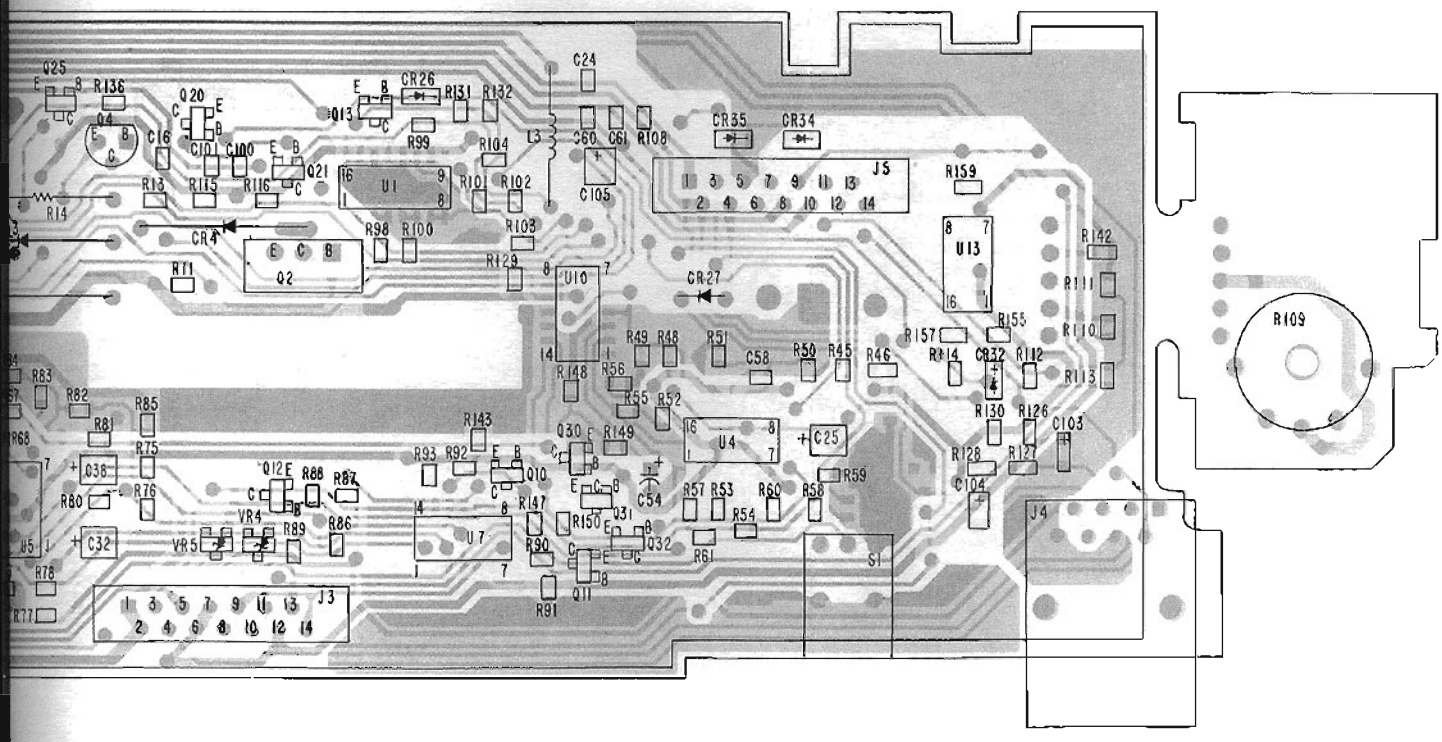
R66	0660076B17	470k
R67	0660076B01	100k
R68	0660076E77	15k±1%
R69	0660076F03	120k±1%
R70	0660076F08	200k±1%
R71	0660076B18	510k
R72	0660076F01	100k±1%
R73,74	0660076A73	10k
R75	0660076B07	180k
R76	0660076B01	100k
R77	0660076B05	150k
R78	0660076A73	10k
R79	0660076A85	33k
R80	0660076B08	200k
R81	0660076B25	1Meg
R82	0660076A67	5.6k
R83	0660076A49	1k
R84	0660076A67	5.6k
R85	0660076A73	10k
R86	0660076A85	33k
R87	0660076A73	10k
R88	0660076A61	3.3k
R89,90	0660076A37	330
R91	0660076A89	47k
R92	0660076A81	22k
R93	0660076B01	100k
R94 thru 97	----------	Not Used
R98	0660076A75	12k
R99	0660076A89	47k
R100	0660076A62	3.6k
R101	0660076A89	47k
R102	0660076A73	10k
R103	0660076A89	47k
R104	0660076A73	10k
R105	0660076A65	4.7k
R106	0660076A89	47k
R107	0660076A73	10k
R108	0660076A89	47k
R109	1805100Q03	Pot; 25k
R110	0660076A49	1k
R111	0660076A73	10k
R112,113	0660076A49	1k
R114	0660076A90	51k
R115	0660076A81	22k
R116	0660076A49	1k
R117	0660076B01	100k
R118	0660076A79	16k
R119	0660076A89	47k
R120	0660076A73	10k
R121	0660076A25	100
R122 thru 124	----------	Not Used
R125	0660076A79	16k
R126	0660076A71	8.2k
R127	0660076A29	150
R128	0660076A31	180
R129	0660076A89	47k
R130	0660076A81	22k
R131	0660076A56	2k
R132,133	0660076A73	10k
R134	0660076A56	2k
R135,136	0660076A89	47k
R137	0660076A49	1k
R138,139	0660076A79	16k
R140	0660076A37	330
R141	----------	Not Used
R142	0660076A35	270
R143	0660076A73	10k
R144	0660076A89	47k
R145	0660076B01	100k
R146	----------	Not Used
R147	0660076A89	47k
R148,149	0660076A73	10k
R150	0660076A79	16k
R152	----------	Not Used
R153,154	0660076A01	10
R155	0660076A79	16k
R156	0660076B01	100k
R157	0660076A79	16k
R158	----------	Not Used
R159	0660076A73	10k
R160 thru 164	0660076A27	120
		SWITCH:
S1	4005088P01	PAC•RT
S2	4002164J01	DIP

		CIRCUIT MODULE: See Note
U1	5102198J29	PWM ; UC2843A
U2	5105469E49	Voltage Reg. 12V; LM340LA
U3	5102198J28	Quad OP Amp; LM2902D
U4, 5	5102198J19	Quad LM2901D
U6	----------	Not Used
U7,8	5102198J20	Diode Array
U9	5102198J26	Voltage Reg. 5V
U10	5102198J20	Diode Array
U11,12	5102198J18	Quad; MMPQ3904
U13	5102198J19	Quad LM2901D
		DIODE: See Note
VR1	4805129M37	Zener; 10V
VR2,3	4805129M61	Zener; 18V
VR4,5	4805129M25	Zener; 5.1V
VR6	4811058B05	Zener; 30V
NONREFERENCED ITEMS		
	0180743T91	ASSY, Mic. Bracket
	0200115123	NUT, Mounting 10-32 Hex
	0300139498	SCREW, Mounting 10-32x5/8" Hex
	0300139913	SCREW, Mounting 8-18x1/2"
	2982044J02	LUG, Ignition
	2982607B05	LUG, Battery
	3700081057	GROMMET, Rubber
	4200893647	CLAMP, S-hook
	4210217A04	STRAP, Tie
	3005442T02	CABLE, Power

NOTE: For optimum performance, order replacement diodes and transistors by Motorola part number only.

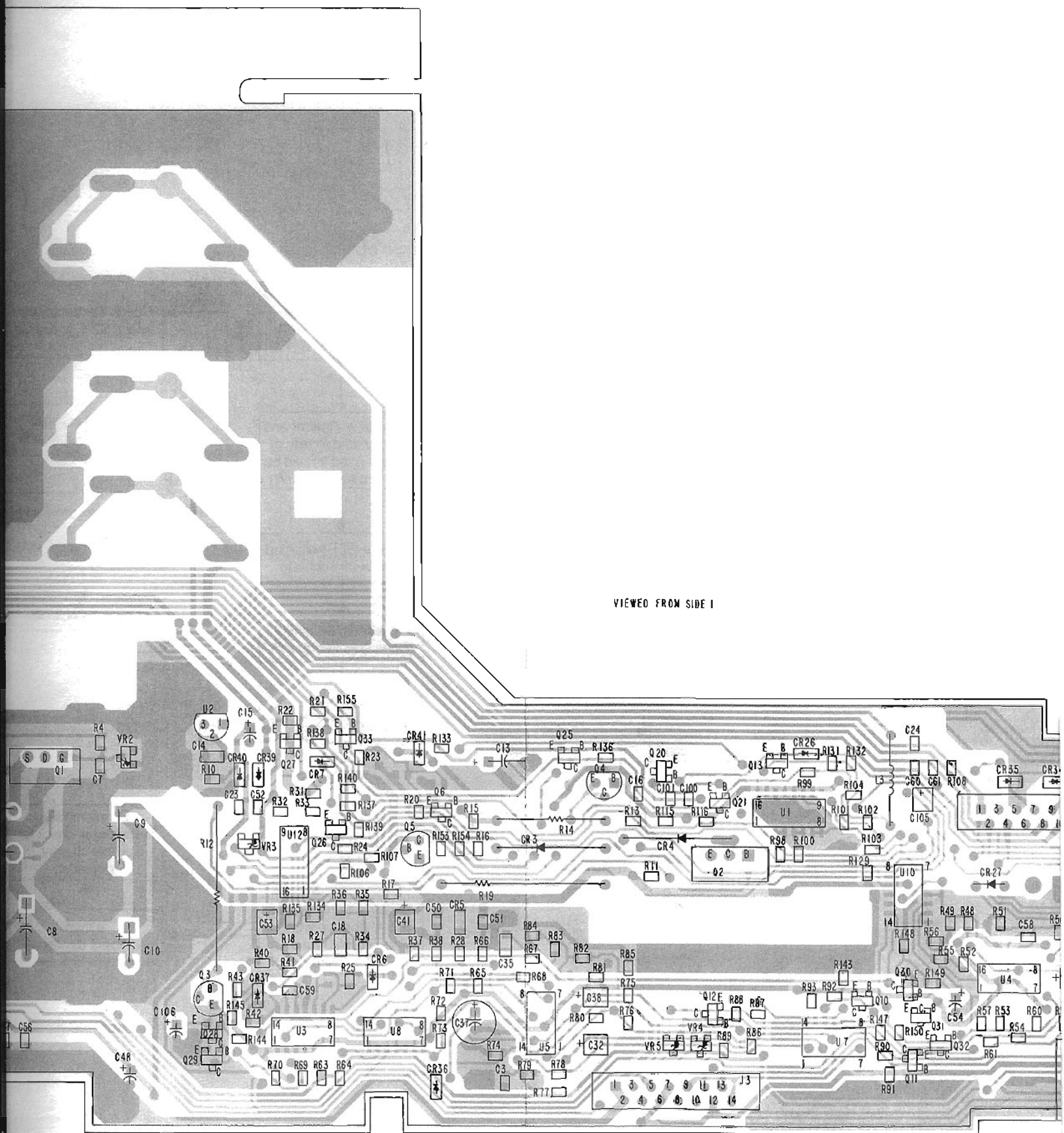

J7
J5
S2
K1
CR43
R164
R163
R162
R161
R160
CR42
R117
R118
R105
R125
Q22
Q23
R120
R121
VR7
R119
Q24
C47
VR6
C1
CR1
L2
R1
C6
R5
Q1
R4
VR2
C7
R6
CR2
C9
U1
R8
R7
C8
C10
C4
C5
C3
R2
R3
C55
U9
C57
C56
C48
U2
C15
C14
R10
R22
R21
R155
R138
Q33
R23
CR41
R133
C13
CR40
CR39
Q27
CR7
R140
Q23
C52
R32
R31
R3
R137
R139
R20
R6
R15
Q5
R153
R154
R16
VR3
U12
Q26
R24
R107
R106
R12
R17
R19
R36
R35
R135
R134
C53
C41
C50
CR5
C51
R16
R27
C18
R34
R37
R38
R28
R66
C35
R40
R41
R25
CR6
Q3
R43
CR37
C59
R71
R65
R72
C106
R145
R42
R144
U3
U8
C37
R73
R74
Q28
Q29
R70
R69
R63
R64
CR36
C3

VIEWED FROM SIDE 1



OL-DEPF-20011-0

16 **CIRCUIT BOARD COMPONENT LAYOUT DIAGRAM**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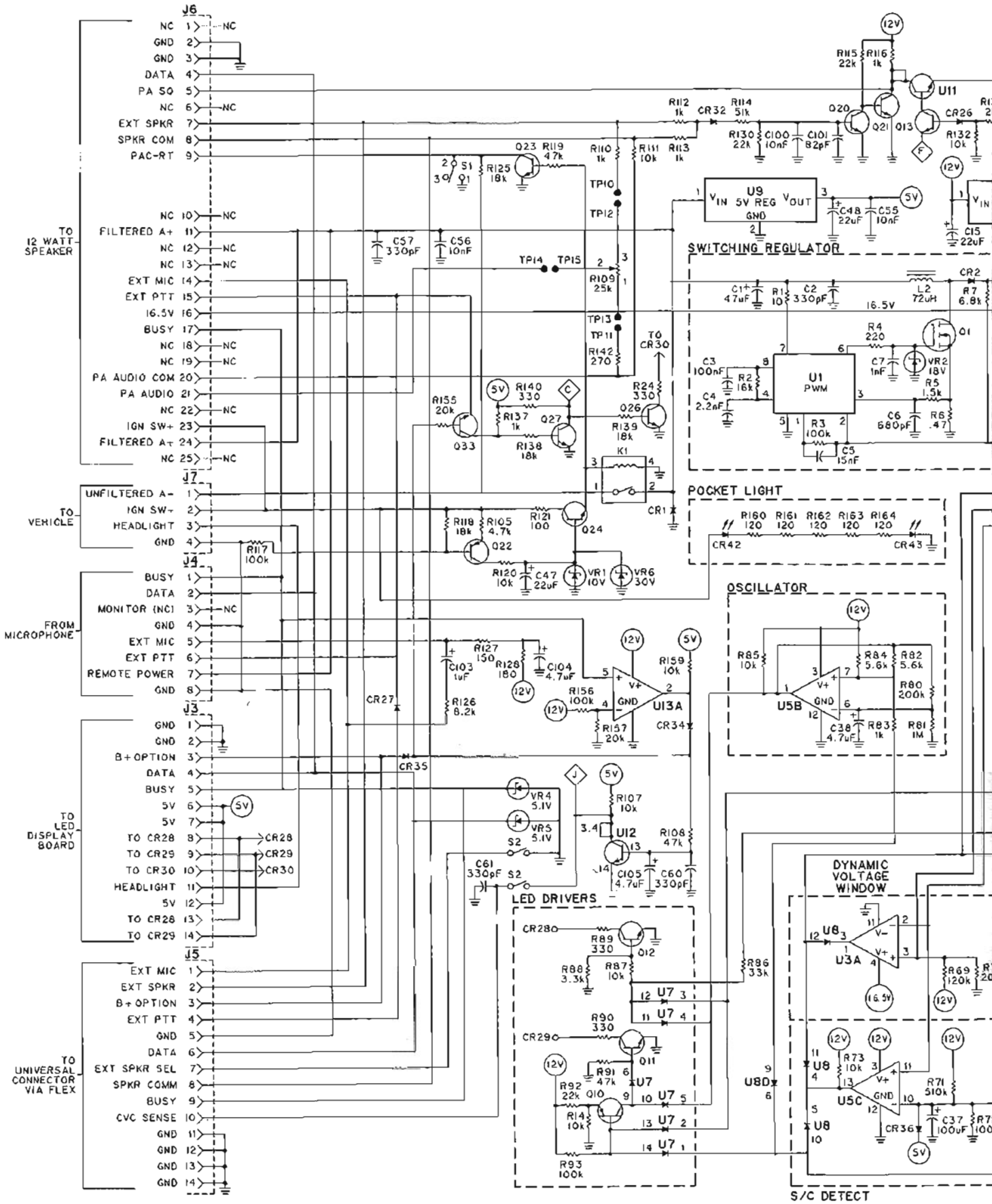
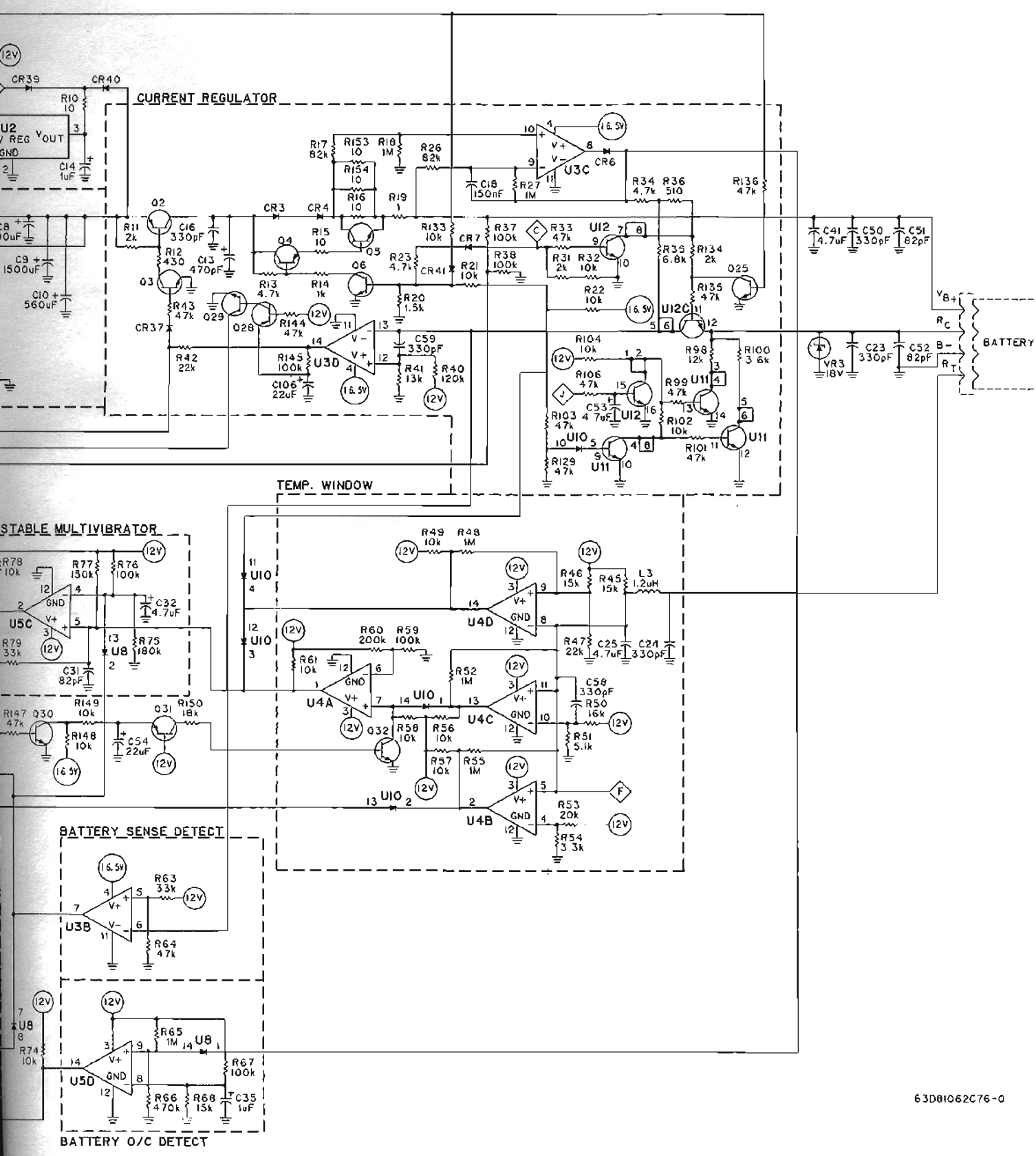
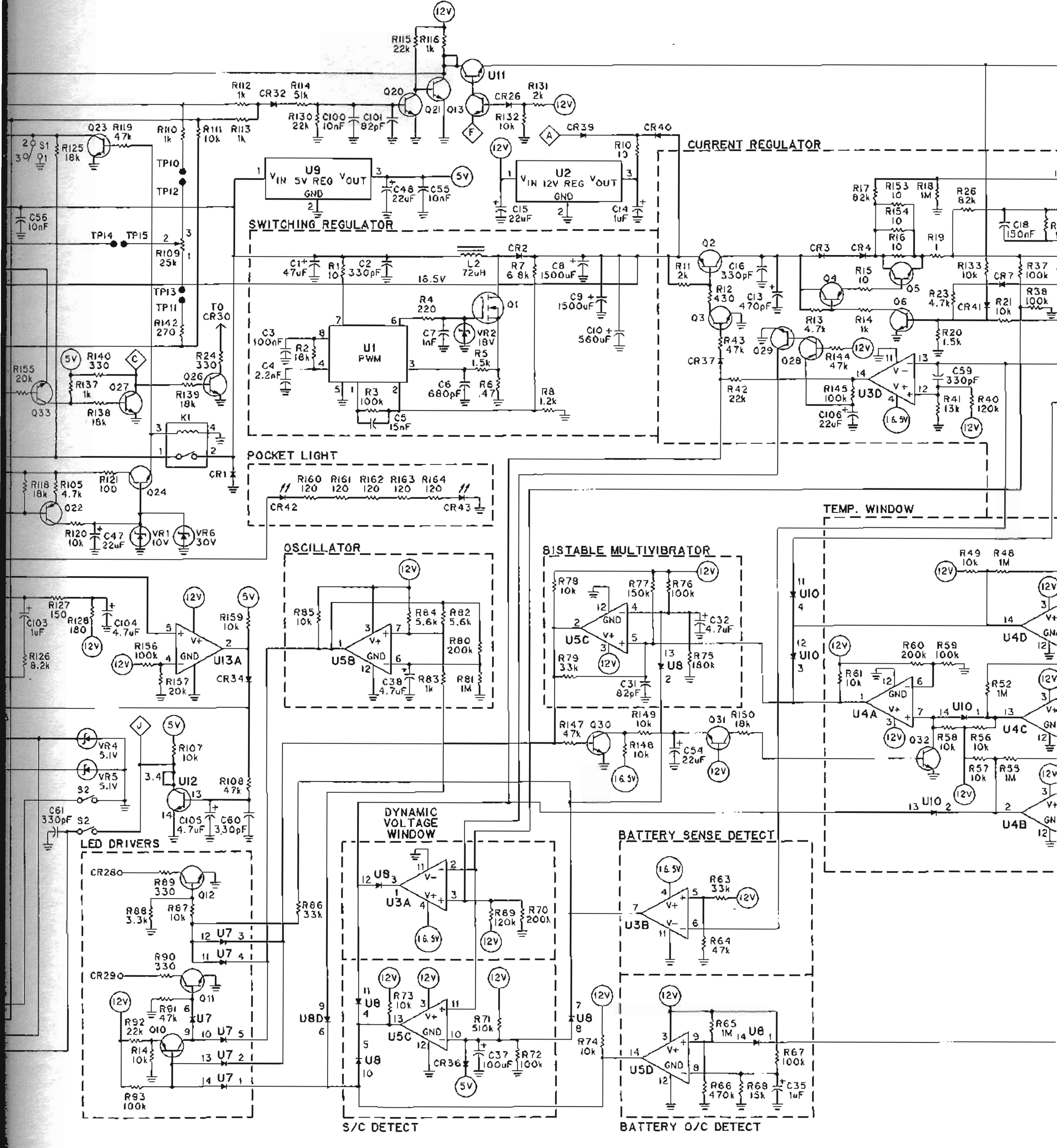

J6
NC 1
GND 2
GND 3
DATA 4
PA SQ 5
NC 6
EXT SPKR 7
SPKR COM 8
PAC-RT 9
NC 10
FILTERED A+ 11
NC 12
NC 13
EXT MIC 14
EXT PTT 15
16.5V 16
BUSY 17
NC 18
NC 19
PA AUDIO COM 20
PA AUDIO 21
NC 22
IGN SW+ 23
FILTERED A+ 24
NC 25
TO 12 WATT SPEAKER
J7
UNFILTERED A- 1
IGN SW+ 2
HEADLIGHT 3
GND 4
TO VEHICLE
J4
BUSY 1
DATA 2
MONITOR (NC) 3
GND 4
EXT MIC 5
EXT PTT 6
REMOTE POWER 7
GND 8
FROM MICROPHONE
J3
GND 1
GND 2
B+ OPTION 3
DATA 4
BUSY 5
5V 6
5V 7
TO CR28 8
TO CR29 9
TO CR30 10
HEADLIGHT 11
5V 12
TO CR28 13
TO CR29 14
TO LED DISPLAY BOARD
J5
EXT MIC 1
EXT SPKR 2
B+ OPTION 3
EXT PTT 4
GND 5
DATA 6
EXT SPKR SEL 7
SPKR COMM 8
BUSY 9
CVC SENSE 10
GND 11
GND 12
GND 13
GND 14
TO UNIVERSAL CONNECTOR VIA FLEX
SWITCHING REGULATOR
U9 5V REG
U1 PWM
POCKET LIGHT
OSCILLATOR
U5B
U13A
U12
LED DRIVERS
DYNAMIC VOLTAGE WINDOW
U3A
U8D
U5C
S/C DETECT


CURRENT REGULATOR
TEMP. WINDOW
STABLE MULTIVIBRATOR
BATTERY SENSE DETECT
BATTERY O/C DETECT
BATTERY
63D81062C76-O



CURRENT REGULATOR
SWITCHING REGULATOR
POCKET LIGHT
OSCILLATOR
BISTABLE MULTIVIBRATOR
TEMP. WINDOW
DYNAMIC VOLTAGE WINDOW
BATTERY SENSE DETECT
LED DRIVERS
S/C DETECT
BATTERY O/C DETECT
U9 VIN 5V REG VOUT GND
U2 VIN 12V REG VOUT GND
U1 PWM
U11
U13A
U12
U5B
U5C
U8
U3A
U3B
U3D
U5D
U4A
U4B
U4C
U4D
U10
U7
K1
L2 72uH
R115 22k
R116 1k
R112 1k
CR32
R114 51k
R131 2k
CR26
R132 10k
CR39
CR40
R130 22k
C100 10nF
C101 82pF
Q20
Q21
Q13
Q23
R119 47k
R110 1k
R111 10k
R113 1k
R125 18k
S1
TP10
TP12
TP14
TP15
TP13
TP11
R109 25k
R142 270
C56 10nF
C48 22uF
C55 10nF
C15 22uF
C14 1uF
R10 10
C1 47uF
R1 10
C2 330pF
16.5V
CR2
R7 6.8k
C8 1500uF
C9 1500uF
C10 560uF
R4 220
Q1
C7 1nF
VR2 18V
R5 1.5k
R6 .47
C6 680pF
R8 1.2k
C3 100nF
R2 18k
C4 2.2nF
R3 100k
C5 15nF
Q2
R11 2k
R12 430
Q3
R43 47k
CR37
R42 22k
C16 330pF
C13 470pF
Q29
Q28
R144 47k
R145 100k
C106 22uF
CR3
CR4
R15 10
R16 10
R154 10
R153 10
R17 82k
R18 1M
R26 82k
C18 150nF
R19 1
Q4
Q5
Q6
R13 4.7k
R14 1k
R23 4.7k
CR41
R133 10k
CR7
R37 100k
R21 10k
R38 100k
R20 1.5k
C59 330pF
R41 13k
R40 120k
R155 20k
R140 330
R137 1k
Q27
R138 18k
Q33
Q26
R24 330
R139 18k
TO CR30
CR1
R118 18k
R105 4.7k
R121 100
Q24
Q22
R120 10k
C47 22uF
VR1 10V
VR6 30V
R160 120
R161 120
R162 120
R163 120
R164 120
CR42
CR43
R85 10k
R84 5.6k
R82 5.6k
R80 200k
C38 4.7uF
R83 1k
R81 1M
R127 150
R128 180
C103 1uF
C104 4.7uF
R126 8.2k
R156 100k
R157 20k
R159 10k
CR34
R78 10k
R77 150k
R76 100k
C32 4.7uF
R79 33k
C31 82pF
R75 180k
R147 47k
Q30
R149 10k
R148 10k
C54 22uF
Q31
R150 18k
R49 10k
R48 1M
R60 200k
R59 100k
R61 10k
R52 1M
R58 10k
R56 10k
R57 10k
R55 1M
Q32
VR4 5.1V
VR5 5.1V
S2
C61 330pF
R107 10k
R108 47k
C105 4.7uF
C60 330pF
CR28
R89 330
Q12
R88 3.3k
R87 10k
R86 33k
R90 330
CR29
Q11
R91 47k
R92 22k
Q10
R14 10k
R93 100k
R69 120k
R70 200k
R73 10k
R71 510k
C37 100uF
R72 100k
CR36
R63 33k
R64 47k
R74 10k
R65 1M
R67 100k
R66 470k
R68 15k
C35 1uF

for
Manual No. 68P81062C75-0
MT1000™ Vehicular Adapter

This revision outlines changes that have occurred since the printing of your manual. Use this information to supplement your manual. Installation of these changes in earlier equipment is not necessary except as recommended in Motorola Service and Repair Notes (SRN's).

REVISION DETAILS

NO	CHANGE AFFECTS	ITEM NO.	SUFFIX
1	General Information	- - - - -	- - - - -

CHANGES

NO

1 On page i **RELATED PUBLICATIONS AVAILABLE SEPARATELY**, add the following manuals:

MTX800™ Service Manual.....68P81049C70
MTX800 Theory/Maintenance Manual.....68P81049C65
MTX900™ Service Manual.....68P81054C45
MTX900 Theory/Maintenance Manual.....68P81054C40

On page ii **MODEL OPTION CHART**, replace with Model Option Chart listed below.

MODEL NUMBER			DESCRIPTION
NTN1048A			Basic Package
	NTN1050A		Enhanced Package
		ITEM NO.	DESCRIPTION
X		NTN5612A	Charging Console (Basic)
	X	NTN5613A	Charging Console (Enhanced)
X	X	NSN6054A	12-Watt Speaker
X	X	NTN5489A	Speaker Adapter
X	X	HMN1035A	Palm Mobile Microphone
A	A	HMN1037A	DTMF Palm Microphone
A	A	HMN1056A	Mini Mobile Microphone
O	O	HMN3013A	DTMF Palm Microphone (Timed Tones)
A	A	TAD6111A	Antenna, 1/4 Wave Rooftop (136-144 MHz)
A	A	TAD6112A	Antenna, 1/4 Wave Rooftop (144-152 MHz)
A	A	TAD6113A	Antenna, 1/4 Wave Rooftop (152-162 MHz)
A	A	TAD6114A	Antenna, 1/4 Wave Rooftop (162-174 MHz)
A	A	RAE4012ARB	Antenna, 5dB Gain Rooftop (406-420 MHz)
A	A	RAE4014ARB	Antenna, 5dB Gain Rooftop (445-470 MHz)
A	A	RAE4015ARB	Antenna, 5dB Gain Rooftop (470-494 MHz)
A	A	RAE4016ARB	Antenna, 5dB Gain Rooftop (494-512 MHz)
A		RAF4001ARG	Antenna, Rooftop (806-866 MHz)
A		RRA4936A	Antenna, Rooftop (890-960 MHz)

KEY X = ITEM INCLUDED
A = ALTERNATE ITEM
O = OPTIONAL

MAEPF-20088-A

NQ

1 On page 1. 1. GENERAL first paragraph, add the following sentences after the first sentence. The words "no external hookup" means the radio has no rf in/out connections at the accessory connector which makes the MVA rear antenna connector not applicable for this radio. For MTX800 radios, operation is obtained by connecting the rooftop antenna coaxial cable end to an adapter (supplied with antenna kit RAF4001ARG). The adapter should be substituted for the radio antennna before the radio is loaded into the MVA.

On page 1.1. GENERAL, third paragraph, change the following sentence to read: The vehicular adapter's external antenna is connected to the radio, and the radio's internal antenna is disconnected. For MTX800 radios, the radio's internal antenna is not disconnected.

On page 1. 4. MOBILE MICROPHONE, add the following paragraph:

Three different types are available; the HMN1035A palm microphone is shipped standard with each vehicular adapter while all the others are optional.

Of the three types of microphones, DTMF palm microphones (HMN1037A and HMN3013A) are unique because they have an internal tone level adjustment that must be set during installation.

CAUTION

To obtain optimum performance, use only one assigned radio per vehicle equipped with a DTMF microphone. Use of several radios per DTMF microphone is not recommended. A compromise microphone tone level setting is required to accommodate slight radio differences and a degraded telephone interconnect performance may result.

On page 3. 3. MICROPHONE BRACKET INSTALLATION third paragraph, add the following sentence: Because the procedure for setting tone levels for trunked radios is more complex than conventional radios, follow the DTMF adjustment procdure as follows:

For adjusting the DTMF microphone tone level (trunked radios), perform the following steps:

a. Remove the portable radio from the MVA.

b. Turn the radio on and enter it in the "air test" ' condition (temporary short between accessory connector terminals 5 and 6).

c. Select a test frequency (quick key the radio's PTT button to frequency 2), speaker beeps equal frequency number.

NOTE

Connect the radio to a service monitor monitoring the deviation at the transmit frequencies. Refer to the following chart for the test frequency combination.

MTX800 Radio	MTX900 Radio
824.9875MHz	901.9875MHz

d. Select the modulation mode (quick key either of the radio's side buttons) speaker beeps equal mode number. Refer to the following chart for the modulation mode.

MTX800 Radio	MTX900 Radio
Mode 1	Mode 6
No Connect Tone	No Connect Tone
	Hear Clear ON

e. Insert the radio into the pocket of the MVA and turn the vehicle's ignition to the ON position.

f. Using the Service Monitor, set it to the radio transmit frequency, monitor deviation and press the # key on the DTMF microphone (the radio will show Tx LED from an automatic mic PTT). Note the deviation.

g. If necessary, adjust the microphone's internal adjustment to the deviation values shown as follows:

MTX800	MTX900
3.3kHz	1.75kHz

NOTE

* To exit the "air test " mode, turn the power to the radio **OFF**.

On page 2 f. **Battery Connections** change last sentence to read: For best results, connect the positive lead (red) directly to the positive terminal and the negative lead (black) to the chassis.

On page 8 top of page, replace existing chart with the following:

BATTERY CAPACITY	RC Ω	CHARGING CURRENT (mA) RAPID WITH RADIO		CHARGING CURRENT (mA) TRICKLE WITH RADIO	
		ON	OFF	ON	OFF
Medium	5.6k	320	250	130	62
High	3.3k	430	360	160	90

On page 8 **g. Oscillator**, change next to last sentence to read: The output of the oscillator flips back and forth and turns the green and red LED's on and off.

On page 8 **h. Battery (O/C) Open Circuit Detector**, change last sentence to read: This low output turns the oscillator on, triggering the green and red LED's which causes them to flash.

On page 9 **i. Shorted Cells and Short Circuit Detect** first paragraph, change last sentence to read: This circuit also activates the oscillator that flashes the green and red LED's.

On page 9 **k. Radio ON/OFF Sensing Circuitry**, change third sentence to read:
When the radio is on, B+ voltage (J5 pin 3) and Busy (J5 pin 9) go high.

On page 9 **l. Microphone and Audio PA Interface** first paragraph, change the sixth sentence to read: For best results, the HT600 or MTX800 radio should be adjusted to 3/4 maximum volume when placed into the console.

On page 9 **l. Microphone and Audio PA Interface**, change chart to read as follows:

METHOD	S2A POSITION	S2B POSITION
12W AUDIO	DOWN	DOWN
RADIO AUDIO	UP	UP

On page 12 **d.Console Disassembly** step (l), change sentence to read as follows:
To remove the volume pot board, unsnap it from the bottom housing by lifting the two catches.

On page 14 **h. Soldering**, change any reference of SVA to read: MVA.

On page 15 **TROUBLESHOOTING CHART**, add the following information to your chart:
Depress PTT switch on mobile microphone. Does radio transmit? The MTX radio PTT switch path closure only occurs when proper conditions are met in communication with the base site controller (signal strength, proper ID, available repeater, etc.). For best results using the flow chart tests, the radio should be placed in the "air test" mode.**

** See the applicable service manual for details.

On page 15 **TROUBLESHOOTING CHART**, delete the following information from your chart:
1/2 W ext audio Check if ext spkr select, S2-1 is enable yes/no Enable S2-1.