MOBILE RADIO

MAINTENANCE MANUAL

VEHICULAR CHARGER MODELS 4EP72A10, 4EP72A11, 4EP72C10 & 4EP72C11 (Options 4451 thru 4459)

SPECIFICATIONS *

VEHICULAR CHARGER

Model Numbers						
4EP72A10, 4EP72C10	12-Volt, Negative Ground					
4EP72A11, 4EP72C11	12-, 24-, 32-, 48- and 72-Volts ± Ground					
Used With	PE Model Two-Way Radios					
Current Drain	12-Volt Neg. Gnd.	12-Volt + Gnd.	24-Volt ± Gnd.	32-Volt ± Gnd.	48-Volt ± Gnd.	72-Volt ± Gnd.
Standard Battery						
Charging	100 mA	275 mA	180 mA	200 mA	130 mA	142 mA
Not Charging	25 mA	190 mA	110 mA	150 mA	110 mA	120 mA
Charging Current	50 mA	80 mA	80 mA	60 mA	60 mA	60 mA
Trickle-Charge Current	25 mA	40 mA	40 mA	40 mA	40 mA	40 mA
Light Duty Battery						
Charging	70 mA	215 mA	140 mA	175 mA	120 mA	130 mA
Not Charging	25 mA	190 mA	110 mA	150 mA	110 mA	120 mA
Charging Current	30 mA	30 mA	30 mA	30 mA	30 mA	30 mA
Trickle-Charge Current	10 mA	10 mA	10 mA	10 mA	10 mA	10 mA
Maximum Charge Time						
100% Charge	16 hours					
70% Charge	6 hours					
Temperature Range	+5°C to +45°C (+41°F to 113°F)					

SPEAKER-AMPLIFIER

Audio Power Output	10 Watts
Audio Input	500 Milliwatts
Power Drain	
Standby	80 milliamperes
Full Power	1.5 amperes maximum
Input Voltage	±12 Volts

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

EP-72A & EP-72C

GENERAL ELECTRIC

TABLE OF CONTENTS

OPTIONS

Option Number	Description
4451	12-Volt, Negative Ground Charger
4452	12-Volt, ± Ground Charger
4453	24-Volt, ± Ground Charger
4454	36-Volt, ± Ground Charger
4455	48-Volt, ± Ground Charger
4456	72-Volt, ± Ground Charger
4457	1/2-Watt, 8-OHM Speaker Model 4EZ16A22
4458	12-Volt, Negative-Ground Charger, Microphone Model 4EM25E10 and 1/2-Watt Speaker Model 4EZ16A22
4459	12-Volt, Negative-Ground Charger, Microphone Model 4EM25E10 and 10-Watt Speaker-Amplifier Model 4EZ18A13

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

General Electric Vehicular Charger Models 4EP72A10 and 4EP72A11 are used for mounting MASTR PE Model Two-Way Radios in a vehicle so that the radio can be used as a mobile unit while recharging the battery. The vehicular charger will recharge the nickel-cadmium battery pack in 16 hours or less.

The charger is equipped with a circuit that prevents the battery from overcharging. When the battery is charged to approximately 70% of capacity, the circuit switches to trickle charge for the remainder of the charging time. When not used the radio can be left on trickle charge indefinitely without damage to the battery.

Placing the radio into the charger automatically connects the radio to the external antenna, microphone, Push-To-Talk, speaker and charging contacts. No external connections to the radio are required.

PE vehicular charger 4EP72C10&11 is electrically identical to vehicular charger 4EP72A10&11. The 4EP72C10 is used in 12 Volt negative ground applications only and the 4EP72C11 is used in 12 Volt positive or negative ground applications. Mechanically, the 4EP72C10&11 has an improved locking mechanism using a press button release rather than the lever release used in the 4EP72A10&11.

Any 500 mAh battery pack 19D413522G1 shipped before November 14, 1975 must be modified to be recharged in the 4EP72C10&11 (see Table of Contents).

INSTALLATION

CHARGER

When installing the charger, speaker and microphone in a vehicle, select mounting locations that will prevent injury to the occupants in case of an accident.

Install the charger where it will be within convenient reach of the operator, and where it will not interfere with the safe operation of the vehicle. The charger is normally mounted on the underside of the instrument panel.

To mount the charger:

1. Use the mounting bracket as a template and drill the two pilot holes with a #29 (9/64-inch) drill.
2. Attach the bracket to the mounting surface with the #10 x 5/8-inch self-tapping screws and lockwashers provided.
3. Mount the charger in the mounting bracket with the four machine screws and lockwashers provided.
4. Connect the Red fused lead to battery plus, and the Black fused lead to battery negative. Leave sufficient slack so that the charger may be pulled out of its case for servicing with the power applied.

SPEAKER

Mount the speaker where it will direct sound to the operator but not interfere with his vision, and the safe operation of the vehicle. In exposed locations or areas of high humidity, mount the speaker so that moisture will not accumulate in the speaker cone.

The universal mounting bracket enables the speaker to be mounted on the top or bottom of the instrument panel, on the firewall above the windshield in trucks, or behind the speaker grille in some vehicles.

To mount the speaker:

1. Use the mounting bracket as a template and drill three mounting holes with a #29 (9/64-inch) drill.
2. Attach the bracket to the mounting surface with the #10 x 5/8-inch self-tapping screws supplied with the unit.
3. Attach the speaker to the mounting bracket and connect the speaker plug to the speaker jack on the back of the charger.

MICROPHONE

Mount the microphone where it will be within easy reach of the operator but will not interfere with the safe operation of the vehicle.

To mount the microphone:

1. Use the microphone bracket as a template and drill two mounting holes with a #32 (1/8-inch) drill.
2. Attach the bracket to the mounting surface with the two #8 x 1/2" screws provided.
3. Connect the microphone plug to the jack on the front of the charger.

ANTENNA

Installation instructions for the antenna are packaged with the antenna. The antenna must be installed in accordance with good engineering practice for optimum results.

OPERATION

To use the vehicular charger, place the radio into the charging insert with the speaker facing down. Then press the radio in against the bottom of the charging insert (see Figure 1). Next, lock the charger to secure the radio. This also assures good contact with the external accessory pins during periods of severe vibration.

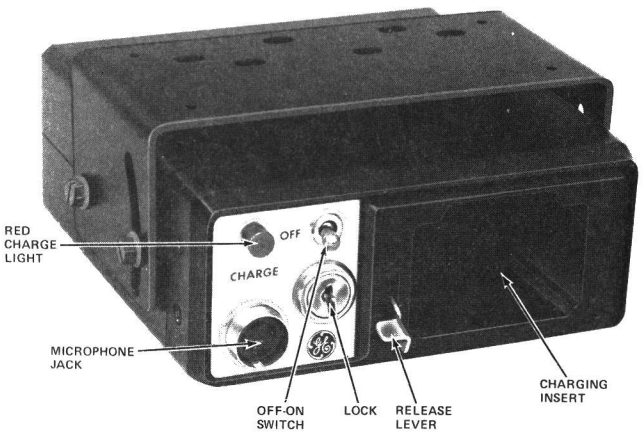


Figure 1 - Vehicular Charger Layout

Turn the OFF-ON switch to the ON position. The red CHARGE light will glow until the battery is charged up to approximately 70% of capacity. The CHARGE light does not glow while the charger is on trickle-charge. When using an external speaker, set the speaker output for a comfortable listening level with the VOLUME control on the radio.

The charger is shipped with an external antenna for sending and receiving messages in the vehicle. The charge rate is sufficient to permit the radio to be operated on a 5% transmit, 10% receive and 85% standby duty cycle while maintaining the battery charge.

To remove the radio from the charger, unlock the charger, press down on the release lever and pull the radio out of the charging insert.

NOTE

Due to the temperature characteristics of nickel-cadmium batteries, the batteries will not accept a full charge at temperature extremes. For maximum capacity, recharge the battery pack at a temperature of from 65° to 85° F whenever possible.

CIRCUIT ANALYSIS

VEHICULAR CHARGERS

Both of the vehicular chargers are equipped with an OFF-ON switch, red CHARGE light, charging circuit, lock and fused power leads. Charger Model 4EP72A11 is also equipped with a DC-to-DC converter to permit operation in positive and negative ground vehicle systems. Modifications required for positive or negative ground, 12-Volt through 72-Volt operation are listed in the Maintenance section of this manual.

References to symbol numbers mentioned in the following text can be found on the Schematic Diagram, Outline Diagram and Parts List (see Table of Contents).

DC-to-DC Converter

Transistors Q1 and Q2 and transformer T1 on charger board A502 operate as a conventional inductively-coupled DC-to-DC converter. Placing S501 in the ON position applies the supply voltage to the collectors of Q1 and Q2 through the primary windings of T1.

Q1 and Q2 act as switches, with one conducting while the other is off. Due to the inherent differences in the transistors, one will start conducting before the other when power is applied to their emitters.

Assume that Q1 starts to conduct first, causing current to flow through one half of the primary winding of T1. The induced voltage in the feedback winding of T1 is coupled to the base of Q1, further increasing collector current. Regenerative action continues until the primary of T1 is saturated. When saturation is reached, there is no increase of collector current and no voltage is induced in the feedback winding. The magnetic field starts to collapse, sending a current through the transformer in the opposite direction. This reverses the polarity of the induced voltage in the feedback winding which cuts off Q1 and provides a forward bias for Q2 causing it to conduct. The two transistors continue to conduct alternately at a frequency of approximately 4000 Hz.

The AC Voltage developed across the secondary windings of T1 is rectified by CR1 through CR4 and applied to the charging circuit.

Charging Circuit

Placing a radio into the charger causes Q5 to conduct, applying the charging current to the battery. When Q5 conducts, Q4 and Q3 also conduct, turning on CHARGE light DS501.

Charging current for the Standard battery pack is applied through contacts E502 and E503. Charging current for the Light Duty battery pack is applied through contact E502 only. Contact E501 provides the ground connection.

While the battery is being charged at the high rate (Q5 conducting), Q8 is off, Q7 is on and Q6 is off. The charge current is limited by R11 and R12. When the battery charges up to approximately 70% of capacity, the voltage developed across the voltage reference circuitry (VR3, CR10, CR11, R21, R22 and R23) turns on Q8. This turns off Q7 and turns on Q6. Turning on Q6 removes the base bias to Q5, turning it off. Turning off Q5 also turns off Q4, Q3 and CHARGE light DS501. This "latching" action is assisted by the positive feedback through R14.

Diodes CR7, CR8 and CR9 prevent the battery from discharging into the charging circuit if power is removed from the charger.

When Q8 is on, Q7 is off and Q6 is on, and the circuit is "latched" in the trickle charge mode, the trickle-charge current is limited by R19 and R20. The charger remains on trickle charge until the battery is removed from the charger or until the transmitter is keyed.

The setting of potentiometer R22 determines the voltage level that causes the charger to switch to the trickle-charge mode. Complete instructions for setting R22 are contained in the Adjustment section.

Removing the battery from the charger turns on Q8 and activates the reset circuit consisting of VR2, R15, R17, R18 and C3. When the battery is removed, the voltage at the cathode of zener diode VR2 rises to approximately 14 Volts, breaking down VR2. Even with Q8 conducting, the voltage at the junction of R15 and R18 is sufficient (over 0.7 Volt) to charge up C3 and turn on Q7. This turns off Q6 and applies base bias to Q5, re-setting the "latching" portion of the charging circuit.

Placing a battery (or radio) into the charger turns off Q8 and removes the breakdown voltage to VR2. However, capacitor C3 keeps Q7 on (and Q6 off) momentarily so that Q5 immediately starts conducting to re-start the charging cycle.

Keying the microphone grounds the base of Q6 through diode CR14, turning Q6 off. This causes Q5 to conduct, re-starting the charging cycle at the high charge rate.

Audio Amplifier

Receiver audio at contact E504 is coupled through C7 to the base of impedance-matching transistor Q9. The output of Q9 is applied to a complimentary amplifier (Q10 and Q11) and then applied to the external speaker.

SPEAKER-AMPLIFIER

Speaker-Amplifier Model 4EZ18A13 is designed for operation in 12-Volt Systems only.

Audio from the charger is coupled through transformer T1 to the base of the Class B, push-pull amplifier transistors Q1 and Q2. Base bias is provided by resistors R4, R5, R8, R9 and RT1. Thermistor RT1 and resistor R4 form a parallel compensating network which stabalizes the emitter current of Q1 and Q2 under varying temperature conditions.

The output taken from the emitters of Q1 and Q2 is coupled through impedance matching auto-transformer T2 to speaker LS2.

ADJUSTMENT

Potentiometer R22 is adjusted at the factory. However, if either VR3, CR10, CR11, R21, R22, R23 or Q8 is replaced, it is recommended that R22 be re-adjusted.

PREFERRED METHOD

Calibrator Model 4EX10A10 is designed for use with the vehicular charger for properly setting R22.

Set R22 as follows:

1. Remove the charging housing as directed in the Disassembly Procedure.
2. Connect positive charging terminals E502 and E503 together.
3. Connect a clip lead from the red jack on the calibrator to positive charger terminal E503. Then connect a clip lead from the black jack on the calibrator to negative charger terminal E501.
4. Place the calibrator switch in Position C.
5. Rotate R22 until the CHARGE light turns on (if necessary). Then carefully adjust R22 until the CHARGE light <u>just</u> turns off.

ALTERNATE METHOD

This alternate method of adjusting R22 may be used if Calibrator Model 4EX10A10 is not available. This procedure requires a DC-VTVM that is accurate to .02 Volts, and a <u>fully charged</u> battery pack.

CAUTION

Failure to adjust potentiometer R22 to within .02-Volt may result in an insufficient charge or damage to the battery.

Set R22 as follows·

1. Connect positive charging terminals E502 and E503 together.
2. Connect the positive meter lead to positive charging terminal E503, and the negative meter lead to negative charging terminal E501.
3. Place the battery into the charger. If necessary, rotate R22 until the CHARGE light turns on. Then turn R22 until the light just turns off.
4. Remove and then replace the battery pack in the charger. Note the meter reading at which the CHARGE light turns off. If reading is not 8.45 Volts, adjust R22 slightly.
5. Repeat Step 4 until the CHARGE light turns off when the meter reads 8.45 Volts.

MAINTENANCE

CHARGER

To gain access to the charger circuitry for servicing, remove the four Phillips-head screws in the rear of the housing and slide the charger out of the housing.

To remove A501/A502 for servicing, remove the Phillips-head screws in each corner of the board. Next, remove the CHARGE light from its holder and carefully lift the board out of the chassis.

To replace the CHARGE light; remove the two screws in each side of the front casting then pull off the casting.

SPEAKER-AMPLIFIER

To gain access to the speaker-amplifier circuitry, remove the two screws on each side of the speaker case. Then lift off the front section of the speaker housing.

TROUBLESHOOTING

Should a difficult service problem arise, the Troubleshooting Procedure listed in the Table of Contents is provided to assist the serviceman. The procedure includes DC voltage readings of the transistor stages in the charge, trickle-charge and reset mode, and voltage readings for the converter circuit.

CHARGER VOLTAGE CHANGES

The following circuit changes must be performed when changing the 4EP72A11 for 12-, 24-, 48- and 72-Volt, positive or negative ground operation. Refer to the Outline and Schematic Diagrams for the location of components changed (see Table of Contents).

12-Volt Operation

1. Connect a jumper from H9 to H11, and from H14 to H16 on charger board A501.
2. If present, remove dropping resistor R1, R2 or R3 (located under the shield on the back of the charger housing) and connect a jumper from TB1-1 to TB2-1.

24-Volt Operation

1. Connect a jumper from H9 to H10, and from H15 to H16 on charger board A501.
2. If present, remove dropping resistor R1, R2 or R3 (located under the shield on the back of the charger housing) and connect a jumper from TB1-1 to TB2-1.

36-Volt Operation

1. Connect a jumper from H9 to H10, and from H15 to H16 on charger board A502.
2. If present, remove the jumper connected from TB1-1 to TB2-1.
3. Mount dropping resistor R1 (40 ohms, 10 Watts) as shown on the Outline Diagram. Connect one lead to TB1-1 and the other lead to TB2-1. Sleeve the leads before connecting.
4. Mount the protective shield (19B216774P1) over R1

48-Volt Operation

1. Connect a jumper from H9 to H10, and from H15 to H16 on charger board A501.
2. If present, remove the jumper connected from TB1-1 to TB2-1.
3. Mount dropping resistor R2 (100 ohms,

10 Watts) as shown on the Outline Diagram. Connect one lead to TB1-1 and the other lead to TB201. Sleeve the leads before connecting.

4. Mount the protective shield (19B216774P1) over R2.

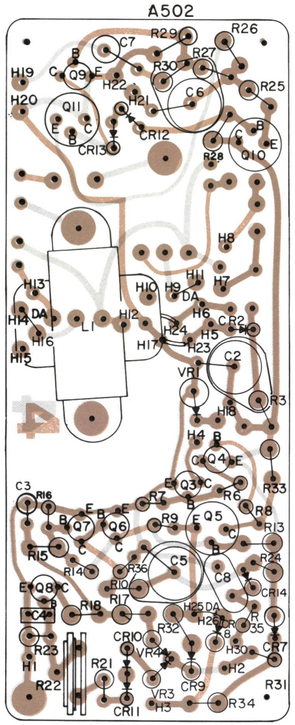
72-Volt Operation

1. Connect a jumper from H9 to H10, and from H15 to H16 on charger board A501.

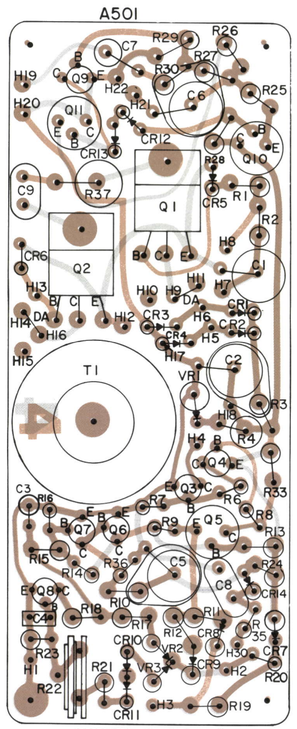
2. If present, remove the jumper connected from TB1-1 to TB2-1.

3. Mount dropping resistor R3 (250 ohms, 20 Watts) as shown on the Outline Diagram. Connect one lead to TB1-1 and the other to TB2-1. Sleeve the leads before connecting.

4. Mount the protective shield (19B216774P1) over R3.



(19C317610, Sh. 1, Rev. 4)
(19C317610, Sh. 2, Rev. 4)



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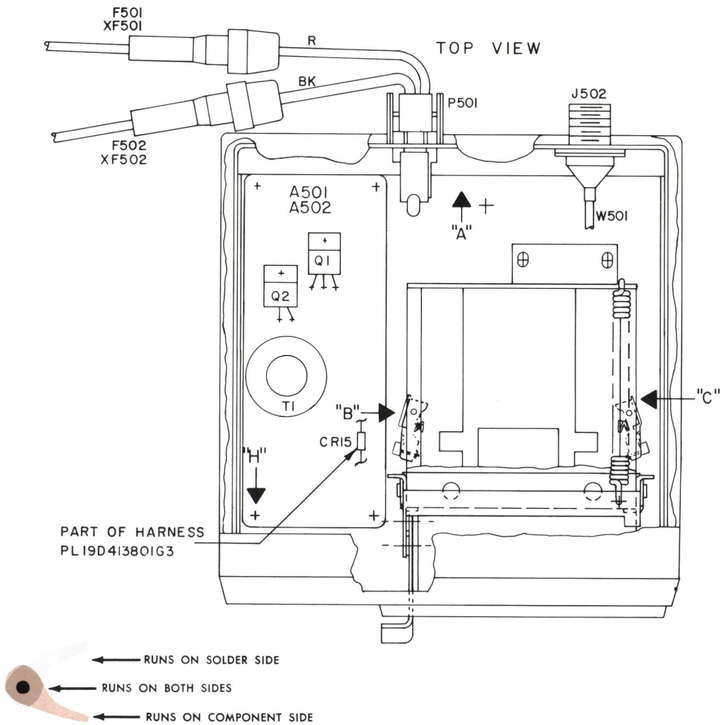
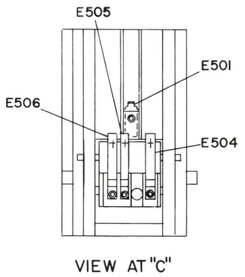
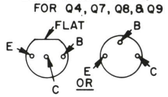
(19C317610, Sh. 2, Rev. 4)



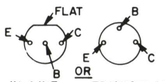


VIEW AT "C"

LEAD IDENTIFICATION
FOR Q4, Q7, Q8, & Q9

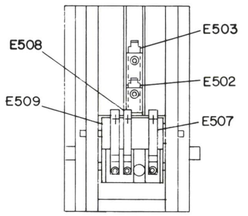


LEAD IDENTIFICATION
FOR Q3, Q5, Q6, Q10 & Q11

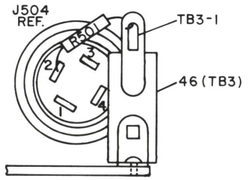


IN-LINE TRIANGULAR
VIEW FROM LEAD END

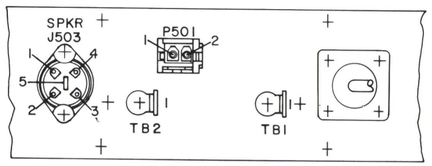
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



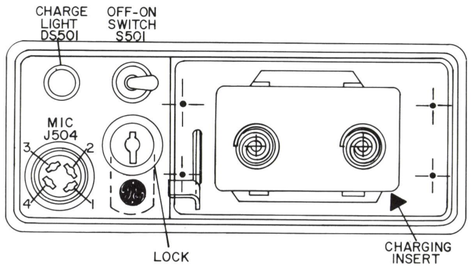
VIEW AT "B"



VIEW AT "H"

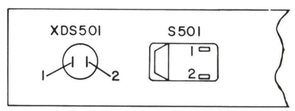


VIEW AT "A"



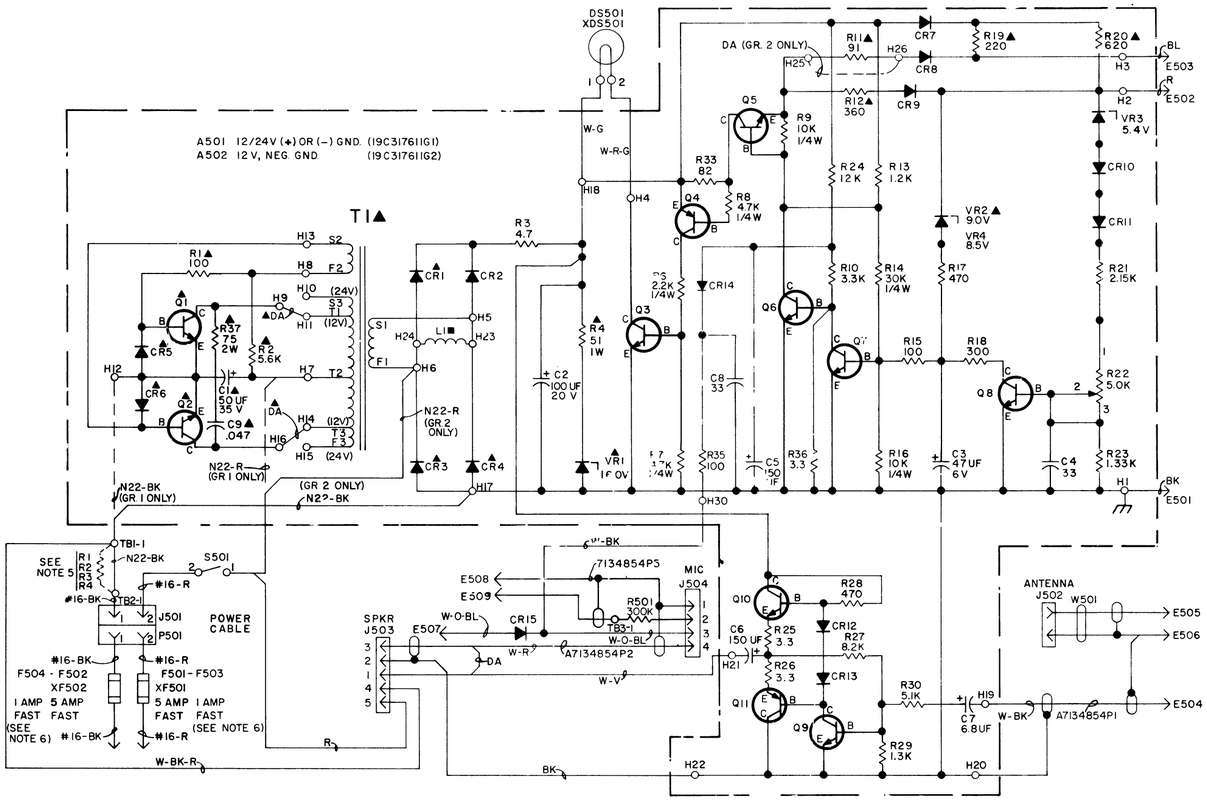
(19D416273, Rev. 12)

TERMINAL VIEW



OUTLINE DIAGRAM

VEHICULAR CHARGER
MODELS 4EP72A10 & 11



NOTES:
1. ALL WIRES SF24 EXCEPT AS NOTED.
2. MODEL 4EP72A10: FOR 12V, NEG GND ONLY.
   MODEL 4EP72A11: FOR 12V THRU 72V ±GND.
3. COMPONENTS MARKED WITH ▲ ARE USED IN 4EP72A11 ONLY.
4. COMPONENT MARKED WITH ■ IS USED ON 4EP72A10 ONLY.
5. R1 (40Ω, 10W) USED FOR 36V OPERATION, R2 (100Ω, 10W) USED FOR 48V OPERATION, R3 (250Ω, 20W, USED FOR 72V OPERATION, R4 (20Ω, 7W) USED FOR 24V OPERATION. } THESE RESISTORS ARE PART OF MOD. KIT 19A128150G1, G2, G3, & G4, OPTIONS 1454, 4455, 4456, 4453
6. F503 AND F504 ARE USED FOR 24-72V OPTIONS AND ARE CONTAINED IN KIT 19A128150G1 4.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.	
THIS ELEM DIAG APPLIES TO	
MODEL NO.	REV. LETTER
4EP72A10	K
4EP72A11	K
19A128150G1	A
19A128150G2	A
19A128150G3	A
19A128150G4	A
4EP72C10	A
4EP72C11	A

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

(19D413833, Rev. 21)

SCHEMATIC DIAGRAM

VEHICULAR CHARGER
MODELS 4EP72A10 & 11

PARTS LIST

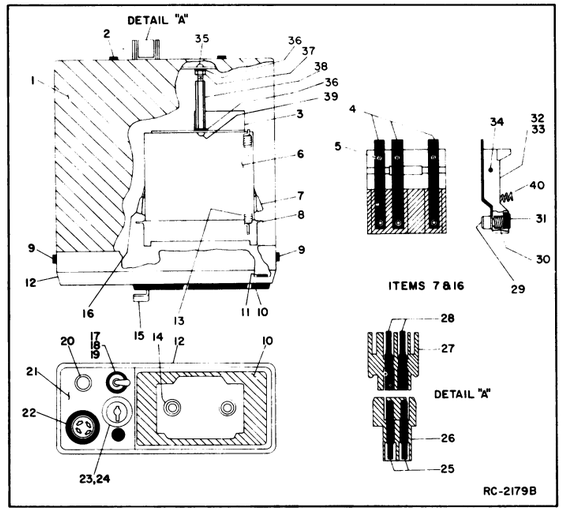
LBI4258J

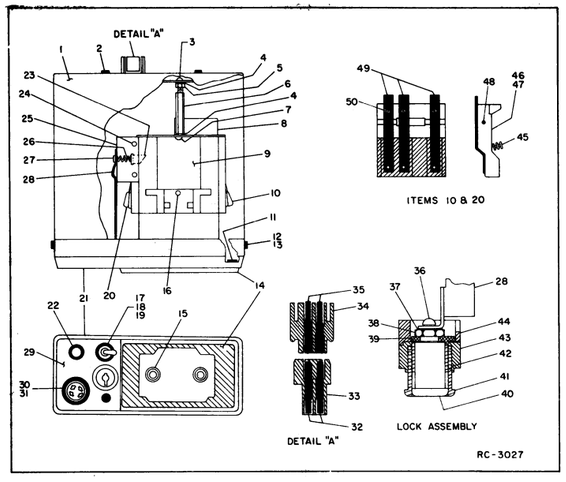
VEHICULAR CHARGER
4EP72A10 12 VOLT
4EP72A11 12/24 VOLT
4EP72C10 12 VOLT
4EP72C11 12/24 VOLT

SYMBOL	GE PART NO.	DESCRIPTION
A501 and A502		COMPONENT BOARD A501 19C317611G1 12/24 VOLT A502 19C317611G2 12 VOLT
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A115680P111	Electrolytic: 50 µf +150% -10%, 35 VDCW; sim to Mallory Type TTX.
C2	5496267P16	Tantalum: 100 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C3	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C4	19A116114P46	Ceramic: 33 pf ±10%, 100 VDCW; temp coef 0 PPM.
C5 and C6	5496267P112	Tantalum: 150 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C7	5496267P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C8*	5490008P15	Silver mica: 33 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15. Added by REV C.
C9*	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW. Added to 4EP72A11 by REV D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1* thru CR4*	4037822P1	Silicon, 1000 mA, 400 PIV.
		In REV H and earlier:
	5494922P1	Silicon.
CR5 thru CR13	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR14*	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV. Added by REV C.
		- - - - - - - - - - - INDUCTORS - - - - - - - -
L1*	19A115743P1	Reactor: 10.1 mh at .500 amp DC, 1.2 ohms DC res max, 24 VDC operating. Added by REV C.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A116118P2	Silicon, NPN.
Q3	19A115330P1	Silicon, NPN.
Q4	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q5	19A115300P2	Silicon, NPN; sim to Type 2N3053.
Q6	19A115330P1	Silicon, NPN.
Q7	19A115123P1	Silicon, NPN.
Q8	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q9	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q10	19A115300P4	Silicon, NPN.
Q11	19A115562P2	Silicon, PNP; sim to 2N2904A.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R2	3R77P562K	Composition: 5.6K ohms ±10%, 1/2 w.
R3	7147161P12	Composition: 4.7 ohms ±10%, 1/2 w.
R4	3R78P510J	Composition: 51 ohms ±5%, 1 w.
R6	3R152P222K	Composition: 2.2K ohms ±10%, 1/4 w.
R7 and R8	3R152P472J	Composition: 4.7K ohms ±5%, 1/4 w.
R9	3R152P103K	Composition: 10K ohms ±10%, 1/4 w.
R10	3R77P332J	Composition: 3.3K ohms ±5%, 1/2 w.
R11	3R77P910J	Composition: 91 ohms ±5%, 1/2 w.
R12	3R77P361J	Composition: 360 ohms ±5%, 1/2 w.
R13	3R77P122K	Composition: 1.2K ohms ±10%, 1/2 w.
R14	3R152P303J	Composition: 30K ohms ±5%, 1/4 w.
R15	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R16	3R152P103K	Composition: 10K ohms ±10%, 1/4 w.
R17	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R18	3R77P301J	Composition: 300 ohms ±5%, 1/2 w.
R19	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
R20	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R21	19A116278P233	Metal film: 2.15K ohms ±2%, 1/2 w.
R22	19B209358P105	Variable, carbon film: approx 200 to 5K ohms ±10%, 0.25 w; sim to CTS Type X-201.
R23	19A116278P213	Metal film: 1.33K ohms ±2%, 1/2 w.
R24	3R77P123J	Composition: 12K ohms ±5%, 1/2 w.
R25 and R26	7147161P15	Composition: 3.3 ohms ±5%, 1/2 w.
R27	3R77P822J	Composition: 8.2K ohms ±5%, 1/2 w.
R28	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R29	3R77P132J	Composition: 1.3K ohms ±5%, 1/2 w.
R30	3R77P512J	Composition: 5.1K ohms ±5%, 1/2 w.
R31	3R152P391J	Composition: 390 ohms ±5%, 1/4 w.
R32	3R77P131J	Composition: 130 ohms ±5%, 1/2 w.
R33	3R77P820J	Composition: 82 ohms ±5%, 1/2 w.
R34	3R77P131J	Composition: 130 ohms ±5%, 1/2 w.
R35*	3R152P101K	Composition: 100 ohms ±10%, 1/4 w. Added by REV C.
R36*	3R152P332K	Composition: 3.3K ohms ±10%, 1/4 w. Added by REV C.
R37*	3R79P750J	Composition: 75 ohms ±5%, 2 w. Added to 4EP72A11 by REV D.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T1	19C317251G1	Coil.
		- - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	19A115528P6	Zener, 1w, 16.0 v. nominal.
VR2	4036887P7	Zener: 500 mW, 9.0 v. nom.
VR3	4036887P5	Zener: 500 mW, 5.4 v. nom.
VR4	4036887P9	Zener: 500 mW, 8.5 v. nom.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR15	19A115100P1	Silicon; sim to Type 1N458A. Added by REV F.
		- - - - - - - INDICATING DEVICES - - - - - - - -
DS501	19A115825P1	Lamp, incandescent: 28 v; sim to Drake 2840.
		- - - - - - - - - TERMINALS - - - - - - - - -
E501 thru E503		Includes:
	19C327044P1	Contact.
	N136AP503C	Tap screw, phillips POZIDRIV: No. 2-32 x 3/16.
E504 thru E509		(See Mechanical Parts, item 4).
		- - - - - - - - - - - FUSES - - - - - - - - - - -
F501 and F502	1R16P8	Quick blowing: 5 amps at 250 v; sim to Littelfuse 312005 or Bussmann MTH-5.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J501		Includes:
	19A115884P5	Shell.
J501-1 and J501-2	19A115884P7	Connector: male contact; sim to AMP 60528-1.
J502		(Part of W501).
J503	5493018P1	Connector: 5-contact, molded black phenolic, steel mounting saddle; sim to Cinch Mfg Co. 203-41-05-081.
J504		Connector. Includes:
	19A116061P2	Receptacle: 4 female contacts; sim to Amphenol Type 91-PM4F-1000.
	19A116061P4	Lockwasher, internal tooth.
	19A122600P1	Nut, knurled.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P501		Includes:
	19A115884P6	Shell.
P501-1 and P501-2	19A115884P8	Connector: female contact; sim to AMP 60527-1.
		- - - - - - - - - RESISTORS - - - - - - - - -
R501*	3R77P304J	Composition: 300K ohms ±5%, 1/2 w.
		In REV C & earlier:
	3R77P473K	Composition: 47K ohms ±10%, 1/2 w. Added by REV A.
R502*	3R77P911K	Composition: 910 ohms ±10%, 1/2 w. Added by REV A. Deleted by REV D.
		- - - - - - - - - SWITCHES - - - - - - - - -
S501	5491899P5	Toggle: SPST, 3 amps at 250 VAC/VDC; sim to Cutler-Hammer 8280K15.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1 and TB2	7775500P44	Phen: 2 terminals.
TB3*	7775500P44	Phen: 2 terminals. Added by REV A.
		- - - - - - - - - - CABLES - - - - - - - - - -
W501	19A127521G3	RF Power Cable: approx 5 inches long. Includes (J502).
		- - - - - - - - - SOCKETS - - - - - - - - -
XF501 and XF502		POWER CABLE XF501 19A122111G1 XF502 19A122111G4
	19A115776P2	Fuseholder, 2 piece: sim to Bussmann Type HHJ.
	19A115776P3	Contact, electrical. (Located in fuseholder-Quantity 2).
	7491823P7	Terminal, solderless. (Optional terminal).
	7491823P8	Terminal, solderless. (Optional terminal).
	4029484P2	Contact, electrical. (Optional terminal).
		HARNESS ASSEMBLY 19D413801G3 (Includes CR15, J501, J503, J504, R501)
		4EP72A10, A11 MECHANICAL PARTS (SEE RC2179)
1	19A121891G2	Cover.
2	19B201074P304	Tap screw, Phillips POZIDRIV*: No. 6-32 x 1/4.
3	19A128022P1	Plate.
4	19B226199G1	Strap. (Part of E504-E509).
5	N136AP503C	Tap screw, phillips POZIDRIV: No. 2-32 x 3/16.
6	19C317465G1	Sleeve.
7	19A127860G2	Contact assembly. (Includes E504-E506, items 4, 5, 29-32, 34, 40).
8	19B219125G1	Support.
9	19B209209P706	Tap screw, Phillips Pozidriv*: No. 6-32 x 3/8.
10	19B226745P1	Collar insert.
11	19B201074P204	Tap screw, Phillips POZIDRIV*: No. 4-40 x 1/4.
12	19C317588G1	Casting.
13	19A130592P1	Spring, helical.
14	19A127392P1	Spring.
15	19A130499P1	Release lever.
16	19A127860G3	Contact assembly. (Includes E707-E709, items 4, 5, 29-31, 33, 34, 40).
17	4033394P1	Knurled nut: 15/32; sim to H.H. Smith 1197. (Used with S501).
18	7115130P11	Lockwasher: 15/32. (Used with S501).
19	7115195P2	Hex nut: 15/32. (Used with S501).
20	19B201122P4	lens, panel light: red; sim to Drake 121A604. (Used with DS501).
21	NP270354P1	Nameplate.
22	19A122600P1	Knurled nut: 13/16-27. (Used with J504).
23	5491682P16	Rim lock; sim to Yale and Towne Fs600P-X2, 90°CCW. (Used with item 24).
24	5491682P24	Cam. (Used with item 23).
25	19A115884P7	Contact: sim to AMP 60528-1. Quantity (2). (Part of J501).
26	19A115884P5	Shell, nylon; sim to AMP 1-480359-0. (Part of J501).
27	19A115884P6	Shell, nylon; sim to AMP 1-480360-0. (Part of P501).
28	19A115884P8	Contact: sim to AMP 60527-1. Quantity (2). (Part of P501).
29	19A130494P1	Nut.
30	19A127850P1	Spring.
31	19A130493P1	Plunger.
32	19A130036G1	Lever. (Part of item 7).
33	19C317457P3	Lever. (Part of item 16).
34	19A127849P1	Pin.
35	N80P13012C6	Screw, phillips: No. 6-32 x 3/4.
36	N404P13C6	Lockwasher, internal tooth: No. 6.
37	7141225P3	Hex nut: No. 6-32.
38	5491541P310	Spacer, hex: No. 6-32 x 1-1/2.
39	19B209209P706	Tap screw, Phillips Pozidriv*: No. 6-32 x 3/8.
40	4035235P10	Spring, helical.
		4EP72C10, C11 MECHANICAL PARTS (SEE RC3027)
1	19A121891G2	Cover.
2	19B201074P304	Tap screw, Phillips POZIDRIV*: No. 6-32 x 1/4.
3	N84P13012C6	Machine screw, phillips: No. 6-32 x 3/4.
4	N404P13C6	Lockwasher, internal tooth: No. 6.
5	7141225P3	Hex nut: No. 6-32.
6	5491541P310	Spacer, hex: No. 6-32 x 1-1/2.
7	19B209209P706	Tap screw, Phillips POZIDRIV*: No. 6-32 x 3/8.
8	19A128022P1	Plate.
9	19B226936G3	Sleeve.
10	19D424593P2	Lever.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
11	19B201074P204	Tap screw, Phillips POZIDRIV©: No. 4-40 x 1/4.
12	19B209209P706	Tap screw, Phillips Pozidriv©: No. 6-32 x 3/8.
13	7483709P8	Cinch nut: No. 6-32; sim to Penn CL-632-2.
14	19D413783P1	Collar insert.
15	19A127392P1	Spring.
16	19A116773P105	Tap screw, Phillips POZIDRIV©: No. 7-19 x 5/16.
17	4033394P1	Knurled nut: 15/32; sim to H.H. Smith 1197. (Used with S501).
18	7115130P11	Lockwasher: 15/32. (Used with S501).
19	7115195P2	Hex nut: 15/32. (Used with S501).
20	19D424593P1	Lever.
21	19C317588G1	Casting.
22	19B201122P4	Lens, panel light: red; sim to Drake 121A604. (Used with DS501).
23	19A137319P2	Latch.
24	N136P904C6	Tap screw: No. 4-24 x 1/4.
25	19B226895P1	Bracket.
26	19A130625P1	Spring.
27	19B226891P1	Screw: thd. size No. 4-40.
28	19B226840P2	Cam.
29	NP270354P2	Nameplate.
30	19A122600P1	Knurled nut: No. 13/16-27. (Used with J504).
31	19A116061P4	Lockwasher, internal tooth.
32	19A115884P7	Contact: sim to AMP 60528-1. (Quantity 2- Part of J501).
33	19A115884P5	Shell, nylon: sim to AMP 1-480359-0. (Part of J501).
34	19A115884P6	Shell, nylon: sim to AMP 1-480360-0. (Part of P501).
35	19A115884P8	Contact: sim to AMP 60527-1. (Quantity 2- Part of P501).
36	N910P18C6	Retaining ring.
37	5493361P5	Washer, spring tension: sim to Shakeproof 3502-18-35.
38	19B226889P1	Screw, hex head: No. 1/4-28 x 2-5/8 with 6-32 tap
39	19B226911P1	Cam.
40	5491682P25	Rim lock; sim to Yale & Towne Lock Co. F6501-P.
41	19C321643P1	Push button.
42	19A130622P1	Spring.
43	19B226880P1	Sleeve.
44	19B226886P1	Cap.
45	4035235P10	Spring, helical.
46	19A127849P1	Pin.
47	19B227847P1	Spring.
48	N136AP503C	Tap screw, phillips head: No. 2-32 x 3/16.
49	19A142590G1	Contact.





PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter," which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

4EP72A10 & 11

REV. A - To reduce transmitter audio input when using the external microphone. Added R501, R502 and TB3.

REV. B - To make PE Model and PR Model input cable assemblies interchangeable. Standardized positive and negative contacts on fused leads.

Rev. C - To eliminate alternator whine. Added L1 to Model 4EP72A10. To cause the charger to switch to the high charge rate when the microphone is keyed. Added C8, CR14, R35, R36 and connection from R35 to E507 in Models 4EP72A10 and 4EP72A11.

REV. D - To prevent failure of converter drive transistors and reduce whine transmitted by radio. Added C9 and R37.

REV. E - To add additional support for sleeve. Changed plate and Support.

REV. F - To prevent the low band PE from causing the charger to to in full charge condition when the ON/OFF switch is in the OFF position. Added CR15.

REV. G - To improve locking mechanism. Added spring loaded retaining block and kick-out springs to bottom plate.

REV. H - To improve alignment with front collar. Added joggle lever.

REV. J - To improve operation. Changed CR1 through CR4.

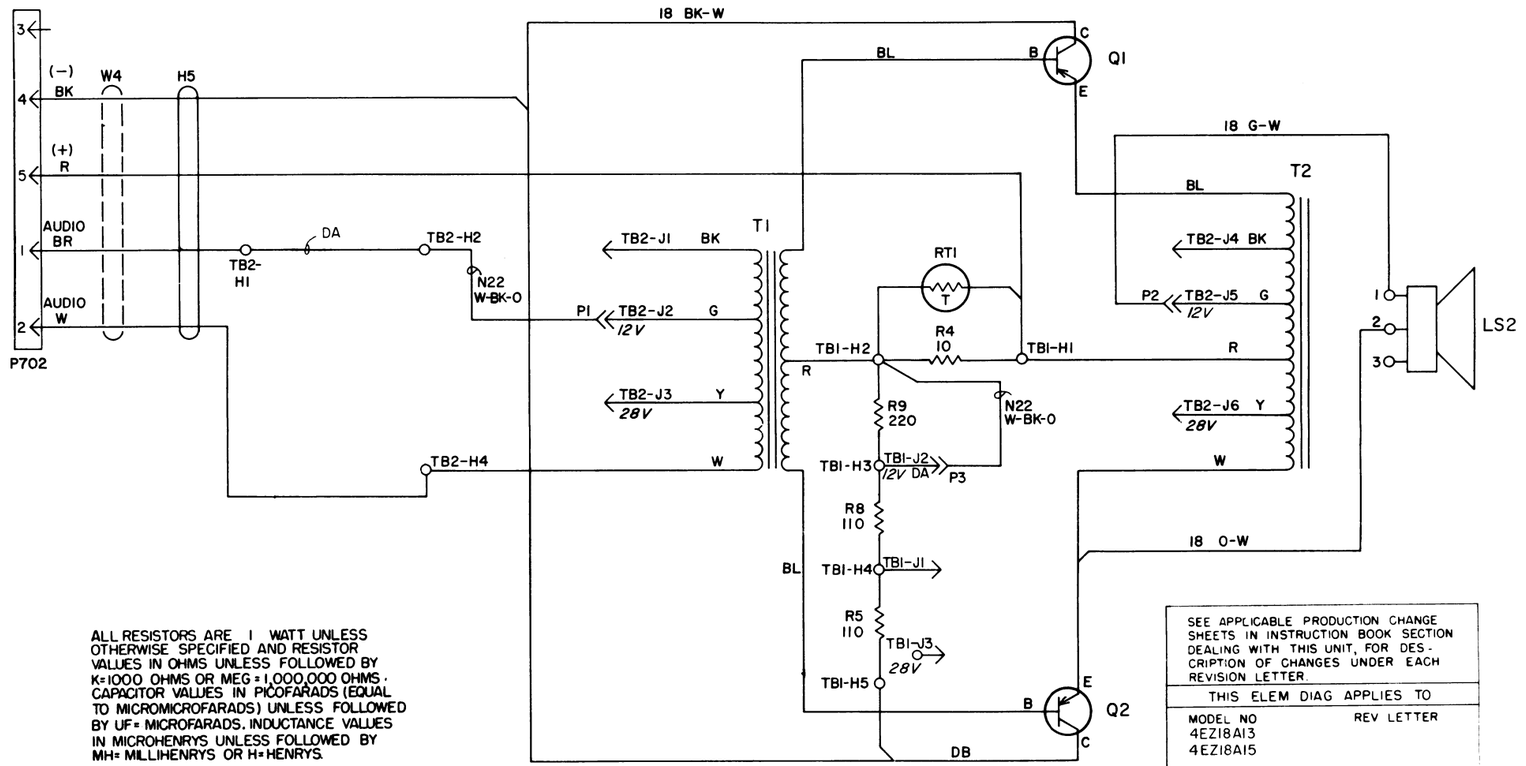
REV. K - To improve method of mounting charging sleeve. Add self tapping screw.

REV. A - 4EP72C10 & 11

To incorporate new charge contacts.
Changed sleeve assembly.

REV. K - To change method of mounting charging sleeve.
Eliminate solvent bonding.
Added self tapping screw.

SCHEMATIC DIAGRAM



ALL RESISTORS ARE 1 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG = 1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF = MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H= HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19C317673, Rev. 1)

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
4EZ18A13	
4EZ18A15	

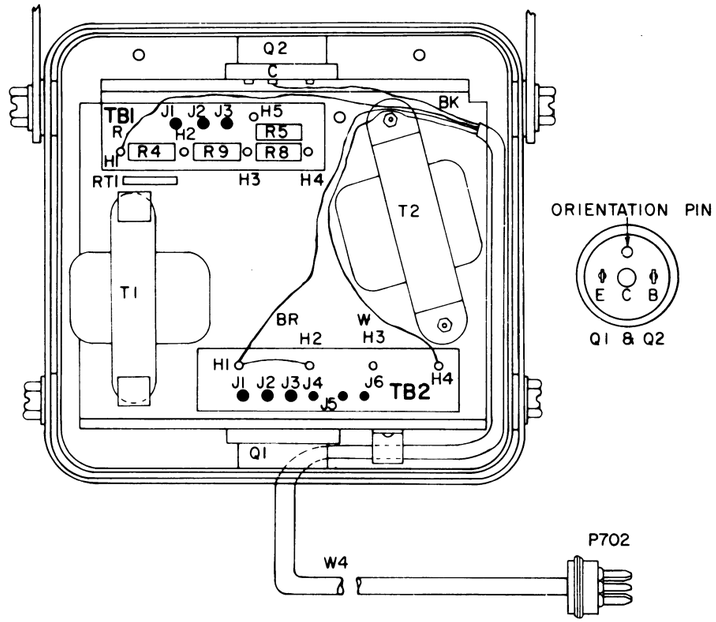
RESISTANCE READINGS

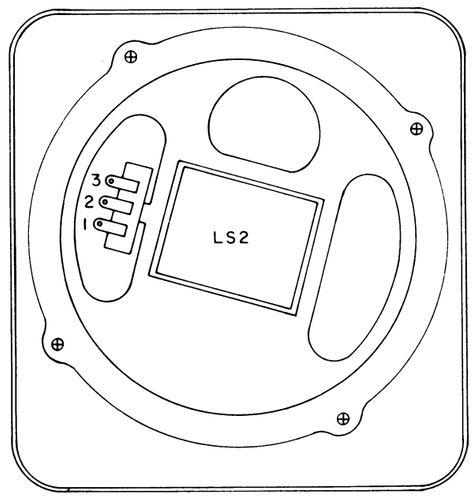
READINGS TAKEN FROM TRANSISTOR PIN TO RED LEAD OF SPEAKER CABLE (POSITIVE).

TRANSISTORS	BASE	EMITTER
Q1 & Q2	3.0Ω*	0.2Ω

*MEASURED AT 70° F AMBIENT

OUTLINE DIAGRAM





(19C317906, Rev. 2)

SCHEMATIC & OUTLINE DIAGRAM

SPEAKER-AMPLIFIER
MODEL 4EZ18A13

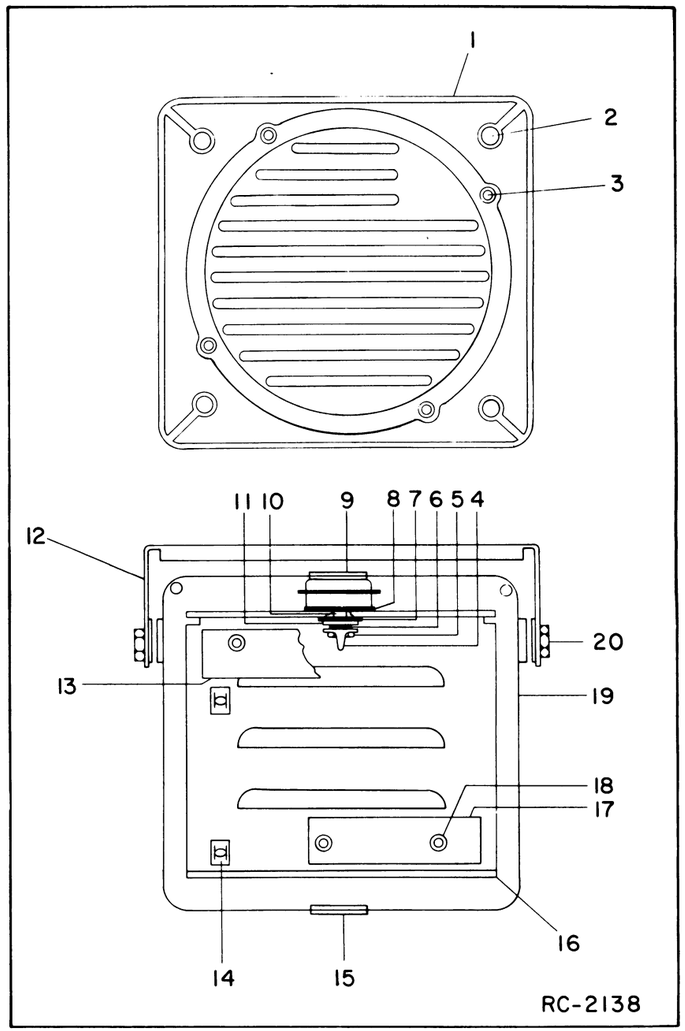
PARTS LIST

LBI-4238A

SPEAKER-AMPLIFIER
MODEL 4EZ18A13 (19D402449G16)

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS2	5491260P7	Permanent magnet, 5-inch: 3.2 ohms ±10% voice coil imp, 15 w max operating, 385 Hz ±15% resonance, paper dust cap; sim to Jensen Model P5-VAS12761.
		- - - - - - - - - - - - PLUGS - - - - - - - - - - -
P1	4036731P1	Contact, friction: sim to Bead Chain M152-30.
P2	4029840P1	Contact, electrical: sim to AMP 41854.
P3	4029840P2	Contact, electrical: sim to AMP 42827-2.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 and Q2	5490810P1	Germanium, PNP.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R4	3R78P100J	Composition: 10 ohms ±5%, 1 w.
R5	3R78P111J	Composition: 110 ohms ±5%, 1 w.
R8	3R78P111J	Composition: 110 ohms ±5%, 1 w.
R9	3R78P221J	Composition: 220 ohms ±5%, 1 w.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT1	19C300048P3	Disc: 1 ohm ±10%.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T1	19B209220P1	Audio freq: 0.3-3 KHz freq range nominal, Pri: 0.17 ohm DC res max, Sec: 5.2 ohms DC res max.
T2	19B209218P1	Audio freq: 0.3-3 KHz freq range nominal, 0.3 ohm DC res max.
		- - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1		BOARD 19A121707G1
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J3	4033513P12	Contact, electrical: sim to Bead Chain L93-3.
TB2		BOARD 19A121291G1
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J3	4033513P12	Contact, electrical: sim to Bead Chain R125-17.
J4 thru J6	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W4	19B205410G1	Power: 4-conductor, 300 VRMS, approx 4 feet (modified).
P702	5493018P2	Plug, phen: 5 contacts; sim to Cinch 204-31-05-010.
		MECHANICAL PARTS (SEE RC-2138)
1	19B216269G1	Housing.
2	19B201806P5	Insert.
3	19B201806P2	Insert.
4	4036835P1	Terminal: solder; sim to Shakeproof 2118-10-01-2520N.
5	4032596P1	Nut: No. 10-32.
6	N405P9C13	Lockwasher: No. 10.
7	19A115221P3	Insulator, washer: mica.
8	4031291P1	Insulator: approx 1-1/8 inch dia.
9	5490407P6	Grommet, rubber. (Upper)
10	4034215P2	Bushing: approx 3/8 inch dia.
11	4034225P1	Flatwasher: approx 1/2 inch dia.
12	19A121521G1	Mounting support.
13	19A121711P1	Insulator: approx 2-1/2 x 3/4 inches.
14	4038072P2	Speed nut: sim to Tinnerman C8092-632-1.
15	19A115470P1	Grommet, rubber: (Lower) sim to Atlantic India Rubber 2279 (without hole).
16	19B204603G2	Chassis.
17	19A121645P1	Insulator.
18	7150186P105	Spacer.
19	19A121550G3	Rear Cover.
20	19A115495P1	Screw, hexhead: No. 1/4-20 x 5/8. (Secures housing to mounting bracket).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



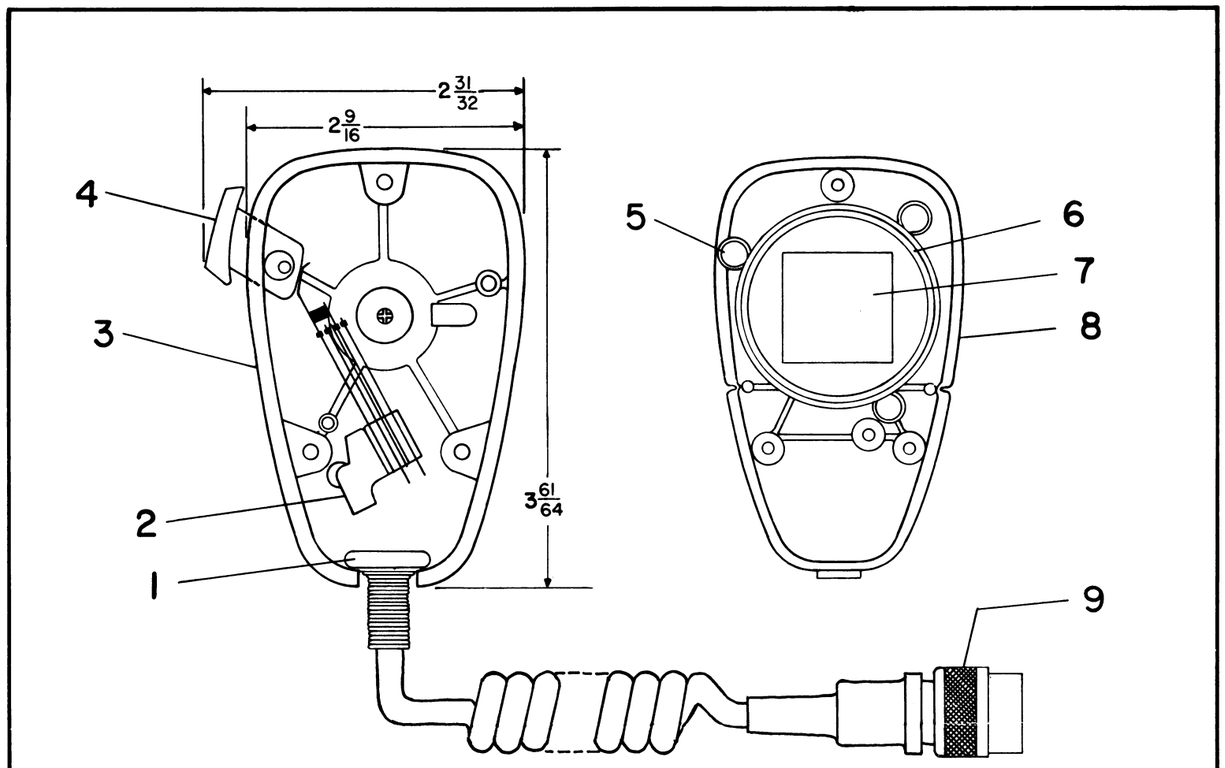
PARTS LIST

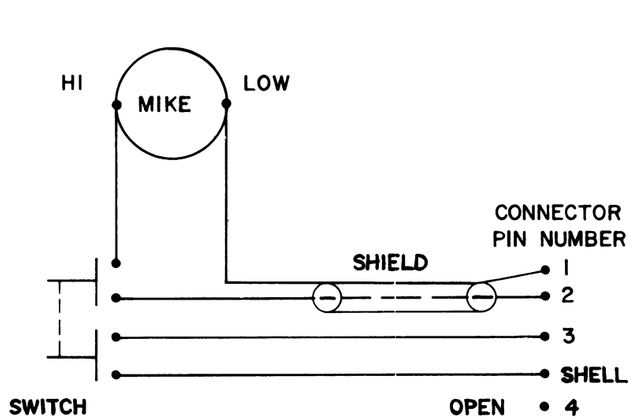
LBI-4236

MICROPHONE
MODEL 4EM25E10
(19B209102P2)
(SEE RC-1163)

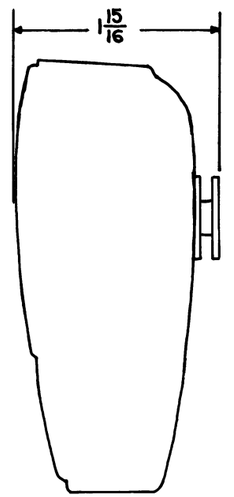
SYMBOL	GE PART NO.	DESCRIPTION
1		Cable clamp. Shure Brothers RP16.
2		Switch. Shure Brothers RP26.
3		Case (back) and mounting button: plastic. Shure Brothers RP96. (RP96 also includes item 8).
4		Switch button: gray plastic. Shure Brothers RP97.
5		Spring. Shure Brothers RP1.
6		Shield. Shure Brothers RP23.
7		Magnetic controlled cartridge. Shure Brothers RP13.
8		Case (front) plastic. Shure Brothers RP96. (RP96 also includes item 3).
9		Cable and plug: approx 6 feet long. Shure Brothers RP14.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.





WIRING DIAGRAM



RC-1163D

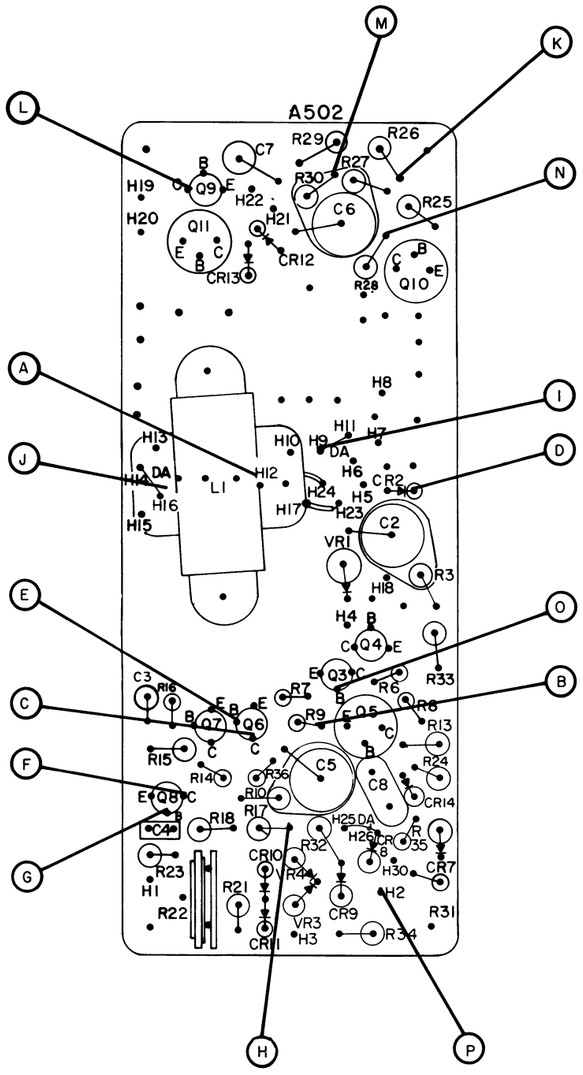
SCHEMATIC & OUTLINE DIAGRAM

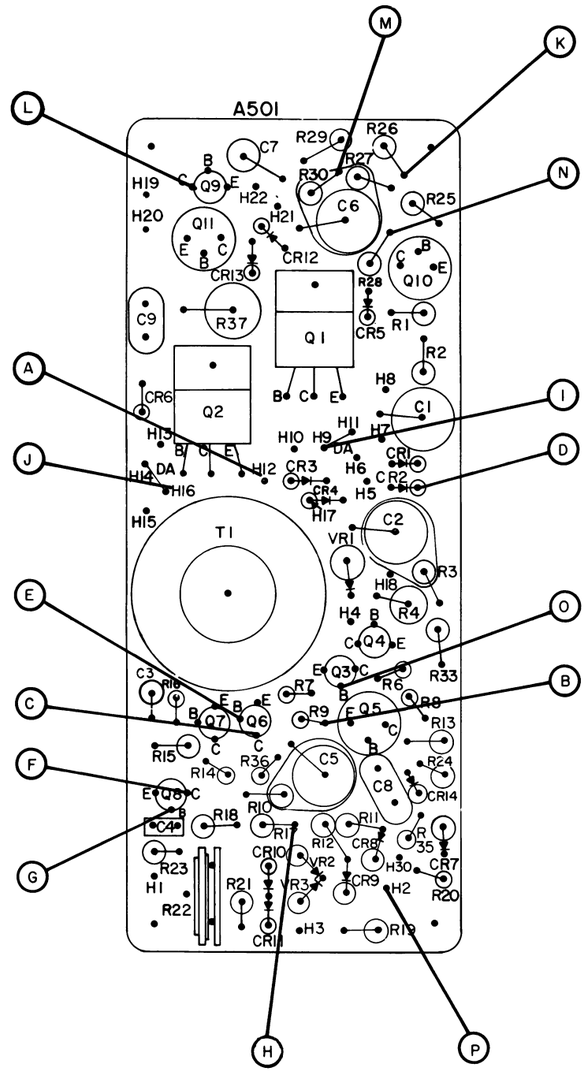
MILITARY MICROPHONE 4EM25E10

VOLTAGE READINGS FOR 4EP72A11

These voltage readings are typical DC readings measured with GE Test Set 4EX3A10, 4EX8K11 or equivalent 20,000 ohms-per-volt meter, and measured from the metering point shown to component board ground.

	METERING POINT	WITH NO BATTERY	HIGH CHARGE RATE (Charge Light ON)		TRICKLE CHARGE (Charge Light OFF)	
			Standard	Light Duty	Standard	Light Duty
Ⓐ	Input Voltage at H7 to H12	13.8 V				
Ⓑ	Q5 Emitter	14.7 V	12.0 V	14.0 V	0.15 V	0.15 V
Ⓒ	Q5 Base	15.3 V	12.7 V	14.6 V	0.15 V	0.15 V
Ⓓ	Rectifier Output Junction of CR2 & R3	16.0 V	15.7 V	15.9 V	16.0 V	16.0 V
Ⓔ	Q7 Collector	13.0 MV	0.02 V	0.02 V	0.79 V	0.79 V
Ⓕ	Q8 Collector	82.0 MV	0.65 V	0.65 V	.02 V	0.02 V
Ⓖ	Q8 Base	.69 V	0.37 V	0.37 V	0.52 V	0.48 V
Ⓗ	Junction of VR4 and R17	3.6 V	0.65 V	0.65 V	.02 V	0.02 V
Ⓘ	H9	13.8 V				
Ⓙ	H16	13.8 V				
Ⓚ	Junction of R25, R26, R27	8.4 V				
Ⓛ	Q9 Collector	7.7 V				
Ⓜ	Q9 Base	.65 V				
Ⓝ	Q10 Base	9.0 V				
Ⓞ	Q3 Base	0.0 V	0.85 V	0.85 V	0.0 V	0.01 V
Ⓟ	H2	12.85 V	7.7 V	7.4 V	8.0 V	8.0 V





(RC-2174A)
(19D416273, Rev. 12)

VOLTAGE READINGS FOR 4EP72A10

	METERING POINT	WITH NO BATTERY	HIGH CHARGE RATE (Charge Light ON)		TRICKLE CHARGE (Charge Light Off)	
			Standard	Light Duty	Standard	Light Duty
Ⓑ	Q5 Emitter	11.5 V	8.9 V	10.8 V	0.15 V	0.15 V
Ⓒ	Q5 Base	12.0 V	9.6 V	11.0 V	0.15 V	0.15 V
Ⓓ	Rectifier Output Junction of CR2&R3	12.8 V	12.7 V	12.7 V	12.85 V	12.85 V
Ⓔ	Q7 Collector	0.03 V	0.04 V	0.04 V	0.79 V	0.79 V
Ⓕ	Q8 Collector	0.05 V	0.65 V	0.65 V	0.55 V	0.55 V
Ⓖ	Q8 Base	0.7 V	0.55 V	0.55 V	0.55 V	0.55 V
Ⓗ	Junction of VR4 & R17	2.4 V	0.65 V	0.65 V	0.04 V	0.04 V
Ⓚ	Junction of R25, R26, & R27	6.0 V				
Ⓛ	Q9 Collector	6.0 V				
Ⓜ	Q9 Base	0.64 V				
Ⓝ	Q10 Base	7.6 V				
Ⓞ	Q3 Base	0.0 V	0.8 V	0.8 V	0.0 V	0.0 V
Ⓟ	H2	10.7 V	8.2 V	8.2 V	8.0 V	8.35 V

QUICK CHECKS

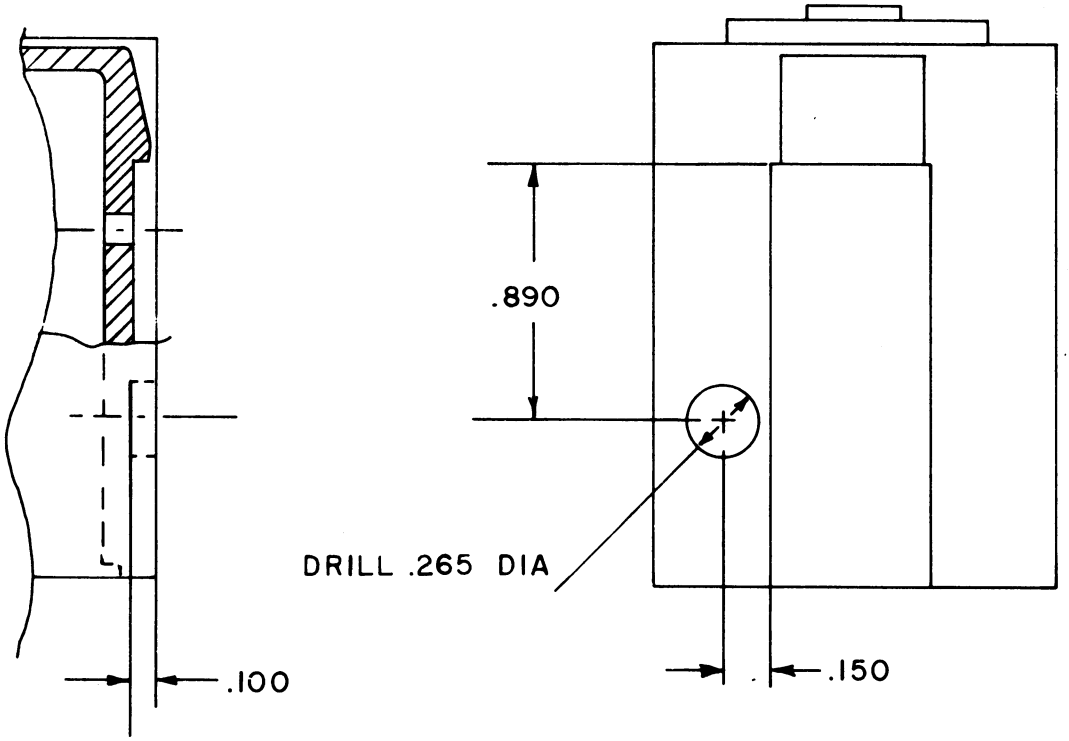
SYMPTON	CHECK FOR:
Battery will not charge at the high rate (charge light won't come on).	1. Open DS501, F502 or F501 2. Defective Q5 3. Q7 not resetting charging circuit 4. Open C3, or battery contact damaged 5. On 4EP72A11, voltage input jumpers connected incorrectly
Battery pack won't charge at high rate.	1. Defective or excessively discharged battery 2. Defective VR3, R22, or R22 improperly adjusted
Charger switches to trickle charge too soon.	1. Improper adjustment of R22 - NOTE - A new battery will not reach full charge on 1st or 2nd charge-discharge cycle
Charger remains on high charge rate.	1. Improper adjustment of R22 or R22 defective 2. Shorted Q7 or open Q8 3. Shorted Q5 or open Q6 4. On 4EP72A11, voltage input jumpers connected incorrectly

TROUBLESHOOTING PROCEDURE

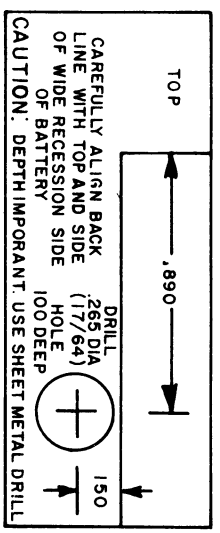
VEHICULAR CHARGER MODELS
4EP72A10 & 11

BATTERY PACK MODIFICATION
(Shipped before November 14, 1975)

To modify battery pack 19D413522G1 for use in vehicular charger model 4EP72C10&11, use a 17/64 sheet metal drill and drill a recess .100 deep as indicated in Figure 1. Template NP280261, also shown in Figure 1, is available from Service Parts.



TEMPLATE
NP280261



NOT TO SCALE

RC—3020