INSTRUCTIONS

for

20-WATT
MOBILE AUDIO AMPLIFIER
MODEL 4EA12A10
6 & 12 volts

LBI-3230

DF-8397

COMMUNICATION PRODUCTS DEPARTMENT

GENERAL ELECTRIC

LYNCHBURG, VIRGINIA

5061

Printed in U.S.A.

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ILLUSTRATIONS

GENERAL INFORMATION

The following information has been included to assist the servicemen in the use of this instruction book.

UNIT IDENTIFICATION

Each piece of G-E Radio Communication Equipment is identified by a MODEL number or TYPE number stamped on the unit. TYPE numbers (e.g., Transmitter Type ET-28-A) describe general classes of equipment and are used only for broad identification and, in the case of transmitters, for FCC filing. MODEL numbers (e.g., Transmitter Model 4ET28A1) describe units in detail and are essential for proper identification. A COMBINATION number (e.g., Portable Combination HB-11-W) describes a complete transmitter-receiver complement. An ISSUE number indicates what models of equipment are in the combination. SERIAL numbers are provided for the convenience of the customer in identifying his transmitters.

PRODUCTION CHANGES

From time to time, changes are made in the equipment described in this book, either to improve performance or to simplify circuits. Each change is identified by a Revision Letter stamped after the model number on the nameplate or on the chassis. Any given revision includes all previous revisions. The Production Change information in each unit's instructions can be used when the instructions are used with a unit of earlier revision.

SERVICE PARTS

A list of the principal service parts are included in the parts list for each unit. The symbol numbers are those appearing on the elementary diagram for the unit. Service parts may be obtained from authorized G-E Service Stations or ordered through any G-E Communications Equipment District Sales Office (see list at end of this book). When ordering a part, include the symbol number, description and drawing number of the part, and the model number and revision letter stamped on the unit.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the nearest General Electric Company District Office.

SPECIFICATIONS

Model Number	4EA12A10
Audio power output (16 ohm load)	6.6 volts dc: More than 10 watts 13.6 volts dc: More than 25 watts
Power source drains	STANDBY / FULL POWER 6.6 v dc: 0.5 amps / 5 amps 13.6 v dc: 0.5 amps / 5 amps
Audio input *	Controlled magnetic microphone. Interconnected with Transistorized Progress Line or Progress Line equipment.
Frequency response	±3 db, 300-3000 cps (1000 cps ref.)
Output impedance	16 ohms
Gain	80 db minimum, continuously adjustable from 0 to maximum
Dimensions (HWD)	3-7/8" x 6-7/8" x 6-5/8" (excludes knobs)
Weight	7 lbs. 3 oz.

* May also be used with carbon microphone and all standard 2-way mobile equipment with appropriate modifications.

GENERAL ELECTRIC
20-WATT TRANSISTORIZED AUDIO AMPLIFIER
MODEL 4EA12A10

DESCRIPTION

The General Electric Transistorized Audio Amplifier Model 4EA12A10 (Fig. 1) is designed as a "2-in-1" amplifier package for use as a public address system or for amplified radio. The amplifier operates from a 6 or 12 volt battery and may be used by itself or with any conventional mobile equipment.

A three-position selector switch (S601) on the front of the unit makes it possible to (1) listen to the regular mobile speaker inside the vehicle (OFF position); (2) monitor the receiver over the externally-mounted speaker, for outside work (RAD position); or (3) use the amplifier and the mobile microphone as a public address system (MIC position). The amplifier may be used as a public address system without a mobile radio.

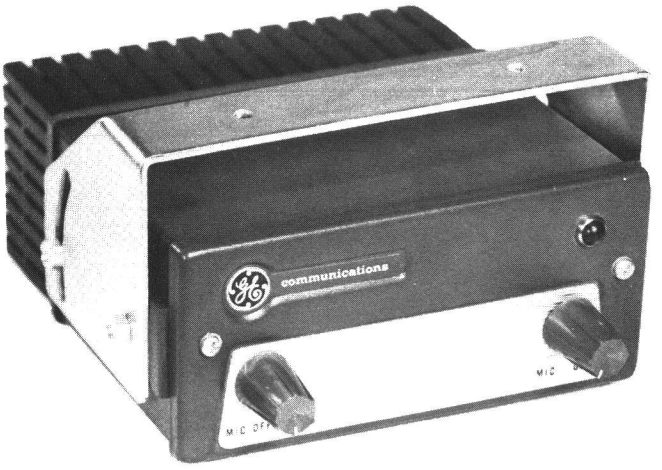


Fig. 1. - Transistorized Audio Amplifier Model 4EA12A10

DESCRIPTION

EXTERNAL SPEAKER

The amplifier is designed to be used with a re-entrant type external horn Model 4EZ6C1 (Fig. 2).

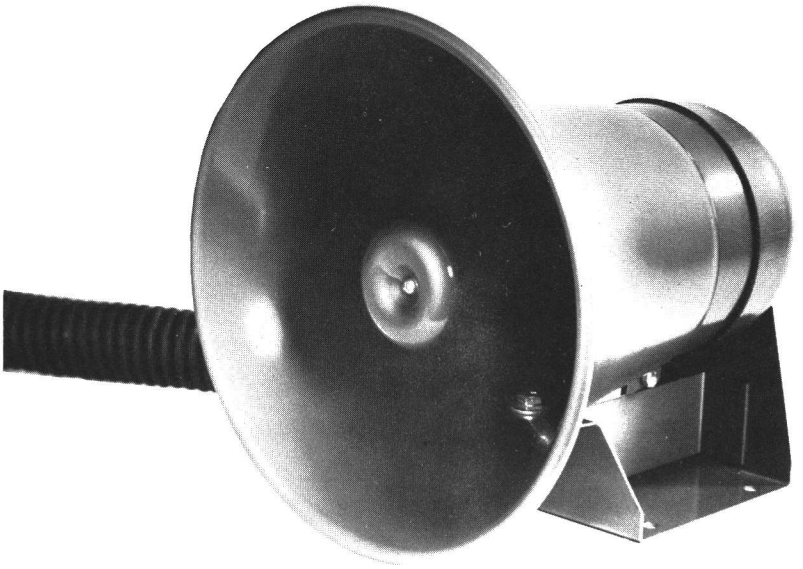


Fig. 2 - External Speaker Model 4EZ6C1

Transistor Protection

A thermostat located on the heat sink protects the transistors against a temperature rise which could endanger their life. The thermostat automatically turns off the power output stage until the temperature drops to a safe point.

CIRCUIT ANALYSIS

The symbol numbers of components referred to in this analysis may be located on the Elementary and Outline Diagrams listed in the Table of Contents. The amplifier obtains its supply voltage from the vehicle battery (6 or 12 volts, positive or negative ground).

The operation of the amplifier with the selector switch in each of its three positions is described below.

MIC POSITION

With the selector switch S601 in the MIC position, contacts 1 and 4 of S601-A close, allowing input power to be applied to the amplifier. Contacts 11 and 12 of S601-A close, connecting the output of the driver transistor Q602 to the input of the driver transformer T602. Contacts 1 and 4 of S601-B close, allowing the microphone output to be applied to the base of the pre-amp transistor Q601. Contacts 11 and 12 of S601-B close, providing a return path for the microphone signal. Contacts 7 and 8 of S601-B close, disabling the push-to-talk button on the microphone.

The audio signal from the microphone is capacity coupled through C602 to the base of the pre-amp transistor Q601. The output of the pre-amp is capacity coupled through C604 and C605 to the base of the driver transistor Q602. R610, the gain control, is located between the emitter and base of Q602. The output of the driver transistor is transformer coupled through T602 to the bases of the power output transistors Q603 and Q605. The power output stage is a Class B compound-connected, push-pull amplifier. The emitters of Q603 and Q605 are connected to the bases of Q604 and Q606 respectively. The output transistors have common collectors connected to the primary of the output transformer T601. The secondary of the output transformer is connected to J603, the external speaker jack.

Taps are provided on the secondary of T601 for changing from 6 to 12 volt operation. For 12-volt operation the low side of the speaker jack is connected to T601-6 and for 6-volt operation the low side of the speaker jack is connected to T601-7.

CIRCUIT ANALYSIS

RAD POSITION

With the selector switch S601 in the RAD position, the output stage of the amplifier is used to drive the external speaker for monitoring the mobile receiver. S601-B in this position does not alter the microphone circuit and it remains in its normal operating condition. S601-A contacts 1 and 2 close, allowing battery power to be applied to the amplifier. S601-A contacts 5 and 6 close, connecting the secondary of the mobile receiver output transformer to the input of the driver transformer T602 (blk-blk).

OFF POSITION

With the selector switch S601 in the OFF position, power is removed from the amplifier, the microphone and speaker circuits are returned to their normal condition, and the mobile system functions normally.

INSTALLATION

AMPLIFIER MOUNTING

The amplifier may be installed in any location convenient for the operator, and should be positioned so that there is good air movement across the heat sink. When installing the amplifier, first mount the bracket and then assemble the amplifier to the bracket.

1. Select the location for the amplifier.

2. Use the mounting bracket as a template to determine the placement of the two mounting holes.

3. Use a #24 (5/32-inch) drill and drill the mounting holes.

CAUTION

Be sure that all dash wiring is cleared away from the drilling area.

4. Mount the bracket with the two hex-head thread-forming screws provided.

5. Assemble the amplifier to the mounting bracket.

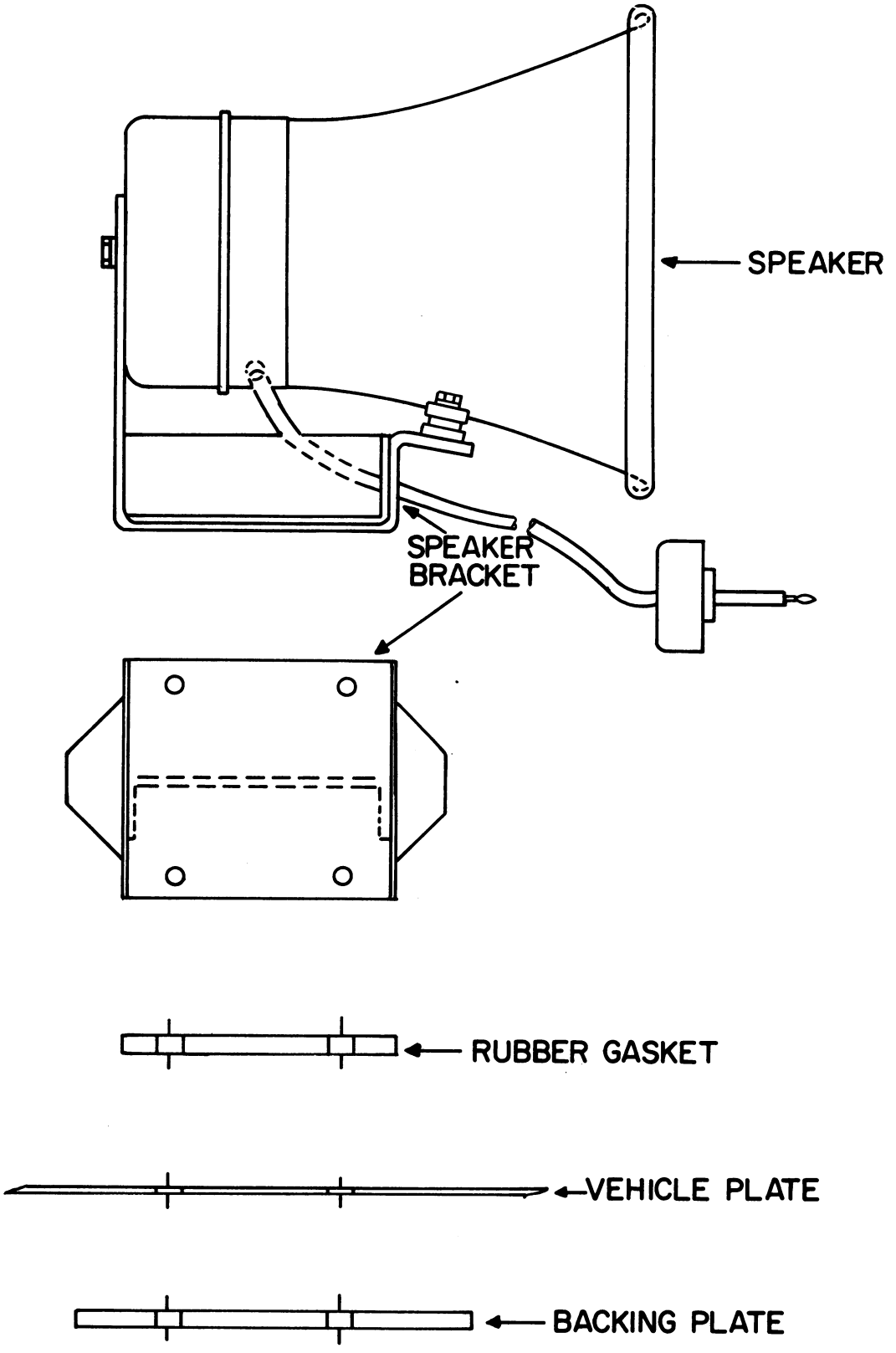


Fig. 3 - Speaker Mounting Installation (RC-656)

INSTALLATION

EXTERNAL SPEAKER MOUNTING

The speaker may be installed on the roof, on the fender, or under the hood of the vehicle.

1. Select the location for the speaker.

2. Use the speaker base as a template to determine the placement of the four mounting holes.

3. Use a 1/4-inch drill and drill the mounting holes.

NOTE

If the mounting surface is a large thin area of metal such as the roof of a passenger car, a rubber gasket and a backing plate should be used. The backing plate should be about 1/8-inch thick. Use the speaker base as a template to drill four holes through the backing plate and the gasket. Make the backing plate of sufficient area to prevent buckling of the mounting surface at high vehicle speeds.

4. Mount the speaker as shown in Fig. 3.

5. Cut a 1/2-inch hole for the speaker cable.

6. Insert the rubber grommet in the entrance hole for the speaker cable.

7. Disassemble the plug from the speaker cable, pass the cable through the grommet, and reassemble the plug.

8. Plug the speaker cable into J603 on the amplifier.

ELECTRICAL CONNECTIONS

Audio Amplifier 4EA12A10 may be used with any standard mobile equipment with the proper modification. The instructions given below and on RC-657 apply to use of the amplifier with General Electric Progress Line and Transistorized Progress Line mobile equipment.

1. Connect cable from J604 to Control Unit as shown on RC-657.

2. If amplifier is to be used without a mobile radio J604 is not used.

FUSE ASSEMBLY AND CABLE KIT PLA-4031186-G1

1. Mount the fuse holder near the starter relay.

2. Cut the red wire to the necessary length and assemble a ring terminal to each end.

3. Connect the red wire from the fuse holder to the starter relay terminal which connects directly to the car battery.

4. Do not shorten the black or brown leads of the power cable assembly as their resistance is critical for proper functioning of the unit.

5. In a positive-grounded vehicle the brown lead must connect to ground and the black lead to the fuse assembly.

6. In a negative-grounded vehicle connect the brown lead to the other end of the fuse assembly and the black lead to vehicle ground.

MAINTENANCE

Mobile units are subject to shock and vibration, and should be checked periodically to insure that mounting hardware and electrical components are secure.

CIRCUIT MAINTENANCE

Disassembly.

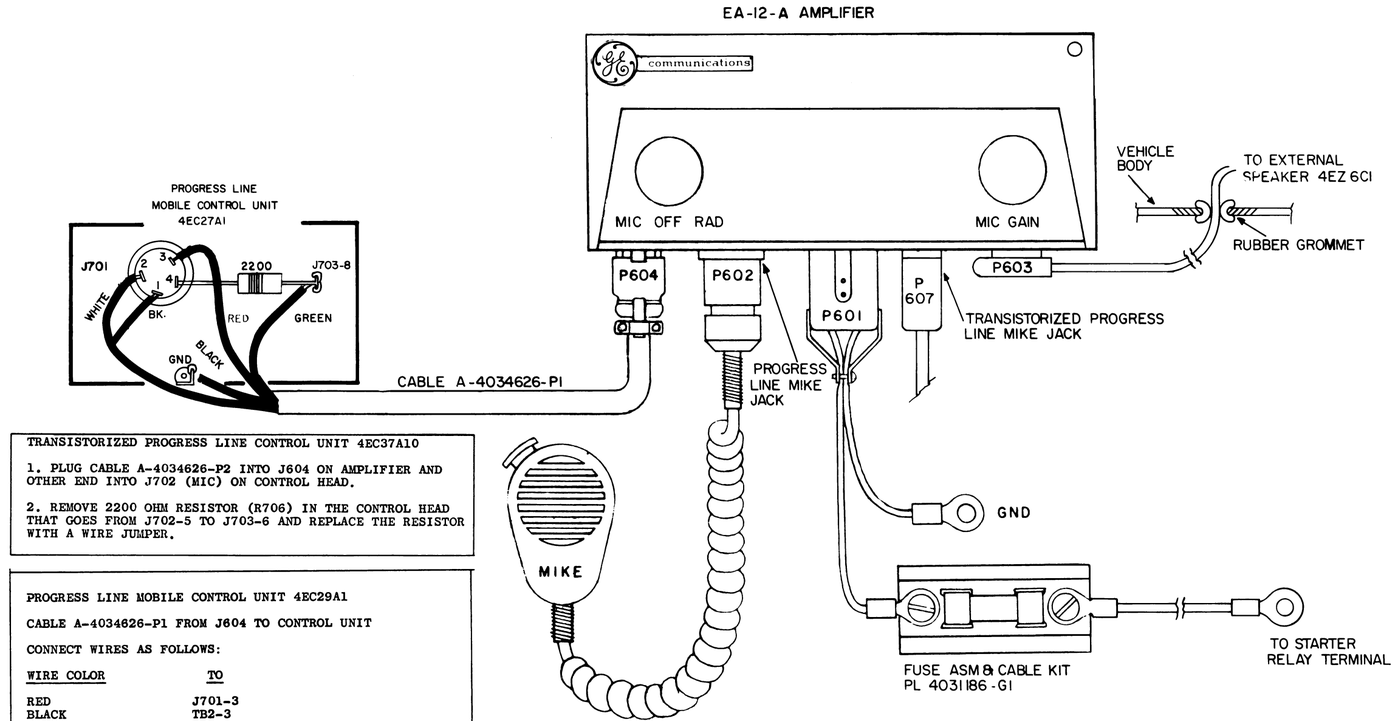
1. Remove the plugs, cables, and accessories from the unit.

2. Remove the unit from the mounting bracket.

3. Remove the two phillips head screws from the front of the unit and pull out on the front panel, to gain access to the circuitry.

4. Remove the two phillips head screws from the inside front of the heat to gain access to the power transistors, thermostat and output circuitry.

5. Refer to Service Hints, Service Outline, Elementary Diagram and Parts List for electrical maintenance of equipment. (See Table of Contents).



TRANSISTORIZED PROGRESS LINE CONTROL UNIT 4EC37A10

1. PLUG CABLE A-4034626-P2 INTO J604 ON AMPLIFIER AND OTHER END INTO J702 (MIC) ON CONTROL HEAD.

2. REMOVE 2200 OHM RESISTOR (R706) IN THE CONTROL HEAD THAT GOES FROM J702-5 TO J703-6 AND REPLACE THE RESISTOR WITH A WIRE JUMPER.

PROGRESS LINE MOBILE CONTROL UNIT 4EC29A1

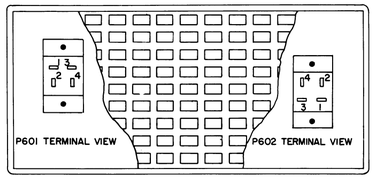
CABLE A-4034626-P1 FROM J604 TO CONTROL UNIT

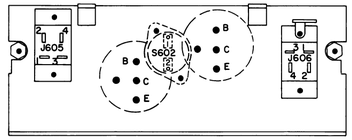
CONNECT WIRES AS FOLLOWS:

WIRE COLOR	TO
RED	J701-3
BLACK	TB2-3
GREEN	TB2-4
WHITE	J701-2
SHIELD ON WHITE	J701-1
BLUE	NO CONNECTION

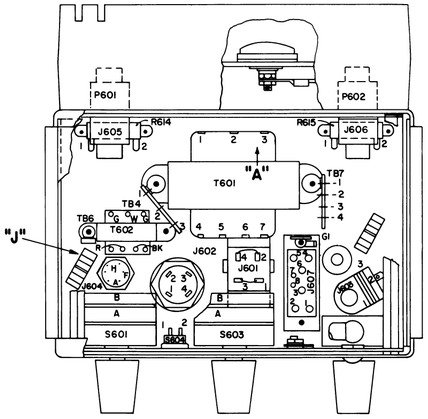
Fig. 4 Pictorial Connnection Diagram

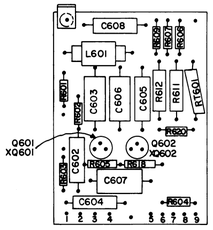
AUDIO AMPLIFIER
MODEL 4EA12A10





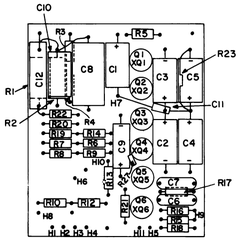
VIEW AT "A"





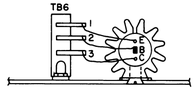
VIEW AT "B"

BOARD, PRE-AMP
A-4032087

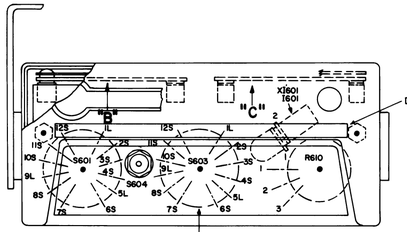


VIEW AT "C"

SIREN BOARD, C-5495744
4EA12B10 ONLY.



VIEW AT "J"



S603 IS ON 4EA12B10 ONLY

VOLTAGE AND RESISTANCE CHARTS
4EA12B10 ONLY

SYMBOL NUMBER	VOLTAGE READINGS		
	E	B	C
Q1	0	-0.4 to ⁄5.5	0 to ⁄5.5
Q2	0	-0.4 to ⁄5.5	0 to ⁄5.5
Q3	1.5 to 2.6	⁄1.5 to 2.6	6.3
Q4	0.35	0.1	1.6
Q5	0	0.9	2.9
Q6	1.8	1.7	11.4

SYMBOL NUMBER	RESISTANCE READINGS		
	E	B	C
XQ1	0	11.6K	1.7K
XQ2	0	11.6K	1.7K
XQ3	2.7K	35K	91
XQ4	68	7.5K	1.1K
XQ5	0	6.5K	1.1K
XQ6	200	INF.	INF.

CONDITIONS OF MEASUREMENTS

1. READINGS TAKEN WITH A 20,000 OHM-PER-VOLT METER.
2. VOLTAGE READINGS TAKEN WITH SIREN IN AUT. SIREN POSITION. ⁄13.6 VDC APPLIED, 16 OHM RESISTOR OR SPEAKER LOAD ON AMPLIFIER.
3. VOLTAGE READINGS ±10%. RESISTANCE READINGS ±20%.
4. VOLTAGE READINGS ARE TAKEN WITH POSITIVE METER PROBE CONNECTED TO J601-3 OF THE AMPLIFIER.
5. WHERE TWO VOLTAGES ARE GIVEN IN THE CHART ABOVE, THE VOLTAGE AT THAT POINT VARIES BETWEEN THE TWO VOLTAGES AT A 6 CPM RATE.
6. RESISTANCE READINGS ARE TAKEN WITH A METER PROBE CONNECTED TO J601-3 OF THE AMPLIFIER.
7. RESISTANCE READINGS ARE TAKEN WITH THE POWER DISCONNECTED FROM THE UNIT.
8. RESISTANCE READING SHOULD BE TAKEN WITH ALL TRANSISTORS OUT OF THEIR SOCKETS. DO NOT USE ANY OHMMETER WHICH PUTS MORE THAN 10 VOLTS ON THE CIRCUIT.

VOLTAGE CHART

4EA12A10/B10

DC READINGS

	Q601	Q602	Q603	Q604	Q605	Q606
E	0.5	2.65	1.0	0.7	1.0	0.7
B	0.65	2.75	0.1	1.1	0.1	1.1
C	4.2	12.4	13.6	13.6	13.6	13.6

ALL DC READINGS ARE TAKEN WITH METER PLUS PROBE ON ⁄13.6 VOLTS.

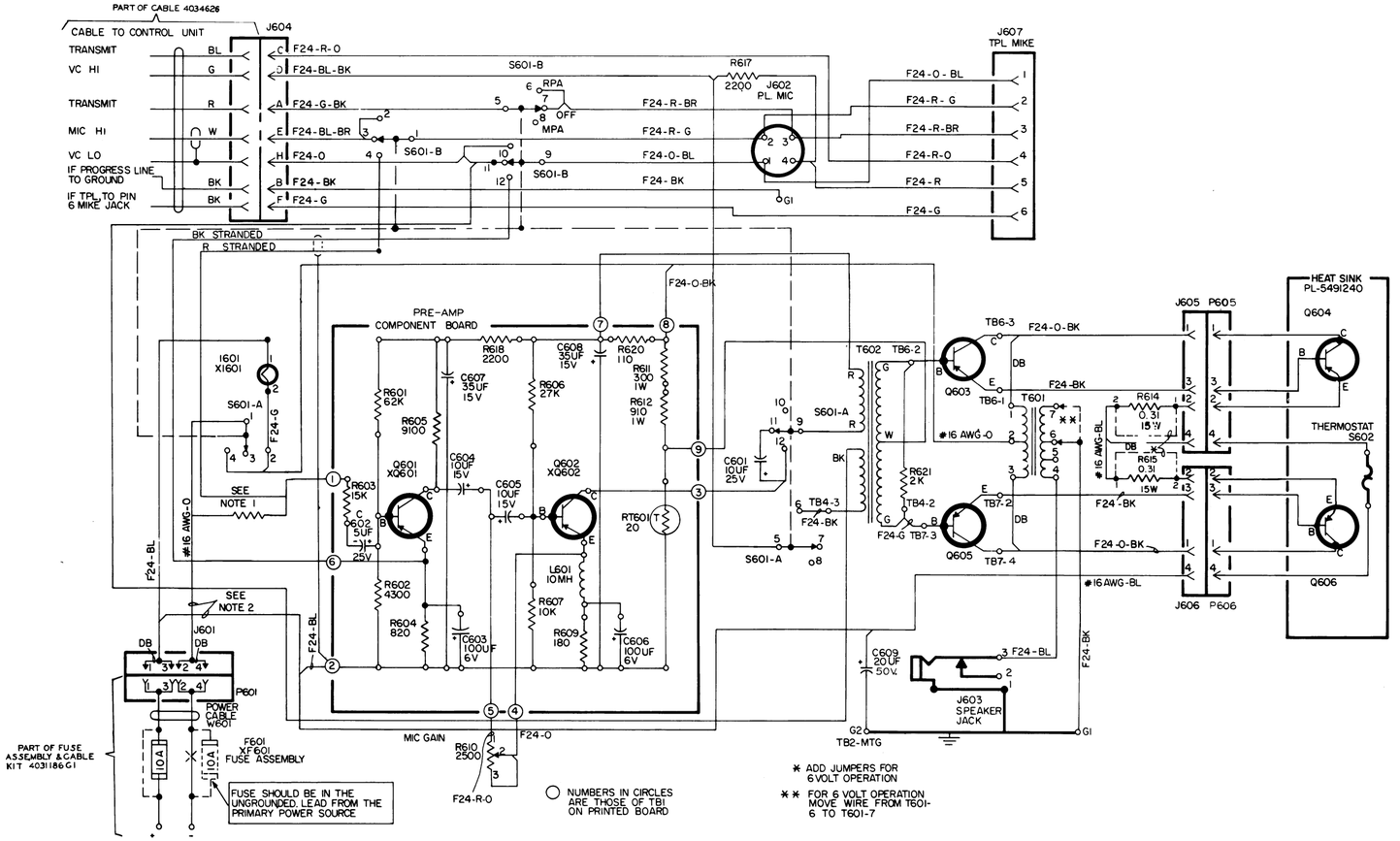
TYPICAL AC READINGS:

Q601c TO B⁄	0.3 V AC
Q602c TO B⁄	4.8 V AC
Q603b TO Q605b	4.8 V AC
Q604c TO Q606c	9.8 V AC

THE AC READINGS ARE TAKEN AT 0.1 V, 1000 OHMS IN, GAIN SET FOR 18 V OUTPUT ACROSS 16 OHM, 25 WATT RESISTOR.

Fig. 5 Outline Diagram

AUDIO/SIREN AMPLIFIER
MODEL 4EA12A10/B10



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.

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.

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

NOTES

1. FOR CARBON MICROPHONE ADD 2.7K 1/2 WATT RESISTOR MOVE BLACK WIRE FROM HOLE 6 TO HOLE 2.
2. TERMINATE 7117269P2 ON END OF #16 AWG-O AND #12AWG-BL AT J601

Fig. 6 Elementary Diagram

AUDIO AMPLIFIER
MODEL 4EA12A10

PARTS LIST

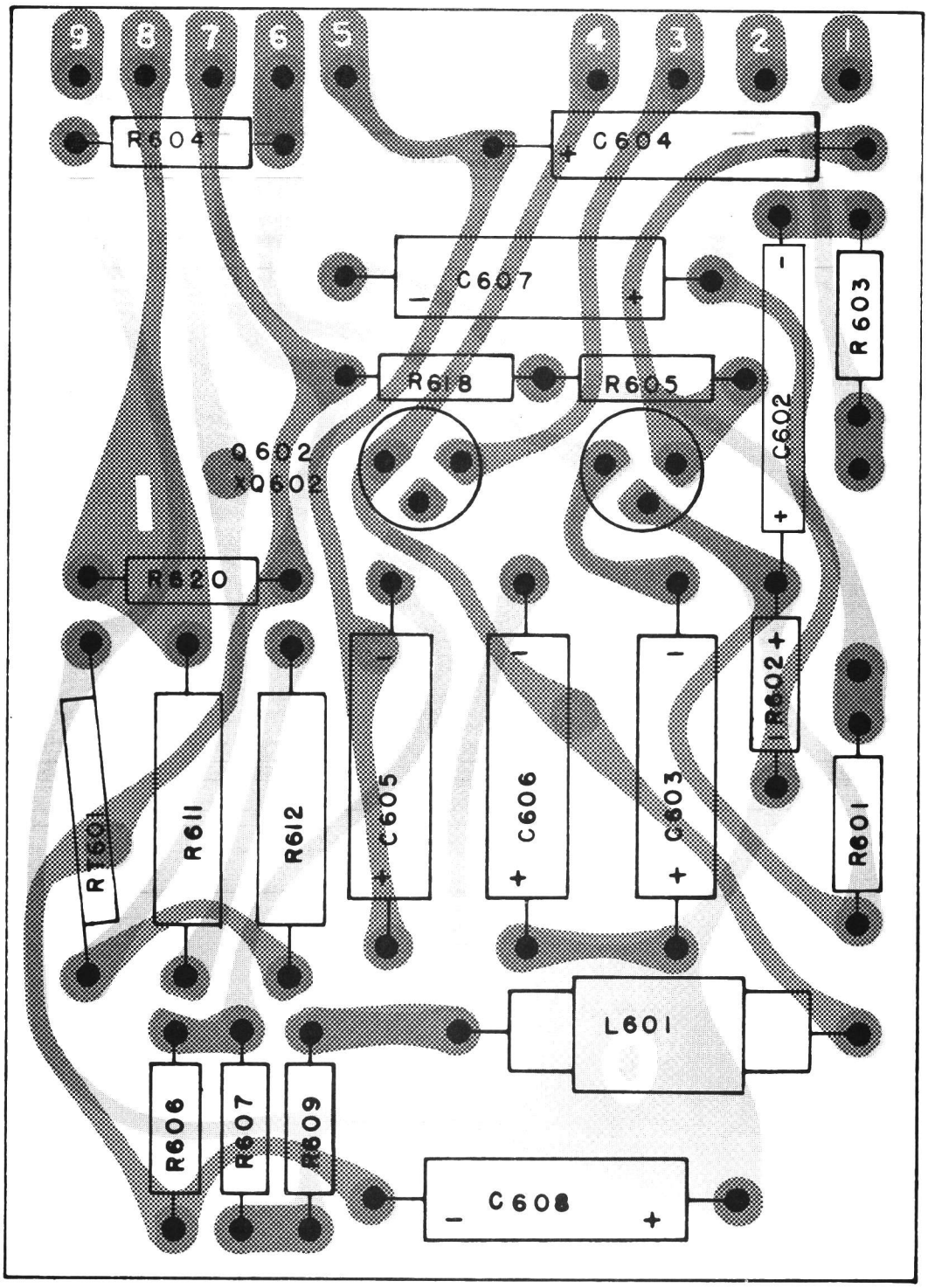
AUDIO AMPLIFIER
MODEL 14A12A10
PL-5490219-G1

SYMBOL	DESCRIPTION	G-E DRAWING & PART NO.
	CAPACITORS	
C601	Capacitor: Electrolytic, (miniature for 85°C operation); hermetically sealed in aluminum tube, 10 µf +100% -10%, 25 VDCW. Sprague Electric Mfg Co Cat. No. 30D182A1.	B-7489483-P7
C602	Capacitor: Electrolytic, (miniature for 85°C operation); hermetically sealed in aluminum tube, 5 µf +100% -10%, 25 VDCW. Sprague Electric Mfg Co Cat. No. 30D179A1. (Included in Pre-Amp Board G-E Dwg and Group No., PL-4032087-G1).	B-7489483-P6
C603	Capacitor: Electrolytic, (miniature for 85°C operation); hermetically sealed in aluminum tube, 100 µf +100% -10%, 6 VDCW. Sprague Electric Mfg Co Cat. No. 30D135A1. (Included in Pre-Amp Board G-E Dwg and Group No., PL-4032087-G1).	B-7489483-P9
C604 and C605	Capacitors: Electrolytic, (miniature for 85°C operation); hermetically sealed in aluminum tube, 10 µf +100% -10%, 15 VDCW. Sprague Electric Mfg Co Cat. No. 30D165A1. (Included in Pre-Amp Board G-E Dwg and Group No., PL-4032087-G1).	B-7489483-P5
C606	Capacitor: Electrolytic, (miniature for 85°C operation); hermetically sealed in aluminum tube, 100 µf +100% -10%, 6 VDCW. Sprague Electric Mfg Co Cat. No. 30D135A1. (Included in Pre-Amp Board G-E Dwg and Group No., PL-4032087-G1).	B-7489483-P9
C607 and C608	Capacitors: Electrolytic, (miniature for 85°C operation); hermetically sealed in aluminum tube, 35 µf +100% -10%, 15 VDCW. Sprague Electric Mfg Co Cat. No. 30D169A1. (Included in Pre-Amp Board G-E Dwg and Group No., PL-4032087-G1).	B-7489483-P10
C609	Capacitor: Electrolytic, (miniature for 85°C operation); hermetically sealed in aluminum tube, 20 µf +100% -10%, 50 VDCW. Sprague Electric Mfg Co Cat. No. 30D198A1.	B-7489483-P11
	INDICATING DEVICE	
I601	Lamp: Incandescent; miniature bayonet base, 14.5 v at 12 amps. (Uses G-3 1/2 size bulb). G-E Type 53.	
	JACKS AND RECEPTACLES	
J601	Connector: Plug; molded compound body, 4-terminals (with angle brackets). HB Jones Co Cat. No. P-304-AB.	B-7473192-P10
J602	Connector: Chassis; 4-female contacts, (silver plated). Amphenol Corp Type 91-PC4F.	K-7117934-P2
J603	Jack: Midget type; (supply with two-brass hex nuts and one-lockwasher). PR Mallory Co Type A2A.	A-7106673-P3
J604	Connector: 7-male contacts, (gold finished), (with locking clip). Amphenol Corp Cat. No. 126-197.	C-5495031-P5
J605 and J606	Connectors: Socket; molded compound body, 4-terminals, (with angle brackets). HB Jones Co Cat. No. S-304-AB.	B-7473192-P3
J607	Connector: Socket; black phenolic, 8-female contacts, (brass), max rating 1,000 VDC, (contact-to-contact), max current 5 amps, (with steel plate). Component Mfg Service Inc Cat. No. 6601-C8A.	C-5495345-P6
	INDUCTOR	
L601	Choke: RF; ind 10.0 mh ±10%, res 40 ohms max, resonate freq 480 KC ±5%, 50 ma DC. National Co Type R50-1. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	A-7129942-P4
	PLUGS	
P605 and P606	Connectors: Plug; molded compound body, 4-terminal (with angle brackets). HB Jones Co Cat. No. P-304-AB.	M-7473192-P10

SYMBOL	DESCRIPTION	G-E DRAWING & PART NO.
	TRANSISTORS	
Q601 and Q602	Transistors: Germanium, PNP. Type 2N324. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-5496666-P1
Q603	Transistor: Germanium, PNP. Type 2N188A.	C-5496667-P1
Q604	Transistor: Germanium, PNP. Type 2N277. (Included in Heat Sink, G-E Dwg and Group No., PL-5491240-G1).	C-5495916-P1
Q605	Transistor: Germanium, PNP. Type 2N188A.	C-5496667-P1
Q606	Transistor: Germanium, PNP. Type 2N277. (Included in Heat Sink, G-E Dwg and Group No., PL-5491240-G1).	C-5495916-P1
	RESISTORS	
R601	Resistor: Composition; 62,000 ohms ±5%, 1/2 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R77-P623J
R602	Resistor: Composition; 4,300 ohms ±5%, 1/2 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R77-P432J
R603	Resistor: Composition; 15,000 ohms ±10%, 1/2 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R77-P153K
R604	Resistor: Composition; 820 ohms ±10%, 1/2 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R77-P821K
R605	Resistor: Composition; 9,100 ohms ±5%, 1/2 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R77-P912J
R606	Resistor: Composition; 27,000 ohms ±10%, 1/2 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R77-P273K
R607	Resistor: Composition; 10,000 ohms ±10%, 1/2 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R77-P103K
R609	Resistor: Composition; 180 ohms ±10%, 1/2 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R77-P181K
R610	Potentiometer: Composition, (for push-on-knob); 2,500 ohms ±20%, 1 w, (mod log taper). Allen Bradley Co Type J.	B-5491971-P2
R611	Resistor: Composition; 300 ohms ±5%, 1 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R78-P301J
R612	Resistor: Composition; 910 ohms ±5%, 1 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R78-P911J
R614 and R615	Resistors: Wire-wound, midget oval; 0.31 ohms ±10%, 15 w. Tru-Ohm Div Type MOR-15.	C-5496941-P6
R617	Resistor: Composition; 2,200 ohms ±10%, 1/2 w.	C-3R77-P222K
R618	Resistor: Composition; 2,200 ohms ±10%, 1/2 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R77-P222K
R620	Resistor: Composition; 110 ohms ±5%, 1/2 w. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	C-3R77-P111J
R621	Resistor: Composition; 2,000 ohms ±5%, 1/2 w.	C-3R77-P202J
	THERMISTOR	
RT601	Thermistor: Thermal resistor; glyptol dipped body, 20 ohms(±10%)at 25°C, max input 3.5 w at 40°C, temp coef 2,700 ±5%-watts. Globar Div Type 343H. (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	B-5490828-P4
	SWITCHES	
S601	Switch: Rotary; high grade phenolic, non-shorting contacts, 2-section, 6-pole, 3-position, rating--make and break 4-amps at 12 VDC. Oak Mfg Co Type F.	C-5495227-P2
S602	Thermostat: Disc type, non-adjustable; black phenolic body, normally closed contact, double-break 2-terminals (straight), (when mounted, bracket must clamp thermostat). (Included in Heat Sink, G-E Dwg and Group No., PL-5491240-G1).	A-4031931-P1

SYMBOL	DESCRIPTION	G-E DRAWING & PART NO.
	TRANSFORMERS	
T601	Transformer: Audio; output (class B push-pull), core and coil construction with bobbin. Pri 1-3: ind 5 mhy CT min at 1 KC and 1 v input, dc res 0.08 ohms max. Sec 4-5: ind 5 mhy min at 1 KC and 1 v input. Sec 4-6: ind 17 mhy min at 1 KC and 1 v input. Sec 4-7: ind 50 mhy min at 1 KC and 1 v input, dc res 0.25 ohms max.	B-5491636-P1
T602	Transformer: Audio, driver (transistor); core and and coil construction with bobbin, operating voltage 12 VDC at 10 MADC. Pri 1: 1,500 ohms imp. Pri 2: 320 ohms imp. Sec: 2,000 ohms imp.	B-5491536-P1
	SOCKETS	
XI601	Holder: Lamp, (miniature bayonet socket); 2-terminals, right-angle downturned bracket. Leecraft Mfg Co Series 7-08.	A-4032238-P1
XQ601 and XQ602	Sockets: Transistor; 4-contacts, insulated, low-loss mica-filled phenolic, 1,000 megohms min, contact res 0.03 ohms max, 1 amp, 400 vrms. Elco Corp Cat. No. 3303. (Used with mounting ring. Elco Corp Cat. No. 757. (G-E Dwg and Part No. A-7162414-P1)). (Included in Pre-Amp Board, G-E Dwg and Group No., PL-4032087-G1).	B-5490277-P1
	SUB-ASSEMBLIES	
	PRE-AMP BOARD Consists of the following components: C602 thru C608 L601 Q601 and Q602 R601 thru R607, R609, R611, R612, R618, R620 RT601 XQ601 and XQ602	PL-4032087-G1
	HEAT SINK Consists of the following components: Q604, Q606 S602	PL-5491240-G1

BOARD PRE-AMP



(A4032087)

(A-4032087, Rev. 3)
(B-5491318, Rev. 1)
(B-5491318, Rev. 0)

TB-1
VIEW AT B

Fig. 7 Outline Diagram

PRE-AMP BOARD
MODEL 4EA12A10

Denotes Solder Circuit
Denotes Component Circuit

(RC-688)

SERVICE HINTS FOR TRANSISTORIZED & PRINTED CIRCUITS

Servicing transistorized and printed circuit equipment requires some special techniques which can be easily acquired. The following hints are intended as a guide in developing these techniques.

TRANSISTORIZED CIRCUITS

TROUBLE SHOOTING

Transistorized circuits require essentially the same trouble-shooting techniques as conventional vacuum-tube circuits. The usual order for locating troubles is still:

1. Use of symptoms discovered by eye and ear, simple realignment, and test jack readings to localize trouble.

2. Substitution of plug-in components, such as transistors, in suspected stages.

3. Use of voltage readings, resistance readings, signal injection, realignment, sensitivity measurements, and gain measurements to further identify faulty components.

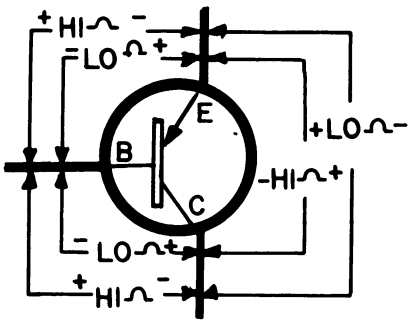
4. Replacement of suspected component.

5. Check out and adjustment of affected circuits.

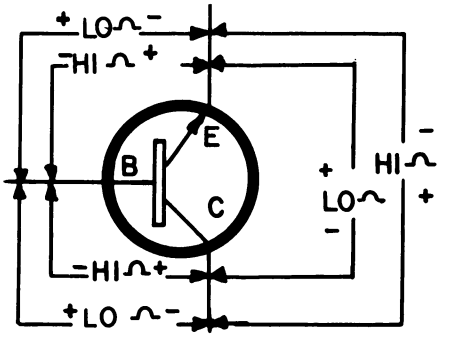
TRANSISTOR TESTING AND REPLACEMENT

A transistor suspected to be defective can either be checked by the substitution method or by the use of a suitable transistor checker.

Although transistor testers are available, it is usual to check a transistor by noting the operation of the circuit when a transistor known to be good is substituted. Some idea of the condition of a transistor can be obtained by judicious use of resistance measurements across the terminals, as shown on page 2 for a good transistor:



PNP TYPE TRANSISTOR



NPN TYPE TRANSISTOR

Equipment using transistor sockets does not present problems for replacement other than making certain that the transistors are seated properly.

Equipment using transistors soldered directly to terminals or printed boards, require special treatment. Care must be taken to avoid overheating the transistor while soldering. Even other transistors near the one being soldered can be damaged.

Use a heat-sink (such as an alligator clip) on any transistor lead being soldered.

Always check the circuit for defects which could damage the new transistor being placed into the circuit.

A heavy duty soldering iron should not be used. Make certain that the iron to be used does not have current leakage. An isolation transformer can be used to prevent current leakage.

A transistor should never be removed or replaced while power is on, as a surge of current may damage the transistor.

If the leads from a transistor are disconnected, make sure that each wire is reconnected to the proper place. Otherwise, voltages of reversed polarity may be applied across a transistor which may damage it before a fuse can blow.

When replacing transistors using a heat sink, make certain that the transistor and the heat sink make firm and secure contact in order to maintain good heat dissipation. Some transistors using heat sinks are electrically insulated from the heat sink by the use of anodized aluminum spacers and silicone grease. Both the anodized aluminum spacer and the silicone grease afford good heat dissipating qualities while offering good electrical insulation. When replacing a transistor of this type, make certain to replace the anodized aluminum spacer and apply silicone grease between the transistor, anodized aluminum spacer and the heat sink.

TEST EQUIPMENT

Equipment used to test transistor circuits is of the same type used for checking conventional circuits. Certain precautions are necessary, however, to prevent damage to transistors.

Signal generators, VTVM's and signal tracers should be of the transformer type which isolates the equipment from the power line. Use an isolation transformer whenever the test equipment uses a transformerless power supply.

Use a common ground between the transistorized equipment and the chassis of the test equipment.

For bench testing of mobile equipment, use a power source which has good filtering and regulation. On some supplies it may be necessary to add a 2000-mfd capacitor across the output, to reduce the ripple and to represent the high internal capacity of a vehicular battery. Be careful to observe the proper power supply polarity when connecting transistorized equipment on the bench.

Use multimeters having a sensitivity of at least 20,000 ohms-per-volt. High currents from a meter of low sensitivity can damage transistors.

Do not use an ohmmeter capable of causing the transistor circuit under test to draw more than one milliampere of current.

Take care when metering transistor circuits so as to avoid accidental short circuits which could damage transistors. A base-to-collector short while a transistor is operating can instantly ruin the transistor.

PRINTED CIRCUITS

Printed circuits have definite advantages in servicing and trouble shooting. They are free of wiring errors sometimes encountered in conventional wiring, leads are easily seen and components are easily accessible. Readings can be taken directly at the socket pins and at most component leads on either the top or bottom of the printed boards.

REPLACING COMPONENTS

Replacing components on printed boards is relatively simple. Damage can be done to the printed board, however, by either excessive heat applied during soldering or in replacing a component. Overheating can cause the bond between the board and the copper foil to break. Use a low wattage soldering iron to prevent this damage. Make certain any splashes of solder are removed to prevent shorts.

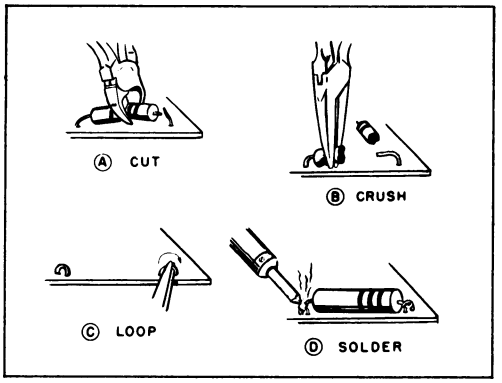
Heat-sink components which may be easily damaged by excessive heat during soldering, by using an alligator clip on the component leads.

Capacitors and Resistors

There are two methods recommended for replacing capacitors and resistors in printed boards. Method 1 can be used to replace a component without removing the board from its mounting.

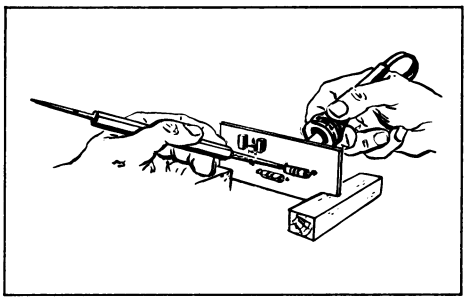
Method 1 - Follow steps A, B, C & D shown in Fig. 1 below:

Figure 1



Method 2 - Cut the leads on the old component as close as possible to the printed board. Heat the solder joint at the bottom side of the board and pull the remainder of the old leads through the bottom. Clean the holes and insert the new component. Bend the leads over on the bottom of the board and clip the excess. Solder the joints.

Figure 2



Coils, Sockets, Shields, Printed Sub-Assemblies and Controls

While applying the soldering iron to each individual lug, brush off any molten solder with a small brush. Take care not to spread solder in order to avoid shorts. When lugs and holes are clean, straighten lugs (while solder is melted) and free the lugs from the board. When all lugs are free, the component can be lifted out.

REPAIRING PRINTED BOARDS

In the event that the copper foil has been damaged, the break can be repaired by flowing solder across the gap, or if the gap is too large, it can be bridged by soldering a piece of hook-up wire across the gap.

If the copper foil becomes raised from the board, clip off the raised portion and replace it with a section of wire.

Small "hairline" breaks in the continuity of printed wiring can normally be found by visual examination or with the aid of a magnifying glass. Through the use of printed circuits, the possibility of intermittents occurring has been greatly reduced. When encountered, however, probing of component leads should be used to locate the point, rather than flexing of the board.

To facilitate circuit tracing of printed wiring, we have included in this instruction book a diagram of each printed board, (Refer to Table of Contents). These diagrams are of particular value when the back side of the board is not visible without removing the board from its mounting. The circuits on two-sided boards (printed wiring boards with wiring on both sides) are indicated by a fine-screened grey for wiring on the solder side of the board and a coarse-screened grey for wiring on the component side, as illustrated in Fig. 3.

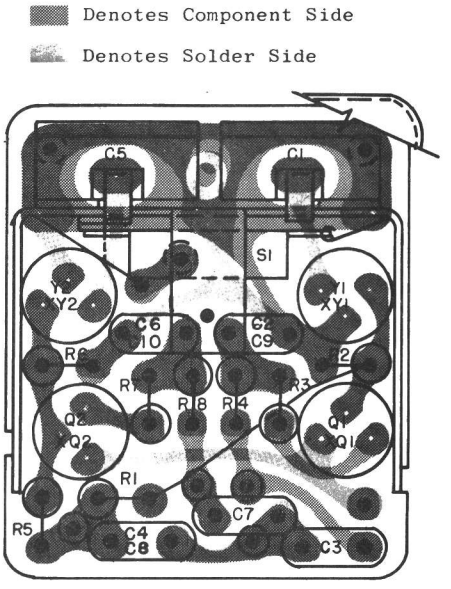


Figure 3 - Outline Diagram of a Typical Printed Board

Outlines of the components are indicated on the diagrams, and black dots are used to indicate connections from one side of the board to the other.

Figure 4 - PRINTED CIRCUIT BOARD SERVICE KIT

The Printed Circuit Board Service Kit illustrated in Figure 4 is available through your nearest General Electric Communication Products District Sales Office. This kit provides the following basic set of tools useful in servicing printed circuits:

37 1/2-watt Ungar Soldering Iron with 3 Tiplets
- ---chisel tip
- ---pointed tip
- ---offset tip

Midget Diagonal Cutters
Midget Long-Nose Pliers
Tweezers
Soldering Aid
Solder Brush (Wire/Bristle)
60/40 Solder

10091

COMMUNICATION PRODUCTS DEPARTMENT
GENERAL ELECTRIC COMPANY
LYNCHBURG, VIRGINIA

Printed in U.S.A.

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