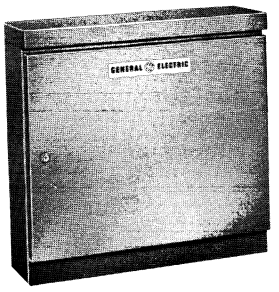
Base — Hayes Mem.
8/24/71

MOBILE RADIO

MASTR
PROGRESS LINE
Executive Series

MAINTENANCE MANUAL



Wall Mount Stations

Desk Top Stations

450-470 MHz

TWO-WAY FM STATION COMBINATION

LBI-4226A

Microphone

GENERAL ELECTRIC

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INTERCONNECTION DIAGRAM (See Power Supply Schematic)	

SCHEMATIC AND OUTLINE DIAGRAMS
(Includes Parts Lists & Production Changes)

	Outline	Schematic
Transmitter (ET-99-A)	RC-2108	RC-2109
Receiver (ER-50-A)	RC-1732	19R621221
Power Supply (4EP51A10)	19D402812	19R640706
Desk Top Control Unit (4EC69A10, 11 & 12)	RC-1421	RC-1421
Wall Mount Control Unit (4EC70A10)	RC-1422	RC-1422
Receiver Oscillator Board (EG-24-A)	RC-1822	RC-1822
Remote Control Board (4KC18A10 - 13)	RC-1423	RC-1423
Microphones (4EM25E10 & F10) (See back of RC-1421 & RC-1422)		
Handset and Hookswitch (4EM26A10)	RC-1424	RC-1424

ILLUSTRATIONS

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.

ADDENDUM TO LBI-3752, 3774 & 4226

Remote Control Board Models 4KC18A14 thru 4KC18A17 have been added to the MASTR Executive stations. The operation and circuit analysis is the same as shown below:

4KC18A14 same as 4KC18A10

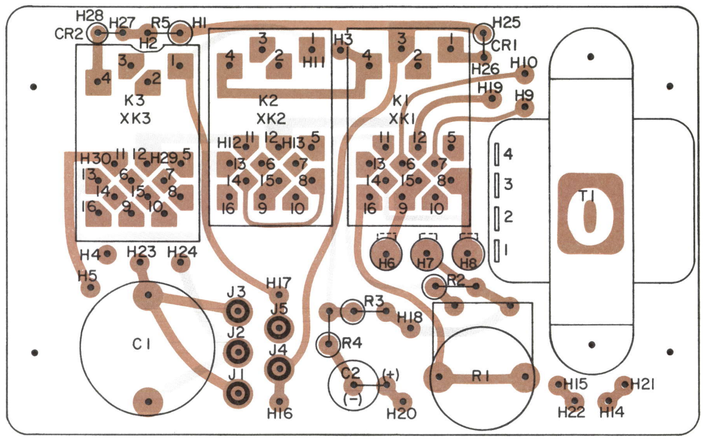
4KC18A15 same as 4KC18A11

4KC18A16 same as 4KC18A12

4KC18A17 same as 4KC18A13

The drawings and Parts List for the new Remote Control Boards are included as a part of this addendum.

On the Wall Mount Control Unit Model 4EC70A10 change the Volume Control (R701) setting from not more than 6 volts RMS to not more than 2.7 volts RMS at the audio pair (TB1-1 & TB1-2).



POLARITY OF CR1 & CR2

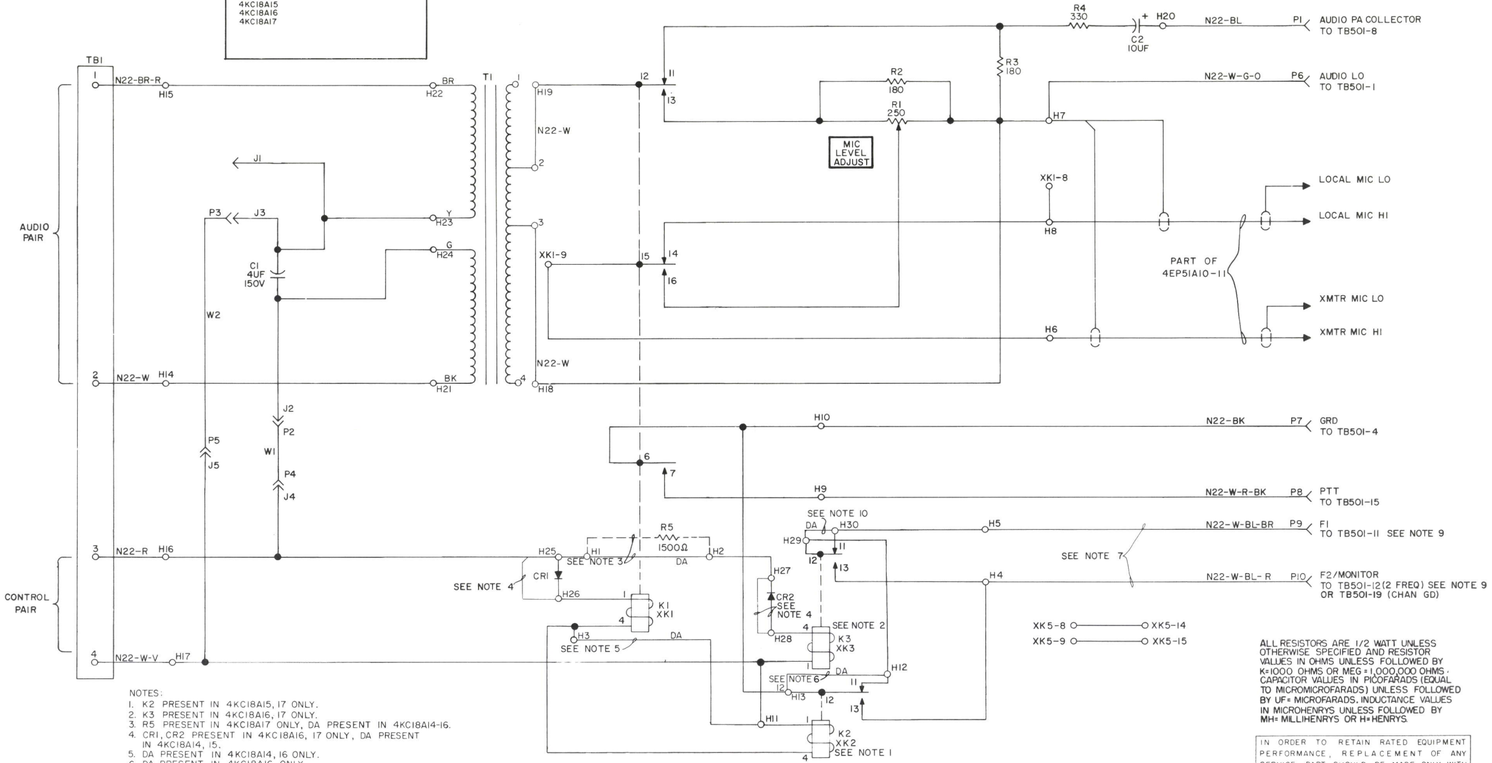
(19B219486, Rev. 0)
(19B219361, Sh. 1, Rev. 0)
(19B219361, Sh. 2, Rev. 0)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

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
4KC18AI4	
4KC18AI5	
4KC18AI6	
4KC18AI7	



NOTES:
1. K2 PRESENT IN 4KC18AI5, I7 ONLY.
2. K3 PRESENT IN 4KC18AI6, I7 ONLY.
3. R5 PRESENT IN 4KC18AI7 ONLY, DA PRESENT IN 4KC18AI4-I6.
4. CR1, CR2 PRESENT IN 4KC18AI6, I7 ONLY, DA PRESENT IN 4KC18AI4, I5.
5. DA PRESENT IN 4KC18AI4, I6 ONLY.
6. DA PRESENT IN 4KC18AI6 ONLY.
7. WIRES OMITTED IN 4KC18AI4.
8. UNLESS OTHERWISE SPECIFIED, ALL WIRES TO BE SN22.
9. FOR SINGLE FREQUENCY TRANSMITTER AND RECEIVER, AND CHANNEL GUARD MONITOR (AI5 ONLY) INTERCHANGE RELAYS. PLUG K1 (19C307010P10) INTO XK2 & PLUG K2 (19C307010P11) INTO XK1. CONNECT W-BL-R WIRE FROM H4 ON 4KC18AI5 TO TB501-10 ON 4EP51A10-11 REV D. ON 4EP51A10-11 REV "A" OR LATER, CONNECT W-BL-R WIRE FROM H4 ON 4KC18AI5 TO TB501-19. REMOVE & DISCARD W-BL-BR WIRE FROM H5 IN 4KC18AI5 TO TB501-11 ON 4EP51A10-11.
10. DA PRESENT IN 4KC18AI5 ONLY.
11. TERMINATE ALL WIRES TO TB501 WITH 19B209260P103.

(19D416223, Rev. 1)

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.

SCHEMATIC & OUTLINE DIAGRAM

REMOTE CONTROL BOARD MODELS 4KC18A14—17

(RC-2233)

PARTS LIST

LBI-4274

REMOTE CONTROL BOARD
MODELS 4KC18A14 THRU 17

SYMBOL	GE PART NO.	DESCRIPTION
		CAPACITORS
C1	7486445P5	Electrolytic, non polorized: 4 µf +100% -10%, 150 VDCW.
C2	7489483P7	Electrolytic: 10 µf +75% -10%, 25 VDCW; sim to Sprague 30D.
		DIODES AND RECTIFIERS
CR1 and CR2	4037822P1	Silicon.
		JACKS AND RECEPTACLES
J1 thru J5	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		RELAYS
K1	19C307010P10	Armature: 28 VDC, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C-3480.
K2	19C307010P11	Armature: 30 VDC, 1.5 w operating, 1550 ohms ±10% coil res, 1 form A, 1 form C, 1 form D contacts; sim to Allied Control T154-X-631.
K3	19C307010P10	Armature: 28 VDC, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C-3480.
		RESISTORS
R1	19B209358P1	Variable, carbon film: approx 25 to 250 ohms ±20%, 0.2 w; sim to CTS Type U-201.
R2 and R3	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R4	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R5	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
		TRANSFORMERS
T1	19A115731P1	Audio freq: 300 to 6000 Hz, Pri (1-4): 22 ohms ±15% DC res, Pri (2-3): 12.5 ohms ±15% DC res, Sec 1: 13 ohms ±15%, Sec 2: 13 ohms ±15%.
		TERMINAL BOARDS
TB1	7117710P4	Phen: 4 terminals; sim to Cinch 1774.
		CABLES
W1		**CABLE 4037741G1**
		PLUGS
P2	4029840P1	Contact, electrical; sim to Amp 41854.
P4	4029840P1	Contact, electrical; sim to Amp 41854.
W2		**CABLE 4037741G1**
		PLUGS
P3	4029840P1	Contact, electrical; sim to Amp 41854.
P5	4029840P1	Contact, electrical; sim to Amp 41854.
		SOCKETS
XK1 thru XK3	5491595P7	Relay: 10 contacts; sim to Allied Control 30054-4.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

EQUIPMENT INDEX

EQUIPMENT	MODEL OR TYPE NUMBER	
	DESK TOP	WALL MOUNT
Transmitter	ET-99-A	ET-99-A
Receiver	ER-50-A	ER-50-A
Power Supply	4EP51A10	4EP51A10
Control Unit	4EC69A10	4EC70A10
Channel Guard Board	4EK14B10	4EK14B10
Four Freq. Oscillator Board	4EG24A10	4EG24A10
Remote Control Board	4KC18A10, 11	4KC18A10, 11, 12, 13
Power Cable	19A122527-G2	19A122527-G1
Microphone	4EM28A10, B10	
Top Cover	19A122161-G1	
Bottom Cover	19B205299-G1	
Fuse Assembly	19B216021-G1	
Antenna Cable		19A122133-G12
Alignment Tools Hex Slug Type Slotted Screw Type	4038831-P1, 2, 3, 4033530-G2	4033831-P1, 2, 3 4033530-G2
Lock Assembly Key Lock		 5491682-P8 5491682-P14

OPTIONAL EQUIPMENT

OPTION	EQUIPMENT	OPTION	EQUIPMENT
7349	Mod. Kit to Adjust Carrier Control Timer timing cycle	8405	Test Meter and 12/24 hour clock (117 VAC, 60 Hz) for Desk Top Station
7610	Carrier operated relay	8406	220 VAC factory connection for Desk Top station
8302	Intermodulation improvement Kit for VHF & UHF receiver	8407	220 VAC factory connection for Wall Mount station
8308	Carrier Control Timer for Executive Station	8421	Speaker (4EZ16A18) and Microphone (19B209102-P2)
8311	30W input limitation for UHF Control link application	8422	Fan for Desk Top Station (117 VAC, 60 Hz)
8401	12 hour clock (117 VAC, 60 Hz)	8493	Handset (4EM26A10) & Hookswitch
8402	12/24 hour clock (117 VAC, 60 Hz)	8494	Handset (4EM26A10)
8403	Test meter for Desk Top station	8495	Military Microphone (19B209102-P2)
8404	Test Meter & 12 hour clock (117VAC, 60 Hz) for Desk Top station.		

SPECIFICATIONS*

GENERAL

FREQUENCY RANGE	450-470 MHz
DIMENSIONS (H x W x D)	
Desk Top	5-3/4" x 20? x 19-3/4"
Wall Mount	21-1/4" x 22-1/2" x 6-7/8"
WEIGHT	
Desk Top	43 pounds
Wall Mount	55 pounds
INPUT VOLTAGE	117/220 VAC ±20%, 50/60 Hz
INPUT POWER	
Standby (transmitter filaments on)	28 watts
Transmit	150 watts
OPERABLE TEMPERATURE RANGE	-3-°C to +60°C (-22°F to 140°F)
DUTY CYCLE	Transmit: 20% Receive: 100%
MAXIMUM FREQUENCY SPACING	0.4%

TRANSMITTER

TYPE NUMBER	ET-99-A
POWER OUTPUT	15, 1-5, 5-12 watts
FREQUENCY STABILITY	±.0002% (-30°C to +60°C, +25°C reference)
SPURIOUS AND HARMONIC RADIATION	At least 60 dB below rated power output
MODULATION	Adjustment from 0 to ±5 kHz swing with instantaneous modulation limiting.
AUDIO FREQUENCY CHARACTERISTICS	Within +1 and -3 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards.
DISTORTION	Less than 5%
DEVIATION SYMMETRY	0.6 kHz maximum (Narrow Band)
CRYSTAL MULTIPLICATION FACTOR	36

RECEIVER

AUDIO OUTPUT	2 watts at less than 5% distortion
SENSITIVITY	
12-dB SINAD (EIA Method)	0.4 µv
20-dB Quieting Method	0.6 µv
SELECTIVITY	
EIA Two-Signal Method	-75 dB (adjacent channel, 25 kHz channels)
SPURIOUS RESPONSE	-85 dB
FIRST OSCILLATOR STABILITY	±.0002%(-30°C to +60°C, 25°C reference)
MODULATION ACCEPTANCE	±8 kHz
INTERMODULATION	-60 dB
FREQUENCY RESPONSE	+1 and -8 dB of a standard 6-dB per octave de-emphasis curve from 300 to 3000 Hz
SQUELCH SENSITIVITY	
Critical Squelch	4 dB SINAD (0.25 µv typical)
Maximum Squelch	Greater than 20 dB quieting

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

DESCRIPTION

MASTR Progress Line Executive Series Desk Top and Wall Mount stations are attractively styled base stations that are designed to meet the most stringent requirements in the field of Two-Way radio. The transmitter exciter board and the receiver are fully transistorized, utilizing silicon transistors for added reliability.

The stations are designed for ease of maintenance. All major modules and tuning adjustments are easily accessible. The Desk Top station transmitter receiver assembly tilts up to provide access to both sides of the unit. In Wall Mount stations, the entire chassis swings out and the transmitter-receiver assembly tilts down to provide access to both sides of the unit.

The transmitter and receiver are equipped with centralized metering jacks for simplified alignment and troubleshooting. The Desk Top station may also be equipped with a built-in test meter to facilitate servicing. The module layout for the stations is shown in Figure 1.

TRANSMITTER

The transmitter assembly consists of the transistorized exciter board and the power amplifier and varactor multiplier section. The transmitter uses only three tubes in the power amplifier. The standard transmitter may be equipped with:

- One through four frequencies
- Channel Guard

RECEIVER

The fully transistorized receiver is mounted on a single printed wiring board for increased reliability. A copper-plated housing and metal cover that completely encloses the receiver provides excellent shielding. The standard receiver may be equipped with:

- One through four frequencies
- Channel Guard

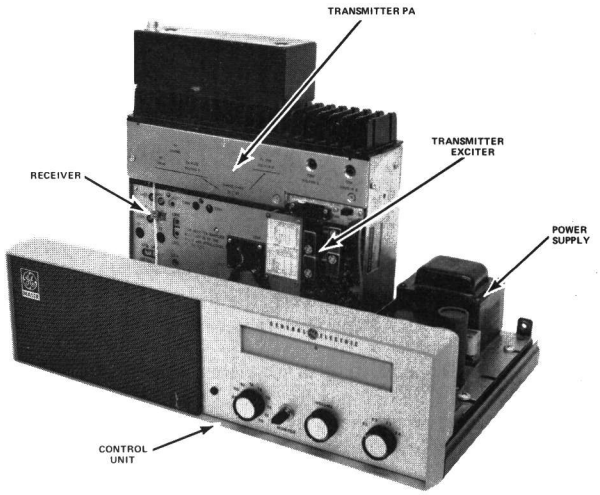
POWER SUPPLY

The power supply provides operating voltage for the transmitter and receiver. In addition to plate, screen and bias voltages for the transmitter PA, the power supply provides a regulated +10 volts for the transmitter exciter board, receiver and four-frequency oscillator board.

CONTROL UNITS

Two different control units are used with the stations. The Desk Top control unit is mounted on the front of the station

DESK TOP



WALL MOUNT

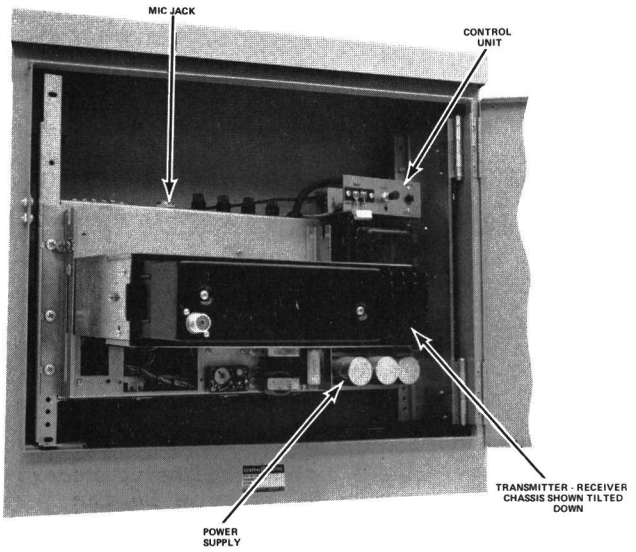


Figure 1 - Module Layout

so that the control will be within convenient reach of the operator. The Wall Mount control unit is mounted within the weatherproof cabinet on the top of the chassis.

INITIAL ADJUSTMENT

After the station combination has been installed (as described in the INSTALLATION Manual), the following adjustments should be made by an electronics technician who holds a 1st or 2nd Class FCC Radiotelephone license. Alignment tools are provided with the radio.

Make sure that a RADIO TRANSMITTER IDENTIFICATION form (FCC Form 452-C or General Electric Form ECP-82) has been filled out and attached to the transmitter.

TRANSMITTER ADJUSTMENT

The initial adjustment for the transmitter includes loading the power amplifier into the antenna, and checking the frequency and modulation. For the Initial Adjustment procedure, refer to the transmitter ALIGNMENT PROCEDURE.

RECEIVER ADJUSTMENT

The initial adjustment for the receiver includes adjusting the receiver to the system operating frequency, and matching the antenna transformer to the antenna. For the initial adjustment procedure, refer to the FRONT END ALIGNMENT PROCEDURE.

REMOTE CONTROL BOARD

In local/remote and remote control applications, it is necessary to set the Mic Level Adjust control (R1) on the remote control board. Refer to the ADJUSTMENT PROCEDURE on page 13.

OPERATION

The basic procedure for receiving and transmitting messages on the Desk Top station is as follows:

TO RECEIVE A MESSAGE

1. Turn the radio on by turning the OFF-VOLUME control halfway to the right. This lights the green power-on lamp.
2. Press down the MONITOR switch and adjust the VOLUME control for a comfortable listening level. Release the MONITOR switch.

The radio is now ready to receive messages from other radios in the system.

TO TRANSMIT A MESSAGE

1. Apply power to the transmitter by turning the OFF-VOLUME control to the ON position. Let the unit warm up for 30 seconds.
2. Press the push-to-talk button on the microphone and speak in a normal (or softer) voice six inches away from the front of the mike. Release the button as soon as the message has been given. The red signal light on the control panel will glow each time the microphone button is pressed, indicating that the transmitter is on the air. The receiver is muted whenever the transmitter is keyed.

> NOTE
> For Desk Top Stations equipped with Channel Guard desk-type microphone Model 4EM28B10, press the MONITOR button down before sending a message and listen to make sure that no one is using the channel. To send a message, press down the TRANSMIT button while holding the MONITOR button down. The MONITOR button may be released after the TRANSMIT button is depressed.

MAINTENANCE

PREVENTIVE MAINTENANCE

To insure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts. This preventive maintenance should include the maintenance checks listed on the following page.

TEST AND TROUBLESHOOTING PROCEDURES

Whenever difficult servicing problems occur, the test procedure for transmitter and receiver can be used by the serviceman to compare the actual performance of the unit against the specifications met by the unit when shipped from the factory. The test procedures are located on the back of the applicable Alignment Procedure.

In addition, specific troubleshooting procedures are available for the transmitter, receiver and power supply (refer to the Table of Contents). For best results, the test procedures should be used in conjunction with the troubleshooting procedures.

REDUCED POWER MODIFICATION

Components are supplied with the station to modify the transmitter and power supply

PREVENTIVE MAINTENANCE PROGRAM

CHECK THE FOLLOWING ONCE A YEAR:	
1. Transmitter frequency and deviation (FCC requires this check-up at least ONCE a year).	☐
2. Measure and record the antenna system V.S.W.R.	☐
3. For 117 VAC operation, check input voltage at TB501-18 and -22 on power supply. Reading should be within 10% of 117 VAC. (Also check during routine service calls).	☐
4. Compare and record transmitter meter readings with voltages taken during initial tune-up. Retune, if necessary.	☐
5. Compare and record receiver meter readings with voltages taken during initial tune-up. Retune, if necessary.	☐
6. Check for positive indication of pressure on transmission line pressure gauge (if pressurized line is used).	☐
7. Clean dust from fan blades and lubricate bearings.	☐
8. Burnish pitted or coated relay contacts to smooth out metallic deposits or remove the coating.	☐

MAKE THE FOLLOWING MAINTENANCE CHECKS DURING ROUTINE CALLS:	
1. Check antenna lines and mast for mechanical stability.	☐
2. Visually check:	
External cables	☐
Internal cables	☐
Plugs	☐
Sockets	☐
Terminal boards	☐
3. Check for tightness of nuts, bolts, and screws to make sure nothing is working loose from its mounting.	☐
4. Replace tubes as necessary. (It may be convenient to replace all station tubes during the yearly check-up.)	☐

for reduced power Mobile Relay applications. For Radio Link Control, option 8311 provides for a limited input of 30 watts (R.F. input to the Varactor Multiplier). Refer to the Table of Contents for Installation Instructions for the Kits 19A127945-G1, G2 and Option 8311.

INTERMODULATION IMPROVEMENT KIT OPTION 8302

This modification kit is used to improve the intermodulation performance of the receiver with some loss of receiver sensitivity. The installation of this kit consists of changing R301 from a 10K-ohm resistor to a 390-ohm resistor. R301 is located in the base circuit of Q301. Then tune L302 for the best quieting sensitivity. The 12-dB SINAD sensitivity is changed from 0.4 microvolt to 0.8 microvolt, and the Intermodulation spurious response is changed from -60 dB to -65 dB.

CIRCUIT ANALYSIS

TRANSMITTER

Transmitter Type ET-99-A is crystal controlled, frequency modulated transmitters designed for one-, two-, or four-frequency operation in the 450-470 megahertz band in station applications. The transmitter consists of the following modules:

- Integrated Circuit Oscillator Module (ICOM)
- Transistorized Exciter Board - Audio, oscillator, modulator and multiplier stages.

- PA Assembly - Multiplier, driver, power amplifier, low-pass filter, varactor multiplier, filter, and antenna relay.

The transmitter uses a total of 7 transistors, 3 tubes and a varactor to provide a minimum power output of 15 watts in the 450-470 MHz range. The frequency of the ICOMs used ranges from 12.5 to 13.05 megahertz, and the ICOM frequency is multiplied 36 times.

A centralized metering jack (J201) is provided for use with GE Test Set Model 4EX3A10 or 4EX8K11. The test set meters the phase modulator, multipliers, driver and PA stage, relative power output, as well as the B-plus and regulated supply voltages. The metering jack also provides access to receiver audio, microphone and push-to-talk leads.

POWER INPUTS

All supply voltages are connected from the power supply to the transmitter through two 7-pin miniature connectors (J202 and J203). Voltages for the PA assembly are connected through J202, and are filtered by feed-through capacitors C222 through C229. Supply voltage, metering and control functions for the exciter board are connected from the PA assembly through a 9-pin miniature connector (J105). Supply voltages for the transmitter are shown in the following chart.

Connection	Voltage	Use
J202-1	+450 VDC	PA B-Plus
J202-2	+300 VDC	multiplier B-Plus
J202-3	ground	
J202-4	-55 VDC	PA bias
J202-5	+12 VDC	relay supply
J202-6 & -7		filament
J105-2	+10 VDC reg.	Exciter supply

ICOM OSCILLATOR

ICOM module Model 4EG25A10 consists of a crystal-controlled Colpitts oscillator, a voltage regulator, a Channel Guard tone modulator and a buffer output stage. The entire module (including crystal) is enclosed in a dust-proof aluminum can, with the ICOM frequency and the transmitter operating frequency printed on the top. Access to the oscillator trimmer is obtained by prying off the plastic GE decal on the top of the can.

The oscillator frequency is temperature-compensated at both ends of the temperature range to provide instant frequency

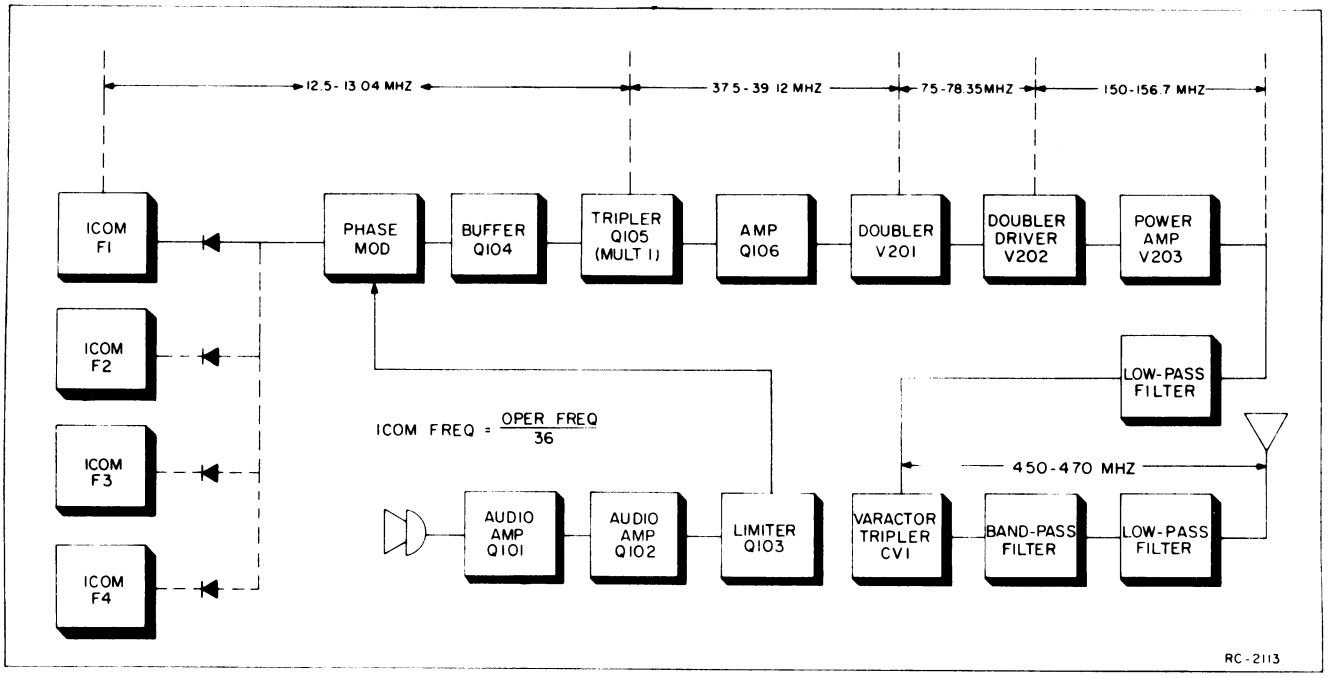


Figure 2 - Transmitter Block Diagram

compensation with a frequency stability of ±.0002%.

In single-frequency transmitters, a jumper from H1 to H2 on the exciter board connects the ICOM to ground and forward biases diode CR101. Keying the transmitter applies +10 volts to the ICOM, turning it on. As CR101 is forward biased, the ICOM output is coupled through blocking capacitor C110 to the phase modulator.

In multi-frequency transmitters, up to three additional ICOM's may be plugged into the exciter board. The single-frequency ground jumper is removed, and the proper frequency is selected by switching the ICOM to ground by means of a frequency selector switch on the control unit.

The ICOM's are grounded through switching transistors Q107 and Q108. The transistors isolate the F1 and F2 receiver ICOM's from the transmitter ICOM's. The F3 and F4 receiver ICOM's are isolated by switching transistors Q2602 and μ2603 that are mounted on the receiver oscillator board.

In Channel Guard applications, tone from Channel Guard Board Model 4EK14B10 is applied to pin 10 of the ICOM. The ICOM output is frequency modulated by the Channel Guard tone.

CAUTION

All ICOM modules are individually compensated at the factory, and cannot be repaired in the field. Any attempt to remove the ICOM cover will void the warranty.

AUDIO AMPLIFIERS AND LIMITER

The audio section of the transmitter consists of direct-coupled feedback amplifiers Q101, Q102 and Q103. Q103 also acts as a limiter at high audio input levels. Audio from the microphone is coupled through an input network (C132 and R101) to the audio stages. The input network, in conjunction with the feedback circuit, provides the audio gain and a 6-dB/octave pre-emphasis.

The output of limiter Q103 is connected through modulation adjust potentiometer R110 to a de-emphasis network for 6-dB/octave de-emphasis and post limiter roll-off. The network consists of C106, C107, C108, R113 and R114. Modulation adjust R108 determines the maximum signal level applied to the modulator circuit, and is normally set for %4.5 kHz (narrow band).

PHASE MODULATOR

The phase modulator uses varactor CV101 (a voltage-variable capacitor) in an R-L-C network that includes R119 and L101. An audio signal applied to the modulator through L101 varies the capacitance of CV101, resulting in a phase modulated output. The modulator output is fed to the base of buffer Q104.

BUFFER, MULTIPLIER & AMPLIFIER

Buffer stage Q104 isolates the modulator from the loading effects of the tripler stage, and provides some amplification. The output is direct-coupled to tripler Q105.

Q105 operates as a Class C multiplier stage (MULT-1) with the collector tank tuned to three times the ICOM frequency. This stage is metered at centralized metering jack J202 across metering resistors R124 and R126.

Following the tripler is RM amplifier Q106. This stage is metered at J202 across metering resistors R127 and R128.

PA ASSEMBLY

MULTIPLIERS

The output of the transistorized exciter is link-coupled through T201, to the grid of beam pentode V201. This stage operates as a doubler with T202 tuned to 12 times the crystal frequency. The grid of V201 is metered through R201 and R202 at J201.

The output of V201 is transformer-coupled to the grid of beam pentode V202. This stage operates as a doubler-driver with the output tuned to 24 times the crystal frequency. The grid of V202 is metered through metering network R207 and R208.

POWER AMPLIFIER

The output of V202 is coupled to the grid of compactron beam power amplifier (V203) by a pi-network consisting of C209, L205 and C236/C210. The grid is tuned by C209 (PA GRID), and current is metered at J201-6 and J201-14 by measuring the voltage drop across R210. Bias voltage (-55 volts) is applied to the PA grid through R210, L209 and L205.

Plate current is metered from J201-1 to J201-9 across metering resistor R214. Plate voltage is supplied through L206, and the PA plate tank is series-tuned by capacitor C214. The screen grid dropping resistor is R213.

WARNING

The meter leads are at plate potential (high B+) when metering the PA plate at J201-1 and J201-9.

Placing TUNE-OPERATE switch S201 in the OPERATE position effectively shorts R212 out of the circuit, and applies 300 volts to grid dropping resistor R213 for normal operation of the stage. Placing the switch in the TUNE position applies the screen voltage to dropping resistor R212 and shunt resistor R211 to drop the screen voltage. This reduces the plate dissipation while tuning the transmitter. PA loading is achieved by varying the coupling between L214 and L208.

The output of the PA is coupled through a series-tuned circuit consisting of C215 and L208 to the Low Pass Filter. The output of the Low Pass Filter is coupled through coaxial cable W203 to Multiplier Filter assembly A201.

MULTIPLIER-FILTER ASSEMBLY

Multiplier-Filter Assembly A201 consists of a varactor tripler, band-pass filter, low-pass filter and antenna switching relay.

RF signals from the Low Pass Filter are applied to a passive tripler circuit. The tripler consists of three tuned stages (C1-L1-C2, C3-L2-C6, and C4-C7) which are coupled together through the common impedance of varactor CV1. The first tuned circuit is tuned to the fundamental frequency. The second tuned circuit is tuned to twice the input frequency and provides a harmonic which mixes with the input frequency to produce the desired output (or operating frequency). The third tuned circuit is tuned to the operating frequency.

Following the tripler is a band-pass filter consisting of two inductively coupled helical resonators (C8-L3 and C9-L4). The filter is tuned to select only the third harmonic, and removes any even harmonics in the tripler output. The RF is then coupled through a low pass filter which contains a sniffer circuit consisting of R3, CR1 and C12. The relative power output from this sniffer circuit can be metered at J201-13.

RF from the low pass filter is coupled through antenna changeover relay K1 to the antenna.

RECEIVER

Receiver Type ER-50-A (450-470 MHz) is a double conversion, superheterodyne FM receiver designed for one-, two-, or four-frequency operation. The receiver is of single-unit construction and is housed in a copper-plated casting for maximum shielding and rigidity. The unit is completely transistorized, using silicon transistors for added reliability.

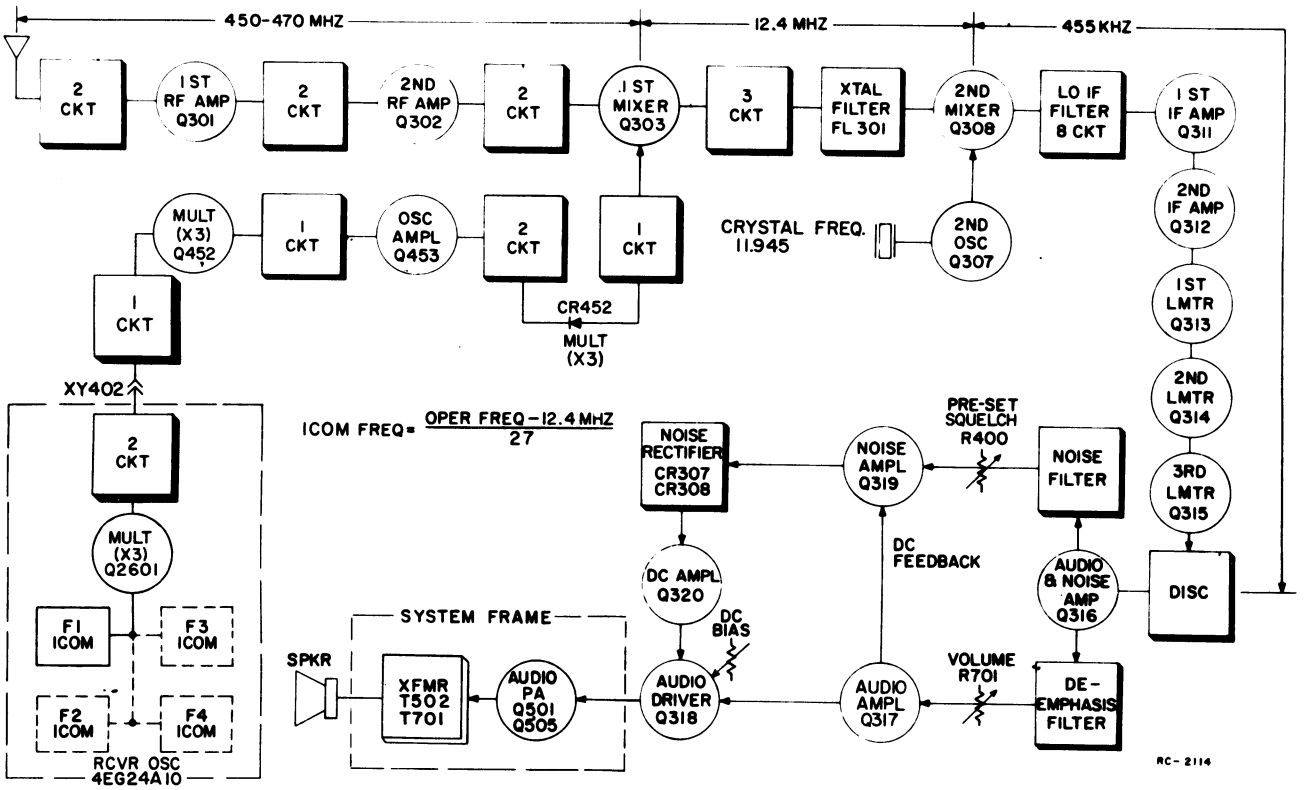


Figure 3 - Receiver Block Diagram

A regulated +10 volts is used for all receiver stages except the audio drivers and audio PA stages, which operate from the 12-volt system supply. Centralized metering jack J304 is provided for use with GE Test Set Models 4EX3A10 or 4EX8K11. The test set meters the oscillator, 1st and 2nd limiters, discriminator and audio driver bias as well as the voice coil, regulated +10 volts and the 12-volt supply.

RF AMPLIFIERS

RF signals from the antenna are link-coupled through helical resonators L301 and L302 to the base of 1st RF amplifier Q301. The output of Q301 is link-coupled through helical resonators L303 and L304 to the base of 2nd RF amplifier Q302. The output of Q302 is link-coupled through L305 and L306 to the base of 1st mixer Q303.

OSCILLATOR BOARD

Oscillator board Model 4EG24A10 is designed for use with GE Integrated Circuit Oscillator Module (ICOM) Model 4EG26A13. Up to four ICOM modules may be plugged into the oscillator board.

The ICOM module consists of a crystal-controlled Colpitts oscillator, a voltage regulator, and a buffer output stage. The entire module (including crystal) is enclosed in a dust-proof aluminum can, with the ICOM frequency and the receiver operating frequency printed on the top. Access to the oscillator trimmer is obtained by prying off the plastic GE decal on the top of the can.

The oscillator frequency is temperature-compensated at both ends of the temperature range to provide instant frequency compensation with a frequency stability of ±0.0002% without crystal ovens or warmers.

In single-frequency receivers, pin 3 of the ICOM is grounded by means of a jumper on the receiver chassis, causing the ICOM to operate.

In multi-frequency receivers, the proper channel is selected by grounding pin 3 of the desired ICOM by means of a frequency selector switch on the control unit.

The ICOM output is applied to the base of tripler Q2601. This stage is metered at J2605 on the oscillator board. The output of Q2601 is coupled through two tuned circuits (L2601 and L2602) to crystal socket XY402 on the receiver chassis.

CAUTION

All ICOM modules are individually compensated at the factory and cannot be repaired in the field. Any attempt to remove the ICOM cover will void the warranty.

MULTIPLIERS AND OSCILLATOR-AMPLIFIER

The oscillator board output is coupled through XY452 to the base of Q452. In station applications, this stage is modified to operate as a tripler. The output of Q452 is coupled through L454 to the base of oscillator-amplifier Q453. L454 is tuned to nine times the ICOM frequency and Tripler Q452 is metered at J304 (OSC).

The oscillator-amplifier output is coupled through two tuned circuits (L455 and L456) to the cathode of multiplier diode CR452. The anode of CR452 is connected to helical resonator L457 which is tuned to 27 times the ICOM frequency.

1st MIXER AND CRYSTAL FILTER

RF from Q302 is applied to the base of 1st mixer Q303, and the low-side injection voltage from the multiplier is applied to the emitter of the 1st mixer. The 12.4 megahertz high IF output is coupled through three tuned circuits (L312-C350, L313-C354 and L314-C357) to provide high IF selectivity and impedance matching to the crystal filter.

High IF crystal filter FL301 has the required selectivity to prevent adjacent channel signals from overloading the 2nd mixer, and to reduce intermodulation spurious responses.

2ND OSCILLATOR AND MIXER

High IF from the crystal filter is applied to the base of the 2nd mixer Q308 with the 11.945 MHz 2nd oscillator output to produce the 455-kHz low IF.

The 455-kHz low IF is coupled to an eight-coil low IF filter which provides the main receiver selectivity.

LO-IF AMPLIFIERS AND LIMITERS

Following the low IF filter are two R-C coupled low IF amplifiers (Q311 and Q312). The amplified output is fed to three R-C coupled limiter stages consisting of Q313, Q314 and Q315, operating as over-driven amplifiers. The 1st and 2nd limiter stages are metered at centralized metering jack J304 thru metering diodes CR302 and CR303.

DISCRIMINATOR

The 3rd limiter output is applied to the Foster-Seely type discriminator, where the audio voltages are recovered from the 455-kHz Lo-IF. A low-pass filter (C422, C423, C424, R377, R379 and R380) removes any 455-kHz signal from the discriminator output.

AUDIO AMPLIFIER AND DRIVER

The audio signal is fed to the base of audio-noise amplifier Q316. Following Q316 is an audio de-emphasis network consisting of C426, C427, C428, R383, R384 and R385.

After the de-emphasis network, the audio signal is fed to the base of audio amplifier Q317 through the VOLUME control mounted on the control unit. The VOLUME control is used to set the amount of drive to audio amplifier Q317, audio driver Q318, and audio PA Q505. DC BIAS trimmer R392 sets the bias on Q318 and Q505, and is adjusted for a 280 millivolt (500 milliamps) reading at metering jack J304-9. The output of Q505 drives the loudspeaker.

SQUELCH

Noise from audio-noise amplifier Q316 is used to operate the squelch circuit. When no carrier is present in the receiver, this noise is coupled through a noise filter (which attenuates any audio frequencies) to the base of noise amplifier Q319. The noise filter consists of C435, C436, C437 and L331. The noise level fed to the noise amplifier is set by SQUELCH control R400. The output of noise amplifier Q319 is rectified by diodes CR307 and CR308, and filtered by C441 and C442 to produce a positive DC voltage. This DC voltage turns on DC amplifier Q320, causing it to conduct. When conducting the collector voltage of the DC amplifier drops to near ground potential, which lowers the bias on audio stages Q317 and Q318, turning them off.

As audio amplifier Q317 is being turned off, its emitter potential decreases. This results in a positive DC feedback through R406 to the emitter of noise amplifier Q319 which causes an increase in the gain. As the gain of Q319 increases, the positive DC voltage to the DC amplifier increases, quickly turning the audio stages off.

When the receiver is quieted by a signal, less noise is present in the circuit and the DC amplifiers turn off. The audio stages are allowed to conduct, and audio is heard from the speaker. When audio amplifier Q317 is conducting, a positive voltage appears across R406 which helps reduce the gain of noise amplifier Q319. This positive feedback causes a quick, positive switching action in the squelch control.

POWER SUPPLY

Power Supply Model 4EP51A10 is used to supply all voltages for the Desk Top or Wall Mount station combinations. The power supply provides:

- Plate, screen and bias voltages for the transmitter multiplier and power amplifier stages.
- Regulated +10 volts for the transmitter exciter board.
- Regulated +10 volts for the receiver and four-frequency board.
- +12 volts for the relays and receiver audio amplifiers.
- AC filament voltage.

The power transformer (T501 and T502) connected in parallel are used in the power supply. Power is applied to the transformer primaries by turning power switch S502 (on back of the station chassis) to the ON position. A 3-amp fuse (F501) is one side of the AC lead protects the power supply against overloads.

The power supply is designed for operation from either a 117 VAC or 220 VAC, 50/60 Hz source. The station is normally shipped connected for 117 VAC operation, with the primary windings of T501 and T502 connected in parallel. For 220 VAC operation, the transformer primaries are connected in series. Refer to the power supply Schematic Diagram for 220 VAC transformer connections.

RECTIFIER AND FILTER CIRCUITS

Negative Bias Supply

The AC voltage developed across secondary windings 8-10 of transformer T501 is rectified by full-wave rectifiers CR501 and CR502. The rectified voltage is then filtered by C501 and R501 to supply a negative 55 volts for the control grid of the transmitter power amplifier. The bias voltage is present as a protective measure to limit cathode current in the PA tube while the PA is untuned, or in the case of loss of drive to the PA.

Multiplier B-Plus (Figure 4)

The AC voltage developed across high voltage secondary windings of T501 is rectified by a full-wave bridge rectifier circuit.

During one-half of each AC cycle, the voltage across T501-6 and -7 of the high voltage output winding is rectified by CR507 and CR509. During the second half of the cycle, the voltage is rectified by CR508 and CR510.

Filtering is provided by L-C filter C505 and L502. R506 is a bleeder resistor.

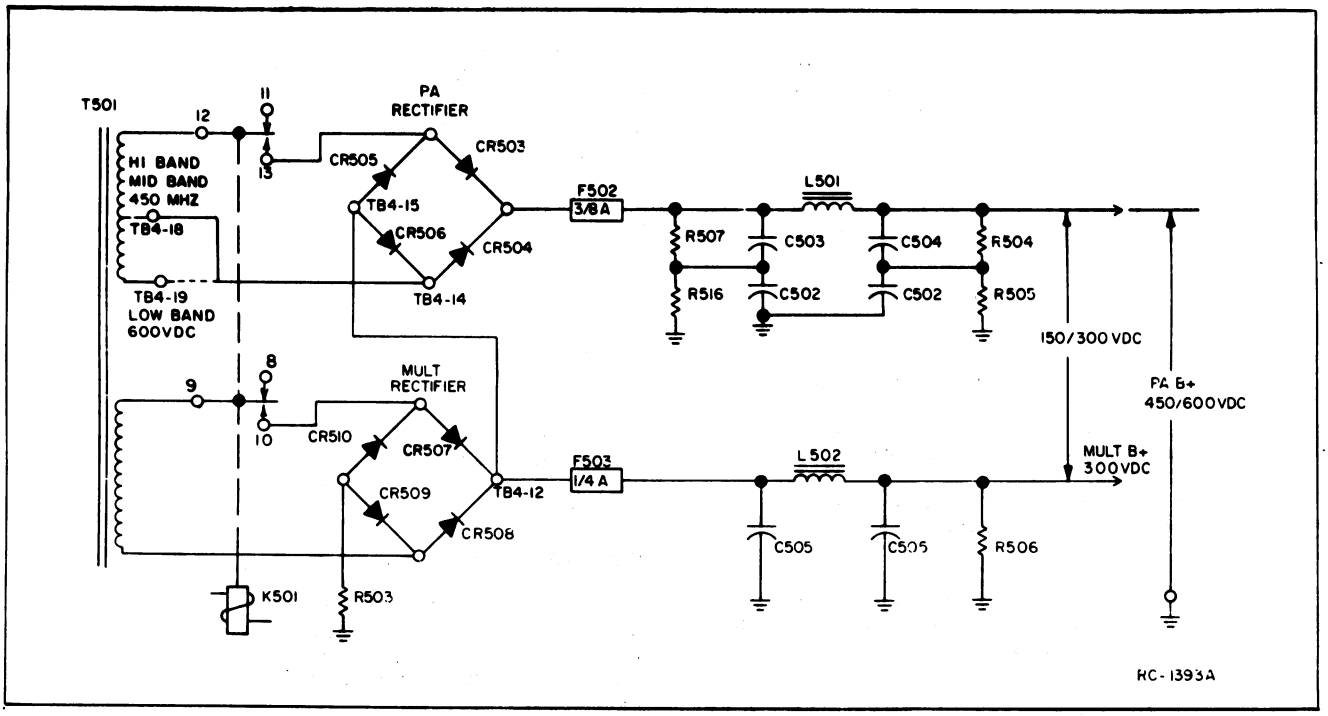


Figure 4 - Multiplier and PA B-Plus Circuits

The transformer and rectifiers are protected by fuse F503.

Power Amplifier B-Plus (Figure 4)

High B-Plus for the power amplifier is provided by the PA rectifier circuit and the multiplier rectifier circuit connected in series.

In high band stations, a jumper is connected from TB4-14 to TB4-18, and the AC voltage developed across T501-11 and -12 is rectified by CR503 and CR504. This output, in series with the multiplier output, supplies 450 volts DC high B-Plus.

In low band stations, the jumper is connected from TB4-14 to TB4-19, and the AC voltage is rectified by a bridge rectifier circuit consisting of CR503, CR504, CR505 and CR506. This output, in series with the multiplier output, supplies 600 volts DC high B-Plus.

The PA filter consists of C502, C503, L501 and C504. R504, R505, R507 and R510 are bleeder resistors. The rectified circuit and transformer are protected by fuse F502.

12-Volt Supply

The AC voltage developed across secondary windings 8-10 of transformer T502 is rectified by full-wave rectifiers CR511 and CR512. The output is filtered by C506 and L503 to provide a nominal 12 volts for the push-to-talk and antenna switching relays, receiver audio amplifiers and 10-volt regulator A501. The rectifiers and transformer are protected by fuse F504.

Filament Supply

The 12-volt, AC filament supply and pilot light voltage is taken from the voltage developed across windings 6-7 of transformer T502.

+10 VOLT REGULATOR (A501)

The 10-volt regulator provides a closely controlled supply voltage for the transmitter exciter, receiver and four-frequency oscillator board.

When the output voltage at the emitter of Q1 tries to increase, the voltage at the base of Q2 tends to become more positive. This makes Q2 conduct more heavile, causing the voltage at the base of Q1 to become more negative. With less base bias, Q1 conducts less and the voltage drop across the transistor is larger. This keeps the output voltage constant.

When the output voltage tries to decrease, Q2 conducts less and the base bias on Q1 increases. This causes Q1 to conduct more heavily, reducing the voltage drop across the transistor and keeping the output constant.

Potentiometer R3 and resistor R4 form a voltage divider so that R3 can be adjusted for a +10 volt output. Zener diode VR1 provides a voltage reference for the regulator.

The output can be metered at the transmitter and receiver centralized metering jacks.

Microphone Pre-Amplifier (A502)

Microphone pre-amplifier A502 provides an additional 10-dB gain for use with desk-type microphones. When a military mike or handset is used, the pre-amplifier is disconnected from the circuit by moving lead P1 from J1 to J2 (refer to Power Supply Outline Diagram) so that the signal is connected directly to the transmitter.

The audio signal from the desk-type mike is connected to the pre-amp transistor Q1 through coupling capacitor C1. Following amplifier Q1, the signal is coupled through audio coupling capacitor C2 to the transmitter.

Base bias for Q1 is provided through voltage divider circuit R1 and R2 from the 10-volt regulated supply.

CHANNEL GUARD MONITORING

In Desk Top stations, Channel Guard monitoring is provided by monitoring transistor Q701. The transistor and biasing resistor R701 are mounted on TB701 on the main chassis.

The base of Q701 is connected to ground through the normally-closed contacts of the MONITOR switch on Channel Guard microphone Model 4EM28B10. The collector is connected to J601-7 on Channel Guard board Model 4EK14B10.

Pressing the MONITOR switch removes the ground on the base of Q701, causing it to conduct. When conducting, the collector of Q701 drops to near ground potential, disabling the decoder circuitry so that the receiver operates on noise squelch only.

CONTROL UNITS

DESK TOP CONTROL UNIT

Three different models of control units are available for use with Desk Top station combinations. All models of the Control Unit have a VOLUME CONTROL, a MONITOR switch, a green Power-On light, a red Transmit light, an audio transformer and speaker. In addition, control units in multi-frequency combinations are equipped with a frequency selector switch. The application of the different model control units and the frequency selector switch used is shown in the following chart:

CONTROL UNIT MODELS	FREQ. SELECTOR SWITCH ADDED	NO. OF FREQ.
4EC69A10	none	One
4EC69A11	S703	Two
4EC69A12	S704	Three or Four

Volume Control (R701)

Volume control R701 is a variable resistor used to control the audio output of the speaker (LS701). In Local/Remote combinations, R701 is replaced by a 3.5-ohm T-pad, R3001.

MONITOR/CG DISABLE (S702)

Placing S702 in the MONITOR position disables the noise squelch circuit in the receiver. In radios equipped with Channel Guard, the MONITOR position also disables the receiver Channel Guard. The CG DISABLE position of the switch disables Channel Guard while permitting normal noise squelch operation.

Multi-Frequency Switches (S703 and S704)

In multi-frequency applications, the frequency-selector switch selects the channel desired for both transmit and receive. The switch connects the emitter of the receiver first oscillator and the transmitter oscillator-switching diode to ground, so that the radio will operate on the frequency determined by the selected crystal-controlled oscillators. In multi-frequency radios, the transmitter and receiver Channel Guard operates on all frequencies.

Fan Option

An optional fan is available for mounting on the back of the control unit to provide ventilation for the transmitter and receiver. The fan is connected at the factory for continuous operation.

Clock Options

A 12-hour or 24-hour electric clock is available for mounting on the Control Unit. The clock is connected so that it will operate with the power switch On or Off. The clock can be set by turning the indicator wheels until the correct time shows in the window.

Tune-Up Meter Option

A 50 micro-amp tune-up meter (M1) and 12-position meter selector switch (S1) is available for mounting on the control unit. The switch connects to the transmitter and receiver centralized metering jacks by a "Y" cable with two plugs, and permits the following functions to be metered:

UNIT METERED	METERING SWITCH POSITION	FUNCTION METERED
Receiver (at J304)	RA	Discriminator
	RB	Lim 2
	RC	Lim 2
	RD	Oscillator
	RJ	Reg.10V (multiply meter reading by 5)
Transmitter (at J201)	TA	Mult-1
	TB	Mult-2
	TD	Mult-3
	TE	Mult-4
	TF	PA Grid
	TG	PA Plate

WARNING

The meter leads are at PA plate potential when the metering switch is in the TG position.

WALL MOUNT CONTROL UNIT

Control Unit Model 4EC70A10 is used with Wall Mount station combinations. The control unit is mounted on the system frame next to the power transformers.

The control unit contains the VOLUME control (R701), audio transformer (T701), MONITOR switch (S701), and the 3.5 ohm audio load resistor (R702) connected across TB701-1 and -2. R702 is removed when the speaker option is used, and the speaker is connected across TB701-1 and -2. Thermostats (S1 and S2) for the fan and heater options plug in to TB2.

Volume Control (R701)

The VOLUME control is set for not more than 6 volts RMS at the audio pair (TB1 & -2) with ±3.3 kHz (Narrow Band) or ±10 kHz (Wide Band) deviation at 1000 Hz applied to the station antenna jack.

Monitor Switch (S701)

When the Wall Mount station is equipped with a speaker option, pressing down the MONITOR switch disables the noise squelch circuit in the receiver. If the radio is equipped with Channel Guard, pressing the MONITOR switch also disables the receiver Channel Guard.

CHANNEL GUARD

Channel Guard Board Model 4EK14B10 is a fully transistorized encoder-decoder for use with Desk Top and Wall Mount station combinations.

The tone frequencies are controlled by plug-in tone networks that are made with precision components for excellent stability and reliability. The tone frequencies range from 71.9 to 203.5 Hz.

Complete instructions for the encoder-decoder are contained in Maintenance Manual LBI-4143.

CARRIER CONTROL TIMER

The Carrier Control Timer option shuts off the transmitter on each transmission after a one-minute timing cycle, and alerts the operator that the transmitter is off by means of an alarm tone in the speaker. The transmitter can be turned on again by releasing and re-keying the push-to-talk switch on the microphone.

The timing cycle (transmitter keyed time) is normally set at the factory for a duration of one minute. An optional potentiometer is available that permits the timing cycle to be adjusted from 15 seconds to 5 minutes. Complete instructions for the Carrier Control Timer are contained in Maintenance Manual LBI-4138.

INTERMODULATION IMPROVEMENT KIT OPTION 8302

This modification kit is used to improve the intermodulation performance of the receiver with some loss of receiver sensitivity. The installation of this kit consists of changing R301 from a 10K ohm resistor to a 390 ohm resistor. R301 is located in the base circuit of Q301. Then tune L302 for the best quieting sensitivity. The 12 dB SINAD sensitivity is changed from 0.4 microvolt to 0.8 microvolt, and the Intermodulation spurious response is changed from -60 dB to -65 dB.

REMOTE CONTROL

Remote Control Board Models 4KC18A10, 11, 12, and 13 were designed for use with Desk Top and Wall Mount Stations in local/remote and remote applications. The remote control board permits a maximum of four remotely controlled operations by the application of two different levels and polarities

of control current from a remote control console. The chart on this page shows the different functions available for each station, and the control current required to select each function.

AUDIO & CONTROL CIRCUITS

4KC18A10

Remote Control Board Model 4KC18A10 uses a 6-milliamp relay (K1) to switch a single-frequency station from receive to transmit. With no control current applied to the remote control board, the output of the station receiver (audio PA) is fed through normally closed contacts K1-11 and -12 through audio transformer T1 to the telephone audio pair (TB1-1 and -2).

Keying the microphone at the remote control console applies 6 milliamps to the control pair (TB-3 and -4). This energizes relay K1 which switches the telephone line audio pair through K1-12 and -13 to the transmitter input, and switches the transmitter keying lead to ground through K1-6 and -7.

4KC18A11

Remote Control Board Model 4KC18A11 uses a 6 milliamp relay (K1) and a 15 milliamp relay (K2) connected in series to provide two-frequency transmit and one-frequency receive, or one-frequency transmit and receive with Channel Guard.

For two-frequency transmit and one-frequency receive, keying the microphone at the remote control console on the F1 channel applies 6 milliamps to the control pair, energizing relay K1. This switches the telephone line audio pair to the transmitter input through K1-12 and -13, and switches the transmitter keying lead (PTT) to ground through K1-6 and -7. The transmitter crystal keying lead is grounded through normally closed contacts K2-11 and -12.

Keying the microphone at the remote control console on the F2 channel applies 15 milliamps to the control pair, energizing relays K1 and K2. Relay K1 switches the audio pair to the transmitter input, and the transmitter keying lead to ground. Relay K2 switches the transmitter F2 crystal keying lead to ground through contacts K2-12 and -13.

With no control current at the control pair, neither of the relays is energized, and audio from the station receiver is coupled through T1 to the remote control console.

In Channel Guard applications, relays K1 and K2 are interchanged on the remote control board. Pressing the MONITOR switch at the remote control console applies 6 milliamps to the control pair, energizing relay K1 (in relay socket XK2). This grounds the anode end of squelch gating diode CR609 through K1-12 and -13 and disables the Channel Guard squelch circuits. The operation of the noise squelch circuit is not affected.

Pressing the TRANSMIT switch at the remote control console applies 15 milliamps to the control pair, energizing relay K2 (in relay socket XK1). This switches audio from the telephone line to the transmitter input, and switches the transmitter keying lead to ground.

4KC18A12

Remote Control Board Model 4KC18A12 uses two 6 milliamp relays K1 and K3 to provide single-frequency transmit and two-frequency receive. Relay-polarizing diodes are installed in series with the relays for different polarities.

With no control current on the control pair, neither relay is energized and audio from the station receiver (F1) is coupled through T1 to the remote control console. When a negative 6 milliamp control current is applied to TB1-3 (with respect to TB1-4),

FUNCTION	STATION	REMOTE CONTROL MODEL	FUNCTION SELECTED BY CONTROL CURRENT AT TB1-3			
			0mA	+6mA	+15mA	-6mA
1-Freq. Xmit & 1-Freq. Rec	Desk Top or wall mount	4KC18A10	Receive	Transmit		
1-Freq. Xmit & Rec with Chan Gd	Desk top or wall mount	4KC18A11	Chan Gd Receive	Monitor (Chan Gd disabled)	Transmit	
2-Freq. Xmit & 1-Freq. Rec	Wall mount only	4KC18A11	Receive	Transmit F1	Transmit F2	
1-Freq. Xmit & 2-Freq. Rec.	Wall mount only	4KC18A12	Receive F1	Transmit		Receive F2
2-Freq. Xmit & 2-Freq. Rec	Wall mount only	4KC18A13	Receive F1	Transmit F1	Transmit F2	Receive F2

current flows through CR2 and K3. Relay K3 energizes and switches ground from receiver oscillator F1 to receiver oscillator F2.

If a positive 6 milliamp control current is applied to TB1-3 (with respect to TB1-4) current flows through CR1 and K1. Relay K1 energizes and switches the audio pair to the transmitter input, and the transmitter keying lead to ground.

4KC18A13

Remote Control Board Model 4KC18A13 uses two milliamp relays (K1 and K3) and a 15 milliamp relay (K2) to provide two-frequency transmit and two-frequency receive. K1 and K2 are connected to series with relay polarizing diode CR1 and K3 is connected in series with CR2.

Keying the microphone at the remote control console on the F1 channel applies +6 milliamps to TB1-3 (with respect to TB1-4), energizing relay K1. This switches the telephone line audio pair to the transmitter input through K1-12 and -13, and switches the transmitter keying lead (PTT) to ground through K1-6 and -7. The transmitter crystal keying lead is grounded through normally closed contacts K2-11 and -12.

Keying the microphone at the remote control console on the F2 channel applies 15 milliamps to the control pair, energizing relays K1 and K2. Relay K1 switches the audio pair to the transmitter input, and the transmitter keying lead to ground. Relay K2 switches the transmitter F2 crystal keying lead to ground through contacts K2-12 and -13.

With no control current at the control pair, no relay is energized, and audio from the station receiver (F1) is coupled through T1 to the remote control console. The F1 receiver oscillator is grounded through normally closed contacts 11 and 12 of K3.

When a negative 6 milliamp control current is applied to TB1-3 (with respect to TB1-4) current flows through CR2 and K3. Relay K3 energizes and switches ground from receiver oscillator F1 to receiver oscillator F2 through normally closed contacts 11 and 12 of K2.

WARNING

When servicing the station, always disable the transmitter keying circuit by placing a jumper from TB1-3 to TB1-4. This shorts out the control paid and prevents keying the transmitter from a remote point.

After servicing the station, always remove the short on the control pair.

CONTROL METHODS

Three types of telephone line connections are commonly used in remote control applications. The remote control board is normally shipped with jumpers connected for operation with a single telephone pair with control simplexed line to line (method 1). Refer to Figure 5 for the three types of telephone line and jumper connections.

Before choosing one of these methods, consider both the cost and performance of each, as one method may be available at a considerably lower rate. Some local telephone companies offer no choice, but will provide only an audio pair and a control pair. The chart on page 15 contains information to assist in selecting the control method and type of telephone line to be leased.

ADJUSTMENT PROCEDURE

Before setting the Mic Level Adjust (R1) on the remote control board, make sure that all power line, phone line and ground connections have been completed at the station and the remote control console. Also, the station should be aligned, and in Wall Mount Stations, VOLUME Control R701 (on Wall Mount Control Unit Model 4EC70A10) set for not more than 6 volts RMS at the audio pair (TB1-1 & -2) with ±3.3 kHz, (Narrow Band) or ±10 kHz (Wide Band) deviation at 1000 Hz applied to the station antenna jack. In Desk Top stations (Local/Remote control), adjust R3002 (on back of the power supply) for 6 volts RMS at the audio pair.

To Set the Mic Level Adjust:

1. Apply a 1000 Hz signal to the microphone jack on the remote control console (use a 30 milli-volt signal level for the Transistorized Control Console, or a 50 milli-volt signal level for the RC4).

2. Key the transmitter from the remote control console and set Mic Level Adjust R1 for 0.2 volt measured across TB3-18 and -19 with an AC-VTVM.

LOCAL/REMOTE CONTROL MODIFICATION (19A127258-G1)

In Local/Remote control applications (Desk Top station), T-pad R3001 (3.5 ohms, GE Part No. 19B209423-P1) replaces the standard volume control R701. The T-pad controls loudspeaker volume, but does not affect line level. Variable resistor R3002 (5K-ohms, GE Part No. 5496870-P22) is installed on the power supply adjacent to MIC jack J502 for adjusting the receiver output to the line and to the T-pad for the loudspeaker (See Figure 6).

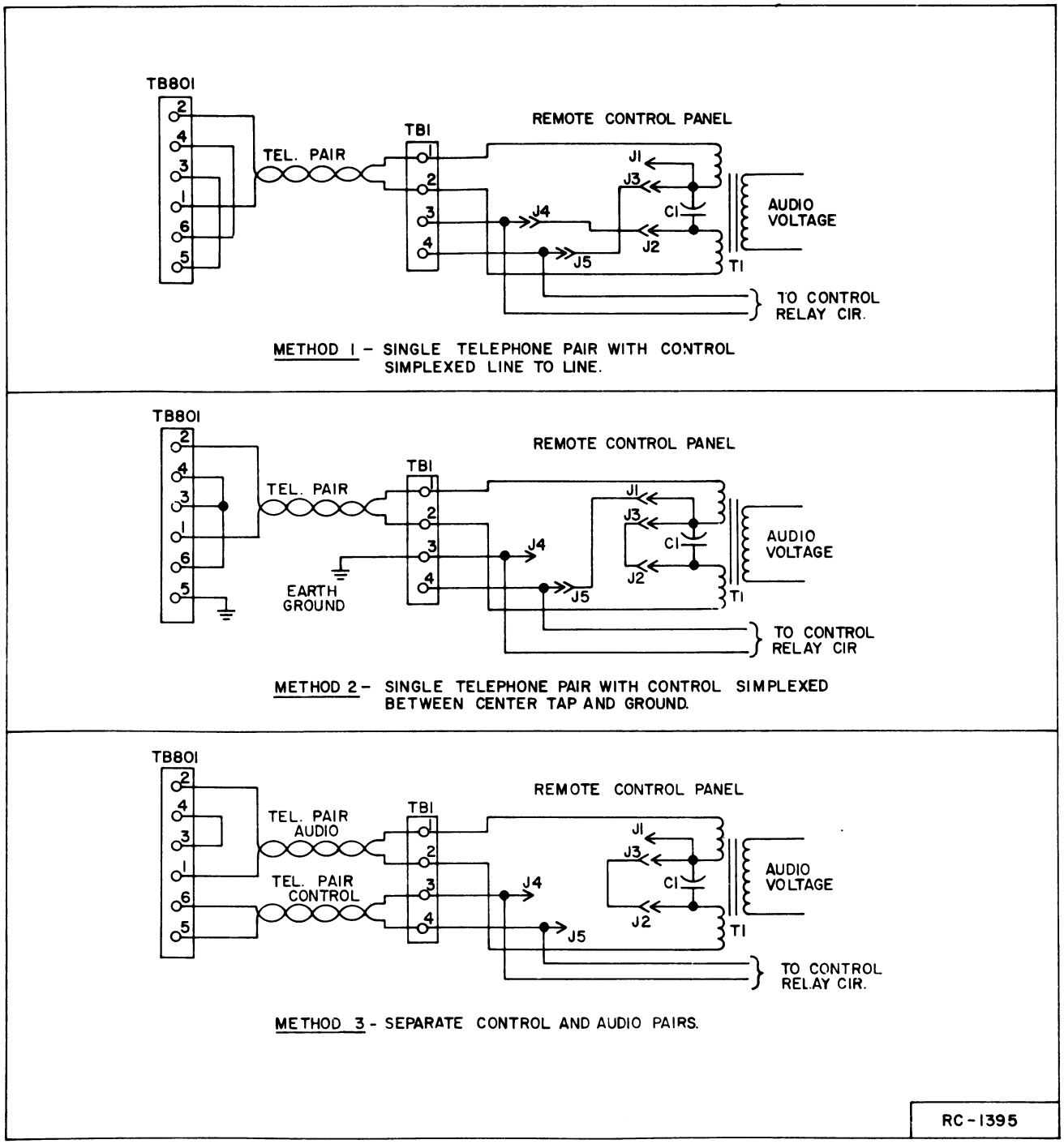


Figure 5 - Telephone Line Connections

Method	Description	Advantage or Disadvantage
1	One metalic pair: for both audio and control voltages with control voltage simplexed from line to line.	Economical; dependable where earth currents may be large, or where a good earth ground cannot be obtained; keying clicks will be heard in paralleled Remote Control Units.
2	One metallic pair: for both audio and control voltages with control voltage simplexed from line to ground.	Economical; earth ground currents (encountered near power company sub-stations) may interfere with control functions; keying clicks minimized.
3	Two telephone pairs; one for audio voltage and one for control voltage.	Provides best performance; keying clicks will not be heard; least susceptible to earth ground currents which may interfere with control functions.

SERVICE INTERCOM

A serviceman at the station can communicate with the operator of the remote control console by keying the station transmitter while holding down the PUSH-TO-NET switch (S501 on the power supply chassis). Holding down S501 feeds audio from the exciter board through the receiver and on to the audio pair. The message is also transmitted by the station.

The serviceman can receive a message from the remote control console by holding down the PUSH-TO-NET switch while the operator of the console keys the transmitter. This message is also transmitted by the station.

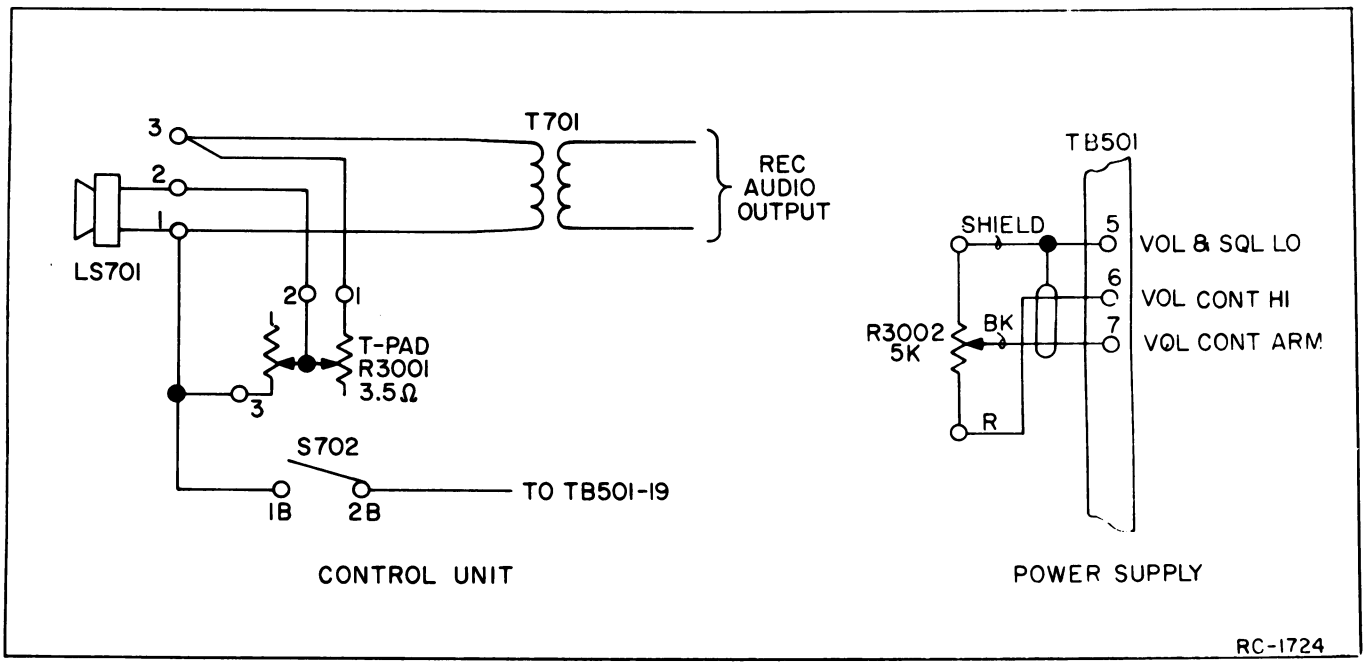


Figure 6 - Circuit Modifications for Local/Remote Control

INSTALLATION INSTRUCTIONS FOR MODIFICATION KIT 19A127945-G1

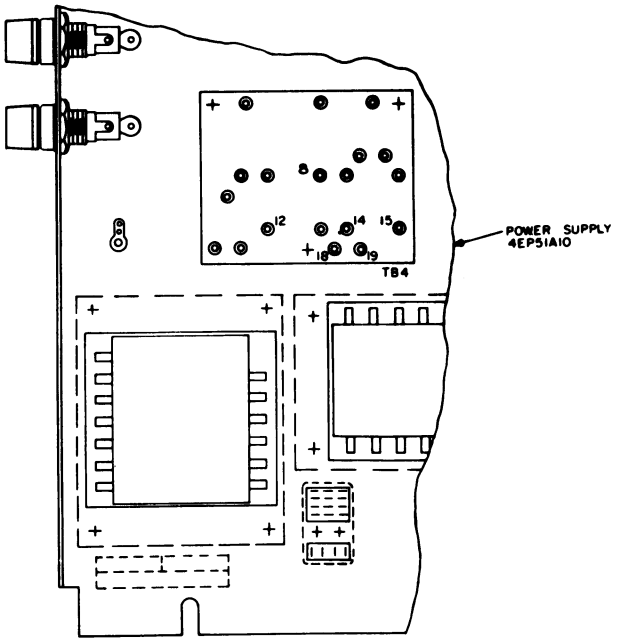
(For 1-5 Watts RF Power Output)

POWER SUPPLY 4EP51A10 (Figure 7)

1. Remove the jumper wire from TB4-14 and TB4-18.
2. Remove the jumper wire from TB4-12 and TB4-15.
3. Add a jumper wire from TB4-14 to TB4-19.
4. Add a jumper wire from TB4-8 to TB4-15.

POWER AMPLIFIER 4EF32J10 (Figure 8)

1. Replace R213 with R220, 33K ohm resistor supplied.
2. Replace R209 with R218, 47K ohm resis tor supplied.
3. Discard the 27K ohm and 12K ohm resistors supplied in the kit.



(19C317589, Rev. 2)

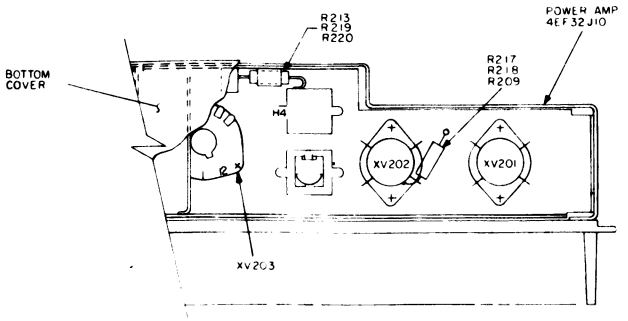
Figure 7 - Power Supply Modification

INSTALLATION INSTRUCTIONS FOR MODIFICATION KIT 19A12745-G2, OPTION 8311

(30 Watt RF Input to the Final Varactor Stage)

POWER AMPLIFIER 4EF32J10 (Figure 8)

1. Replace R213 with R219, 12K ohm resistor supplied.
2. Replace R209 with R217, 27K ohm resistor supplied.
3. Add "OPTION 8311" in the box where the Model Number is printed on the Amplifier.



(19C317589, Rev. 2)

Figure 8 - Power Amplifier Modification

INSTALLATION INSTRUCTIONS FOR MODIFICATION KIT 19A127945-G1

(For 5-12 Watt RF Power Output)

POWER AMPLIFIER 4EF32J10 (Figure 8)

1. Replace R213 with R219, 12K ohm resistor supplied.
2. Replace R209 with R217, 27K ohm resistor supplied.
3. Discard the 33K ohm and the 47K ohm resistors supplied in the kit.

ICOM FREQUENCY ADJUSTMENT

First, check the transmitter frequency to determine if any adjustment is required. The frequency should be checked with a frequency meter or counter having an accuracy of 0.4 part-per-million (PPM), and with the ICOM module at 80°F (±4°F) or 26.5° (±2°C) when possible. The ICOM temperature can be determined by taping a mercury thermometer to the side of the ICOM.

If an adjustment is required, use one of the following procedures:

If the ICOM is stabilized at 80°F, pry off the GE emblem and adjust the ICOM trimmer for correct transmitter operating frequency.

If the ICOM is not stabilized at 80°F, pry off the GE emblem and check for a color dot on the top of the can. This color dot indicates which correction curve to use in setting the unit on frequency (see Figure 2). Next, tape a thermometer to the ICOM and check the temperature when the thermometer is stabilized. Then proceed as shown in the following example:

1. Assume that the ICOM is marked with a green color dot and the temperature reading is 50°F. At that temperature, the green curve shows a correction factor of approximately +1.5 PPM. (At 450 MHz, 1 PPM is 450 Hz. At 470 MHz, 1 PPM is 470 Hz.)

2. With a transmitter operating frequency of 450 MHz, adjust the ICOM trimmer for a reading of +675 Hz (+1.5 x 450) higher than the licensed operating frequency.

3. If a negative correction factor is obtained (at temperatures above 80°F), adjust the ICOM trimmer for the indicated PPM lower than the operating frequency.

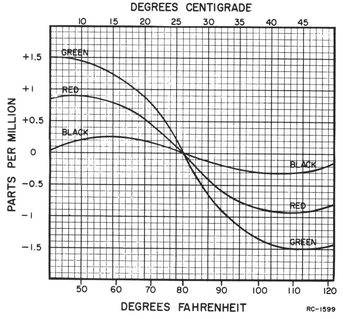


Figure 1 - ICOM Frequency Correction Curves

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R110) was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause over-modulation are clipped by the modulation limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing over-modulation while preserving intelligibility.

TEST EQUIPMENT

1. Audio Oscillator Model 4EX6A10
2. Frequency Modulation Monitor
3. AC VTVM or output meter
4. G-E Test Set Model 4EX3A10 (TM11 or TM12)

PROCEDURE

1. Connect the audio signal generator and the meter across audio input terminals J5 (green-hi) and J6 (black-lo) on G-E Test Set, or across J201-15 (mike hi) and J201-7 (mike lo) on the Centralized Metering Jack.
2. Apply a 0.6 volt signal at 1000 Hz to Test Set or across J201-15 and J201-7 on the Centralized Metering Jack.
3. Set MOD ADJUST (R110) for a 4.5 KHz swing with deviation polarity which gives the highest reading as indicated on the frequency modulation monitor.

Transmitters with CHANNEL GUARD

1. Set the Channel Guard TONE ADJUST (R643) for 0.75 KHz tone deviation.
2. Follow Steps 1 thru 3 described above.

Multi-Frequency Transmitters

Check all channels for deviation as described in Steps above.

MULTIPLIER FILTER POWER INPUT

For FCC purposes, the Mult. Filter input power can be determined by measuring the PA plate voltage and plate current indication, and using the following formula:

$$P_i = \frac{\text{Plate Voltage x Plate Current Indication}}{4.3} \times 0.485$$

where

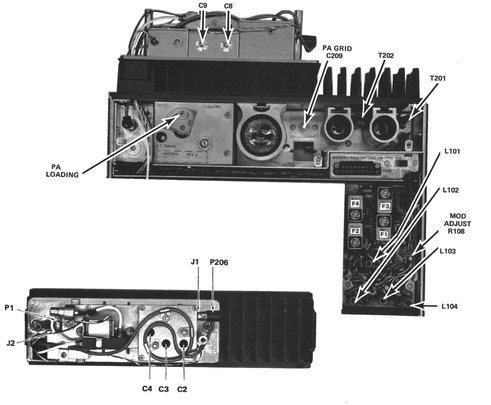
P_i is the power input in watts.

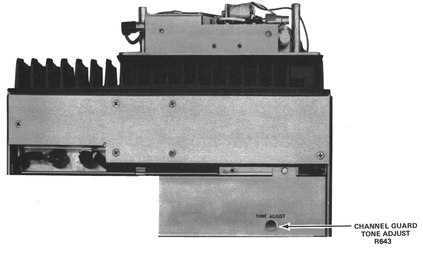
Plate voltage is measured with G-E Test Set in Position G, using the 1000-volt scale (or measured from J201-1 to -16 with multimeter).

Plate current indication is measured with G-E Test Set in Position G, using the TEST 1 scale (or measured from J201-1 to -9 with multimeter).

4.3 is the value of the plate current metering resistor in ohms.

0.485 is the PA plate efficiency factor.





TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. General Electric Test Set TM11 or TM12, or a 20,000 ohms-per-volt Multimeter with a 1-volt scale, 50-ohm wattmeter, and a frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place ICOM(s) in proper socket (ICOM frequency - operating frequency ÷ 36). Do not adjust ICOM trimmer.
2. Turn PA LOADING to minimum position.
3. For multi-frequency transmitters, set the Control Unit CHANNEL SELECTOR Switch to the highest frequency channel.
4. Place the TUNE-OPERATE Switch (S201) in the TUNE position.
5. For a large change in frequency or a badly mis-aligned transmitter, turn the slugs in the Exciter Coils (L101, L102, L103, L104) to the bottom of the coil. Set the T201 slug to the top of the coil. Set the T202 top slug to the top of the coil and the bottom slug to the bottom of the coil. Set C2 and C3 on the MULTIPLIER FILTER ASSEMBLY for maximum capacity with the plates fully meshed. Set C4 plates approximately 1/2 meshed. Set C8 and C9 with the tuning screw extended approximately 3/8 inch.
6. Connect TEST SET to the Transmitter Centralized Metering Jack J201. Turn the test set polarity switch to (+). If using a multimeter, connect the leads as shown below.
7. Connect wattmeter to P206.
8. With TEST SET in position I, key the transmitter and check for a regulated 10 volts (read on 15-volt scale). If voltage is not correct, adjust 10-volt regulator potentiometer R3 for 10-volts. Then move TEST SET plug to receiver metering jack and check 10-volts at position J. If reading is not approximately 10 volts, refer to the Power Supply Troubleshooting Diagram.
9. All adjustments are made with the transmitter keyed and the TEST SET on the 1-volt TEST scale.

TRANSMITTER ALIGNMENT PROCEDURE

STEP	METERING POSITION 4EX3A10	METERING POSITION MULTIMETER AT J201	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			EXCITER BOARD		
1.	A MULT-1	pin 10 (+) pin 16 (−)	L101 & L102	SEE Procedure	Carefully tune L101 for maximum meter reading. Then tune L102 for a small change in meter reading. If two responses occur, with L102, use the response with the slug nearest the center of the coil.
2.	B MULT-2	pin 2 (+) pin 16 (−)	L103, L102 & L104	SEE Procedure	Tune L103 and then L102 for maximum meter reading. Next, tune L104 for minimum meter reading.
			MULT-3 AND POWER AMPLIFIER		
3.	D MULT-3	pin 16 (+) pin 4 (−)	T201 & L116	Maximum	Adjust T201 for maximum meter reading, then re-adjust L104 maximum meter reading.
4.	E MULT-4	pin 16 (+) pin 5 (−)	T202	Maximum	Adjust top slug of T202 for maximum meter reading. Adjust bottom slug of T202 for maximum meter reading, then re-adjust top slug for maximum meter reading.
5.	F PA GRID	pin 14 (+) pin 6 (−)	PA GRID C209	Maximum	Tune C209 for maximum meter reading.
6.	G PA PLATE	WARNING High B+ on pins 1 & 9 pin 1 (+) pin 9 (−)	PA PLATE (C214)	SEE Procedure	Carefully tune PA Plate for minimum meter reading. Adjustment is quite sharp and will be only a small dip in meter reading.
7.					Place TUNE/OPERATE Switch S201 in the OPERATE position.
8.	G PA PLATE	pin 1 (+) pin 9 (−)			Carefully re-tune PA Plate for minimum meter reading.
9.	G PA PLATE	pin 1 (+) pin 9 (−)	PA LOADING	0.7 volts	Adjust PA LOADING for meter reading of 0.7 volts.
10.	G PA PLATE	pin 1 (+) pin 9 (−)	ANT TUNING C215	Maximum	Adjust ANT TUNING for maximum meter reading.
11.	G PA PLATE	pin 1 (+) pin 9 (−)	PA LOADING AND ANT TUNING	SEE Procedure	Re-adjust PA LOADING for 0.7 volts. Re-adjust ANT TUNING for maximum meter reading.
12.	F PA GRID	pin 14 (+) pin 6 (−)	PA GRID	Maximum	Repeak PA GRID for maximum meter reading.
13.	G PA PLATE	pin 1 (+) pin 9 (−)	PA LOADING	0.79 volts	Increase PA LOADING until meter reads 0.79 volts.
14.	G PA PLATE	pin 1 (+) pin 9 (−)	ANT TUNING	Maximum	Repeak ANT TUNING, then repeat Step 13 and repeak ANT TUNING until 0.79 volts is set.

STEP	METERING POSITION 4EX3A10	METERING POSITION MULTIMETER AT J201	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			MULTIPLIER FILTER		
15.					Remove plug P206 from the wattmeter and connect the plug to multiplier input J1. Remove P1 from J2 and connect J2 (Multiplier Filter Output) to the wattmeter.
16.	H (Varactor input)	pin 16 (+) pin 11 (−)	C2	0.6 volts	Place Tune/Operate switch S201 in the Tune position. Tune C2 for maximum meter reading. Several peaks are possible.
17.					Remove J2 from the Wattmeter and connect P1 to J2. Remove P206 from J1 and connect P206 to the Wattmeter. Place the tune/operate switch S201 in the operate position. Decrease the PA LOADING (on the Power Amplifier) until 10 Watts power output is set on the wattmeter. Repeat step 15, then proceed with Step 18.
18.	J (Rel.Pwr. Out)	pin 16 (+) pin 13 (−)	C9, C8, C4 & C3	0.6 volts	Tune C9, C8, C4 and C3, in that order, for maximum meter reading. NOTE Meter position "J" is a relative indication of power output. The wattmeter or position "J" meter reading can be used for further peaking of power output.
19.	J (Rel.Pwr. Out)	pin 16 (+) pin 13 (−)	C2, C3, C4, C8 & C9	0.6 volts	Tune for maximum power output on Wattmeter or meter.
20.					Remove plug P206 from J1 and connect P206 to the Wattmeter. After repeating steps 13 and 14, tighten the locking screw on the loading adjustment. Repeat steps 15, 18 and 19.
21.	G	pin 1 (+) pin 9 (−)	C2	0.79 volts	Carefully set C2 for a meter reading of 0.79 volts. Increasing the capacitance of C2 decreases this voltage and decreasing the capacitance increases this voltage. NOTE This adjustment requires only a small change of C2. Avoid large changes of C2 which will cause an excessive drop of output power and a false setting of 0.79 volts. DO NOT RETUNE ANY OF THE PA CONTROLS DURING THIS ADJUSTMENT.
22.	J (Rel.Pwr. Out)	pin 16 (+) pin 13 (−)	C3, C8, & C9	0.6 volts	Tune for maximum. Repeat Step 19 if reading has changed from 0.79 volts.
			FREQUENCY ADJUSTMENT		
			C101(C102 in 2-freq. units, and C2625 or C2619 in multi-freq. units.		Loosely couple frequency counter to output and adjust C101 for proper frequency output. (Switch to F2 and adjust C102 on 2-frequency units. In 3- or 4-frequency units, adjust C2625 or C2619 as required. NOTE For proper frequency control of the transmitter, it is recommended that all frequency adjustments be made when the equipment is at a temp. of approximately 75° F. In no case should frequency adjustments be made when the equipment is outside the temp. range of 50° to 90°F.

ALIGNMENT PROCEDURE

TRANSMITTER TYPE
ET-99-A

RC-2107A

TEST PROCEDURES

These Test Procedures are designed to assist you in servicing a transmitter that is operating--but not properly. Problems encountered could be low power output, low B plus, tone and voice deviation, defective audio sensitivity and modulator adjust control set too high. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once a defect is pin-pointed, refer to the "Service Check" and the additional corrective measures included in the Transmitter Troubleshooting Procedure. Before starting with the Transmitter Test Procedures, be sure the transmitter is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

for test hookup as shown:

1. Wattmeter similar to

   Bird #43
   Jones #711N

2. VTVM similar to:

   Triplett #850
   Heath #IM-21

3. Audio Generator similar to:
   GE Model 4EX6A10
   Heath #1G-72

4. Deviation Meter (with a .75 kHz scale) similar to:

   Measurements #140
   Lampkin #205A

5. Multimeter similar to:

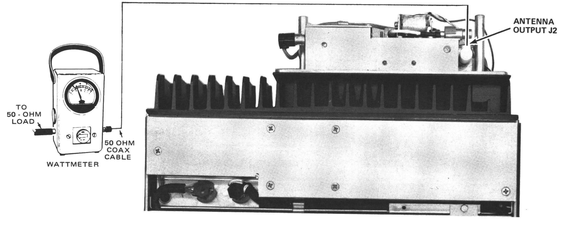
   GE METERING TEST SET MODEL 4EX3A10 or Triplett #631 or 20,000 ohms-per-volt voltmeter

STEP 1

POWER MEASUREMENT

TEST PROCEDURE

1. Connect transmitter output to wattmeter as shown below:



2. Key transmitter and check wattmeter for rated power output.

SERVICE CHECK

Refer to Service Hints on Transmitter Troubleshooting Procedure.

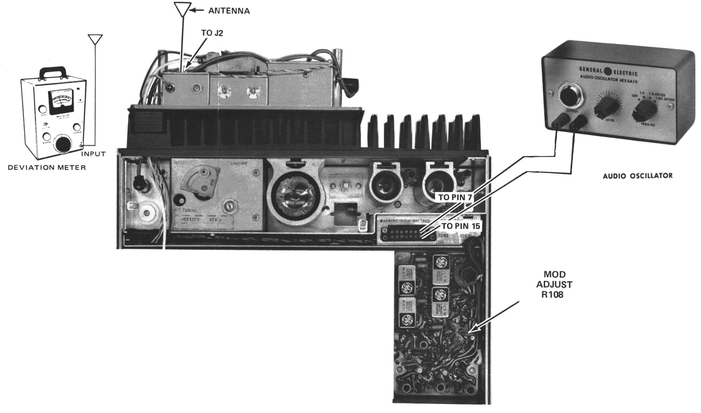
STEP 2

VOICE DEVIATION AND SYMMETRY

TEST PROCEDURE

1. Unplug the microphone.

2. Connect test equipment to transmitter as shown below:



3. Set the generator output to 0.6 VOLTS RMS and frequency to 1 kHz.

4. Key the transmitter by connecting a jumper from J201-18 to J201-16 (GND). Then adjust Deviation Meter to carrier frequency.

5. Deviation reading should be ±4.5 kHz.

6. Adjust MOD ADJUST Control R108 until deviation reads 4.5 kHz on plus (+) or minus (-) deviation, whichever is greater. This adjustment should be made with the correct level of tone applied on Channel Guard transmitters.

DEVIATION METER

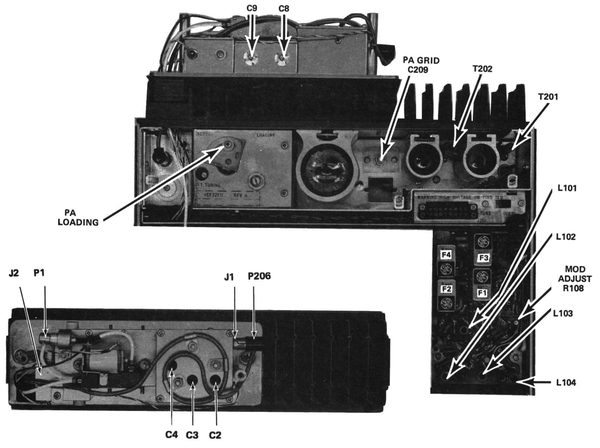
NOTES:--These transmitters are adjusted for 4.5 kHz deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 kHz under the worst conditions of frequency, voltage and temperature.

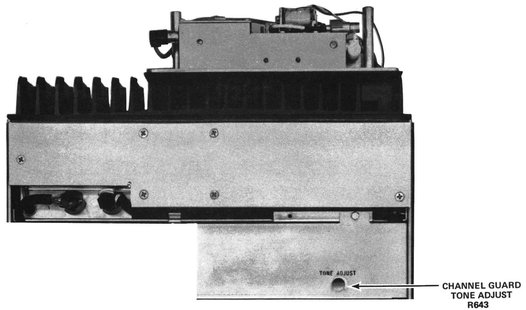
If the deviation reading plus (+) and minus (-) differs by more than 0.5 kHz check the following:

1. Recheck Step 1 as shown in the Transmitter Alignment Chart.

2. Check Audio Sensitivity by reducing generator output until deviation falls to 3.3 kHz. Voltage should be LESS than 90 millivolts (typically 75 mV).

METER





TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. General Electric Test Set TM11 or TM12, or a 20,000 ohms-per-volt Multimeter with a 1-volt scale, 50-ohm wattmeter, and a frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place ICOM(s) in proper socket (ICOM frequency - operating frequency ÷ 36). Do not adjust ICOM trimmer. In multi-frequency units, set the frequency selector switch to the F1 position.
2. Turn PA LOADING to minimum loading position, set crystal trimmer C101 to mid-capacity.
3. For multi-frequency transmitters, set all trimmers to mid-capacity and set the Control Unit CHANNEL SELECTOR Switch to the highest frequency channel.
4. Place the TUNE-OPERATE Switch (S201) in the TUNE position.
5. For a large change in frequency or a badly mis-aligned transmitter above 450 MHz, turn the slugs in the Exciter coils (L113, L114, L115, L116) to the bottom of the coil. (For transmitters below 450 MHz, set the slugs in the center of the coils.) Set the T201 slug to the top of the coil. Set the T202 top slug to the top of the coil and the bottom slug to the bottom of the coil. Set C2, C3 and C4 on the MULTIPLIER FILTER ASSEMBLY for maximum capacity with the plates fully meshed. Set C8 and C9 with the tuning screw extended approximately 3/8 inch.
6. Connect TEST SET to the Transmitter Centralized Metering Jack J201. Turn the test set polarity switch to (+). If using a multimeter, connect the leads as shown below.
7. Connect wattmeter to P206.
8. With TEST SET in position I, key the transmitter and check for a regulated 10 volts (read on 15-volt scale). If voltage is not correct, adjust 10-volt regulator potentiometer R3 for 10-volts. Then move TEST SET plug to receiver metering jack and check 10-volts at Position J. If reading is not approximately 10 volts, refer to the Power Supply Troubleshooting Diagram.
9. All adjustments are made with the transmitter keyed and the TEST SET on the 1-volt TEST scale.

TRANSMITTER ALIGNMENT PROCEDURE

STEP	METERING POSITION 4EX3A10	METERING POSITION MULTIMETER AT J201	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			EXCITER BOARD		
1.	A MULT-1	pin 10 (+) pin 16 (-)	L101 & L102	SEE Procedure	Carefully tune L101 for maximum meter reading. Then tune L102 for a small change in meter reading. If two responses occur, use the response with the slug nearest the center of the coil.
2.	B MULT-2	pin 2 (+) pin 16(-)	L103, L102 & L104	SEE Procedure	Tune L103 and then L102 for maximum meter reading. Next, tune L104 for minimum meter reading.
			MULT-3 AND POWER AMPLIFIER		
3.	D MULT-3	pin 16 (+) pin 4 (-)	T201 & L116	Maximum	Adjust T201 for maximum meter reading, then re-adjust L116 maximum meter reading.
4.	E MULT-4	pin 16 (+) pin 5 (-)	T202	Maximum	Adjust top slug of T202 for maximum meter reading. Adjust bottom slug of T202 for maximum meter reading, then re-adjust top slug for maximum meter reading.
5.	F PA GRID	pin 14 (+) pin 6 (-)	PA GRID C209	Maximum	Tune C209 for maximum meter reading.
6.	G PA PLATE	WARNING High B+ on pins 1 & 9 pin 1 (+) pin 9 (-)	PA PLATE (C214)	SEE Procedure	Carefully tune PA Plate for minimum meter reading. Adjustment is quite sharp and will be only a small dip in meter reading. (Omit this step for 1-5 Watt operation).
7.					Place TUNE/OPERATE Switch S201 in the OPERATE position. (Omit this step for 1-5 Watt operation).
8.	G PA PLATE	pin 1 (+) pin 9 (-)			Carefully re-tune PA Plate for minimum meter reading. (Omit this step for 1-5 Watt operation).
9.	G PA PLATE	pin 1 (+) pin 9 (-)	PA LOADING	SEE Procedure	Adjust PA LOADING for meter reading of 0.55 volts for 5-12 Watt operation. (Adjust for 0.35 volts for 1-5 Watt operation). See Figures 1 & 2 on the reverse side of this sheet for more precise setting of position "G" reading.
10.	G PA PLATE	pin 1 (+) pin 9 (-)	ANT TUNING C215	Maximum	Adjust ANT TUNING for maximum meter reading.
11.	G PA PLATE	pin 1 (+) pin 9 (-)	PA LOADING AND ANT TUNING	SEE Procedure	Re-adjust PA LOADING for same as Step 9. Re-adjust ANT TUNING for maximum meter reading.
12.	F PA GRID	pin 14 (+) pin 6 (-)	PA GRID	Maximum	Repeak PA GRID for maximum meter reading.
13.	G PA PLATE	pin 1 (+) pin 9 (-)	PA LOADING	SEE Procedure	Increase PA LOADING until meter reads same as Step 9.
14.	G PA PLATE	pin 1 (+) pin 9 (-)	ANT TUNING	Maximum	Repeak ANT TUNING, then repeat Step 13 and repeak ANT TUNING until readings in Step 9 are set. (For 30 Watt limited input set loading control for 30 Watts output on wattmeter). Tighten the locking screw on the loading adjustment.

STEP	METERING POSITION 4EX3A10	METERING POSITION MULTIMETER AT J201	TUNING CONTROL	TYPICAL METER READING	Procedure
			MULTIPLIER FILTER		
15.					Remove plug P206 from the wattmeter and connect the plug to multiplier input J1. Remove P1 from J2 and connect J2 (Multiplier Filter Output) to the wattmeter.
16.	H (Varactor Input)	pin 16 (+) pin 11 (-)	C2 & C3		Tuning C2 for maximum meter reading. Several peaks are possible. (Use a non-metallic screwdriver to adjust C2, C3, and C4).
17.	J (Rel.Pwr. Out)	pin 16 (+) pin 13 (-)	C9, C4, & C8		Tune C9, C4, and C8, in that order, for maximum meter reading (C4 and C8 must be tuned alternately for maximum meter reading due to the interaction between the two.) NOTE Meter position "J" is a relative indication of power output. The wattmeter or position "J" meter reading can be used for further peaking of power output.
18.	J (Rel.Pwr. Out)	pin 16 (+) pin 13 (-)	C2, C3, C4, C8, & C9	SEE Procedure	Tune for maximum power output on Wattmeter or meter.
19.	G	pin 1 (+) pin 9 (-)	C2	SEE Procedure	Carefully set C2 for a meter reading of 0.55 volts for 5-12 Watts. (0.35 volts for 1-5 Watts.) Increasing the capacitance of C2 decreases this voltage and decreasing the capacitance increases this voltage. NOTE This adjustment requires only a small change of C2. Avoid large changes of C2 which will cause an excessive drop of output power and a false setting of the above readings. DO NOT RETUNE ANY OF THE PA CONTROLS DURING THIS ADJUSTMENT.
20.	J (Rel.Pwr. Out)	pin 16 (+) pin 13 (-)	C3, C8 & C9		Tune for maximum. Repeat Step 19 if reading has changed from Step 19 readings.
21.			PA LOADING		Loosen the screw locking the loading control. Adjust for the desired output power on the wattmeter. Re-tighten the screw on the loading control.
					For ICOM FREQUENCY ADJUSTMENT or MODULATION LEVEL ADJUSTMENT refer to RC-2107. To find the MULTIPLIER FILTER RF INPUT POWER see the reverse side of this sheet.

ALIGNMENT PROCEDURE

TRANSMITTER TYPE
ET-99-A WITH VARIABLE
RF POWER

RC-2131

MULTIPLIER FILTER RF INPUT POWER

For FCC purposes, the Multiplier Filter RF input power can be measured on the wattmeter in Step 14 of the Alignment Procedure. The RF input power can also be determined from the following curves.

How to use the curves:

1. Determine which curve to use. If the plate voltage (Ep) is 450 volts, use Figure 1 curve. If the plate voltage (Ep) is 300 volts, use Figure 2 curve. Plate voltage is measured with G-E Test Set in Position G, using the 1000-volt scale (or measured from J201-1 to -16 with multimeter.

2. After determining which of the two curves to use, select the desired RF power output on left side of the vertical axis. From this value of R.F. Power output, move to the right on a straight line to intersect the Power output curve. At the point of intersection of the Power output curve, move straight down to the horizontal axis to read the value of test set position "G" reading. This reading will be set in Step 9 of the alignment procedure. To convert this reading to plate current divide by 4.3.

3. To determine the RF input power to the varactor multiplier, select the desired R.F. power output on the left side of the vertical axis. From this value of R.F. Power output, move to the right on a straight line to intersect the Power output curve. At the point of intersection of the Power output curve, move straight up to intersect the power input curve; at this point of intersection move to the left on a straight line and read the R.F. input power on the vertical axis.

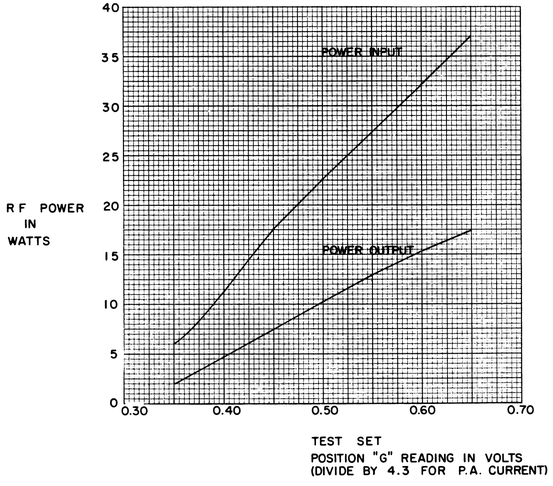


Figure 1 - Power input and output versus Position "G" reading with Ep=450 Volts

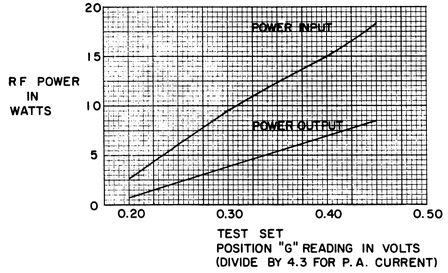


Figure 2 - Power input and output versus Position "G" reading with Ep=300 Volts

FREQUENCY ADJUSTMENT

STANDARD OSCILLATOR

METERING POSITION		TUNING CONTROL	METER READING	PROCEDURE
TEST SET	MULTIMETER + at J304			
A	pin 10	L451 (L452 for 2-freq.)	Zero	Apply the exact channel frequency signal to J301 and tune L451 (L452 for 2-frequency) for zero discriminator reading. In 3- or 4-frequency units, refer to the ICOM alignment Procedure.
				NOTE For proper frequency control of the receiver, it is recommended that all frequency adjustments be made when the equipment is at a temp. of approx. 75°F. In no case should frequency adjustments be made when the equipment is outside the temp. range of 50° to 90°F.

ICOM OSCILLATOR:

Due to the high stability of the ICOM module, it is not recommended that zero discriminator be used as the indication for setting the oscillator frequency. Instead, measure the ICOM frequency as described in the following procedure.

EQUIPMENT REQUIRED:

1. Frequency Counter capable of measuring the 42-52 MHz frequency range. The counter should have an accuracy of 0.4 part-per million (PPM).
2. Coaxial cable with test loop as described in Figure 15.
3. Mercury thermometer.

PROCEDURE:

1. Check the ICOM temperature by taping the mercury thermometer to the side of the ICOM.
2. Connect the frequency counter to L2602 on multi-frequency board 43G22H10, using the 4-turn test loop and cable shown in Figure 15.
3. If the ICOM temperature is 80°F (±4°F) or 26.5°C (±2°C), the frequency indication on the counter should be 3 times the frequency stenciled on the ICOM case. Adjust the ICOM trimmer (if necessary) to obtain this frequency.
4. If the temperature is not within the 80°F (±4°F) or 26.5°C (±2°C) range, use the correction curves of Figure 16 for setting the ICOM frequency as follows:
   a. Check the color dot beneath the GE emblem and select the matching curve to determine the correction factor in parts-per-million (PPM).
   b. Multiply the frequency stenciled on the ICOM by 3 and then multiply this figure by the correction factor (from Figure 16) observing the sign (±) given to the correction factor.
   c. The frequency measured at L2602 should be 3 times the ICOM frequency ± the correction factor. Adjust the ICOM trimmer (if required) to obtain this frequency.

FOR EXAMPLE

ICOM Frequency	-	16.948,148 MHz
ICOM Color Dot	-	Green
Ambient Temperature	-	35°C (95°F)
Correction Factor (from Figure 16)	-	-1.15 PPM
Multiply ICOM Frequency by 3; (16.948,148 MHz x 3 = 50.844,444 MHz)		
Multiply preceding figure by correction factor; (50.844 MHz x -1.15 PPM = -58.47 hertz (or -58 hertz)		
Set the frequency measured at L2602 for 50.844,386 MHz;		
50.844,444		
- 58		
50.844,386		

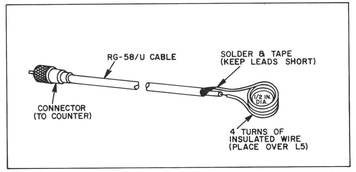


Figure 15 - Coaxial Cable and Test Loop

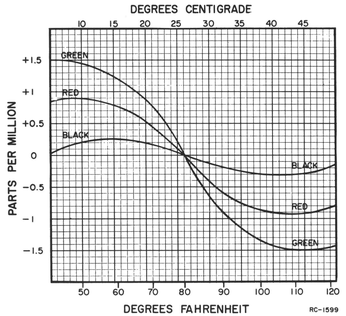
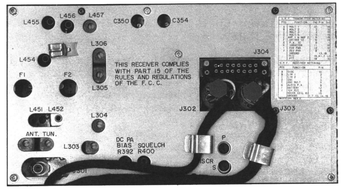
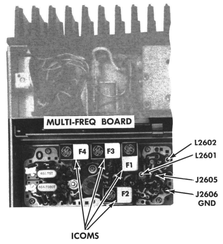


Figure 16 - ICOM Correction Curves





MULT-FREQ BOARD ALIGNMENT

Remove cover from the multi-frequency board.

1. Place ICOM's ($\frac{Fo - 12.4}{27}$) in proper socket. Do not adjust ICOM trimmer.
2. Connect test set probes to J2605 (+) and J2606 (GND) on multi-frequency board.
3. Tune L2601 for maximum meter reading. Then tune L2602 for minimum meter reading.
4. Tune L452 on receiver board for maximum meter reading. Next, complete the receiver alignment procedure.

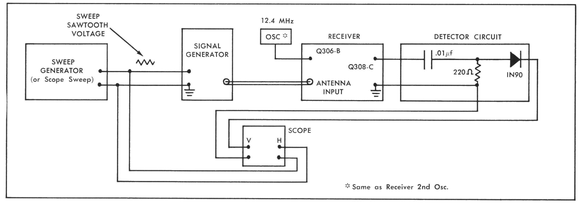


Figure 17 - High and Low IF Filter TEST Circuit

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A10 (TM11 or TM12), 4EX8K11 or 20,000 ohms-per-volt.
2. A 12.4 MHz (±200 Hz) and 406-470 MHz signal source. Couple the 12.4 MHz signal through a 0.01 μf capacitor. Keep signal levels below saturation.
3. For Alignment steps 4 thru 8 - Oscilloscope, sweep generator, 12.4 MHz marker generator and construct a detector circuit (see Figure 17 for circuitry).

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug Test Set into the receiver centralized metering jack J304. Set meter polarity switch on + and meter sensitivity switch to TEST 1. If using multimeter, connect the negative lead to J304-13 (ground).
2. Switch Test Set to Position "I" (or measure at collector of Q318 with multimeter). Reading should be a nominal 13.8 volts.
3. Switch to Position "J" (or measure at top of C443 with multimeter), and check for a reading of 10 volts. If reading is not correct, refer to power regulator Outline Diagram and set R19 for +10 volts.
4. Turn SQUELCH control fully clockwise and VOLUME control to minimum. Switch to Position "G" (or measure at J304-9 with multimeter) and adjust R4 Bias R392 for a reading of 0.28 volt (500 milliamps).
5. For multi-frequency receivers with ICOM oscillators, refer to the MULTI-FREQUENCY BOARD ALIGNMENT.

ALIGNMENT PROCEDURE

STEP	METERING POSITION: TEST SET	METERING POSITION: MULTIMETER + at J304	TUNING CONTROL	METER READING	PROCEDURE
			DISCRIMINATOR		
1.					Remove 1st oscillator crystal and apply a 12.4 MHz signal to the base of Q308.
2.	A DISC	pin 10	L329	See Procedure	Adjust L329 (discriminator primary) 1/2 turn up from bottom of range.
3.	A DISC	pin 10	L330	Zero	Turn L330 (discriminator secondary) for zero meter reading.
			HIGH and LOW IF FILTER (SEE NOTE 1)		
4.	B LIM	pin 2	L321 thru L328	Maximum	Adjust L321 thru L328 for maximum meter reading.
5.	B LIM	pin 2	C357, C354, C350	Maximum	Adjust C357, C354 and C350 for maximum meter reading.
6.			C357 & C360		Disable the 2nd oscillator by grounding base of Q307 through a .01 μf capacitor. Connect scope, signal generator and detector as shown in Figure 17. Sweep RF 250 kHz at 20 Hz. Connect 12.4 MHz marker to base of Q306. Tune C357 and C360 for scope pattern shown. Keep marker signal centered between humps and signal level below saturation.
7.			L321 thru L328		Disconnect detector, remove short from base of Q307 and connect scope to 1st LIM test point. Adjust L321 thru L328 for symetrical waveform shown, with marker in center.
8.	A DISC	pin 10			Check to see that discriminator idling voltage is within 0.05 volts of zero with no signals applied and the modulation acceptance bandwidth is between ±8 and 10 kHz.
			OSC'MULT & AMPLIFIER		
9.	D OSC	pin 4	L451	Maximum	Remove short from base of Q307, if present, then insert 1st oscillator crystal and adjust L451 for maximum meter reading.
10.	D OSC	pin 4	L454 & L451	Maximum (0.17 - 0.5v)	Adjust L454 and L451 for maximum meter reading (0.17-0.5v).
11.	E OSC	pin 5	L455 & L456	See Procedure	Adjust L455 and L456 for maximum meter reading (.06-0.5 volts). Then adjust L457 for a small dip in meter reading.
12.	E OSC	pin 5	L452	Maximum	For 2-frequency receivers with crystal oscillators, insert F2 crystal and adjust L452 for maximum meter reading.
			RF		
13.	C LIM 2	pin 3	L457 & L201 thru L206	Maximum	Apply on-frequency signal to J301,then adjust L457 and L201 thru L306 for maximum meter reading. Keep signal below saturation at each stage andon discriminator zero.
14.	C LIM 2	pin 3	L301 thru L206		While receiving a weak on-frequency signal from the antenna, tune L201 thru L306 for best quieting while maintaining the highest limiter reading possible.
			SQUELCH ADJUSTMENT		
15.				120°	Set SQUELCH Control (R400) to open with a 4 dB SINAD signal. (Approximately 30° counterclockwise of critical squelch position.)

NOTE 1 -- High and Low IF coils and capacitors have been set at the factory and will normally require no further adjustment. Do not re-align unless there is positive evidence of a defective filter. For location of components, refer to the Receiver Outline Diagram.

FRONT END ALIGNMENT

These instructions are for tuning the oscillator and RF stages of the receiver and may be used when changing the receiver crystal or frequency. When necessary to realign the entire receiver, refer to the COMPLETE RECEIVER ALIGNMENT.

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A10 (TM11 or TM12), 4EX8K11 or 20,000 ohms-per-volt Multimeter.
2. 406-470 MHz signal source (keep signal level below saturation).

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug GE Test Set into receiver centralized metering jack J304. Set meter polarity switch on + and meter sensitivity switch to 1. If using Multimeter, connect the negative lead to J304-13 (ground).
2. Turn SQUELCH control (R400) fully clockwise and VOLUME control to minimum. Switch to position "G" (or measure at J304-9 with Multimeter) and adjust PA Bias R392 for a reading of 0.28 volt (500 milliamps).

ALIGNMENT PROCEDURE

STEP	METERING POSITION: TEST SET	METERING POSITION: MULTIMETER + at J304	TUNING CONTROL	METER READING	PROCEDURE
1.	D OSC	pin 4	L451	See Procedure	Switch to F1, put in F1 crystal and tune L451 for maximum meter reading.
2.	D OSC	pin 4	L454 & L451	Maximum (0.17 - 0.5 V)	Apply an on-frequency signal to J301 adjust L454 and L451 for a maximum reading (0.17 - 0.5 volts).
3.	E OSC	pin 5	L455, L456 & L457	See Procedure	Apply an on-frequency signal and adjust L455 and L456 for maximum meter reading (.06 - 0.5 volts). Then adjust L457 for a slight dip in meter reading.
4.	E OSC	pin 5	L452 (2-freq. only)	Maximum	For 2-frequency receivers, switch to F2, insert F2 crystal and adjust for maximum.
5.					Preset RF coils L301 thru L306 to approximately the same positions as L457.
6.	C LIN 2	pin 3	L457 & L301 thru L306	Maximum	Apply on-frequency signal to J301. Tune L457 and L301 thru L306 for maximum meter reading. Keep signal below saturation at each stage and on discriminator zero.
7.	A DISC	pin 10	L451 (L452 for 2-freq.)	Zero	Apply the exact channel frequency signal to J301 and tune L451 (L452 for 2-frequency) for zero discriminator reading. NOTE For proper freq control of the receiver, it is recommended that all freq adjustments be made when the equipment is at a temp. of approx. 75°F. In no case should freq. adjustments be made when the equipment is outside the temp. range of 50° to 90°F.
8.	C Lim 2	Pin 3	L301 thru L306		While receiving a weak on-frequency signal from the antenna, tune L201 thru L306 for best quieting while maintaining the highest limiter reading possible.
			SQUELCH ADJUSTMENT		
9.				120°	Set SQUELCH Control (R400) to open with a 4 dB SINAD signal. (Approximately 30° counterclockwise of critical squelch position.)

ALIGNMENT PROCEDURE

TWO-WATT RECEIVER TYPE ER-50-A

RC-2080A

TEST PROCEDURES

These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pin-pointed, refer to the "Service Check" list to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to:

  Heath IM-12

- Signal Generator similar to:

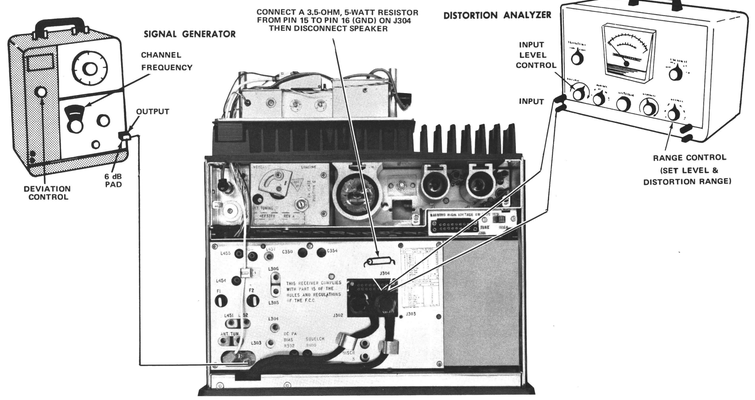
  Measurements M-800

- 6-dB attenuation pad, and 3.5 ohm,

  5-watt resistor

PRELIMINARY ADJUSTMENTS

1. Connect the test equipment to the receiver as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure.
3. Turn on all of the equipment and let it warm up for 20 minutes.



STEP 1

AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Connect a 1,000-microvolt test signal modulated by 1,000 hertz with +3.3 kHz deviation to the antenna jack J301.

B. When speaker is used, disconnect speaker (and handset if present). Hook up a 3.5-ohm load resistor from J304-15 to J304-16 as shown.

C. Set VOLUME control for two-watt output (2.65 VRMS).

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5%. If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than two watts, make the following checks:

E. Battery and regulator voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages).

F. DC Bias Adjust R392 (Position "G" on Test Set)--- should be adjusted for 0.28 volts (500 milliamps). (Refer to Receiver Alignment on reverse side of page).

G. Audio Gain (Refer to Receiver Troubleshooting Procedure).

H. Discriminator Alignment (Refer to Receiver Alignment on reverse side of page).

STEP 2

USABLE SENSITIVITY (12-dB SINAD)

If STEP 1 checks out properly, measure the receiver sensitivity as follows:

A. Apply a 1000-microvolt, on-frequency signal modulated by 1000 Hz with 3.3-kHz deviation to J301.

B. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000-Hz distortion range position (1000-Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)

C. Place the RANGE switch to the SET LEVEL position (filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).

D. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range until a 12-dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

E. The 12-dB difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specifications with an audio output of at least one watt (1.87 volts RMS across the 3.5-ohm receiver load using the Distortion Analyzer as a VTVM).

F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD specification, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3

MODULATION ACCEPTANCE BANDWITH (IF BANDWITH)

If STEPS 1 and 2 check out properly, measure the bandwidth as follows:

A. Set the Signal Generator output for twice the microvolt reading obtained in the 12-dB SINAD measurement.

B. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000-Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

D. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±8 kHz (but less than ±10 kHz).

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

PARTS LIST

LBI-4227A

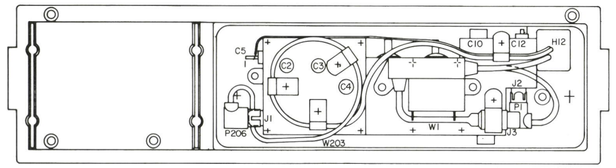
450-470 MHz STATION TRANSMITTER
TYPE ET-99-A

SYMBOL	GE PART NO.	DESCRIPTION
		EXCITER BOARD **MODEL 4EG23A10 1 FREQ.** **MODEL 4EG23A11 1 FREQ. WITH CHANNEL GUARD** **MODEL 4EG23A12 4 FREQ.** **MODEL 4EG23A13 4 FREQ. WITH CHANNEL GUARD**
		- - - - - - - - CAPACITORS - - - - - - - -
C101	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCV.
C102	7491395P111	Ceramic disc: 1500 pf ±10%, 500 VDCW; sim to RMC Type JL.
C103	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C104	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C105	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C106	7491395P111	Ceramic disc: 1500 pf ±10%, 500 VDCW; sim to RMC Type JL.
C107 and C108	7491395P109	Ceramic disc: 1000 pf ±10%, 500 VDCW; sim to RMC Type JL.
C110	5493366P220K	Mica: 220 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C111	5493366P150J	Mica: 150 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
C112	5493366P220J	Mica: 220 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
C113	5493366P220K	Mica: 220 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C114	5493366P56K	Mica: 56 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C115 and C116	5494481P129	Ceramic disc: 3900 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C117 and C118	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C119	7130348P3	Molded, phen: 1 pf ±0.05, 500 VDCW, temp coef 0 PPM; sim to Jeffers Type JM-5/32.
C120	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C121	5494481P127	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C122	5496219P253	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C123	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C124 and C125	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C126	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C127 thru C130	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C131 thru C134	19B209243P7	Polyester: 0.1 µf ±20%, 50 VDCW.
		- - - - DIODES AND RECTIFIERS - - - - -
CR101 thru CR104	19A115603P1	Silicon.
CV101	5495769P9	Varactor, silicon: 33 µf ±10% at 4 VDC; sim to Pacific Semiconductors Varicap Type V-596.
		- - - - - - JACKS AND RECEPTACLES - - - - - -
J101 thru J104	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
J105	19B209303P1	Connector, phen: 9 pins.
J106 and J107	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L101	19C303883G18	Coil. Includes tuning slug 5491798P2.
L102	19C303883G19	Coil. Includes tuning slug 5491798P2.
L103	19C303883G20	Coil. Includes tuning slug 5491798P2.
L104	19C303883G21	Coil. Includes tuning slug 5491798P2.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q101 thru Q103	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q104	19A115330P1	Silicon, NPN.
Q105 and Q106	19A115328P1	Silicon, NPN.
Q107 and Q108	19A115552-P1	Silicon, NPN.
		- - - - - - - - - RESISTORS - - - - - - - - -
R101	3R77P204J	Composition: 0.20 megohm ±5%, 1/2 w.
R102	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R103	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R104	3R77P681K	Composition: 680 ohms ±10%, 1/2 w.
R105	3R77P565J	Composition: 5.6 megohm ±5%, 1/2 w.
R106 and R107	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R108	19B208358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 1/4 w; sim to CTS Type X-201.
R109	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R110	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R111	3R77P124J	Composition: 0.12 megohm ±5%, 1/2 w.
R112	3R77P433J	Composition: 43,000 ohms ±5%, 1/2 w.
R113	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R114	3R77P563J	Composition: 56,000 ohms ±5%, 1/2 w.
R115	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R116	3R77P242J	Composition: 2400 ohms ±5%, 1/2 w.
R117	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R118	3R77P512J	Composition: 5100 ohms ±5%, 1/2 w.
R119	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R120	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R121	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R122	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R123	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R124	3R77P201J	Composition: 200 ohms ±5%, 1/2 w.
R125	3R77P390K	Composition: 39 ohms ±10%, 1/2 w.
R126	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R127	3R77P560K	Composition: 56 ohms ±10%, 1/2 w.
R128	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R129	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R130	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R131 thru R134	3R152P272K	Composition: 2700 ohms ±10%, 1/4 w.
R135	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R136 and R137	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
		- - - - - - - - THERMISTORS - - - - - - - -
RT101	19C300048P8	Disc: 2500 ohms ±10%; sim to GE 4D.
		- - - - - - - - - SOCKETS - - - - - - - - -
XY101 thru XY104	19B216043G1	Socket assembly. Includes:
	19D413071P1	Socket cavity.
	19A115834P2	Electrical contacts. (6)
		- - - - - - - - OSCILLATORS - - - - - - - -
		When reordering, specify ICOM frequency.
		ICOM Frequency = (OF ÷ 36).
Y101 thru Y104	4EG25A10	Integrated Circuit Oscillator Module (ICOM).
	19D413070P1	Cap, decorative.
		POWER AMPLIFIER **MODEL 4EF32J10** **MULTIPLIER FILTER** **19D413402G1**
A201		
		- - - - - - - - CAPACITORS - - - - - - - -
C1	7146331G7	Silver mica: 10 pf ±10%, 500 VDCW; sim to Underwood Type J1HF.
C2 thru C4	19B209418P1	Variable, air: 1.75 to 7.65 pf; sim to EF Johnson Type V.
C5	5493392P7	Ceramic, feed-thru: .001 pf +100%-0%, 500 VDCW; sim to Allen Bradley Type FA5C.
C6	7146331G6	Silver mica: 5 pf ±20%, 500 VDCW; sim to Underwood Type J1HF.
C7	7484398P7	Silver mica: 10 pf ±10%, 500 VDCW; sim to Underwood Type J1HF.
C8 and C9		(See Mechanical Parts, items 3 and 4).
C10 and C11		(See Mechanical Parts, items 9-11, 13, 14).
C12	5493392P7	Ceramic, feed-thru: .001 pf +100%-0%, 500 VDCW; sim to Allen Bradley Type FA5C.
C13	7489162P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
		- - - - - DIODES AND RECTIFIERS - - - - -
CR1	19A115250P1	Silicon.
CV1	19A115809P2	Silicon, capacitive.
		- - - - - - - - TERMINALS - - - - - - - -
E1	4034512P3	Terminal, feed-thru: sim to Sealectro RST-MM-10-TUR.
		- - - - - - JACKS AND RECEPTICLES - - - -
J1 and J2	7104941P16	Jack, phono: sim to National Tel.
J3		(Part of K1).
		- - - - - - - - - RELAYS - - - - - - - - -
K1	19A127785G1	Armature, coaxial: 100 ohms ±10% coil res, 13.6 VDC ±20% operating, 2.2 w, 1 form C contacts; sim to Magnecraft 123X09A. (Includes J3, P1, P2, W1-W3).
		- - - - - - - - - INDUCTORS - - - - - - - - -
L1	19A122802P1	Coil.
L2	19A127799P1	Coil.
L3	19A122707P2	Coil.
L4	19A122707P1	Coil.
L5		db wire.
L6	4035338P2	Terminal: sim to Zierick Mfg 401.
L7	19A127445P1	Coil.
L8		(Part of L7).
L9	19A127336G1	Coil.
L10	7488079P9	Choke, RF: 2.70 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4411-13K.
		- - - - - - - - - PLUGS - - - - - - - - -
P1		(Part of K1).
P2		(Part of K1).
		- - - - - - - - - RESISTORS - - - - - - - -
R1	3R77P103K	Composition: 10,000 megohm ±10%, 1/2 w.
R2	3R77P201J	Composition: 200 ohms ±5%, 1/2 w.
R3	3R152P683K	Composition: 68,000 ohms ±10%, 1/4 w.
R4	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
		- - - - - TERMINAL BOARDS - - - - - - -
TB1	7487424P6	Miniature, phen: 3 terminals.
		- - - - - - - - - CABLES - - - - - - - - -
W1		(Part of K1).
W2		(Part of K1).
W3		(Part of K1).
		- - - - - - - - CAPACITORS - - - - - - - -
C202	5494481P27	Ceramic disc: .0027 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C203	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C204 and C205	5494481P27	Ceramic disc: .0027 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C206 and C207	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C208	7489162P141	Silver mica: 390 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C209	19B209328P5	Variable, air: approx 1.85-14.8 pf, 650 v peak; sim to EF Johnson 193.
C211 and C212	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C213	19A116470P1	Ceramic, feed-thru: 680 pf ±20%, 1000 VDCW; sim to Erie 2432-019-X5R0-681M.
C214	19B209329P1	Variable, air: approx 5.1-50 pf, 1700 v peak; sim to Star Products Model APL.
C215	19B209328P10	Variable, air: approx 2.62-30.6 pf, 650 v peak; sim to EF Johnson 193.
C216	5494481P27	Ceramic disc: .0027 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C218 and C219	5494481P11	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C220 and C221	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C222 thru C224	7160807P1	Ceramic, feed-thru: .001 µf +100% -0%, 500 VDCW.

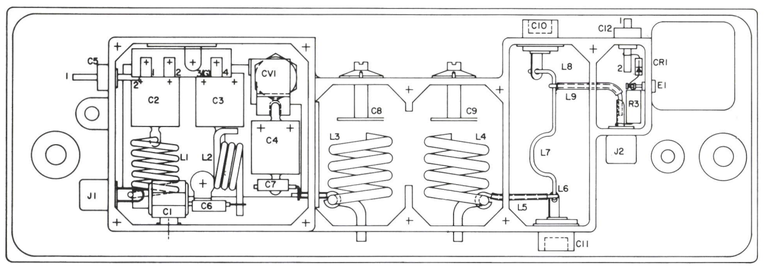
(Cont'd on back of RC-2109)

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

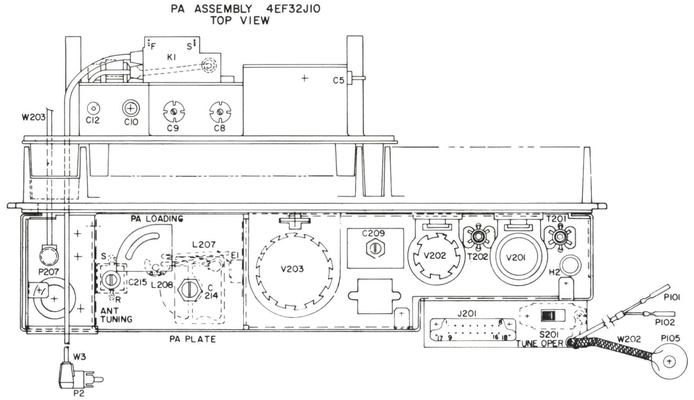
MULTIPLIER FILTER
A201



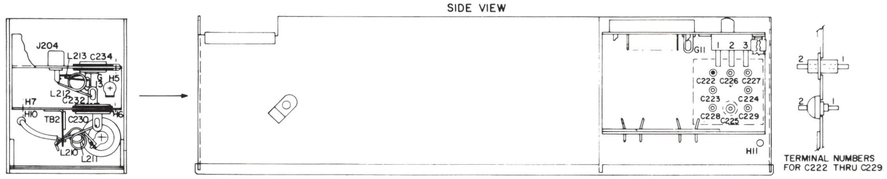
MULTIPLIER FILTER
A201



PA ASSEMBLY 4EF32J10
TOP VIEW

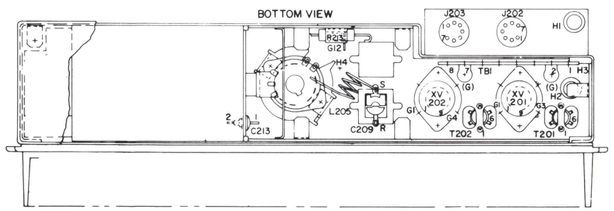


SIDE VIEW

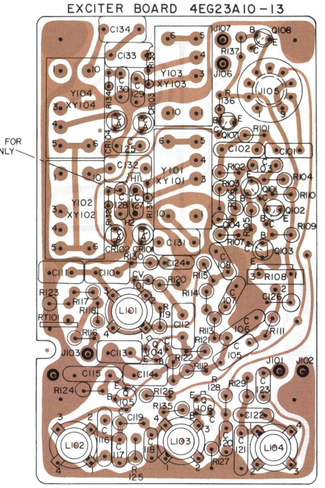


TERMINAL NUMBERS FOR C222 THRU C229

BOTTOM VIEW



EXCITER BOARD 4EG23A10-13



RESISTANCE READINGS

ALL READINGS ARE TYPICAL READINGS MEASURED FROM TRANSISTOR PINS TO GROUND WITH A 20,000 OHM-PER-VOLT METER, AND WITH THE TRANSMITTER UNKEYED.
+ OR — SIGNS SHOW METER LEAD GROUNDED.

FOR READINGS OF:	USE SCALE
1 - 50	X1
51 - 500	X10
501 - 50K	X1000
51K - ∞	X100,000

EXCITER BOARD

TRANSISTOR SYMBOL	EMITTER +	EMITTER −	BASE +	BASE −	COLLECTOR +	COLLECTOR −
Q101	680	680	3.4K	13K	2.7K	8.5K
Q102	0	0	2.7K	8.5K	2.65K	11.5K
Q103	0	0	2.65K	11.5K	8.5K	7.1K
Q104	0	0	3.1K	33K	1.8K	1.8K
Q105	200	145	1.8K	1.8K	220	100
Q106	56	13	0	0	200	12

PA ASSEMBLY

SYMBOL NO.	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10	PIN 11	PIN 12
V2C1	6.3K	180	47K	FIL	FIL	180	100K	47K	100			
V2C2	6K	220	47K	FIL	FIL	220	27K	47K	220			
V203	FIL	0	20K	20K	20K	0	22K	0	0	6K	22K	FIL

(19B621498, Rev. 0)
(19B216134, Sh. 1, Rev. 1)
(19B216134, Sh. 2, Rev. 1)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

450--470 MHZ TRANSMITTER
TYPE ET-99-A

RC-2108A

SCHEMATIC DIAGRAM

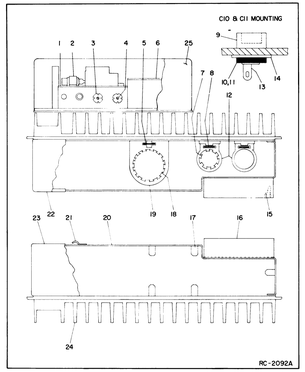
450--470 MHZ TRANSMITTER
TYPE ET-99-A

RC-2109A

SYMBOL	GE PART NO.	DESCRIPTION
C225	19B209282P1	Ceramic, feed-thru: 680 pf ±20%, 1000 VDCW; sim to Sprague Type 546C.
C226 thru C229	7160807P1	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW.
C231	5494481P27	Ceramic disc: .0027 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C236	5496218P610	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef -470 PPM.
C238	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C239	5494481P27	Ceramic disc: .0027 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		TERMINALS
E1	7135118P1	Solder.
		JACKS AND RECEPTICLES
J201	19B205689G1	Connector: 18 contacts.
J202 and J203	19B205219P1	Connector: 7 pins.
J204	7104941P16	Jack, phono type: coaxial.
		INDUCTORS
L204	748079P34	Choke, RF: 1.5 µh ±10%, 0.28 ohm DC res max; sim to Jeffers 4412-7K.
L205	19A123076P1	Coil.
L206	7772834P5	Choke, RF: 1.8 µh ±10%, 0.33 ohm DC res; sim to Ghaite E-144.
L208	19B205222P1	Coil.
L209	748079P35	Choke, RF: 2.2 µh ±10%, 0.5 ohm DC res max; sim to Jeffers 4412-9K.
L210	19A123072P1	Coil.
L211	19A123073P1	Coil.
L212	19A123072P1	Coil.
L213	19A123074P1	Coil.
L214	19B205220P2	Coil.
		PLUGS
P101	40298402P2	Contact, electrical: sim to AMP 42827-2.
P102	40298460P1	Contact, electrical: sim to AMP 41854.
P206 and P207		(Part of W203).
		RESISTORS
R201	3R77P202J	Composition: 2000 ohms ±5%, 1/2 w.
R202	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R203	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R204	3R78P273K	Composition: 27,000 ohms ±10%, 1 w.
R206	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
R207	3R77P273K	Composition: 27,000 ohms ±10%, 1/2 w.
R208	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R209	3R78P183K	Composition: 18,000 ohms ±10%, 1 w.
R210	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R211	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R212	3R79P683K	Composition: 68,000 ohms ±10%, 2 w.
R213	3R149P822K	Composition: 8200 ohms ±10%, 4 w.
R214	19B209022P30	Wirewound: 4.3 ohms ±5%, 2 w; sim to IRC Type BWH.
R215	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
		SWITCHES
S201	7145098P3	Slide: SPDT, 0.75 amp at 125 VAC or 0.5 amp at 125 VDC; sim to Stackpole SS-32.

SYMBOL	GE PART NO.	DESCRIPTION
		TRANSFORMERS
		COIL 19B205215G1
T201		
		CAPACITORS
C1	5494481P11	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
	5491798P4	Tuning slug.
		COIL 19B205213G1
T202		
		CAPACITORS
C1	5494481P11	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	5491238P10	Ceramic disc: 2 pf ±0.5 pf, 500 VDCW, temp coef -470 ±250 PPM.
		RESISTORS
R1	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
	5493185P5	Tuning slug.
		TERMINAL BOARDS
TB1	7775500P124	Phen: 8 terminals.
TB2	7775500P1	Phen: 2 terminals.
		TUBES
V201 and V202		Type 8106.
V203		Type 7984.
		CABLES
		CABLE 19B205268G1
W202		
		PLUGS
P105	19B209341P2	Socket: 9 contacts; sim to Elco 04-920-XX.
W203	5491689P78	RF: approx 20-1/2 inches long. Includes P206 and P207.
		SOCKETS
XV201 and XV202	7480532P8	Tube, phen: 9 pins; sim to Elco 04-903-84.
XV203	19C30100?P5	Tube: 12 pins; sim to Alcon Metal Products 371G.
		MISCELLANEOUS
	19A122133G11	Antenna Cable. (Internal- Connects to J3 of Multiplier Assembly).
	19A122133G12	Antenna cable. (External- Used with wall mount station).
		MECHANICAL PARTS (SEE RC-2092)
1	19B216898G1	Cover.
2	7763541-P6	Clip, spring tension.
3	7117825P1	Washer, spring tension; sim to Tinnerman C6378B-632-24. (Part of C8 and C9).
4	4036765G9	Screw. (Part of C8 and C9).
5	19A123195P2	Support. (Used with V203).
6	19B216899G2	Cover.
7	7165167P5	Insert, tube shield: sim to Atlas 106-332-5. (Used with V202).
8	19B205622P1	Spring. (Used with V201, 202).
9	19A123764P1	Insulator.
10	19A123100?P11	Washer. (Part of C10).

SYMBOL	GE PART NO.	DESCRIPTION
11	19A121006-P12	Washer. (Part of C11).
12	19A121523P3	Heat sink. (Used with V201, 202).
13	4035338P2	Terminal, solderless; sim to Zierick Mfg 201.
14	19A127163P1	Washer.
15	7147223P3	Clip, loop: sim to Patton-Macguyer 40. (Used with W202).
16	19B205211P1	Support.
17	4035017P4	Support, angle: sim to Tinnerman C-19185-020-24.
18	7165167P7	Insert, tube shield: sim to Atlas 106-332-22. (Used with V203).
19	19B204571P1	Heat sink. (Used with V203).
20	19C303875G1	Chassis.
21	7763541P2	Strap, retaining.
22	19B205475G1	Cover, top.
23	19B205476G1	Cover, bottom.
24	19C317470P1	Casting.
25	19A129087G1	Cover. (Multiplier Assembly).



PARTS LIST

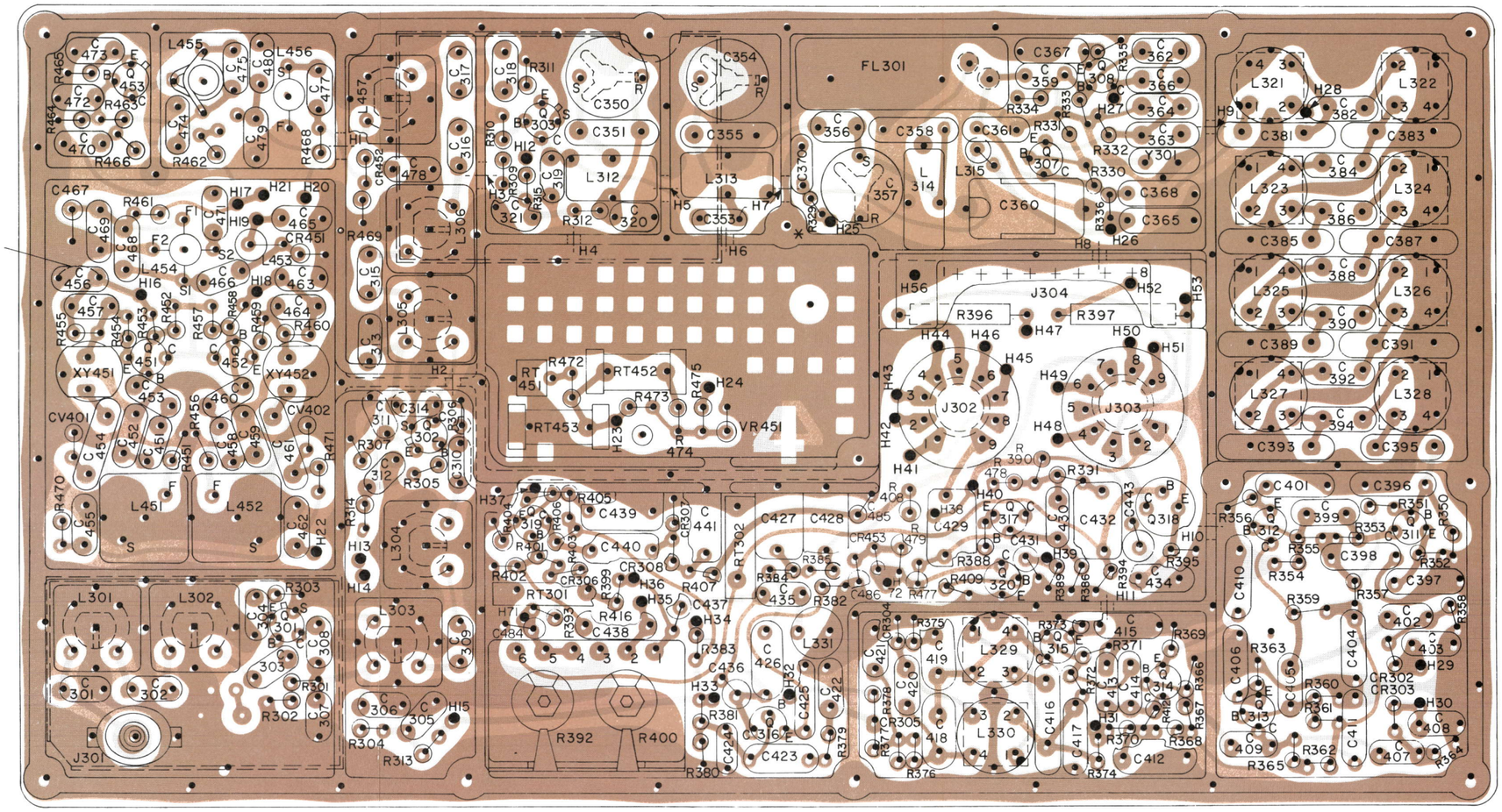
LBI-3912D

406--470 MHz RECEIVER
MODELS 4ER49A10-12 406--420 MHz
MODELS 4ER50A10-12 450--470 MHz

SYMBOL	GE PART NO.	DESCRIPTION
		---------CAPACITORS---------
C301 and C302	5496219P36	Ceramic disc: 5 pf ±5%, 500 VDCW, temp coef 0 PPM.
C303	5496219P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C304*	5494481P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		Earlier than REV D:
	5496219P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C305 and C306	5496219P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C307	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C308	5496219P36	Ceramic disc: 5 pf ±5%, 500 VDCW, temp coef 0 PPM.
C309	5496219P34	Ceramic disc: 3 pf ±5%, 500 VDCW, temp coef 0 PPM.
C310*	5496219P351	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -150 PPM.
		Earlier than REV E:
	5496219P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C311 and C312	5496219P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C313	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C314	5496219P36	Ceramic disc: 5 pf ±5%, 500 VDCW, temp coef 0 PPM.
C315	5496219P34	Ceramic disc: 3 pf ±5%, 500 VDCW, temp coef 0 PPM.
C316	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C317	5496219P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C318	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C319	5496219P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C320 and C321	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C350	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie Style 557-36.
C351	5496218P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C353	5496219P35	Ceramic disc: 4 pf ±5%, 500 VDCW, temp coef 0 PPM.
C354	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie Style 557-36.
C355	5496218P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C356	5496219P36	Ceramic disc: 5 pf ±5%, 500 VDCW, temp coef 0 PPM.
C357	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie Style 557-36.
C358	5496218P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C359	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C.
C360	19A115659P1	Variable, compression mica: approx 16-141 pf, 150 VDCW; sim to El-Menco Type 42.
C361	5496219P54	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef 0 PPM.
C362	5496219P13	Ceramic disc: 22 pf ±10%, 500 VDCW, temp coef 0 PPM.
C363 and C364	5490008P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C365	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C366	5490008P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C367	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C368	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C370	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C.
C381	5496219P368	Ceramic disc: 160 pf ±5%, 500 VDCW, temp coef -150 PPM.
C382	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C383	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C384	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C385	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C386	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C387	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C388	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C389	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C390	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C391	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C392	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C393	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C394	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C395	5490008P34	Silver mica: 200 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C396	5494481P128	Ceramic disc: 2700 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C397	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C398	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C399	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C401	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C402	5490008P119	Silver mica: 47 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C403	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C404	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C405	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C406	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C407	7491393P1	Ceramic disc: .001 µf +100% -0%, 500 VDCW; sim to Sprague 1219C4.
C408	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C.
C409	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C410	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C411	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C412	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C413	5494481P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C414	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C415	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C416	5496219P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C417	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C418 and C419	5490008P137	Silver mica: 270 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C420	5496219P656	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -470 PPM.
C421 and C422	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C423	5492638P108	Ceramic disc: 0.22 µf +80 -20%, 12 VDCW; sim to Sprague 44C.
C424	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C425	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C426	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C427 and C428	19A116080P108	Polyester: 0.15 µf ±10%, 50 VDCW.
C429	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C430	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C431	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C432	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C433*	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D. Deleted by REV C:
C434	5490008P131	Silver mica: 150 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C435	5491189P302	Polyester: 0.022 µf ±5%, 50 VDCW.
C436	19C300075P 47000J	Polyester: 4700 µf ±5%, 100 VDCW; sim to GE Type 61F.
C437	19C300075P 33000J	Polyester: 3300 µf ±5%, 100 VDCW; sim to GE Type 61F.
C438	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C439	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C440	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C441	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C442*	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Deleted by REV C:
C443	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C451	5496219P544	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -330 PPM.
C452	5496219P545	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -330 PPM.
C453	5496219P35	Ceramic disc: 4 pf ±5%, 500 VDCW, temp coef 0 PPM.
C454	5496219P667	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -470 PPM.
C455 and C456	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C457	5496219P3	Ceramic disc: 3 pf ±10%, 500 VDCW, temp coef 0 PPM.
C458	5496219P544	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -330 PPM.
C459	5496219P545	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -330 PPM.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

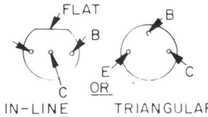
(Cont'd on 19R621221)



(19D413179, Rev. 3)
(19C311420, Sh. 1, Rev. 4)
(19C311420, Sh. 2, Rev. 4)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

LEAD IDENTIFICATION FOR Q307, Q311-Q317 & Q319-Q320



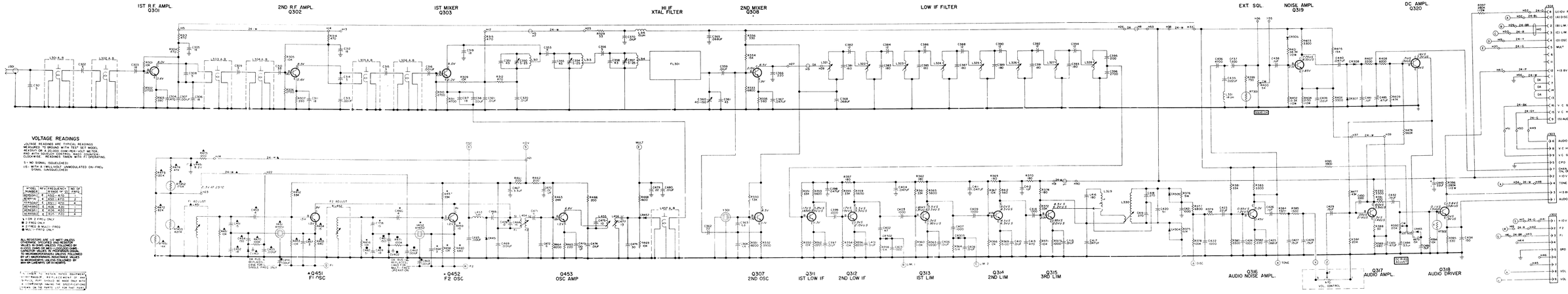
IN-LINE TRIANGULAR
VIEW FROM LEAD END

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

OUTLINE DIAGRAM

406—470 MHZ RECEIVER
MODELS 4ER49A10-12 &
4ER50A10-12

RC-1732D



SCHEMATIC DIAGRAM

406—470 MHZ RECEIVER
MODELS 4ER49A10-12 & 4ER50A10-12

19R621221, Rev. 9

(Cont'd from RC-1722)

SYMBOL	GE PART NO.	DESCRIPTION
C460	5496219P35	Ceramic disc: 4 pf ±5%, 500 VDCW, temp coef 0 PPM.
C461	5496219P67	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -470 PPM.
C462 and C463	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Dincap.
C464	5496219P3	Ceramic disc: 3 pf ±10%, 500 VDCW, temp coef 0 PPM.
C465	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Dincap.
C466	5496219P3	Ceramic disc: 3 pf ±10%, 500 VDCW, temp coef 0 PPM.
C467	5496267P9	Tantalum: 3.3 pf ±20%, 15 VDCW; sim to Sprague Type 150D.
C468	5496219P244	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C469	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Dincap.
C470	749162?P2	Ceramic disc: .01 pf +80% -30%, 50 VDCW; sim to Sprague 19C.
C471 and C472	5496219P37	Ceramic disc: 6 pf ±5%, 500 VDCW, temp coef 0 PPM.
C473	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Dincap.
C474	749182?P2	Ceramic disc: .01 pf +80% -30%, 50 VDCW; sim to Sprague 19C.
C475	5496219P241	Ceramic disc: 10 pf ±5%, 500 VDCW, temp coef -80 PPM.
C476	5496219P242	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef -80 PPM.
C477	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C478	5496219P250	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C479	5496219P347	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -150 PPM.
C480	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C481	5496267P5	Tantalum: 4.7 pf ±20%, 10 VDCW; sim to Sprague Type 150D.
C482	5496219P256	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -80 PPM.
C483*	5496219P36	Ceramic disc: 5 pf ±5%, 500 VDCW, temp coef 0 PPM. Added by REV A.
C484*	5496267P9	Tantalum: 3.3 pf ±20%, 15 VDCW; sim to Sprague Type 150D. Added by REV C.
C485*	5496267P228	Tantalum: 0.47 pf ±10%, 35 VDCW; sim to Sprague Type 150D. Added by REV C.
C486*	5496267P14	Tantalum: 15 pf ±20%, 20 VDCW; sim to Sprague Type 150D. Added by REV C.
- - - - - - - DIODES AND RECTIFIERS - - - - - - -		
CR301*	19A115250P1	Silicon. Deleted by REV D.
CR302 and CR303	403B0569?1	Germanium.
CR304 and CR305	19A115250P1	Silicon.
CR306	5494922P1	Silicon.
CR307 and CR308	19A115250P1	Silicon.
CR451	19A115250P1	Silicon.
CR452	19A119081P1	Silicon.
CR453*	19A115250P1	Silicon. Added by REV C.
CV401 and CV402	19A116034P1	Silicon.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - FILTERS - - - - - - - - -
FL301	19C304219G5	Bandpass.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - -
J301	7104941P9	Jack, phono type: phen; sim to Cinch 14M.
J302 thru J303	19B209303?1	Connector, phen: 9 pins.
J304	19B205689G2	Connector: 16 contacts.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L301A	19D413078G1	Coil: frequency range 438-483 MHz.
L301B	19D413078G3	Coil: frequency range 394-433 MHz.
L302A	19D413078G1	Coil: frequency range 438-483 MHz.
L302B	19D413078G3	Coil: frequency range 394-433 MHz.
L303A	19D413078G5	Coil: frequency range 443-478 MHz.
L303B	19D413078G3	Coil: frequency range 394-433 MHz.
L304A	19D413078G1	Coil: frequency range 438-483 MHz.
L304B	19D413078G3	Coil: frequency range 394-433 MHz.
L305A	19D413078G1	Coil: frequency range 438-483 MHz.
L305B	19D413078G3	Coil: frequency range 394-433 MHz.
L306A	19D413078G1	Coil: frequency range 438-483 MHz.
L306B	19D413078G3	Coil: frequency range 394-433 MHz.
L312	19B205224G5	Coil.
L313	19B205224G2	Coil.
L314	19B205224G6	Coil.
L315	7488079P18	Choke, RF: 15 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4421-84.
L321 and L322	19A115711P1	Freq: 455 KHz; sim to Automatic Mfg EXI2670.
L323	19A115711P2	Freq: 455 KHz; sim to Automatic Mfg EXI2671.
L324	19A115711P1	Freq: 455 KHz; sim to Automatic Mfg EXI2670.
L325	19A115711P2	Freq: 455 KHz; sim to Automatic Mfg EXI2671.
L326	19A115711P1	Freq: 455 KHz; sim to Automatic Mfg EXI2670.
L327	19A115711P2	Freq: 455 KHz; sim to Automatic Mfg EXI2671.
L328	19A115711P1	Freq: 455 KHz; sim to Automatic Mfg EXI2670.
L329	19A115711P6	Freq: 455 KHz; sim to Toko PEFCN-14733 CX12.
L330	19A115711P7	Freq: 455 KHz; sim to Toko PEFCN-14734 BM12.
L331	19B209405P1	Reactor, audio freq: 142 mh ±5%, at 0.1 v thru 0.27 v; sim to Aladdin 405-101.
L451 and L452	19B205917G1	Coil. Includes tuning slug 19B200497P2.
L453	7488079P6	Choke, RF: 1 µh ±10%, .30 ohms DC res max; sim to Jeffers 4411-84.
L454	19B205236G1	Coil. Includes tuning slug 19B200497P2.
L455	19B205239G1	Coil. Includes tuning slug 19B200497P2.
L456	19B205240G2	Coil. Includes tuning slug 19B200497P2.
L457A	19D413078G2	Coil: frequency range 419-464 MHz.
L457B	19D413078G4	Coil: frequency range 376-414 MHz.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q301*	19A115691P1	Silicon, NPN. Earlier than REV D:
	19A115440P1	Silicon, NPN.
Q302*	19A115440P2	Silicon, NPN. Earlier than REV D:
	19A115440P1	Silicon, NPN.

SYMBOL	GE PART NO.	DESCRIPTION
Q303*	19A115991P1	Silicon, NPN. Earlier than REV D:
	19A115440P1	Silicon, NPN.
Q307 and Q308	19A115245P1	Silicon, NPN.
Q311 thru Q313	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q314 thru Q317	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q318	19A115300P2	Silicon, NPN; sim to Type 2N3053.
Q319 and Q320	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q321*	19A115889P1	Silicon, NPN; sim to Type 2N2712. Deleted by REV C.
Q451 thru Q453	19A115666P1	Silicon, NPN.
		- - - - - - - - - RESISTORS - - - - - - - - -
R301	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R302	3R152P273J	Composition: 27000 ohms ±5%, 1/4 w.
R303	3R152P391J	Composition: 390 ohms ±5%, 1/4 w.
R304	3R152P471J	Composition: 470 ohms ±5%, 1/4 w.
R305	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R306	3R152P273J	Composition: 27000 ohms ±5%, 1/4 w.
R307	3R152P391J	Composition: 390 ohms ±5%, 1/4 w.
R309	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R310	3R152P273J	Composition: 27000 ohms ±5%, 1/4 w.
R311	3R152P473J	Composition: 47000 ohms ±5%, 1/4 w.
R312 thru R313	3R152P471J	Composition: 470 ohms ±5%, 1/4 w.
R329	3R152P330K	Composition: 33 ohms ±10%, 1/4 w.
R330	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R331	3R152P822K	Composition: 8200 ohms ±10%, 1/4 w.
R332	3R152P392K	Composition: 3900 ohms ±10%, 1/4 w.
R333	3R152P682K	Composition: 6800 ohms ±10%, 1/4 w.
R334	3R152P153K	Composition: 15,000 ohms ±10%, 1/4 w.
R335	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R336	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R350	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R351	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R352	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R353	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R354	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R355	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R356	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R357	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R358	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R359	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R360	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R361	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R362	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R363	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R364	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R365	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R366	3R152P123K	Composition: 12,000 ohms ±10%, 1/4 w.

SYMBOL	GE PART NO.	DESCRIPTION
R367	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R368	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R369	3R152P513J	Composition: 5100 ohms ±5%, 1/4 w.
R370	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R371	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R372	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R373	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R374	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R375 and R376	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R377	3R152P682K	Composition: 6800 ohms ±10%, 1/4 w.
R378	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R379	3R152P153K	Composition: 15,000 ohms ±10%, 1/4 w.
R380	3R152P333J	Composition: 3300 ohms ±5%, 1/4 w.
R381	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R382	3R152P221K	Composition: 220 ohms ±10%, 1/4 w.
R383 and R384	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R385	3R152P152K	Composition: 1500 ohms ±10%, 1/4 w.
R386	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R387*	3R152P753J	Composition: 75,000 ohms ±5%, 1/4 w. Deleted by REV C.
R388	3R152P300J	Composition: 30 ohms ±5%, 1/4 w.
R389	3R152P681J	Composition: 680 ohms ±5%, 1/4 w.
R390	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R391	3R152P431J	Composition: 430 ohms ±5%, 1/4 w.
R392(R400	19B209320P1	Resistor assembly. Variable, carbon film, includes: (R392): 20,000 ohms ±20%, 0.25 w; (R400): 5000 ohms ±20%, 0.25 w; sim to Centralab Series S (Type 71-2).
R393	3R152P392K	Composition: 3900 ohms ±10%, 1/4 w.
R394	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R395	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R396 and R397	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
R399	3R152P751J	Composition: 750 ohms ±5%, 1/4 w.
R400		(Part of R392).
R401	19A116278P357	Metal film: 38,300 ohms ±2%, 1/2 w.
R402	19A116278P313	Metal film: 13,300 ohms ±2%, 1/2 w.
R403	3R152P333J	Composition: 3300 ohms ±5%, 1/4 w.
R404	19A116278P233	Metal film: 2150 ohms ±2%, 1/2 w.
R405	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R406	3R152P333J	Composition: 3300 ohms ±5%, 1/4 w.
R407	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R408	3R152P822J	Composition: 8200 ohms ±5%, 1/4 w.
R409	3R152P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R410*	3R152P182J	Composition: 1800 ohms ±5%, 1/4 w. Deleted by REV C.
R411*	3R152P473J	Composition: 47,000 ohms ±5%, 1/4 w. Deleted by REV C.
R412	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R451	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R452*	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w. Earlier than REV B:
	3R152P183J	Composition: 18,000 ohms ±5%, 1/4 w.
R453	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.

SYMBOL	GE PART NO.	DESCRIPTION
R454	3R152P150K	Composition: 15 ohms ±10%, 1/4 w.
R455	3R152P681J	Composition: 680 ohms ±5%, 1/4 w.
R456	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R457*	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w. Earlier than REV B:
	3R152P183J	Composition: 18,000 ohms ±5%, 1/4 w.
R458	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R459	3R152P150K	Composition: 15 ohms ±10%, 1/4 w.
R460	3R152P681J	Composition: 680 ohms ±5%, 1/4 w.
R461 and R462	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
R463*	3R152P243J	Composition: 24,000 ohms ±5%, 1/4 w. Earlier than REV B:
	3R152P123J	Composition: 12,000 ohms ±5%, 1/4 w.
R464	3R152P822J	Composition: 8200 ohms ±5%, 1/4 w.
R465	3R152P221K	Composition: 220 ohms ±10%, 1/4 w.
R466	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
R468	3R152P162J	Composition: 1600 ohms ±5%, 1/4 w.
R469	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R470 and R471	3R152P104J	Composition: 0.10 megohm ±5%, 1/4 w.
R472	3R152P823J	Composition: 82,000 ohms ±5%, 1/4 w.
R473	3R152P134J	Composition: 0.13 megohm ±5%, 1/4 w.
R474	3R152P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R475	3R152P132J	Composition: 1300 ohms ±5%, 1/4 w.
R476*	3R152P153J	Composition: 1500 ohms ±5%, 1/4 w. Deleted by REV C.
R477*	3R77P433J	Composition: 43,000 ohms ±5%, 1/2 w. Added by REV C.
R478*	3R77P564J	Composition: 0.56 megohm ±5%, 1/2 w. Added by REV C.
R479*	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w. Added by REV C.
		- - - - - - - - THERMISTORS - - - - - - - -
RT301	5490828P28	Thermistor: 1400 ohms ±5%, color code green and white; sim to Global Type 492B.
RT302	5490828P35	Thermistor: 3800 ohms ±5%, color code green and green; sim to Global Type 723B-4.
RT451	5490828P44	Thermistor: 14,000 ohms ±5%, color code black and yellow; sim to Global Type 416B.
RT452	19C300648P12	Disc: .175 megohm ±10%; sim to GE 26D.
RT453	5490828P45	Thermistor: 0.42 megohm ±5%, color code black and blue; sim to Global Type 055GB.
		- - - - - - VOLTAGE REGULATORS - - - - - -
VR451	4036887P40	Silicon, Zener.
		- - - - - - - - - SOCKETS - - - - - - - - -
XT451 and XT452	5490277P1	Transistor, phen: 4 contacts; sim to Elco 3303.
		- - - - - - - - - CRYSTALS - - - - - - - - -
Y301	19B213403G1	Crystal: frequency 11945 KHz, temp range -30°C to +80°C. When reordering, give GE Part Number and specify exact frequency needed. Crystal Frequency = (OF - 12.4) ÷ 27.
Y451 and Y452	19B206980P1	Quartz: freq range 42-55 MHz, temp range -30°C to +85°C.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - MISCELLANEOUS - - - - - -
	4036555P1	Insulator, disc: nylon. (Used with Q318).
	19A127006P2	Can. (Used with L301-L306 and L457).
	19B215185G1	Plate.
	19A121068P1	Can. (Used with L451 and L452).
	19E300824P1	Chassis.

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 description of parts affected by these revisions.

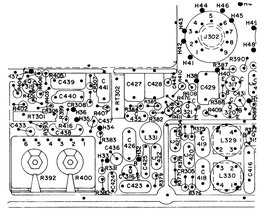
REV. A - To improve performance of 1st RF Amplifier. Added C483.

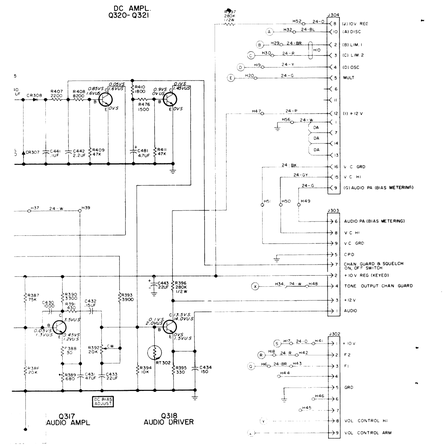
REV. B - To provide adequate 1st oscillator injection voltage. Changed R452, R457, and R463.

REV. C - To eliminate objectionable squelch thump. Deleted R387, R410, R411, C432, C442, R476, C481, and Q321. Added CR453, R477, R478, R479, C484, C485, and C486.

Outline Diagram was:

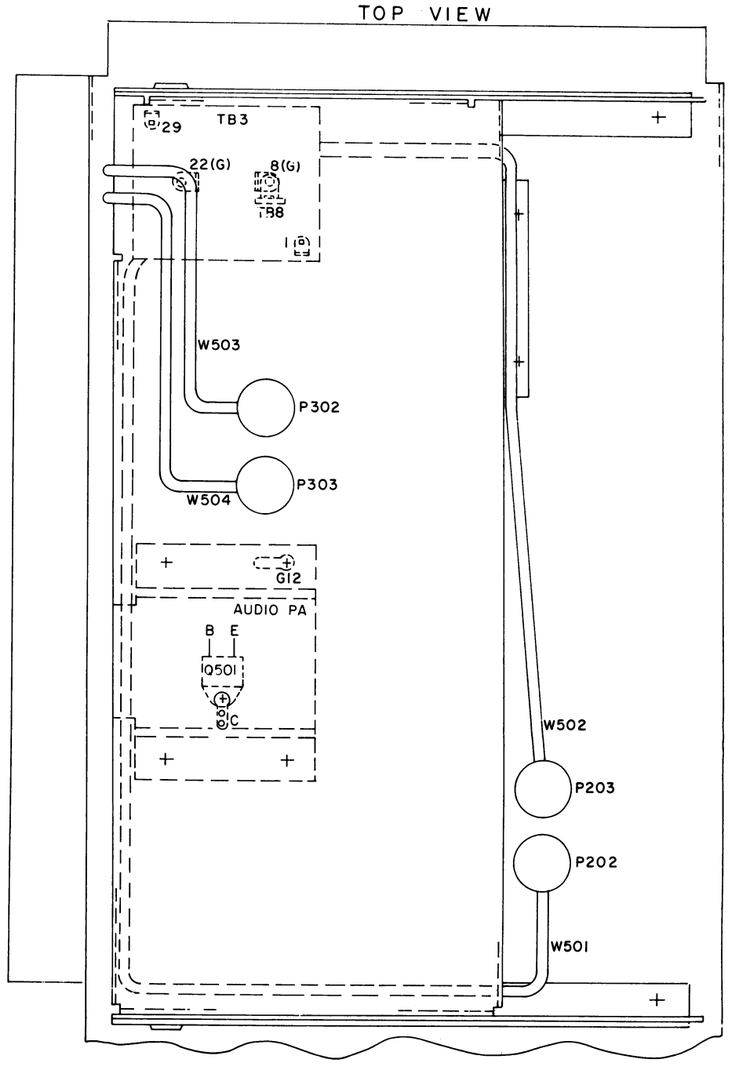
Schematic Diagram was:





REV. D - To replace transistor no longer available and improve receiver front end stability. Deleted C483 and CR301. Changed C304, Q301, Q302 and Q303.

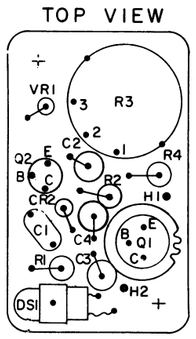
REV. E - To stabilize the 2nd R.F. Amplifier. Changed C310 and applied a solder heat along the copper plated frame and printed wiring board in the area where the first oscillator thermistors are mounted, on the opposite side of the frame from L305 and Q302.



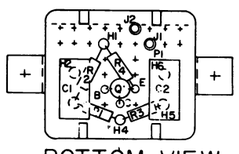
RESISTANCE READINGS

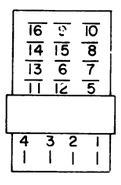
RESISTANCE READINGS ARE MEASURED FROM TB3 TO GROUND WITH A 20,000 OHM-PER-VOLT METER, AND WITH ALL EXTERNAL CONNECTIONS REMOVED - OR + SIGN SHOWS METER LEAD GROUNDED

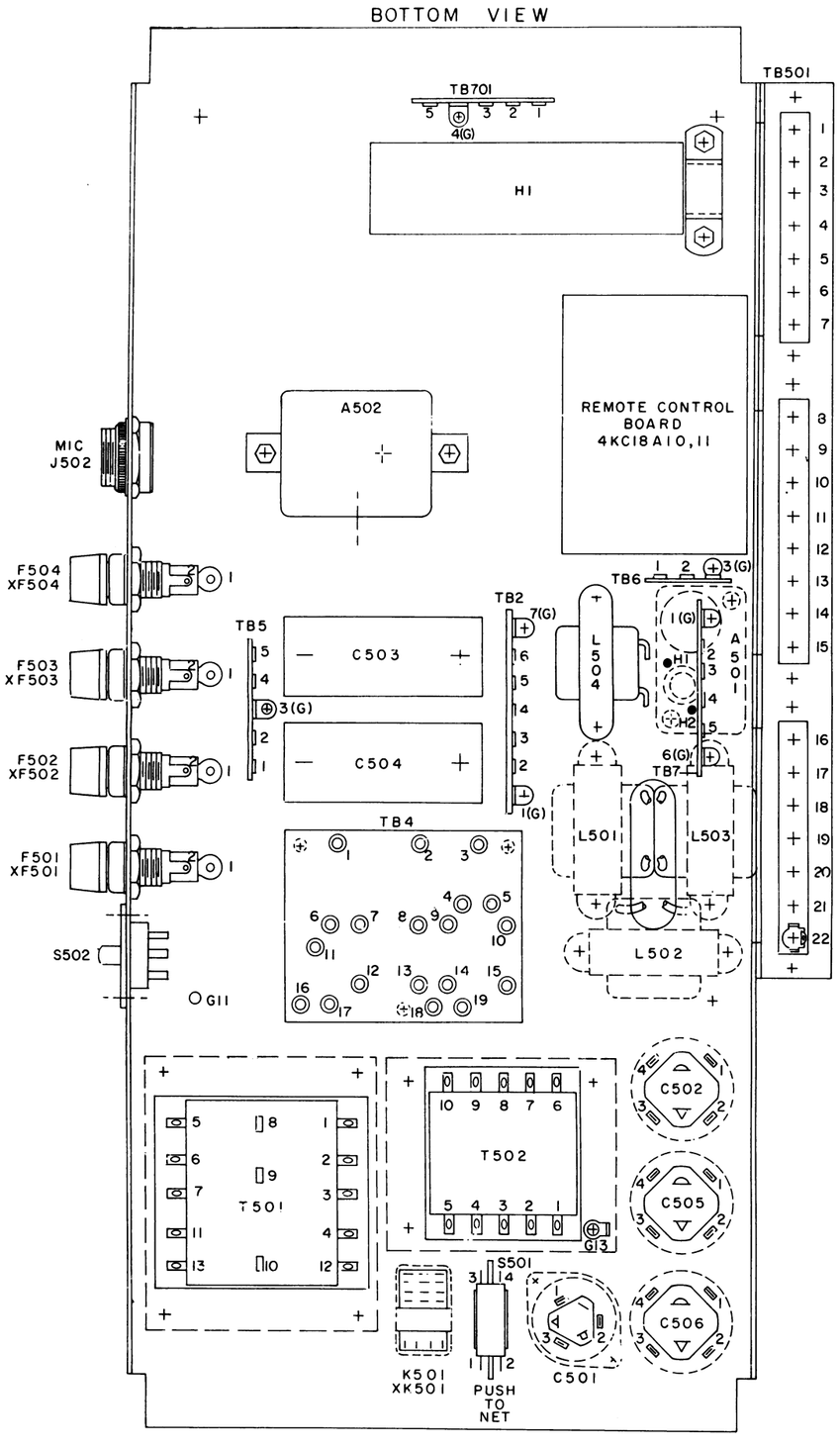
MEASURED FROM	-	+
TB3-21	∞	∞
TB3-26	∞	∞
TB3-25	36Ω	30K
TB3-14	20Ω	250K
T501-5	∞	∞
T501-3	∞	∞
TB3-16	6.4K	2.25K
TB3-17	5.6K	50K
TB3-20	21K	90K
TB3-27	0	0



A501
10-VOLT REGULATOR



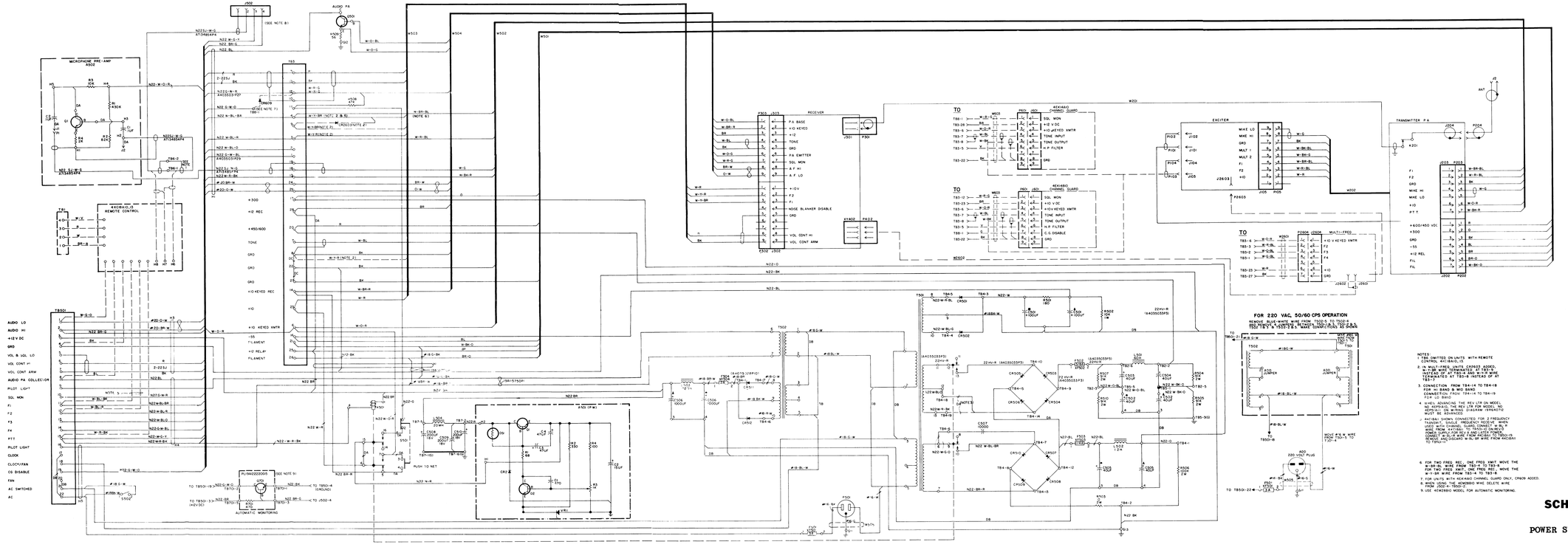




OUTLINE DIAGRAM

POWER SUPPLY MODEL 4EP51A10

(19D402812, Rev. 8)



SCHEMATIC DIAGRAM

POWER SUPPLY MODEL 4EP51A10

(19R640706, Rev. 22)

PARTS LIST

LBI-31302E

STATION POWER SUPPLY
MODEL 4EP51A10

SYMBOL	G-E PART NO.	DESCRIPTION
A501		10 VOLT REGULATOR 19B205255-G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5494481-P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	5496267-P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C3 and C4	5496267-P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1	4037822-P1	Silicon.
VR1	4036887-P6	Silicon, Zener.
		- - - - - - - - - INDICATING DEVICES - - - - - - - -
DS1	4034664-P1	Lamp, incandescent: 28 v; sim to GE 2148.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115300-P2	Silicon, NPN; sim to Type 2N3053.
Q2	19A115133-P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1*	3R77-P680K	Composition: 68 ohms ±10%, 1/2 w. In Models earlier than Rev B:
	3R77-P161J	Composition: 160 ohms ±5%, 1/2 w.
R2	3R77-P331J	Composition: 330 ohms ±5%, 1/2 w.
R3	19A115681-P1	Variable, wirewound: 1000 ohms ±20%, 3 w; sim to CTS Series 115.
R4	3R77-P101K	Composition: 100 ohms ±10%, 1/2 w.
A502*		MICROPHONE PRE - AMPLIFIER 19B204653-G2 Added by Rev C
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	19A115028-P114	Polyester: 0.1 µf ±20%, 200 VDCW.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 and J2	4033513-P4	Contact, electrical: sim to Bead Chain L-93-3.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	4029840-P2	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115488-P1	Silicon, NPN; sim to Type 2N3712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77-P43KJ	Composition: 0.43 megohm, ±5%, 1/2 w.
R2	3R77-P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R3	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R4	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.

SYMBOL	G-E PART NO	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C501	5496456-P4	Electrolytic, twist-prong: 100-100 µf +100% -10%, 150-150 VDCW; sim to GE 43F.
C502	7770994-P25	Electrolytic, twist-prong: 40-40 µf +50% -10%, 450-450 VDCW; sim to Mallory Type FP.
C503 and C504	7774786-P45	Electrolytic: 40 µf +50% -10%, 450 VDCW; sim to PR Mallory TC7A.
C505	7770994-P25	Electrolytic, twist-prong: 40-40 µf +50% -10%, 450-450 VDCW; sim to Mallory Type FP.
C506	7676442-P21	Electrolytic, twist-prong: 1000-1000 µf +250% -10%, 25-25 VDCW; sim to GE 43F.
C507	5494481-P21	Ceramic disc: 10,000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C508 thru C510	19A115680-P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TT.
C511*	5494481-P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by Rev D. Deleted by REV G.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR501 and CR502	4037823-P1	Silicon.
CR503 thru CR510	4037823-P2	Silicon.
CR511 and CR512	4037823-P1	Silicon.
		- - - - - - - - - - FUSES - - - - - - - - - -
F501	1E16-P6	Quick blowing: 3 amps at 250 v; sim to Littel-fuse 312003 or Bussman AGC-3.
F502	7487942-P2	Slow blowing: 3/8 amp at 250 v; sim to Bussman MDL-3/8.
F503	7487942-P1	Slow blowing: 1/4 amp at 250 v; sim to Bussman MDL-1/4.
F504	7487942-P27	Slow blowing: 2 amps at 125 v; sim to Bussman MDL-2.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J502	19A116061-P1	Connector, chassis: 4 female contacts.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K501	19C307010-P5	Armature: 12 VDC nominal, 1.5 w max operating, 130 ohms ±10% coil res, 4 form C contacts; sim to Allied Control T154-3-413.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L501	19B209346-P1	Reactor: 0.6 h min, 40 ohms max DC res, 600 VDC operating.
L502	19B209347-P1	Reactor: 1.2 h min, 50 ohms max DC res, 300 VDC operating.
L503	19B209343-P1	Reactor: .02 h min, 0.5 ohm max DC res, 15 VDC operating.
L504	5490936-P1	Reactor: .02 h min, 1.3 ohms ±10% DC res, 1.3 VDC operating.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P501		(Part of W505).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q501*	19A116203-P3	Silicon, NPN. Earlier than REV G.
	19A115527-P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R501	3R77-P181K	Composition: 180 ohms ±10%, 1/2 w.
R502	3R7B-P103K	Composition: 10,000 ohms ±10%, 1 w.
R503	3B79-P100J	Composition: 10 ohms ±5%, 2 w.
R504 and R505	3B79-P913J	Composition: 91,000 ohms ±5%, 2 w.

SYMBOL	G-E PART NO	DESCRIPTION
R506	3B79-P104K	Composition: 0.1 megohm ±10%, 2 w.
R507	3B79-P913J	Composition: 91,000 ohms ±5%, 2 w.
R508	3B77-P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R509	19B209022-P109	Wirewound: 0.56 ohm ±10%, 2 w; sim to IRC Type BWH.
R510	3B79-P913J	Composition: 91,000 ohms ±5%, 2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S501	4038038-P1	Pushbutton, red: DPDT, 1 amp at 125 VAC; sim to Arrow-Hart and Hegeman H392-A.
S502*	7145098-P1	Slide: DPDT, 0.75 amp at 125 VAC, or 0.5 amp at 125 VDC; sim to Stackpole SS-150. Added by Rev E.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T501	19A115698-P1	Power: 117/220 VAC.
T502	19A115699-P1	Power.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB2	7775500-P17	Phen: 7 terminals.
TB3	19B205258-G1	Board: 27 terminals.
TB4	19A122174-G1	Component board: 19 eyelets.
TB5	7775500-P11	Phen: 5 terminals.
TB6	7775500-P2	Phen: 3 terminals.
TB7	7775500-P16	Phen: 6 terminals.
TB8*	7487424-P22	Miniature, phen: 1 terminal. Added by Rev A.
TB501	7117710-P7 7117710-P8	Board. Includes the following: Phen: 7 terminals; sim to Cinch 1770. Phen: 6 terminals; sim to Cinch 1780.
		- - - - - - - - - - CABLES - - - - - - - - - -
W501		CABLE 19B205266-G2 (Used in Transmitter)
		- - - - - - - - - - PLUGS - - - - - - - - - -
P202	19B209341-P1	Socket: 7 contacts; sim to Elo 04-720-XX.
W502		CABLE 19B205267-G1 (Used in Transmitter)
		- - - - - - - - - - PLUGS - - - - - - - - - -
P203	19B209341-P1	Socket: 7 contacts; sim to Elo 04-720-XX.
W503		CABLE 19B205265-G1 (Used in Receiver)
		- - - - - - - - - - PLUGS - - - - - - - - - -
P302	19B209341-P2	Socket: 9 contacts; sim to Elo 04-920-XX.
W504		CABLE 19B205264-G2 (Used in Receiver)
		- - - - - - - - - - PLUGS - - - - - - - - - -
P303	19B209341-P2	Socket: 9 contacts; sim to Elo 04-920-XX.
W505	19A122527-G2	Cable: includes 3-pin socket (P501).
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XF501 thru XF504	19B209005-P1	Fuseholder, post type, phen: 15 amps at 250 v; sim to Littelfuse 342012.
XK501	5491595-P5	Relay: 16 contacts; sim to Allied Control 30054-2.

SYMBOL	G-E PART NO	DESCRIPTION
		HOOKSWITCH ASSEMBLY 19B204887-G1 (See RC-1394)
20	4029851-P4	Cable clamp; sim to Heckeseer 3/16-4.
21	19A121613-P1	Holder and switch: thermoplastic case, contact rating 1 amp at 125 v.
22	19A121581-G1	Cable: approx 25 inches long, includes five 19A121429-P1 pins.
23	5493035-P10	Resistor, wirewound ceramic: 3.5 ohms ±5%, 5 w; sim to Ttw-Ohm Type S-60.
24	7775500-P55	Terminal board, phen: 5 terminals.
		MILITARY MICROPHONE MODEL 4EM25A10 19B209101-G1 (SEE RC-1163)
1		Cable clamp. Shure Brothers 53A532.
2		Switch. Shure Brothers EP26.
3		Case (back) and mounting button; plastic, Shure Brothers EP07.
4		Switch button: red plastic. Shure Brothers EP25.
5		Spring. Shure Brothers 44A113.
6		Shield. Shure Brothers EP23.
7		Magnetic controlled cartridge. Shure Brothers EP13.
8		Case (front) plastic. Shure Brothers EP07.
9		Cable and plug: approx 6 feet long. Shure Brothers EP14.
		5 WATT SPEAKER 4EZ16A10 19D406248-G12
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19B209233-P2	Electrolytic, non-polorized: 25 µf ±20%, 25 VDCW; sim to Sprague 442C.
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - - -
LS3	19B209422-P1	Permanent magnet: 5 inch, 3.2 ohms ±10% imp, 2.98 ohms ±15% DC res, 7.5 w max operating.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	19A121546-G1	Cable assembly: approx 48 inches long, includes (2) 19A121429-P1 pins.
		MECHANICAL PARTS
	19B216269-G2	Speaker housing.
	19A121550-G3	Cover.
	19A121521-G1	Mounting support.
	5490407-P3	Neoprene grommet. (Upper)
	19A115470-P1	Rubber grommet. (Lower)
		TONE CONNECTOR KIT 19A127270-G5
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J704	19B216279-G1	Receptacle: 9 contacts, sim to Winchester MRB-LAB.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R706	3R77-P560K	Composition: 56 ohms ±10%, 1/2 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

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.

REV. A - Model 4EP51A10

To permit the addition of a Channel Guard disable switch, added TB8, deleted jumper from TB301-18 to TB301-19, and added G-W-G wire from TB301-19 to TB8-1.

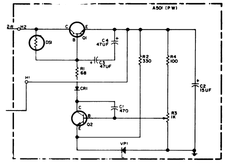
REV. B - To improve operation of 10-volt regulator A501. Changed R1.

REV. C - To amplify the microphone output. Added pre-amplifier A502.

REV. D - To prevent high frequency oscillations in audio PA when a high gain transistor is used. Added C511.

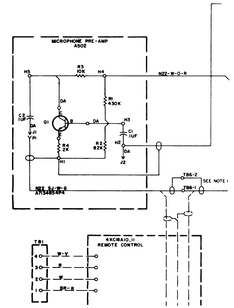
REV. E - To provide a station power ON-OFF switch on the rear of the power supply chassis. Added S502.

REV. F - To protect 10-Volt Regulator A501 against reverse polarity. Deleted CR1 and added CR2.
Schematic Diagram Was:

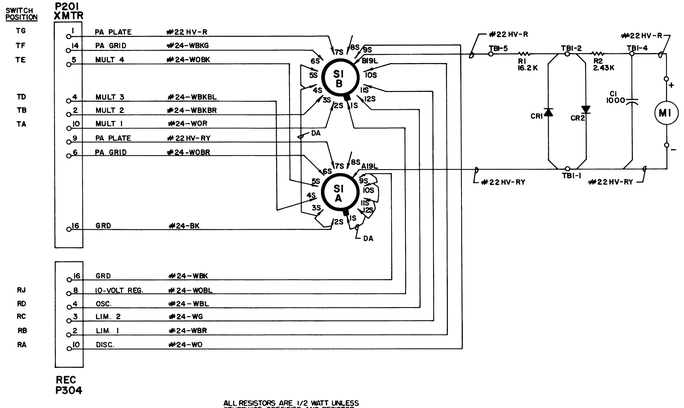


REV. G - To incorporate a new susio output transistor. Deleted C551, and changed Q501.

REV. H - To increase the line level sensitivity for use with remote line levels as low as -20 dBm. Re-routed wiring of Mic Preamp. A502.
Schematic Diagram was:



TEST METER OPTION

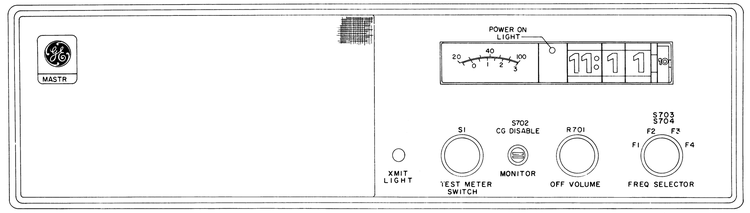


IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

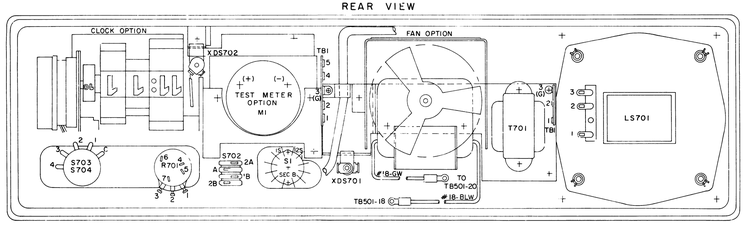
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR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

(19C311061, Rev. 2)

FRONT VIEW

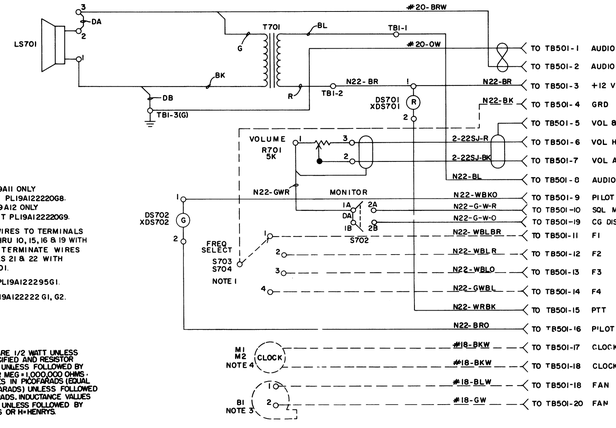


REAR VIEW



(19D402814, Rev. 5)

CONTROL UNIT SCHEMATIC



NOTES:
1. S703 IN 4EC69A11 ONLY TWO FREQ. KIT PL19A122220G8. S704 IN 4EC69A12 ONLY FOUR FREQ. KIT PL19A1222209.
2. TERMINATE WIRES TO TERMINALS 1 THRU 3, 5 THRU 10, 15, 16 & 19 WITH 19B209260P103. TERMINATE WIRES TO TERMINALS 21 & 22 WITH 19B209268P101.
3. BLOWER KIT PL19A122295G1.
4. CLOCK KIT PL19A122222 G1, G2.

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.

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
4EC69A10	B
4EC69A11	B
4EC69A12	B

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.

(19C303970, Rev. 5)

SCHEMATIC & OUTLINE DIAGRAM

DESK TOP CONTROL UNIT MODEL 4EC69A10-12

(RC-1421F)

PARTS LIST

LBI-3722C

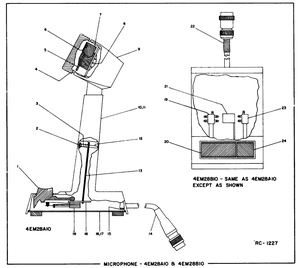
DESK STATION CONTROL UNIT

MODEL 4EC69A10 (PL-19D403689-G1) (1 FREQUENCY)
MODEL 4EC69A11 (PL-19D403689-G1) (2 FREQUENCY)
(PL-19A122220-G5)
MODEL 4EC69A12 (PL-19D403689-G1) (4 FREQUENCY)
(PL-19A122220-G9)

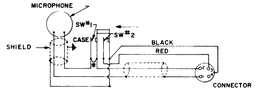
SYMBOL	GE PART NO.	DESCRIPTION
		-------- INDICATING DEVICES --------
DS701 and DS702	19C307037-P19	Lamp, incandescent: 14 v; sim to GE 756.
		--------LOUDSPEAKERS ------
LS701	19B209101-P1	Permanent magnet, 5-inch: 2-1/4 w voice input operating; sim to Clevtron 312271.
		---------- RESISTORS --------
R701*	5496870-P23	Variable, carbon film: 5000 ohms ±20%; sim to Mallory LC(58).
		In Models earlier than REV B:
	5496870-P13	Resistor/switch: includes Resistor, variable, carbon film, 5000 ohms ±20%, 0.5 w; Switch (S702), rotary, DPST, 6 amps at 125 VAC; sim to Mallory LC(58)DAC-2.
		---------- SWITCHES ----------
S701*		(Part of R701). Deleted by REV B.
S702*	19B209139-P6	Lever: 3 amps at 120 VAC, 1 form A contact locking, 1 form A contact momentary; sim to Switchcraft Series 208-1023.
		In Models earlier than REV A:
	19B209139-P3	Lever: 3 amps at 120 VAC, 1 form A contact momentary; sim to Switchcraft Series 28201.
		--------TRANSFORMERS --------
T701	19A115612-P1	Audio frequency: 0.3-3 KHz freq range. Pri: 24.0 ohms ±5% imp, 1.38 ohms DC res. Sec: 2.3 ohms imp, 0.16 ohm DC res.
		------ TERMINAL BOARDS --------
TB1	7775500-P2	Phen: 3 terminals.
		---------- SOCKETS ----------
XDS701 and XDS702	19B209342-P1	Lampholder: sim to Leecraft 7-04.
		--------- MISCELLANEOUS ---------
	19B305292-P1	Window, clear. (Used in front of clock and meter)
	19A115679-P1	Knob, push-on: black. (Used with R701).
	19B304949-P1	Jewel: red. (Used with DS701).
		MODIFICATION KIT 19A122220-G8 (MODEL 4EC69A11) (2 FREQ) 19A122220-G9 (MODEL 4EC69A12) (4 FREQ)
		---------- SWITCHES ----------
S703	19B304441-G2	Rotary: 1 pole, 2 positions, non-shorting contacts, 1 amp at 115 VAC or 28 VDC; sim to Grayhill Series 24 (modified).
S704	19B304441-G3	Rotary: 1 pole, 4 positions, non-shorting contacts, 1 amp at 115 VDC; sim to Grayhill Series 24 (modified).
		ASSOCIATED ASSEMBLIES 12/24 HOUR CLOCK PL-19A122225-G3
		---------- METERS ----------
M1	19B305374-G1	Clock, direct reading: 110 VAC, 60 Hz; sim to Pennwood Numechron 1P-128.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

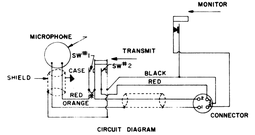
SYMBOL	GE PART NO.	DESCRIPTION
		12 HOUR CLOCK PL-19A122222-G1
		---------- METERS ----------
M2	19B305374-G4	Clock, direct reading: 110 VAC, 60 hertz; sim to Pennwood Numechron 1P-248-4R/7R.
		METER KIT PL-19A122134-G1
		---------- CAPACITORS ----------
C1	5494481-P12	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Dimcap.
		-------- DIODES AND RECTIFIERS ------
CR1 and CR2	5494923-P6	Silicon; sim to Type 1N456.
		---------- METERS ----------
M1	19A115716-P1	Panel, DC: -10/0/+50 µa mechanism.
		---------- RESISTORS ----------
R1	5495948-P321	Deposited carbon: 16,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CDL/2MR.
R2	5495948-P238	Deposited carbon: 2430 ohms ±1%, 1/2 w; sim to Texas Instrument Type CDL/2MR.
		-------- TERMINAL BOARDS --------
TB1	7775500-P11	Phen: 5 terminals.
		---------- CABLES ----------
W1		CABLES PL-19C311056-G1
		---------- PLUGS ----------
P301	19A122278-G1	Connector: 13 terminals.
P304	19A122278-G1	Connector: 13 terminals.
		---------- SWITCHES ----------
S1	5495454-P24	Rotary: 2 sections, 2 poles, 12 positions, non-shorting contacts, 2 amps at 20 VDC or 1 amp at 110 VAC; sim to Oak Type A or Centralab Series 100.
		FAN KIT 19A122295-G1
		---------- MOTORS ----------
B1	19B205436-G1	AC: 115 VRMS at 60 Hz continuous, .0017 hp, 2400 rpm max, cw rotation.
	19B209068-P1	Impeller, fan: axial, cw rotation. (Part of B1)
		MASK PLATE PL-19B205401-G2 CLOCK AND METER PL-19B205401-G3 12/24 HOUR CLOCK PL-19B205401-G4 METER
		---------- MISCELLANEOUS ----------
	19A122210-P1	Lens: green.
	19A305291-P1	Plate. (Used in 19B205401-G2).
	19A305291-P2	Plate. (Used in 19B205401-G3).
	19A305291-P3	Plate. (Used in 19B205401-G4).



MICROPHONE - 4EM28A10 & 4EM28B10



CIRCUIT DIAGRAM 4EM28A10



CIRCUIT DIAGRAM 4EM28B10

* JUMPER MAY BE REMOVED FOR PARALLEL OR SPECIAL OPERATION

NOTES:

1. SWITCH #1 OF THE MICROPHONE CIRCUIT MUST CLOSE FIRST AND OPEN LAST.
2. MONITOR AND TRANSMIT BUTTONS ARE MECHANICALLY INTERLOCKED, MAKING IT NECESSARY TO PRESS MONITOR BUTTON BEFORE TRANSMIT BUTTON. TO LOCK TRANSMIT BUTTON, PRESS MONITOR BUTTON DOWN AND SLIDE FORWARD TO "LOCK" POSITION. TO UNLOCK AND PUSH BACK BUTTON RELEASE. TO OPERATE MONITOR AND TRANSMIT FUNCTIONS INDEPENDENTLY, REMOVE LOCKING ARM BRACKET (PART 21 SHOWN ABOVE AND IN PARTS LIST).

RC-302A
SHEET 2

PARTS LIST

LBI-3623B

MAGNETIC CONTROLLED DESK MICROPHONE

MODEL 4EM28A10 (19C307105-P1)
MODEL 4EM28B10 (19C307106-P1)
(REB RC-1227)

SYMBOL	GE PART NO.	DESCRIPTION
		MECHANICAL PARTS MODEL 4EM28A10
1		Pushbutton. Shure Brothers RP-68.
2		Washer. Shure Brothers 30A697.
3		Spring. Shure Brothers 44A149.
4		Cap and grille. Shure Brothers RP-72.
5		Magnetic controlled cartridge. Shure Brothers RP-13.
6		Washer. Shure Brothers 34A223.
7		Shield. Shure Brothers 53A528.
8		Damping pad. Shure Brothers 20B33.
9		Housing. (Part of item 4).
10		Base. (Part of item 4).
11		(Not used).
12		Pin. Shure Brothers 31A868.
13		Bracket. Shure Brothers 53A637.
14		Cable and plug. Shure Brothers RP-65.
15		Cable clamp. Shure Brothers 53A532.
16		Bottom plate. Shure Brothers 90A1015.
17		(Not used).
18		Mounting bracket. Shure Brothers 53A633.
19		Switch. Shure Brothers RP-70.
		MODEL 4EM28B10
1		(Not used).
2		Washer. Shure Brothers 30A697.
3		Spring. Shure Brothers 44A149.
4		Cap and grille. Shure Brothers RP-72.
5		Magnetic controlled cartridge. Shure Brothers RP-13.
6		Washer. Shure Brothers 34A223.
7		Shield. Shure Brothers 53A528.
8		Damping pad. Shure Brothers 20B33.
9		Housing. (Part of item 4).
10		(Not used).
11		Base. (Part of item 4).
12		Pin. Shure Brothers 31A868.
13		Bracket. Shure Brothers 53A637.
14		(Not used).
15		Cable clamp. Shure Brothers 53A532.
16		(Not used).
17		Bottom plate. Shure Brothers 90B1015.
18		Mounting bracket. Shure Brothers 53A633.
19		Switch. Shure Brothers RP-71.
20		Pushbutton (Transmit). Shure Brothers RP-69.
21		Locking arm. Shure Brothers 53A667.
22		Cable and plug. Shure Brothers RP-66.
23		Switch. (Part of item 19).
24		Pushbutton (Monitor). (Part of item 20).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

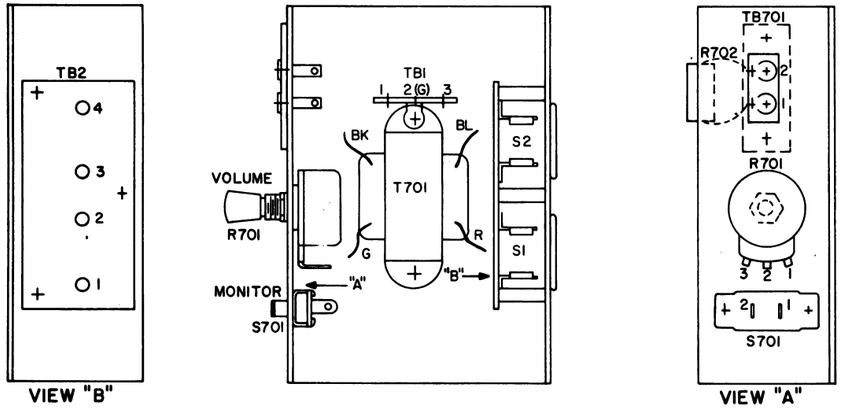
PRODUCTION CHANGES

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.

REV. A - Models 4EC69A10 - 12

To make Channel Guard disable a standard function. Changed S702.

REV. B - To provide volume control that is separate from power switch. Replaced OFF-VOLUME control R701/S701 with volume control R701. (Power OFF-ON switch is now on the power supply).



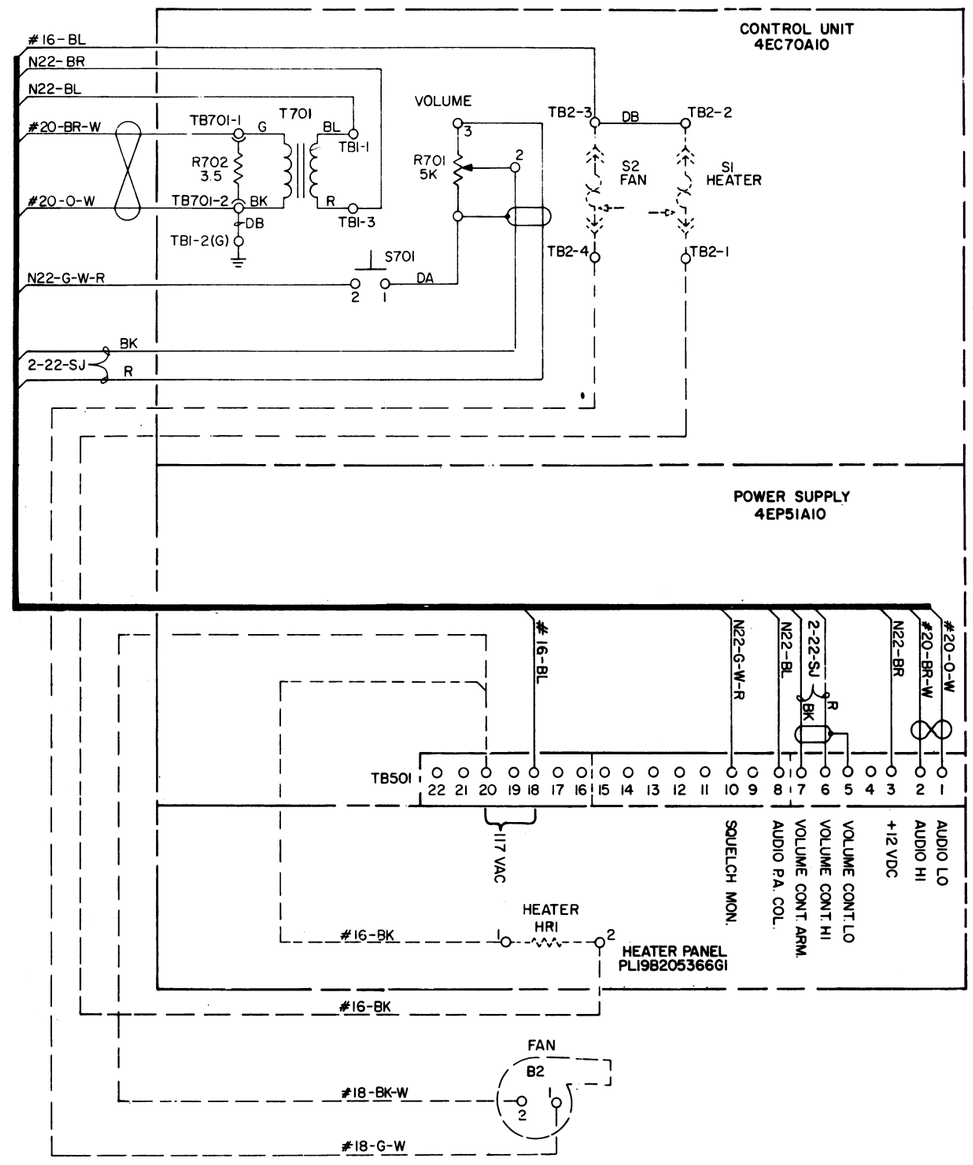
(19C311223, Rev. 0)

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
4EC70A10	



(19C303969, Rev. 3)

SCHEMATIC & OUTLINE DIAGRAM

WALL MOUNT CONTROL UNIT
MODEL 4EC70A10

RC-1422C

PARTS LIST

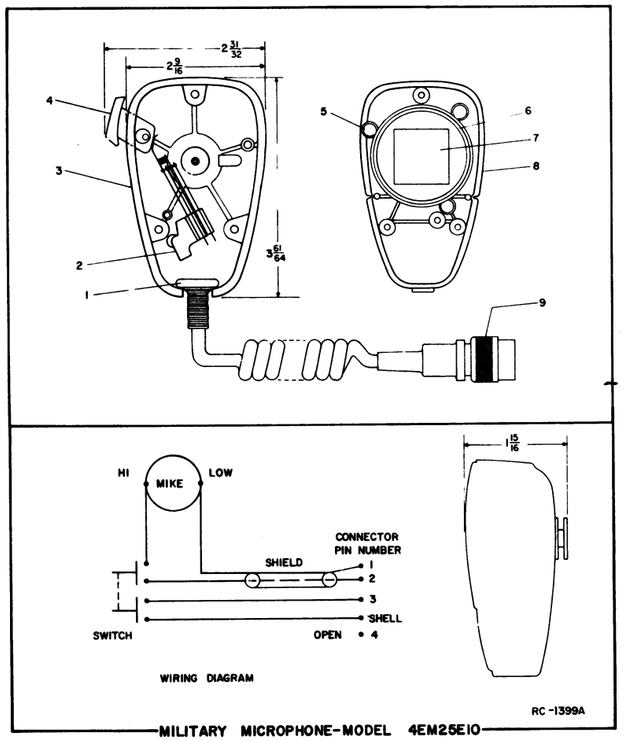
LBI-3721A

WALL MOUNT CONTROL UNIT
MODEL 4EC70A10
(19C303959-G1)

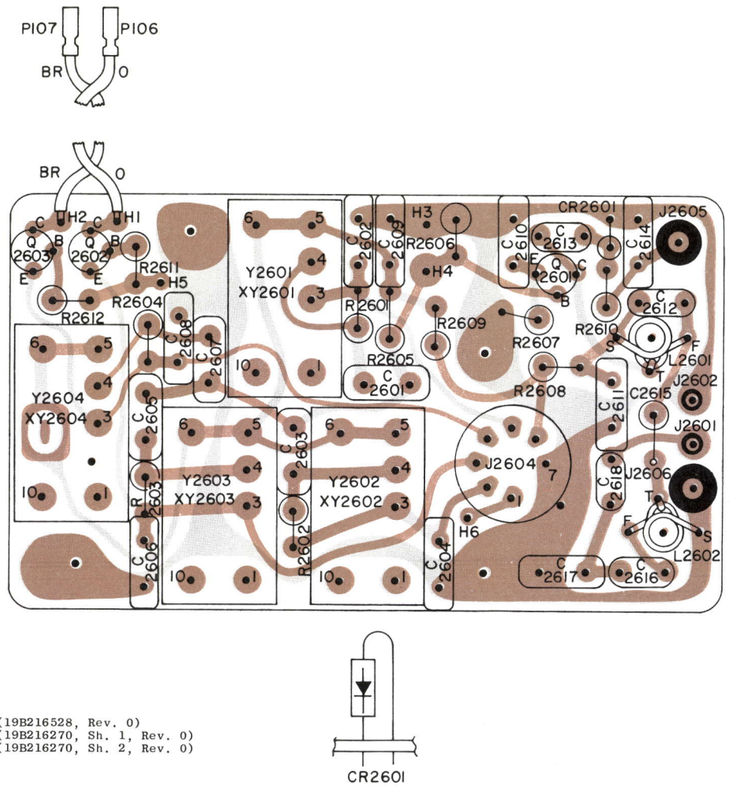
SYMBOL	G-E PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R701	5496870-P14	Variable, carbon film: 5000 ohms ±20%, 0.5 w; sim to Mallory LC(5K).
R702	7141971-G1	Resistor kit: wirewound, 3.5 ohms ±10%, 4 w; sim to Clarostat Type C4GJ (modified).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S701	4031922-P1	Push: SPST, normally open, momentary contact, 0.5 amp at 12 VDC; sim to Stackpole Type SS-15.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T701	19A115612-P1	Audio freq: 0.3-3 KHz freq range, Pri: 24.5 ohms ±5% imp, 1.38 ohms DC res, Sec: 3.3 ohms imp, 0.18 ohm DC res.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500-P7	Phen: 3 terminals.
TB2	19A122201-G1	Board: 4 terminals.
TB701	7117710-P2	Phen: 2 terminals; sim to Cinch 1781.
		ASSOCIATED ASSEMBLIES
		SPEAKER AND MICROPHONE OPTION **MILITARY MICROPHONE MODELS 4EM25E10** **TWO-WATT SPEAKER MODEL 4EZ16A13**
		MILITARY MICROPHONE **MODEL 4EM25E10** **(19B209102-P2)** **(See RC-1163)**
1		Cable clamp, front and back case. Shure Brothers RP96.
2		Switch. Shure Brothers RP26.
3		(See item 1).
4		Switch button. Shure Brothers RP97. (Quantity 5 only).
5		Spring and internal hardware. Shure Brothers RP16.
6		Shield. Shure Brothers RP23. (Quantity 5 only).
7		Magnetic controlled cartridge, grille cloth, screen and resonator. Shure Brothers RP13.
8		(See item 1).
9		Cable and plug: approx 6 feet long. Shure Brothers RP14.
		TWO-WATT SPEAKER **MODEL 4EZ16A13** **(19D402449-G6)**
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19B209233-P2	Electrolytic, non-polorized: 25 µf ±20%, 25 VDCW; sim to Sprague 4DC.
		- - - - - - - - - LOUDSPEAKERS - - - - - - - - - -
LS1	19B209101-P1	Permanent magnet, 5-inch: 2-1/4 w voice input operating; sim to Cletron X10271.

SYMBOL	G-E PART NO	DESCRIPTION
		- - - - - - - - - - CABLES - - - - - - - - - -
W5		**CABLE** **19A122167-G1**
		- - - - - - - - - - PLUGS - - - - - - - - - -
P702	5493018-P2	Plug, phen: 5 contacts; sim to Cinch 204-31-05-010.
		FAN KIT **19A122295-G2**
		- - - - - - - - - - MOTORS - - - - - - - - - -
B2	19B205437-G1	Fan, single phase: 115 VAC, 60 Hz, 14 w, ccw rotation; sim to Rotron "Gold Seal Venturi Muffin Fan".
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S2	19A115687-P2	Thermostatic: temp range 110°F ±6° closed, 90°F ±5° open; rated 5 amps at 240 VAC.
		HEATER **19A122203-G1**
		- - - - - - - - - - HEATERS - - - - - - - - - -
HR1	4034002-P1	Strip: 120 VAC, 150 w nominal; sim to GE 2A425-G16.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19A115687-P1	Thermostatic: temp range 3°F ±6° closed, 18°F ±5° open, 5 amps at 240 VAC.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	7150186-P19	Spacer: No. 4. (Used with TB2 in 19C303959-G1).
	19A115308-P1	Knob. (Used in 19C303959-G1).
	N529P42C13	Button, plug. (Used in 19C303959-G1).
	19C303500-P1	Grille. (Used in 19D402449-G6).
	19A121521-G1	Support, mounting. (Used in 19D402449-G6).
	5490407-P3	Grommet, rubber. (Located top of casting in 19D402449-G6).
	19A115470-P1	Grommet, rubber. (Located bottom of casting in 19D402449-G6).
	19C303504-G3	Housing, speaker. (Used in 19D402449-G6).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

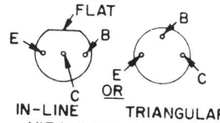


MILITARY MICROPHONE-MODEL 4EM25E10



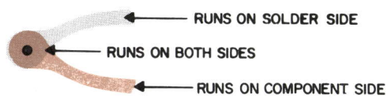
(19B216528, Rev. 0)
(19B216270, Sh. 1, Rev. 0)
(19B216270, Sh. 2, Rev. 0)

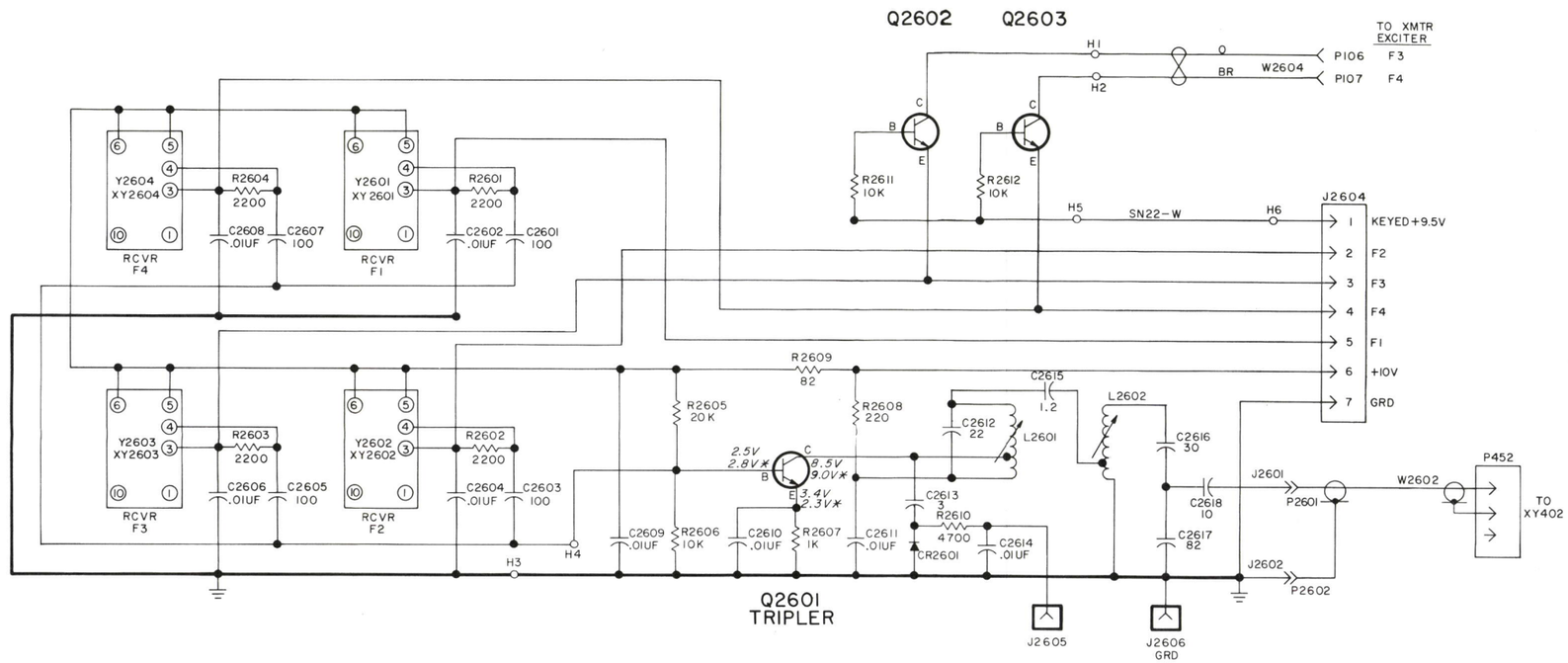
LEAD IDENTIFICATION
FOR Q2602 & Q2603



VIEW FROM LEAD END

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





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VOLTAGE READINGS

VOLTAGE READINGS TAKEN WITH A 20,000 OHM-PER-VOLT METER FROM TRANSISTOR PIN TO GROUND. READINGS FOLLOWED BY AN ASTERISK (*) TAKEN WITH ICOM REMOVED.

(19D413159, Rev. 2)

SCHEMATIC & OUTLINE DIAGRAMS

RECEIVER OSCILLATOR BOARD
MODEL 4EG24A10

RC-1822

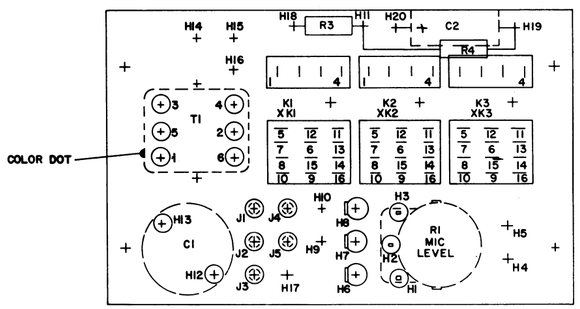
PARTS LIST

LBI-4020

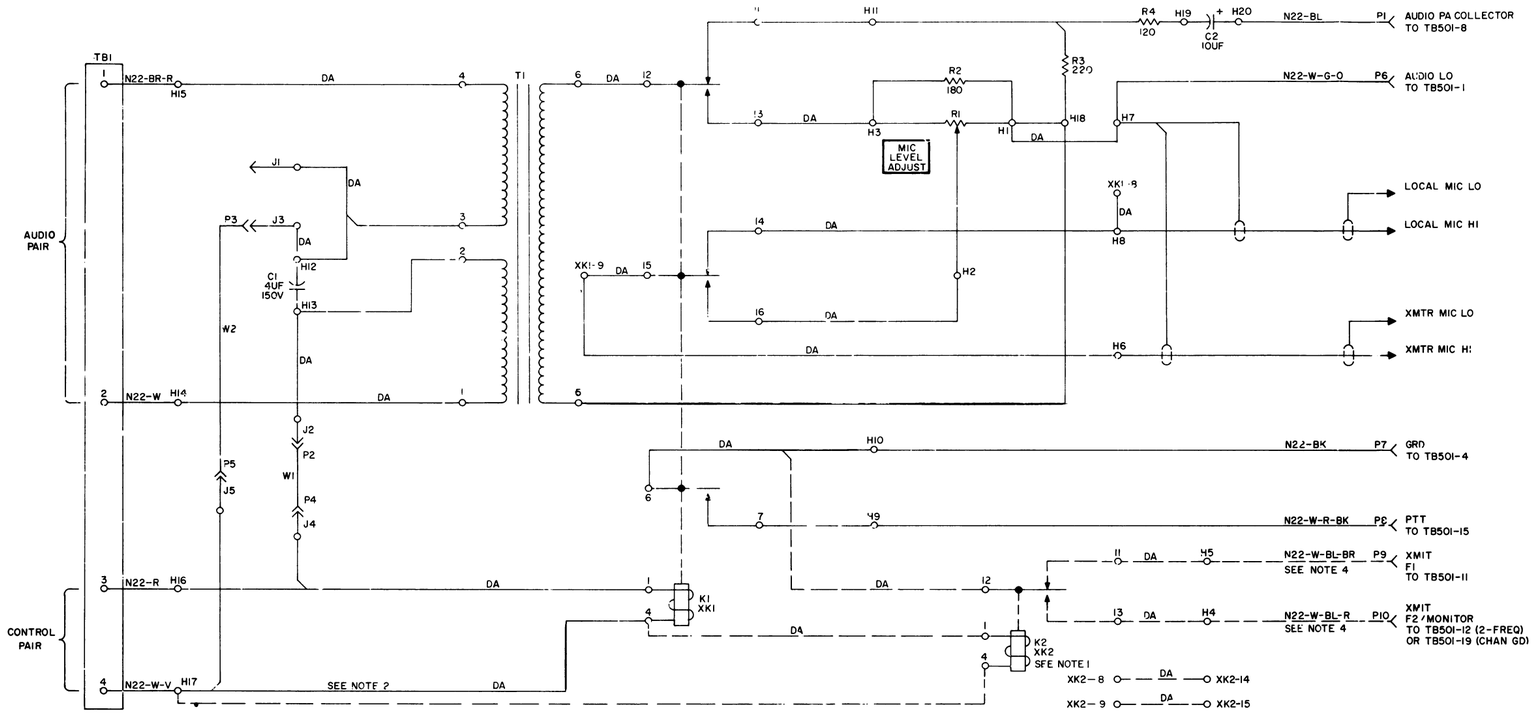
RECEIVER OSCILLATOR BOARD
MODEL 4EG24A10

SYMBOL	G-E PART NO.	DESCRIPTION
		CAPACITORS
C2601	5490008-P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2602	19B209243-P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C2603	5490008-P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2604	19B209243-P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C2605	5490008-P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2606	19B209243-P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C2607	5490008-P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2608 thru C2611	19B209243-P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C2612	5496219-P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2613	5496219-P34	Ceramic disc: 3.0 pf ±5%, 500 VDCW, temp coef 0 PPM.
C2614	19B209243-P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C2615	7130348-P5	Molded, phen: 1.20 pf ±0.06 pf, 500 VDCW, temp coef 0 PPM; sim to Jeffers Type JM-5/32.
C2616	5496219-P250	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2617	5490008-P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2618	5496219-P41	Ceramic disc: 10 pf ±5%, 500 VDCW, temp coef 0 PPM.
		DIODES AND RECTIFIERS
CR2601	7777146-P3	Germanium.
		JACKS AND RECEPTACLES
J2601 and J2602	4033513-P4	Contact, electrical: sim to Bead Chain L93-3.
J2604	19B209303-P2	Plug, phen: 7 pins.
J2605 and J2606	4037265-P1	Jack, tip: black plastic body; sim to Component Mfg Service A-1128.
		INDUCTORS
L2601 and L2602	19C303960-G3	Coil.
		PLUGS
P106 and P107	4029840-P1	Contact, electrical; sim to Amp 41854.
		TRANSISTORS
Q2601	19A115330-P1	Silicon, NPN.
Q2602 and Q2603	19A115552-P1	Silicon, NPN.
		RESISTORS
R2601 thru R2604	3R77-P222J	Composition: 2200 ohms ±5%, 1/2 w.
R2605	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R2606	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R2607	3R77-P102J	Composition: 1000 ohms ±5%, 1/2 w.
R2608	3R77-P221K	Composition: 220 ohms ±10%, 1/2 w.
R2609	3R77-P820K	Composition: 82 ohms ±10%, 1/2 w.
R2610	3R77-P472K	Composition: 4700 ohms ±10%, 1/2 w.
R2611 and R2612	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
		CABLES
W2602	19B205263-G1	Cable, RF: approx 14 inches long. Includes P402, P2601 and P2602.
W2603	19B205275-G2	Cable assembly, (Multi-Freq). Includes P2604.
		SOCKETS
XY2601 thru XY2604	19B216043-G1 19D413071-P1 19A115834-P2	Socket assembly. Includes: Socket cavity. Electrical contacts. (6)
		OSCILLATORS
		When reordering, specify ICOM Frequency.
		ICOM Frequency = (OF - 12.4) ÷ 27.
Y2601 thru Y2604	4EG26A13	Integrated Circuit Oscillator Module (ICOM).
	19D413070-P1	Cap, decorative.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



(19C311214, Rev. 1)



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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
4KC18A10	
4KC18A11	

NOTES
1. K1 IN 4KC18A11.
2. WIRE TO BE OMMITED IN 4KC18A11.
3. UNLESS OTHERWISE SPECIFIED ALL WIRING TO BE SN22
4. FOR SINGLE FREQUENCY TRANSMITTER AND RECEIVER AND CHANNEL GUARD MONITOR, INTERCHANGE RELAYS, PLUG K1 (19C307010P10) INTO XK2 & PLUG K2 (19C307010P11) INTO XK1. CONNECT W-BL-R WIRE FROM H4 ON 4KC18A11, TO TB501-10 ON 4EP51A10-11 REV D,ON 4EP51A10-11 REV "A" OR LATER, CONNECT W-BL-R WIRE FROM H4 ON 4KC18A11 TO TB501-19. REMOVE & DISCARD W-BL-BR WIRE FROM H5 IN 4KC18A11 TO TB501-11 ON 4E51A10-11.

(19D402679, Rev. 6)

SCHEMATIC & OUTLINE DIAGRAM

REMOTE CONTROL BOARD MODEL 4KC18A10 & 11

RC-1423D

PARTS LIST

LBI-3741A

REMOTE CONTROL PANEL
MODEL 4KC18A10 - PL-19C303945-G1
MODEL 4KC18A11 - PL-19C303945-G1

SYMBOL	G-E PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	7489445-P5	Electrolytic, non polorized: 4 µf +100% -10%, 150 VDCW.
C2	7489483-P7	Electrolytic: 10 µf +75% -10%, 25 VDCW; sim to Sprague 30D.
		- - - - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J5	4033513-P4	Contact, electrical: sim to Bead Chain L03-3.
		- - - - - - - - - - - - RELAYS - - - - - - - - - - - -
K1	19C307010-P10	Armature: 28 VDC, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C-3480.
K2	19C307010-P11	Armature: 30 VDC, 1.5 w operating, 1550 ohms ±10% coil res, 1 form A, 1 form C, 1 form D contacts; sim to Allied Control T154-X-631.
		- - - - - - - - - - - - PLUGS - - - - - - - - - - - -
P1	19B209280-P103	Terminal, solderless: sim to Amp 60495-1.
P6 thru P10	19B209280-P103	Terminal, solderless: sim to Amp 60495-1.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	7491365-P11	Variable, carbon film: 250 ohms ±20%, 0.15 w, sim to CTS Type UPE-70.
R2	3R77-P181K	Composition: 180 ohms ±10%, 1/2 w.
R3	3R77-P221K	Composition: 220 ohms ±10%, 1/2 w.
R4	3R77-P121K	Composition: 120 ohms ±10%, 1/2 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1	19C300687-P1	Audio: 300 to 3000 Hz.
		- - - - - - - - - - TERMINAL BOARDS - - - - - - - - - -
TB1	7117710-P4	Phen: 4 terminals; sim to Cinch 1774.
		- - - - - - - - - - - - CABLES - - - - - - - - - - - -
W1		**CABLE 4037741-G1**
		- - - - - - - - - - - - PLUGS - - - - - - - - - - - -
P2	4029840-P1	Contact, electrical; sim to Amp 41854.
P4	4029840-P1	Contact, electrical; sim to Amp 41854.
W2		**CABLE 4037741-G1**
		- - - - - - - - - - - - PLUGS - - - - - - - - - - - -
P3	4029840-P1	Contact, electrical; sim to Amp 41854.
P5	4029840-P1	Contact, electrical; sim to Amp 41854.
		- - - - - - - - - - - - SOCKETS - - - - - - - - - - - -
XK1 and XK2	5491595-P5	Relay: 16 contacts; sim to Allied Control 30054-2.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	5491595-P9	Retainer, spring: sim to Allied Control 30040-2. (Used with K1 and K2).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

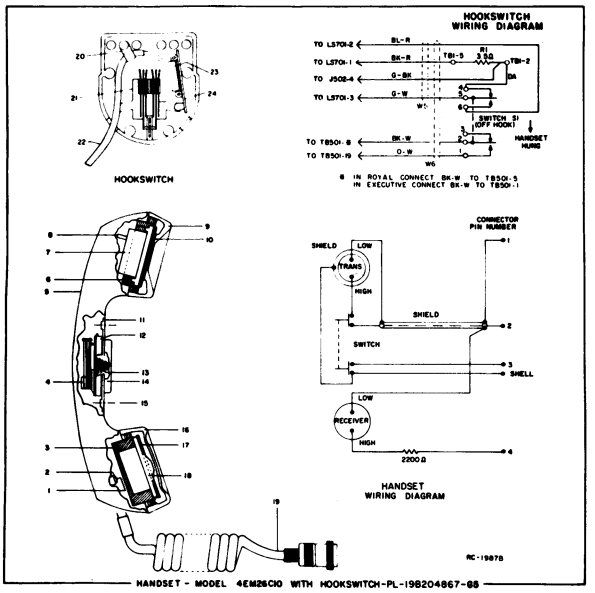
PARTS LIST

LBI-4120A

HANDSET MODEL 4EM26C10 HOOKSWITCH 19B204867G5 AND ASSOCIATED ASSEMBLIES

SYMBOL	GE PART NO.	DESCRIPTION
		(Refer to RC-1987)
1		Self tap screw, bind head: No. 4 x 5/16. Shure Brothers 30C640C.
2		Cable clamp. Shure Brothers 53A532.
3		Shield. Shure Brothers RP19.
4		Switch. Shure Brothers RP81.
5		Case. Shure Brothers 21RP899F.
6		Adapter. Shure Brothers 65A230.
7		Magnetic controlled cartridge, Receiver. Shure Brothers RP41.
8	3R77-P222K	Resistor, composition: 2200 ohms ±10%, 1/2 w.
9		Receiver cap. (Part of item 5).
10		Washer. Shure Brothers 34A321.
11		Escutcheon. Shure Brothers 53A536A.
12		Actuator. Shure Brothers 53A556.
13		Spring. Shure Brothers 44A140.
14		Plunger bar. Shure Brothers RP82.
15		Flat head screw, socket cap: No. 4-40 x 1/4. Shure Brothers 30C557B.
16		Transmitter cap. (Part of item 5).
17		Washer. Shure Brothers 34A309.
18		Magnetic controlled cartridge, Transmitter. Shure Brothers RP13.
19		Cable and plug. Shure Brothers 21RP738F.
		HOOKSWITCH 19B204867G5
20	4029851P5	Cable clamp; sim to WEC Kesser 2/16-4.
21	19A121612P1	Holder and switch: thermoplastic case, contact rating 1 amp at 125 v.
22	19B205667G1	Cable: approx 8-1/2 feet long.
23	5493035P10	Resistor, wirewound, ceramic: 3.5 ohms ±5%, 5 w; sim to Tru-Ohm Type X-50.
24	7775500P55	Terminal board, phen: 5 terminals.
		ASSOCIATED ASSEMBLIES
		EXTENSION CABLE 19B204988G4
	7478726P6	Plug: 4 contacts, sim to Amphenol 91-MC4M.
	4034669P4	Cable, 6 ft.
	19A116061P1	Receptacle: 4 contacts; sim to Amphenol 91-PN4F-1000.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



SCHEMATIC & OUTLINE DIAGRAM

HANDSET MODEL 4EM26C10
HOOKSWITCH 19B204867G5

RC-1424D

STEP 1 - QUICK CHECKS

Power Out	A	B	D	E	F	G	H	I	J	Probable Defect
low	0.7	0.8	0.7	0.8	0.3	0.7	0.5	10	0.5	weak 7984
low	0.7	0.8	0.7	0.8	0.1	0.7	0.5	10	0.5	weak 8106 V202
low	0.7	0.8	0.7	0.3	0.1	0.7	0.5	10	0.5	weak 8106 V201
0	0.7	0.8	0.7	0.8	0.3	0	0	10	0	defective 7984
0	0.7	0.8	0.7	0.8	0	0	0	10	0	defective 7984
0	0.7	0.8	0.7	0.8	0	0.8	0	10	0	defective bias supply
0	0.7	0.8	0.7	0	0	0	0	10	0	V202 failure
0	0.7	0.8	0	0	0	0	0	10	0	V201 failure, open coax to exciter board or Q106 defective
0	0.7	0	0	0	0	0	0	10	0	Q106 defective
0	0	0	0	0	0	0	0	0	0	10 V regulator defective

STEP 2
CHECK TYPICAL DC VOLTAGES
EQUIPMENT REQUIRED
- G.E. TEST MODEL 4EX3A10 OR
- 20,000 OHM-PER-VOLT METER

V-DC	V-DC	V-DC
WITH TRANSMITTER KEYED, READING AT COLLECTOR OF Q101 SHOULD BE APPROX 0.5 VDC	WITH TRANSMITTER KEYED, READING AT COLLECTOR OF Q102 SHOULD BE APPROX 0.55 VDC	WITH TRANSMITTER KEYED, READING AT COLLECTOR OF Q103 SHOULD BE APPROX 4.5 VDC

STEP 3
CHECK AUDIO AC VOLTAGES
EQUIPMENT REQUIRED
- AUDIO OSCILLATOR
- AC VTVM

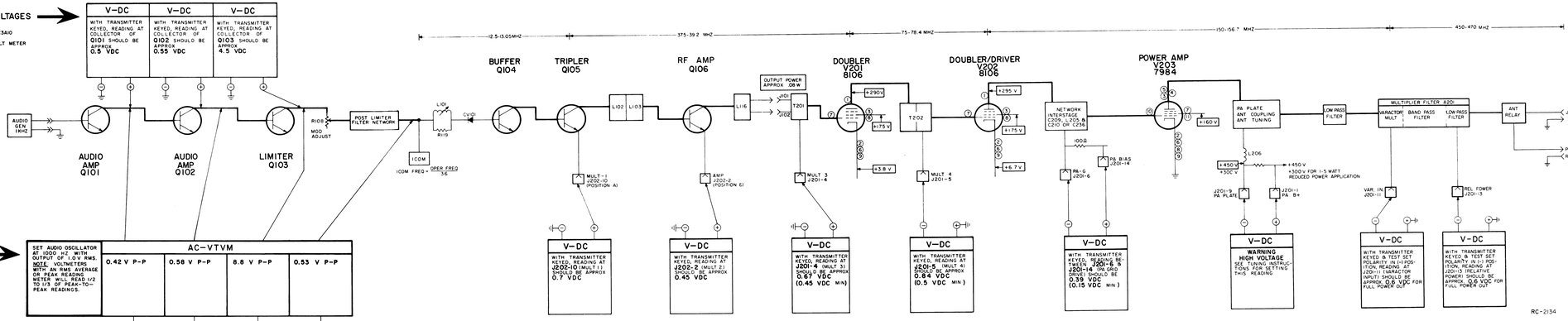
SET AUDIO OSCILLATOR AT 1000 HZ WITH OUTPUT OF 1.0 V RMS.
NOTE: VOLTMETERS WITH AN RMS AVERAGE OR PEAK READING METER WILL READ 1/2 TO 1/3 OF PEAK-TO-PEAK READINGS.

AC-VTVM			
0.42 V P-P	0.58 V P-P	8.8 V P-P	0.53 V P-P

STEP 4
AUDIO & OSC WAVEFORMS
EQUIPMENT REQUIRED
- AUDIO OSCILLATOR
- OSSILLOSCOPE

SET AUDIO OSCILLATOR AT 1000 HZ WITH OUTPUT OF 1.0 V RMS.

SCOPE SETTING				
HORIZONTAL	0.2 MS/DIV (500 HZ SWEEP)			
VERTICAL	0.1 VOLT/DIV	0.1 VOLT/DIV	1.0 VOLT/DIV	0.1 VOLT/DIV



TROUBLESHOOTING PROCEDURE

TRANSMITTER TYPE ET-99-A

RC-2134

STEP I - QUICK CHECKS

TEST SET CHECKS

These readings are typical readings measured with GE Test Set Model 4EX3A10 in the Test 1 position, or with Model 4EX8K10 or 11 in the 1 volt position.

Metering Position	Reading With No Signal In	Reading with 10 Microvolts
A (Disc)	0 VDC	0 VDC
B (Lim 1)	0 VDC	0.1 VDC
C (Lim 2)	0.1 VDC	0.45 VDC
D (Osc.)	0.15 VDC	
E (Osc.)	0.1 VDC	
G (Audio Bias)	0.28 VDC	
I (Supply Voltage)	Approx. 13 VDC (15 volts full scale)	
J (Reg 10V)	+ 10 VDC (15 volts full scale)	

SYMPTOM CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	Check power connections and continuity of supply leads, and check fuses. If fuse is blown, check for short circuits by disconnecting all plugs in the unit. Reconnect plugs one at a time until a fuse blows.
NO REGULATED 10 VOLTS	Check the 12-volt supply. Then check Q503 in 10-volt regulator. Disconnect all plugs and control cable plugs from the receiver, exciter board and option board, and take resistance readings from jack pins to ground (Refer to Outline Diagrams).
LOW 2ND LIM READING	Check supply voltages and then check oscillator reading at J304-4 as shown in STEP 2A. Make SIMPLIFIED VTVM GAIN CHECKS from 2nd Mixer through 2nd Limiter stages as shown on STEP 2A. Check receiver RF alignment (refer to Receiver Alignment Procedure).
LOW OSCILLATOR READING	Check alignment of Oscillator (Refer to Front End Alignment Procedure). Check voltage readings of Q451 and Q543. Check resistance readings on J302-1, -2 and -3. Check crystal Y451.
LOW RECEIVER SENSITIVITY	Check Front End Alignment (Refer to Receiver Alignment Procedure). Check input signal required for 0.2-volt reading at Lim-1. Reading should be less than 20 uv. Check antenna connections, cable and relay. Check voltage readings of 1st and 2nd IF Amps and 1st and 2nd Mixers. Make SIMPLIFIED GAIN CHECKS (Step 2A).
LOW AUDIO	Check Audio PA (Q505) output current at J304-9. If reading is low: a. Check BIAS ADJ for 0.28 VDC at J304-9. If incorrect, set for 0.28 volt with R392. (Position G on Test Set). b. If correct, check Audio Amp Q317. Make SIMPLIFIED GAIN and WAVEFORM CHECKS (STEPS 2A and 2B) of Audio and Squelch Stages. Check unsquelched DC voltage readings in Audio section (Refer to Receiver Service Sheet). Check voltage readings on Channel Guard receiver. Check setting of SQUELCH control R400 (Refer to Receiver Alignment Procedure).
IMPROPER SQUELCH OPERATIONS	Make GAIN and WAVEFORM CHECKS (STEPS 2A and 2B) of Audio and Squelch stages. Check voltage readings of Squelch circuit (Refer to Receiver Alignment Procedure).
DISCRIMINATOR IDLING TOO FAR OFF ZERO	See if discriminator zero is in the center of IF bandpass.

TROUBLESHOOTING PROCEDURE

RECEIVER MODEL 4ER50A10-12

RC-2081

STEP 3- GAIN-PER-STAGE READINGS-

EQUIMENT REQUIRED:

1. RF VOLTMETER (SIMILIAR TO BOONTON MODEL 91-CA OR MILLIVAC TYPE MV-18 C.
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION) CORRECT FREQUENCY CAN BE DETERMINED BY ZEROING THE DISCRIMINATOR.

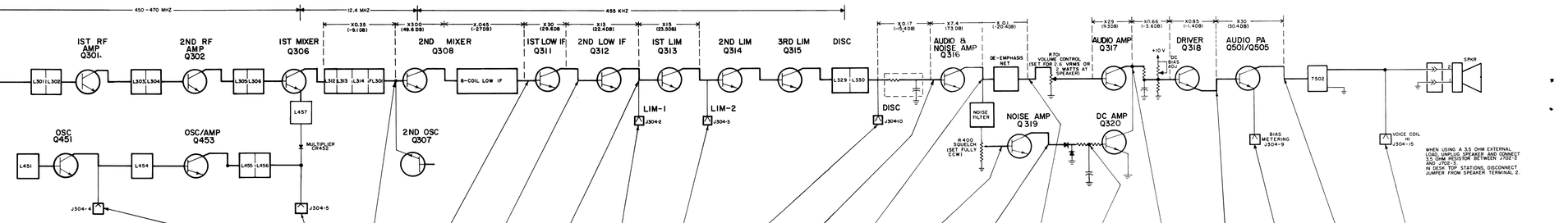
PROCEDURE

1. APPLY PROBE TO INPUT OF STAGE (FOR EXAMPLE, BASE OF RF AMP). PEAK RESONANT CIRCUIT OF STAGE BEING MEASURED AND TAKE VOLTAGE READING (E_1).
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (1ST MIXER IN. REPEAK FIRST RESONANT CIRCUIT THEN PEAK CIRCUIT BEING MEASURED AND TAKE READING (E_2).
3. CONVERT READINGS (BY SUBTRACTING E_1 FROM E_2 ON THE DB SCALE OF RF VOLTMETER, OR) BY MEANS OF THE FOLLOWING FORMULA:

$$\text{AMP FACTOR} = \frac{E_2}{E_1}$$

4. CHECK RESULTS WITH TYPICAL GAINS SHOWN ON DIAGRAM BELOW.
5. USE PROCEDURE LISTED ABOVE TO FIND GAIN OF EACH STAGE.

M NOTE: REMOVE CRYSTAL OR SHORT OUT OSC. BASE BEFORE MEASURING MIXER STAGES TO ELIMINATE INJECTION VOLTAGE



STEP 2A- SIMPLIFIED VTVM GAIN CHECKS

EQUIPMENT REQUIRED:

1. VTVM-AC&DC
2. SIGNAL GENERATOR (MEASUREMENTS M560 EQUIV.)

PRELIMINARY STEPS:

1. SET VOLUME CONTROL FULLY CLOCKWISE.
2. SET SQUELCH CONTROL FULLY COUNTERCLOCKWISE.
3. RECEIVER SHOULD BE PROPERLY ALIGNED.

SIGNAL GENERATOR INPUT AT J301 MAINTAIN SETTING AT DISCRIMINATOR ZERO			UNMODULATED	UNMODULATED	UNMODULATED	UNMODULATED	10 MICROVOLTS UNMODULATED	1 MICROVOLT UNMODULATED	STANDARD SIGNAL-(1MV AT RCVR FREQ MOD BY 1KHZ WITH 3.5 KHZ 150 KHZ WIDDEV.	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	NO SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	NO SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL
PROCEDURE			INCREASE GENERATOR OUTPUT UNTIL VTVM READING UNTIL VTVM SCALE DECREASES BY 50 MV	INCREASE SIGNAL GENERATOR OUTPUT UNTIL VTVM READING DECREASES BY 5 %	INCREASE SIGNAL GENERATOR OUTPUT UNTIL VTVM READING DECREASES BY 5%	INCREASE SIGNAL GENERATOR OUTPUT UNTIL VTVM READING DECREASES BY 5 %													AFTER CHECKING WAVEFORMS ADJUST VOLUME CONTROL FOR RATED 2 WATT OUTPUT ACROSS 3.5 Ω LOAD	
READING	0.4 VDC MIN EX-3-A 0.1 VDC MIN MULTMTR 0.15 VDC MIN	0.08 VDC MIN EX-3-A 0.07 VDC MIN MULTMTR 0.07 VDC MIN	GENERATOR OUTPUT SHOULD BE APPROX 20 MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 500 MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 250 MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 10 MICROVOLTS	0.4 VDC EX-3-A 0.1 VDC MULTMTR 0.2 VDC	1.2 VDC EX-3-A 0.3 VDC MULTMTR 0.6 VDC	0.57 VAC	0.05 VAC	0.89 VAC	0.045 VAC	1.2 VAC	.03 VAC	0.56 VDC	0.34 VAC	0.2 VAC	0.28 VDC	8 VAC (COLLECTOR TO GROUND)	2.6 VAC

STEP 2B-AUDIO & SQUELCH WAVEFORMS

EQUIPMENT REQUIRED:

1. OSCILLOSCOPE
2. SIGNAL GENERATOR (MEASUREMENTS M560 OR EQUIVALENT).

SCOPE SETTING													
	HORIZONTAL	0.5 MS/DIV (APPROX 200 CPS)	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV		0.5 MS/DIV	0.5 MS/DIV		0.5 MS/DIV	0.5 MS/DIV
	VERTICAL	0.5 VOLT/DIV	100 MILLIVOLTS/DIV	1 VOLT/DIV	100 MILLIVOLTS/DIV	1 VOLT/DIV	100 MILLIVOLTS/DIV		200 MILLIVOLTS/DIV	200 MILLIVOLTS/DIV		5 V/DIV	1 VOLT/DIV
PEAK-TO-PEAK VOLTAGE		2.1 V P-P	340 MV P-P	2.6 V P-P	0.4 V P-P (NOISE)	3.0 VP-P (NOISE)	0.24 V P-P		1.2 V P-P	900 MV P-P		22 V P-P	7.2 V P-P
NOISE WAVE FORM													
STANDARD SIGNAL 1 MILLIVOLT AT RECEIVER FREQ MODULATED BY 1KHZ WITH 3.5KHZ (10KHZ, WIDE BAND) DEVIATION													

QUICK CHECKS

SYMPTOM	CHECK FOR:
No output voltages at TB3	1. Blown fuses F501, F502, F503 & F504. 2. Defective switch S701. 3. Short or open in primary of T501 or T502. 4. Relay contacts K501.
No high B+	1. Shorted C502, C503, C504 or T501. 2. Open F502, L501, T501 or shorted CR505 thru CR510.
No low B+	1. Shorted CR507 thru CR510, C505 or T501. 2. Open F503, L502 or T501.
No -55 volts	1. Shorted CR501, CR502 or T501. 2. Open T501, R501, CR501 or CR502.
No 13.6 volts	Open CR511, CR512, F504, L503 or T502.
B+ output with transmitter not keyed	Burned relay contacts or shorted C507.
Low output voltages	1. Open diodes. 2. Excessive load (short in transmitter).
Excessive output ripple voltage	1. Open diodes. 2. Open C501 thru C506, C508 thru C510.
10-VOLT REGULATOR	
No output	1. 12 V at input of regulator. 2. C to E open circuit in Q1. 3. Open DS1. 4. Short between emitter of Q1 and ground. 5. Open T501, F504, L503.
Output too high - cannot adjust with R3	1. Open in VR1 or Q2. 2. Defective R3.
Output equals input	Shorted Q1.
Regulation poor but output is adjustable with R3	Q1 is probably defective and should be replaced.

TROUBLESHOOTING PROCEDURES

POWER SUPPLY MODEL 4EP51A10

(RC-1434)

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service Parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on 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, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MAINTENANCE MANUAL

LBI-4226

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

PRINTED IN U.S.A.

ECP-199