2-WAY MOBILE RADIO

MAINTENANCE MANUAL FOR TRANSISTORIZED PROGRESS LINE DUAL FRONT END LOW BAND

SPECIFICATIONS

Type Number	EF-28-B Low Band
Frequency Range	25-50-MC
Input Voltage	12-VDC
Current Drain	.010-amps
Frequency Stability	Within 0.0005% of assigned center frequency over specified temperature range (25°C reference)
Spurious	-60-db to -30-db when operating simultaneously (dependent on frequency separation). -90-db or better when monitoring individual channels.
Antenna	Same antenna may be used. For optimum performance separate antennas are recommended, especially for cross band operation.
Size	1-1/2" H x 8" W x 5-1/2" D.
Weight	1-1/2 lbs.

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GENERAL ELECTRIC
TRANSISTORIZED PROGRESS LINE
LOW BAND DUAL FRONT END
MODEL 4EF28B10

DESCRIPTION

The General Electric Low Band Dual Front End for use with Transistorized Progress Line radio, is designed for both low band and cross band application. The Dual Front End allows TPL units to monitor two frequencies separately or simultaneously over a single receiver. The cross band model uses a high band receiver and a low band Dual Front End.

Normal receiver sensitivity will not be degraded more than 6 db with the receiver and the dual front end assembly operating with one channel separation or more. For most low band combinations a single antenna will be adequate. With cross band combinations separate antennas are recommended to insure the best performance.

With front mounted TPL units, the Dual Front End is operated by a special switch mounted on the TPL control unit in the ACCESSORY position. When the TPL is rear mounted, the Dual Front End is controlled by rear mount Control Head 4EC45A12. The Dual Front End uses the same cover and support for both front mounted or rear mounted TPL.

INSTALLATION

When the low band Dual Front End is used with a low band receiver, capacitor C2, 82 pf, in the receiver high IF should be removed and replaced by C17, 30 pf, which is provided with Modification Kit PLA-4036179-G1. Instructions for replacing capacitor C2 and attaching cable W423 to the high IF of the receiver are found in Modification Instruction A-4036172. Cable W423 is part of Support Assembly A-4036082.

In cross band applications, the low band Dual Front End is used with a high band receiver. Instructions for modifying the RF board of the receiver are given in Modification Instructions A-4036173.

A special switch is installed in the ACCESSORY position on the TPL Control Panel when the Dual Front End is used with a front mount TPL. The nameplate, switch assembly, and other parts needed for the installation are provided in Dual Frequency Control Kit PLA-4036087. Installation instructions are given on RC-740.

For rear mount applications the Dual Front End is controlled by a three position switch mounted on Control Head 4EC45A12. The wiring procedure for mounting the switch is given on Installation Instruction RC-858.

MAINTENANCE

The Dual Front End is suspended from the TPL mounting brackets by means of a support assembly. The same method is used for both rear mount or front mount installations. In trunk mount installations, a deeper "U" frame is provided, to insure floor clearance of the Dual Front End.

For maintenance or repair remove the four screws holding the cover on the Dual Front End. Removing the cover will expose the RF assembly. Refer to the Service Outline, RC-970 for information on components and wiring.

ALIGNMENT PROCEDURE

Using the standard alignment procedure given in the Maintenance Manual for the TPL receiver, align the RF assembly of the Dual Front End, the antenna coil in the receiver, and the lst high IF coil in the receiver. Be sure to have both collectors of the first converters connected together when aligning the lst High IF transformer. The collector coil must tune through resonance to enable the receiver to be phase tuned. (To check for resonance, two resonance points should be observed as the IF collector padder is turned through 360 degrees.)

For frequency separation smaller than 1 MC, the best sensitivity will be obtained by connecting the signal generator to each receiver individually and aligning the antenna transformer. Then connect both receiver inputs in parallel, but do not retune the antenna transformers.

When a high band receiver and a low band Dual Front End are used in cross-band application, the alignment procedure given above should be followed. However, when both oscillators are working, the sensitivity of the high band receiver may be degraded, due to increase of noise in the high IF from the low band. Balancing the gain in the IF of the receiver will alleviate this condition. To achieve this, decrease the value of coupling condenser C434, in the low band RF assembly 4EF28B10, from 47 pf to 18 pf. Then retune the first high IF transformer and mixer of the Dual Front End.

CIRCUIT ANALYSIS

The RF input from the antenna is coupled to antenna transformer T414 through RF cable W421. The RF input is coupled to a tap on L421 to obtain the proper impedance match required for transistor circuits. Tank coils L421 and L422 are tuned to resonate at the incoming signal frequency by capacitors C412 and C414. The signal from L421 is coupled through C415 to the base of Q411, the RF amplifier. The collector of Q411 is directly coupled to L422. Diode CR412 in the first coil circuit prevents burnout of Q411 by high level RF signals.

Following the RF amplifier stage is a three coil transformer, T415. The coils are tuned to resonate at the incoming signal frequency by C414, C418 and C422. The output of T415 is coupled through C423 to the base of mixer Q412.

Oscillator voltage is coupled to L415 from the TPL receiver and through C438 to the base of the mixer Q412. The mixer output from the collector of Q412 is fed to the high IF on the receiver.

Oscillator Model 4EG12A12

The first oscillator and crystal are located in an enclosed box which is warmed when the temperature in the box drops below 32 degrees F. Crystal warmer HR1 is controlled by thermostat S1.

The oscillator uses a mode crystal cut in the 45-55 MC region. The crystal is connected in series with C1, a frequency adjusting trimmer, and the base of Q1, a PNP transistor.

The first oscillator is a Miller circuit with feedback supplied by C9. If two operating frequencies are used, a second oscillator is connected with its collector parallel to the first oscillator.

CABLE KIT

Cable Kit PLA-4036169-G1 is provided for use with low band combinations where one antenna will be adequate. Instructions A-4036725 should be carefully followed when cutting matching cables. Special care should be taken when cutting cables for installations which have closely spaced channels.

Cable connections for single and double antenna applications are shown on Diagram 19D400439.

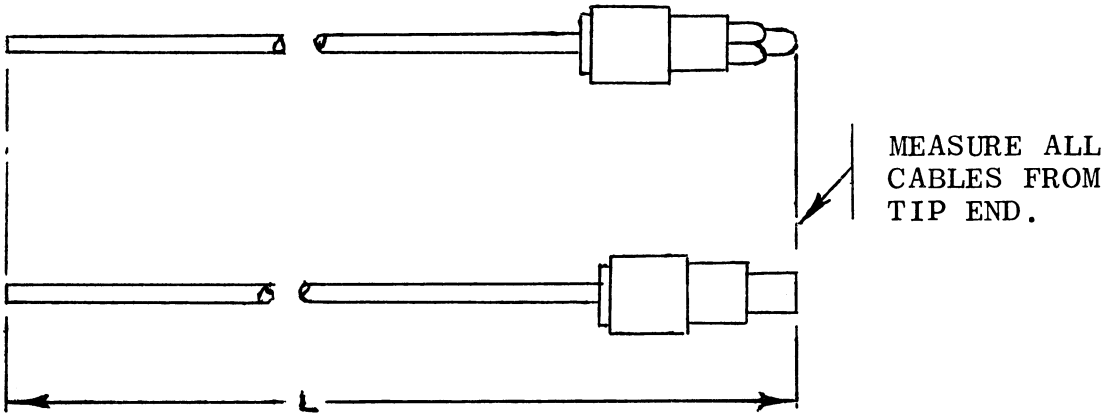
PARTS LIST

G-E DRAWING & PART NO.	DESCRIPTION
4036363-P1	"T" Connector. Three way. Black molded plastic coating over shield. Solid center conductor. Sim to Components.
5491689-P36	Cable assembly consisting of: Cable, RG174/4 black, 66 inches long. Connector, phono, molded on Termination on coaxial cable, Two contacts. G-E Dwg. No. 4032504-P5.
7104941-P11	Phono connector, phenolic insulation, brass shell, brass contact. Max. operation voltage 350 vrms, 500 VDC. Sim to Accurate 10033-8.

These instructions cover the exact length the two unterminated cables shall be cut before adding the phono connectors supplied with cable kit A4036169. Also, the proper method of measuring and assembling these cables is specified.

A. DETERMINING CABLE LENGTH

In measuring cables, the following method must be followed explicitly to assure obtaining the exact length of cable required for proper functioning of the equipment. This requirement is particularily true in closely spaced channels.



B. PROCEDURE

Measure existing cable length on the main RF board in the receiver and the dual front end as follows:

1. Measure total length of existing cable on each unit from eyelet (where cable enters can or cavity) for the particular unit.
   4EF13A10,11 - High Band receiver RF boards
   4EF16A10,B10 - Low Band receiver RF boards.
   4EF27A10,11 - High Band dual front end RF boards.
   4EF28A10,B10 - Low Band dual front end RF boards.
   4EF13B10,11 - High Band receiver RF boards.

   Caution: Each unit should be measured per the above procedure as the production units vary in cable length and the cable length has been changed on certain models.

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Installation Instructions

FOR CABLE KIT
PL-4036169
MODELS 4EF27A10, 11
MODELS 4EF28A10, B10

(A-4036725, Sh. 1, Rev. 1)

2. The following length must be added to the length measured in step B1. This allows for cable from outside of can to coil tap inside the can or cavity, length of tee connector and overlap of connectors. This length has not varied in production units enough to require measuring each individual unit.

MODEL	4EF13A10, 11	4EF16A10, B10 4EF28A10, B10	4EF13B10, 11 4EF27A10, 11
Length to add	2.32 inches	1.00 inches	1.15 inches

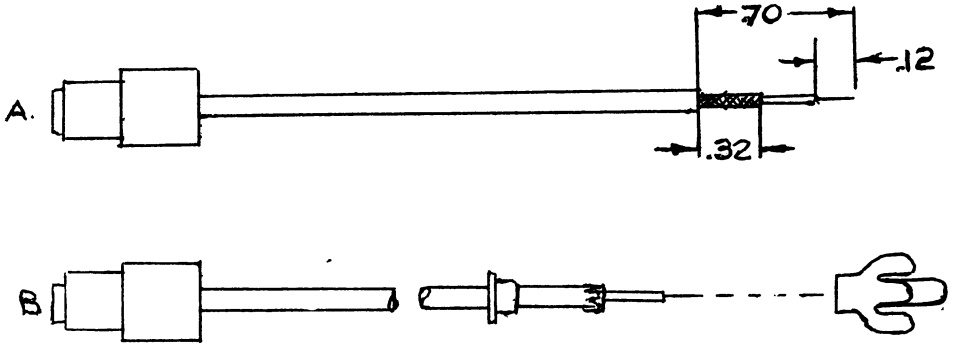
3. Determine total connected length of cable from curve for a specific operating frequency. Subtract sum of lengths determined in steps B1 and B2 from this total connected length. The resultant calculated length of cable is length to cut cable.

4. A sample problem will illustrate the method. Assume we are cutting cable for 4EF13A10 RF board for 165 MC. Total connected length of cable is 33.3 inches.

Length of cable outside of can (step B1) = 9.50
Length of cable (step B2) = 2.32
Total length of existing cable =11.82

Length needed = 33.30 - 11.80 = 21.50 inches
Cut cable to a length of 21.50 inches.

5. Strip cable to dimensions shown:

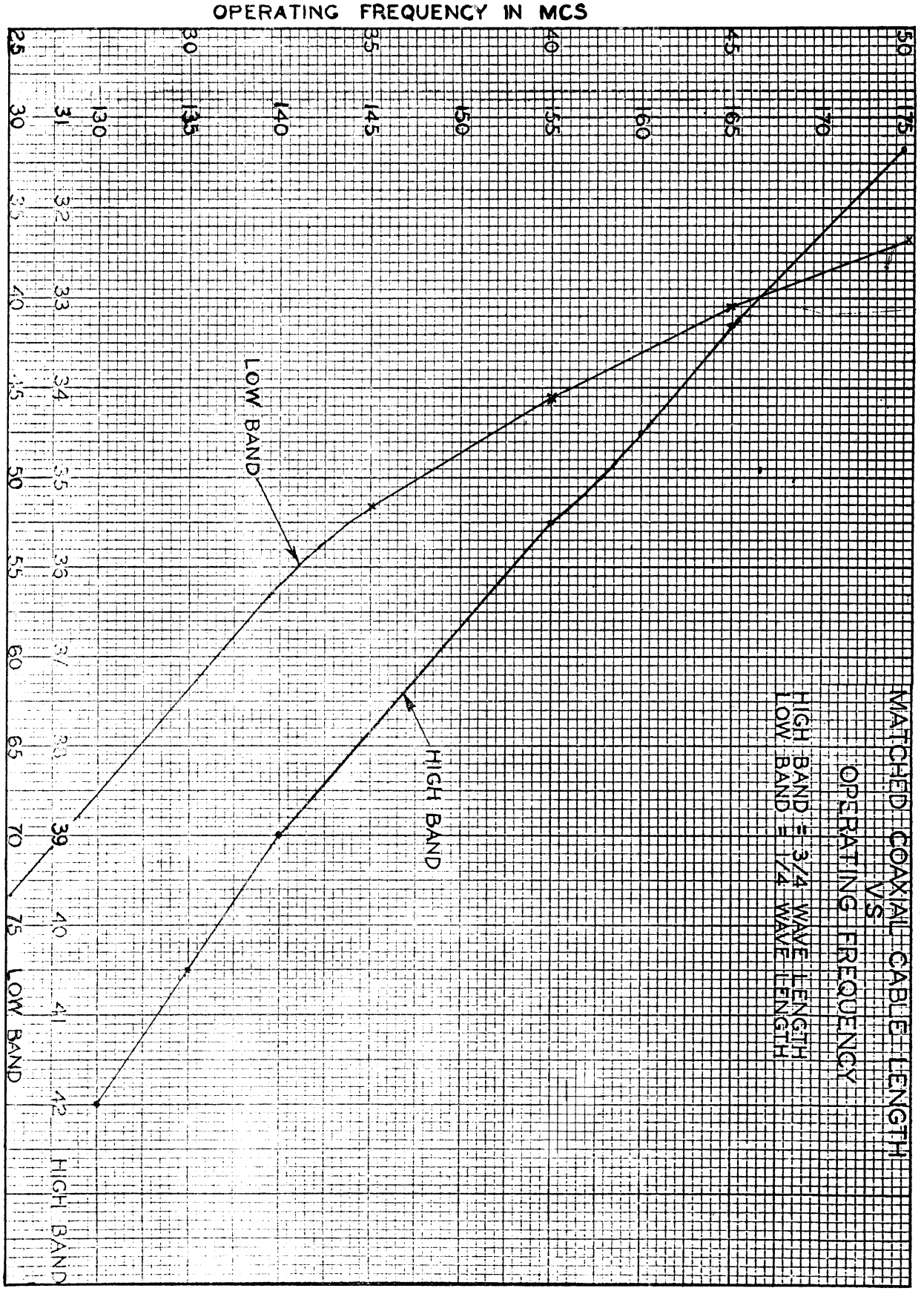


Slide eyelet onto cable as shown, then spread braid back evenly all around as shown. Slide eyelet forward and under turned-back braid to end of cut-off of outer jacket. Slide phone connector onto cable against braid and eyelet and solder all around. The center connector should be even with the tip of the phono connector. Care should be exercised in not using excessive heat, then solder tip.

Installation Instructions

FOR CABLE KIT
PL-4036169
MODELS 4EF27A10, 11
MODELS 4EF28A10, B10

(A-4036725, Sh. 2, Rev. 2)



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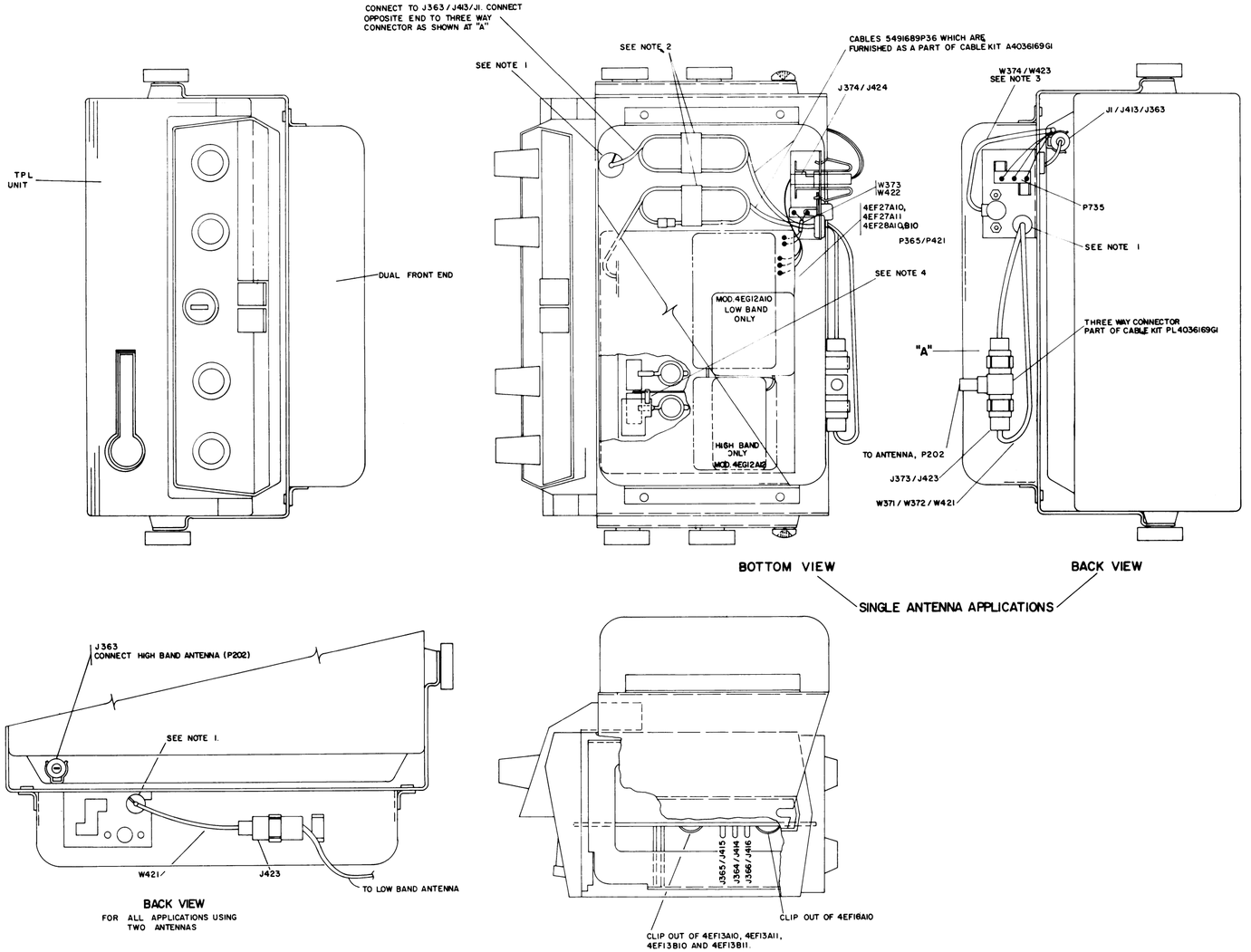
Installation Instructions

FOR CABLE KIT
PL-4036169
MODELS 4EF27A10, 11
MODELS 4EF28A10, B10

(A-4036725, Sh. 3, Rev. 1)



DUAL FRONT END

1. SLIT GROMMET, THEN INSERT APPLICABLE CABLE OR CABLES AND ROTATE GROMMET. SO SLIT IS NOT ALIGNED WITH CUTOUT.
2. COIL EXCESS CABLE AND TAPE COIL OF CABLE WITH TAPE AS REQUIRED.
3. THIS CABLE TERMINATED BY P365 OR P421 IS SUPPLIED AS A PART OF SUPPORT ASSEMBLY.
4. FOR LOW BAND 4EF28A10, WHEN FREQ RANGE MODIFICATION KIT IS NOT USED, CLIP OUT STRAP SHOWN.

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Cable Connection Diagram

FOR HIGH & LOW BAND
DUAL FRONT END

(19D400439, Rev. 1)

1. Capacitor C2 of the HI-IF Filter Mixer/Oscillator (Z411) of 4EF16A10,B10 shall be replaced with C17 furnished as a part of this kit.

2. Figure 1 shows approximate orientation of the HI-IF Board on 4EF16A10 RF Assembly.

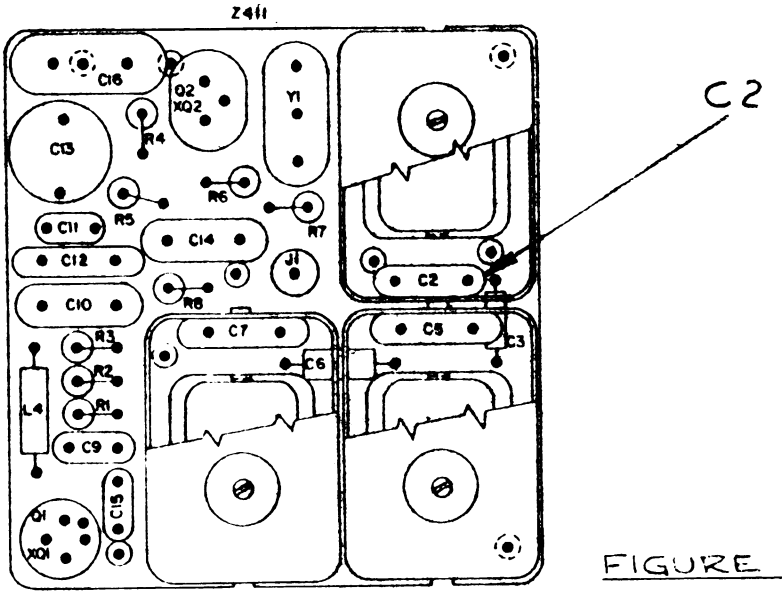


FIGURE 1

3. To replace capacitor C2 with C17:

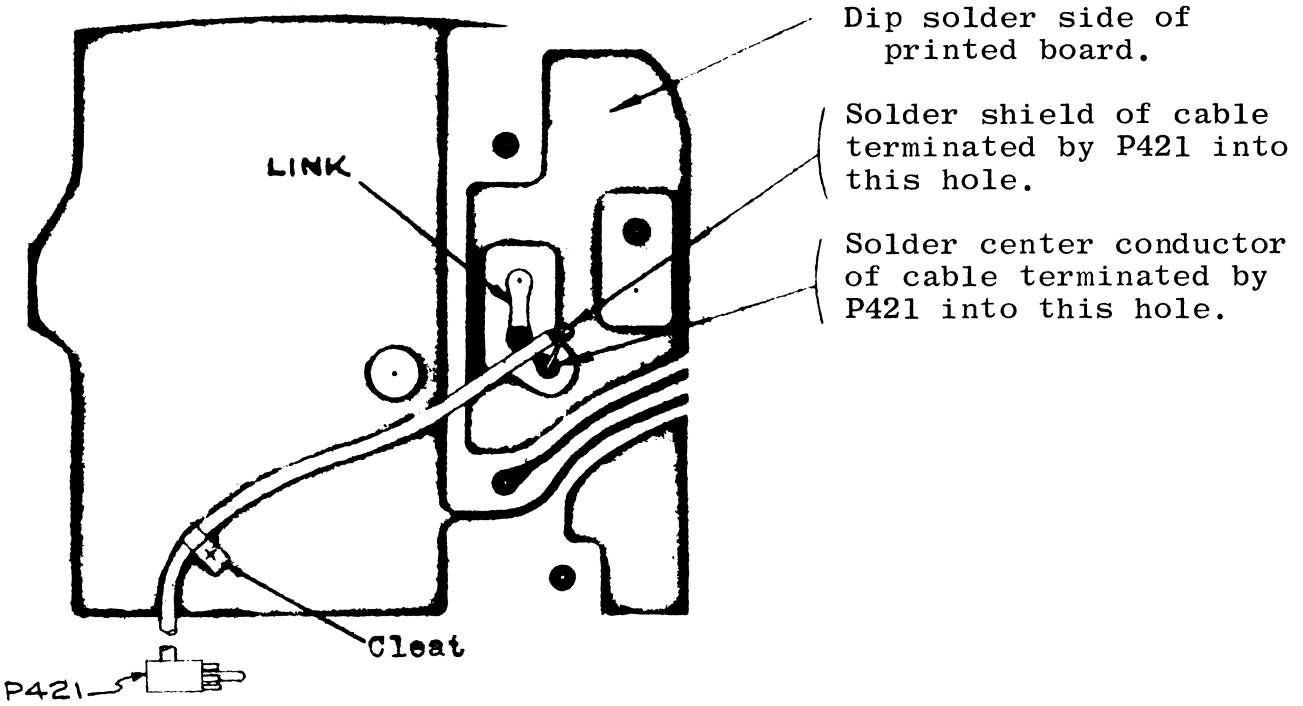
   A. Remove HI-IF Assembly from main board (4EF16A10,B10) by unsoldering the 9 links on the underside of the main board.

   B. Remove can which is shown cut away, exposing C2, in figure 1 by unsoldering the can tabs from the HI-IF Assembly.

   C. Replace C2 with C17.

   D. Replace parts disassembled above in reverse order.

1. Cable terminated by P421 which is called for on PLA4036082G1, as part 8, shall be attached to 4EF16A10,B10 as shown below:



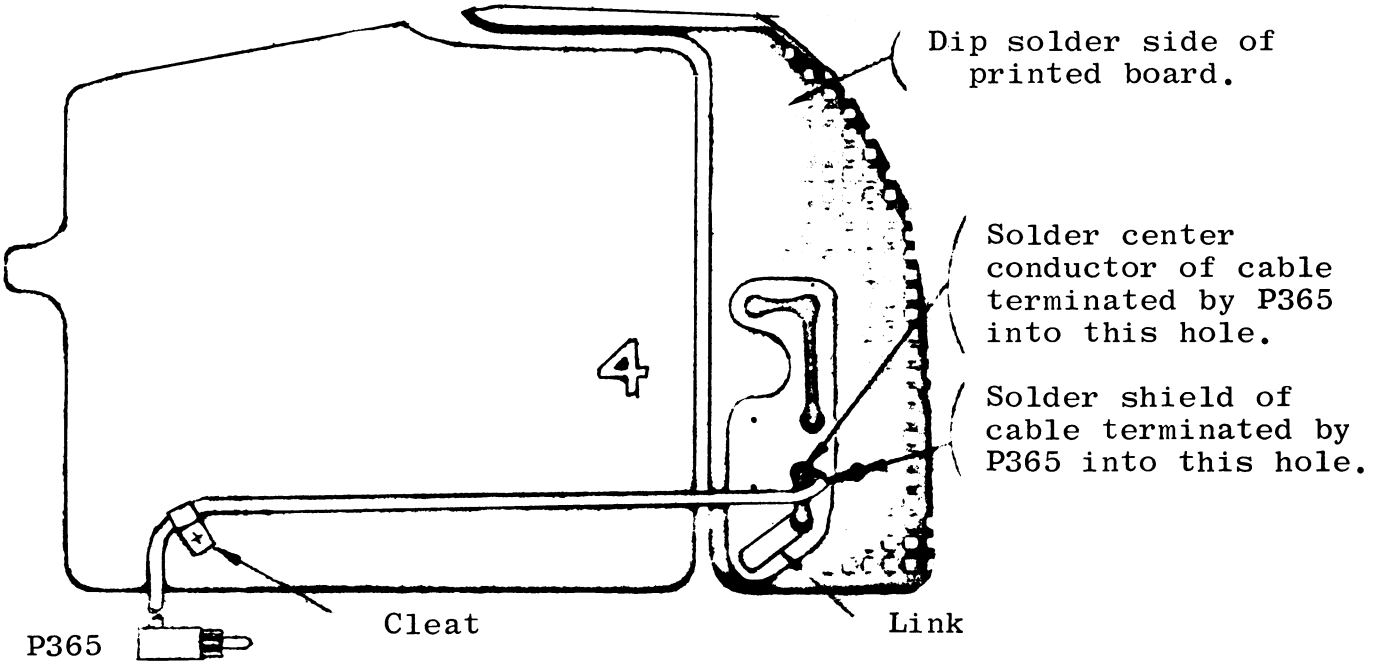
2. A. Remove hex head screw from hole in position where cleat is shown.
   B. Using hex head screw removed in step 2A, install cable and cleat as shown. (Cleat is part one of Hardware Kit PLA4036170G1).
   C. Some printed boards do not have holes for inserting leads of the cable. In this case solder the proper lead directly to the link or pattern so that indicated connections will result.
   D. The stripped ends of the coaxial cable should be short so that the possibility of the shield shorting will be eliminated.
   E. When these instructions are to be applied to field modified units, package cleat (P7763541P1) of PLA4036170G1 Hardware Kit with the Dual Front End Unit, and C17 Capacitor of PLA4036179G1.

Modification Instructions

RF BOARD
LOW BAND RECEIVER
MODELS 4EF16A10,B10

(A-4036172, Sh. 2, Rev. 1)

1. Cable terminated by P365, which is a part of part 8 of A4036082G1, shall be attached to 4EF13A10, or 4EF13A11, 4EF13B10, 11 as shown below:



2. A. Remove hex head screw from hole in position where cleat is shown.

   B. Using hex head screw removed in step 2A, install cable and cleat as shown. (Cleat is part one of Hardware Kit PLA4036170G1).

   C. Some printed boards do not have holes for inserting leads of the cable. In this case solder the proper lead directly to the link or pattern so that indicated connections will result.

   D. The stripped ends of the coaxial cable should be short so that the possibility of the shield shorting will be eliminated.

   E. When these instructions are to be applied to field modified units, package cleat (P7763541P1) of PLA4036170G1 Hardware Kit with the Dual Front End Unit.

3. A. Further instructions for 4EF13B10,11. Paragraph 1 & 2 applies except a Phillips head screw is used instead of a hex head. Also remove C13 of A368/A369 as shown on Sheet #2.

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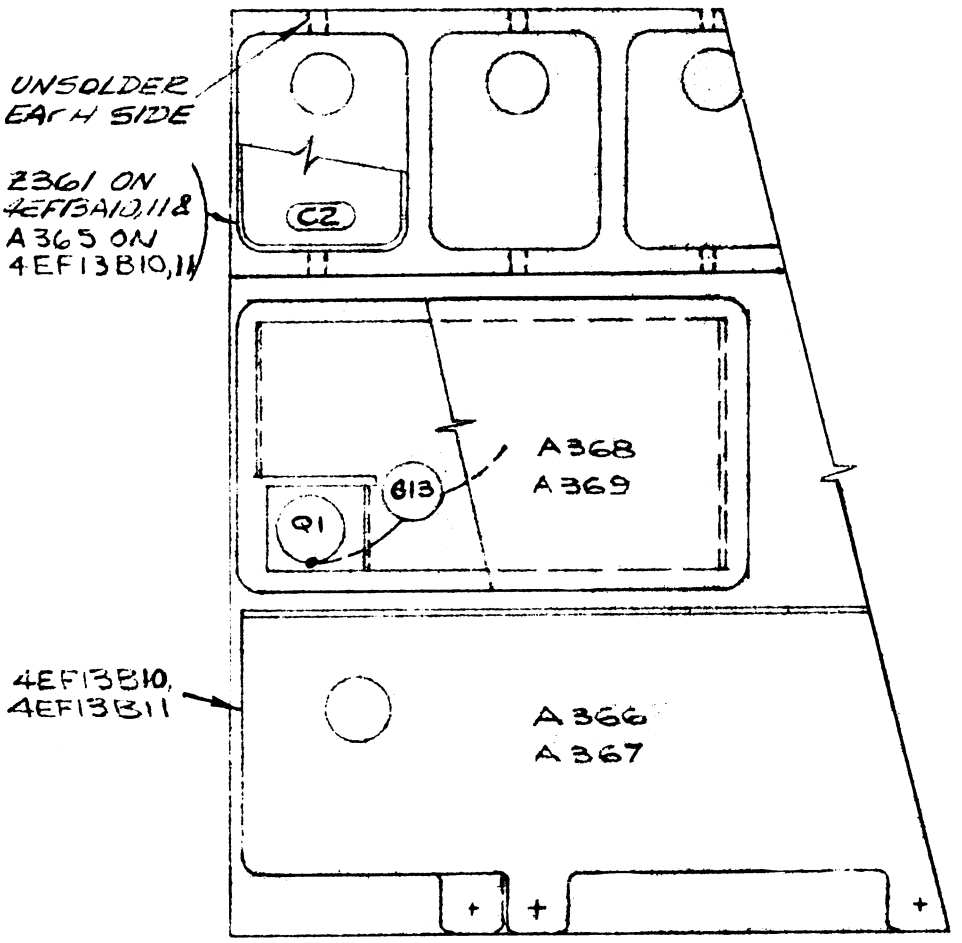
Modification Instructions

RF BOARD HIGH BAND
MODEL 4EF13A10,11 & B10,11

(A-4036173, Sh. 1, Rev. 3)



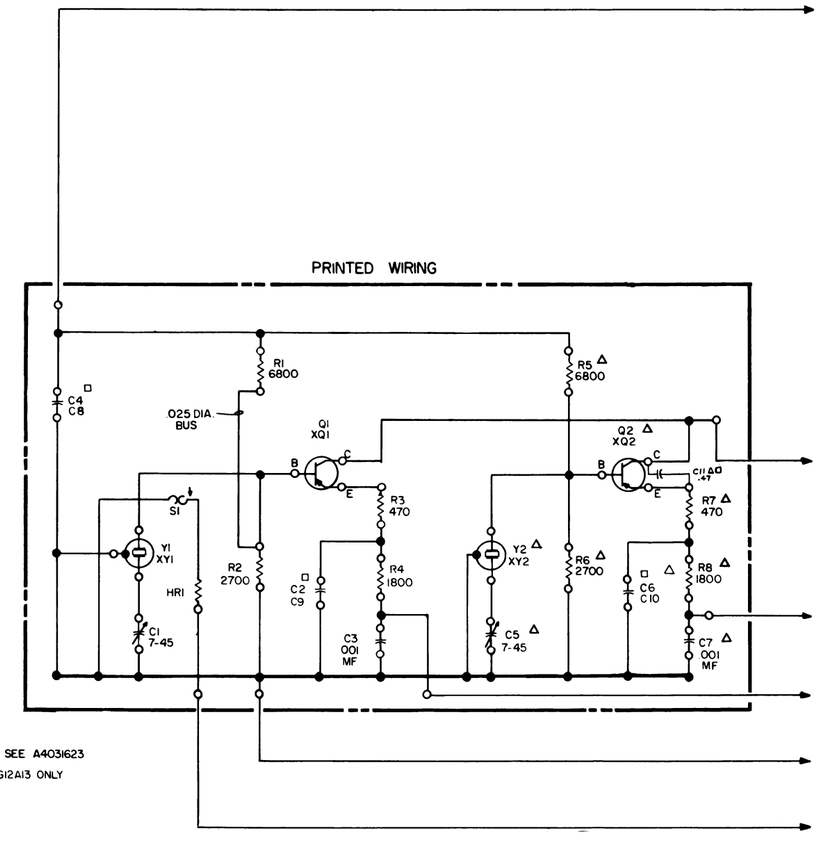
4. This step may have to be performed on some units (High Band Receivers containing 4EF13A10,11 or 4EF13B10,11). To prevent possible unnecessary assembly and disassembly of the complete package, it is desirable to make all connections up to this point and bench check out the unit.
   If the first coil in the High IF Transformer in the receiver, located in the High IF strip Z361, does not resonate after all connections are made with the check-out mentioned above the following procedure must be followed:
   Remove the HI/IF strip (Z361) from the main RF Board by unsoldering the seven links from the main board. Then unsolder the shield can covering C2 as shown in the above sketch. Remove Capacitor C2 and replace with C16, 82pf, Capacitor B5494210P361 included as a part of this kit. Then Re-assemble parts removed in reverse order.

5. When the Low Band Dual Front is applied in cross band operations, the High Band Receiver Sensitivity in some units will be degraded. If this occurs, Capacitor C434, coupling Capacitor, on 4EF28A10, B10 will have to be replaced with C18 Capacitor, 18 pf, supplied as a part of this kit. Refer to instruction book elsewhere for location of C434. After the exchange of capacitors mentioned above retune the first High IF Transformer and Mixer of 4EF28A10, B10 (Dual Front End).

Modification Instructions

RF BOARD HIGH BAND
MODEL 4EF13A10, 11 & B10, 11

(A-4036173, Sh. 2, Rev. 4)
(A-4036173, Sh. 3, Rev. 1)



FOR WIRING INSTRUCTIONS SEE A4031623

△ PARTS FOR 4EG12A11, 4EG12A13 ONLY

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.

□

4EG12A10	4EG12A11	4EG12A12	4EG12A13
C2 = 7	C2 = 7	C9 = 15	C9 = 15
C4 = 001MF	C4 = 001MF	C8 = 01MF	C8 = 01MF
	C6 = 7		C10 = 15
			C11 = .47

ALL RESISTORS ARE IN OHMS AND ARE HALF WATT UNLESS OTHERWISE SHOWN

K = 1000 OHMS
MEG = 1,000,000 OHMS

ALL CAPACITORS ARE IN MICRO MICRO FARADS UNLESS OTHERWISE SHOWN

MF = MICRO FARAD.

(C-5495636, Rev. 5)

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
4EG12A10	C
4EG12A11	C
4EG12A12	B
4EG12A13	C

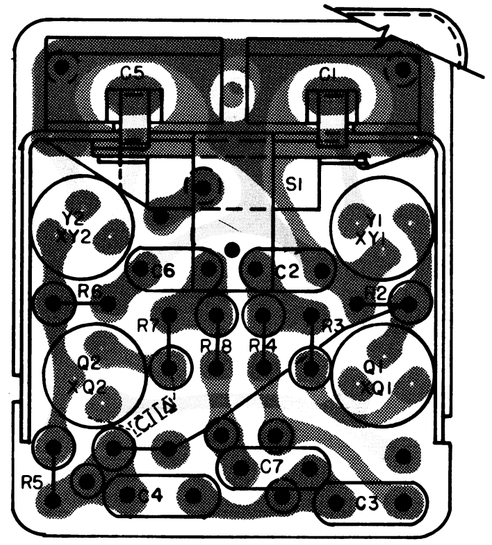
Service Sheet

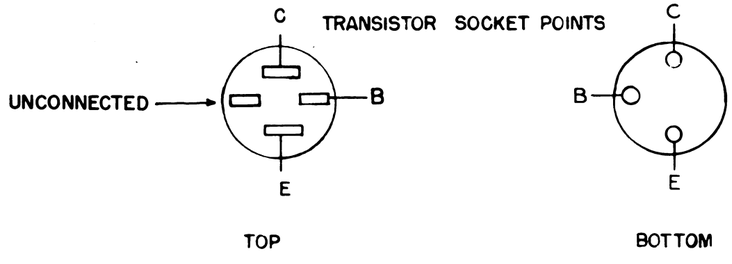
OSCILLATOR
MODEL 4EG12A10, REV. C
MODEL 4EG12A11, REV. C
MODEL 4EG12A12, REV. B
MODEL 4EG12A13, REV. C

(RC-812)

▒▒ Denotes Component Side

▒▒ Denotes Solder Side





(B-5492232, Rev. 2)
(B-5491781, Sh. 1, Rev. 0)
(B-5491781, Sh. 2, Rev. 0)

△ Located on Dip Solder Side of 4EG12A13 only.

VOLTAGE READINGS

SYMBOL NUMBER	TRANSISTOR		
	E	B	C
Q1	-3.1	-3.3	-12.5
Q2	-3.1	-3.3	-12.5

RESISTANCE READINGS

SYMBOL NUMBER	TRANSISTOR		
	E	B	C
Q1	2300 NOTE 5	2K	0
Q2	2300 NOTE 5	2K	0

CONDITIONS OF MEASURMENTS.

VOLTAGE :

1. READINGS TAKE WITH A 20,000 OHM-PER-VOLT METER - POSITIVE PROBE TO J304 REF. BUS.
2. INPUT VOLTAGE - 13.8 V D-C
3. READINGS TAKEN WITH RECEIVER TERMINATED INTO 2-WATT SPKR/AMP.
4. READINGS TAKEN FROM BOTTON OF TRANSISTOR SOCKETS ARE APPROX. ± 10%

RESISTANCE

1. OSCILLATOR CONNECTED TO RF BOARD.
2. TRANSISTOR REMOVED FROM SOCKET UNDER TEST.
3. 4EF13A11-P361 CONNECTS TO REF. BUS. J363.
4. READINGS TAKFN FROM TOP OF TRANSISTOR SOCKET TO REFERENCE BUS. ARE WITHIN ± 20 %
5. RESISTANCE WILL BE INF. ON CHANNEL NOT SELECTED

PARTS LIST

1st OSCILLATOR

MODEL 4EG12A10 (1-FREQ) REV. C
MODEL 4EG12A11 (2-FREQ) REV. C
MODEL 4EG12A12 (1-FREQ) REV. B
MODEL 4EG12A13 (2-FREQ) REV. C
PL-5491299-G1,2,3,4

SYMBOL	DESCRIPTION	G-E DRAWING & PART NO.
	CAPACITORS	
C1	Ceramic; variable; 7 uufd to 45 uufd, 500 vdcw, stator terminal straight out, rotor terminal bent. Similar to Erie Type TS2A-N500.	M-7484389-P66
C2	Ceramic disc, insulated, temp. compensating; 7.0 uufd ±5%, 500 vdcw. Used in Models 4EG12A10, 11 only.	C-5494210-P38
C3	Ceramic disc, insulated, 1000 uufd ±10%, 500 vdcw, RMC Corp. Type JF Discap.	C-5494481-P112
C4	Ceramic disc, insulated; 1000 uufd ±10%, 500 vdcw. RMC Corp. Type JF Discap. Used in Models 4EG-12A10, 11 only.	C-5494481-P112
C5	Ceramic, variable; 7 uuf to 45 uufd, 500 vdcw, stator terminal straight out, rotor terminal bent. Similar to Erie Type TS2A-N500. Used in Models 4EG12A11, 13 only.	M-7484389-P66
C6	Ceramic disc, insulated, temp. compensating; 7.0 uufd ±5%, 500 vdcw. Used in Model 4EG12A11 only.	C-5494210-P38
C7	Ceramic disc, insulated; 1000 uufd ±10%, 500 vdcw, RMC. Corp. Type JF Discap. Used in Models 4EG-12A11, 13 only.	C-5494481-P112
C8	⊛Mylar-dielectric; 0.01 uf ±20%, 50 vdcw. Good-All Type 601PE. Used in Models 4EG12A12, 13 only.	B-5491189-P101
C9	Ceramic disc, insulated, temp compensating; 15 uufd ±5%, 500 vdcw. Used in Models 4EG12A12, 13 only.	C-5494210-P44
C10	Ceramic disc, insulated, temp compensating; 15 uufd ±5%, 500 vdcw. Used in Model 4EG12A13 only.	C-5494210-P44
C11#	Moulded Type, 0.47 mmfd, ±10%, 500 VDCW 4EG12A13 only. Added by REV. A	C-5491601P13
	HEATER	
HR1	Heater and bracket assembly.	A-4031390-G1
	TRANSISTORS	
Q1#	Transistor, Germanium: PNP; hermetically sealed, metallic case with glass seal. Similar to Type 2N1744. In Models 4EG12A10, 4EG12A11 and 4EG12A13 of Rev A or earlier: In Model 4EG12A12 earlier than Rev A: Transistor, Germanium: MADT, PNP; hermetically sealed in metallic case with glass seal. Similar to Type 2N502.	A-4036830-P2 19B200130-P2
Q2#	Transistor, Germanium: PNP; hermetically sealed, metallic case with glass seal. Similar to Type 2N1744. (Used in Models 4EG12A11 and 4EG12A13 only). In Models of Rev A or earlier: Transistor, Germanium: MADT, PNP; hermetically sealed in metallic case with glass seal. Similar to Type 2N502, (Used in Models 4EG12A11 and 4EG12A13 only).	A-4036830-P2 19B200130-P2
	RESISTORS	
R1#	Composition, 6,800 ohms ± 5%, 1/2 w. Added by Rev. A.	C-3R77-P682J
	Composition, 6,800 ohms ± 10%, 1/2 w. Deleted by Rev. A.	C-3R77-P682K
R2#	Composition, 2,700 ohms ± 5%, 1/2 w. Added by Rev. A.	C-3R77-P272J
	Composition, 2,700 ohms ±10%, 1/2 w. Deleted by Rev. A.	C-3R77-P272K
R3	Composition, 470 ohms ±10%, 1/2 w.	C-3R77-P471K
R4#	Composition, 1,800 ohms ±5%, 1/2 w. Added by Rev. A.	C-3R77-P182J
	Composition, 1,800 ohms ±10%, 1/2 w. Deleted by Rev. A.	C-3R77-P182K
R5#	Composition, 6,800 ohms ±5%, 1/2 w. Used in Models 4EG12A11,13 only. Added by Rev. A in Model 4EG12A11.	C-3R77-P682J
	Composition, 6,800 ohms ±10%, 1/2 w. Used in Model 4EG12A11 only. Deleted by Rev. A.	C-3R77-P682K

SYMBOL	DESCRIPTION	G-E DRAWING & PART NO.
	RESISTORS (CONT'D)	
R6#	Composition, 2,700 ohms ±5%, 1/2 w. Used in Models 4EG12A11, 13 only. Added by Rev. A in Model 4EG12A11.	C-3R77-P272J
	Composition, 2,700 ohms ±10%, 1/2 w. Used in Model 4EG12A11 only. Deleted by Rev. A.	C-3R77-P272K
R7	Composition, 470 ohms ±10%, 1/2 w. Used in Models 4EG12A11, 13 only.	C-3R77-P471K
R8#	Composition, 1800 ohms ±5%, 1/2 w. Used in Models 4EG12A11, 13 only. Added by Rev. A in Model 4EG12A11.	C-3R77-P182J
	Composition, 1,800 ohms ±10%, 1/2 w. Used in Model 4EG12A11 only. Deleted by Rev. A.	C-3R77-P182K
	SWITCH	
S1	Thermostat, snap-acting, non-adjustable; semi-enclosed type; closes at 30° ±5°, opens at 65° ±7°. Stevens Mfg Co. Cat. No. M-262.	A-4033082-P1
	SOCKETS	
XQ1#	Socket, Transistor: PW (Stand-off); low loss mica filled phenolic insulation, 3-pins (beryllium copper), current rating 1 amp, contact resistance 0.30 ohms maximum (per contact). Similar to Elco Corp Part No. 3308. In Models of Rev. B or earlier: Socket, Transistor: 4-contacts, low loss mica filled phenolic; contact resistance 0.03 ohms max., 1 amp. Similar to Elco Corp Part No.3303.	A-4036353-P2 B-5490277-P1
XQ2#	Socket, Transistor: PW (Stand-off); low loss mica filled phenolic insulation, 3-pins (beryllium copper), current rating 1 amp, contact resistance 0.30 ohms maximum (per contact). Similar to Elco Corp Part No. 3308. Used in Model 4EG12A11, 13 only. In Models of Rev. B or earlier: Socket, Transistor: 4-contacts, low loss mica filled phenolic: contact resistance 0.30 ohms max., 1 amp. Similar to Elco Corp Part No. 3303.	A-4036353-P2 B-5490277-P1
XY1	4-contacts, low loss, mica-filled phenolic; contact resistance .03 ohms max. 1 amp. Elco Cat. #3303.	B-5490277-P1
XY2	4-contacts, low loss mica-filled phenolic; contact resistance .03 ohm max. 1 amp. Elco Cat. #3303. Used in Model 4EG12A11,13 only.	B-5490277-P1
	CRYSTALS	
Y1	Quartz, anti-resonance, freq. range: 20 to 55.5 MC. When reordering give G-E dwg. and part no. and specify exact frequency needed. 150-170 MC operation: Crystal frequency - (operating frequency -8.7) ÷ 3. 25-50 MC operation: Crystal frequency - 4.7.	A-4033466-P1
Y2	Quartz, anti-resonance, freq. range: 20 to 55.5 MC. When reordering give G-E dwg. and part no. and specify exact frequency needed. 150-170 MC operation: Crystal frequency - (Operating frequency -8.7) ÷ 3. 25-50 MC operation: Crystal frequency - 4.7. Used in Model 4EG12A11, 13 only.	A-4033466-P1

PRODUCTION CHANGES

(Refer to Parts List for description of parts affected by these revisions.)

REV. A (Models 4EG12A10, 4EG12A11 only.)

To assure more uniform operation of oscillator. Decrease tolerance on components R1, R2, R4, R5, R6 and R8.

REV. A (Model 4EG12A13 only)

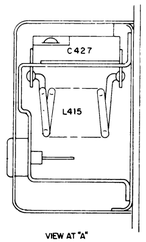
To improve 2-frequency receiver operation. Add capacitor C11 to solder side of 4EG12A13 board.

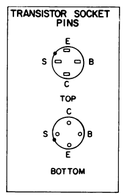
REV. A (Model 4EG12A12 only)
REV. B (Model 4EG12A10, 11, 13 only)

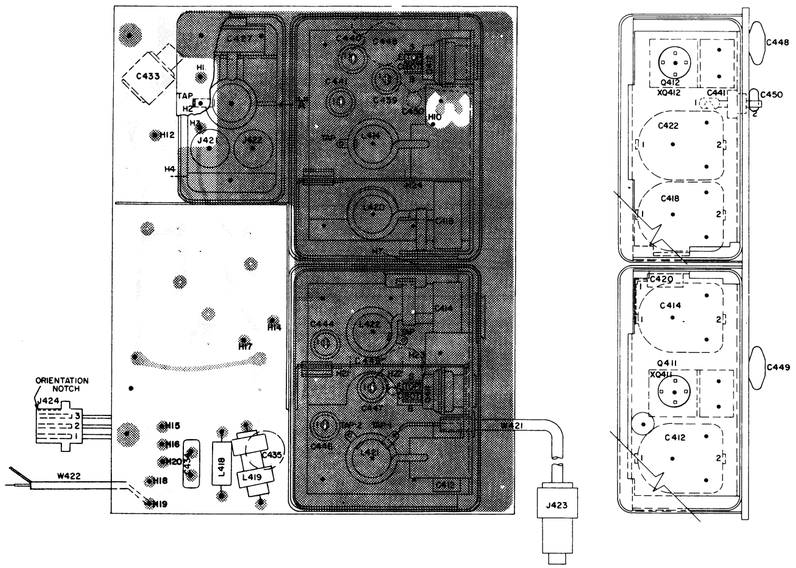
To employ transistors with more uniform characteristics. Q1 of 4EG12A10 & 4EG12A12 changed. Q1 and Q2 of 4EG12A11 and 4EG12A13 changed.

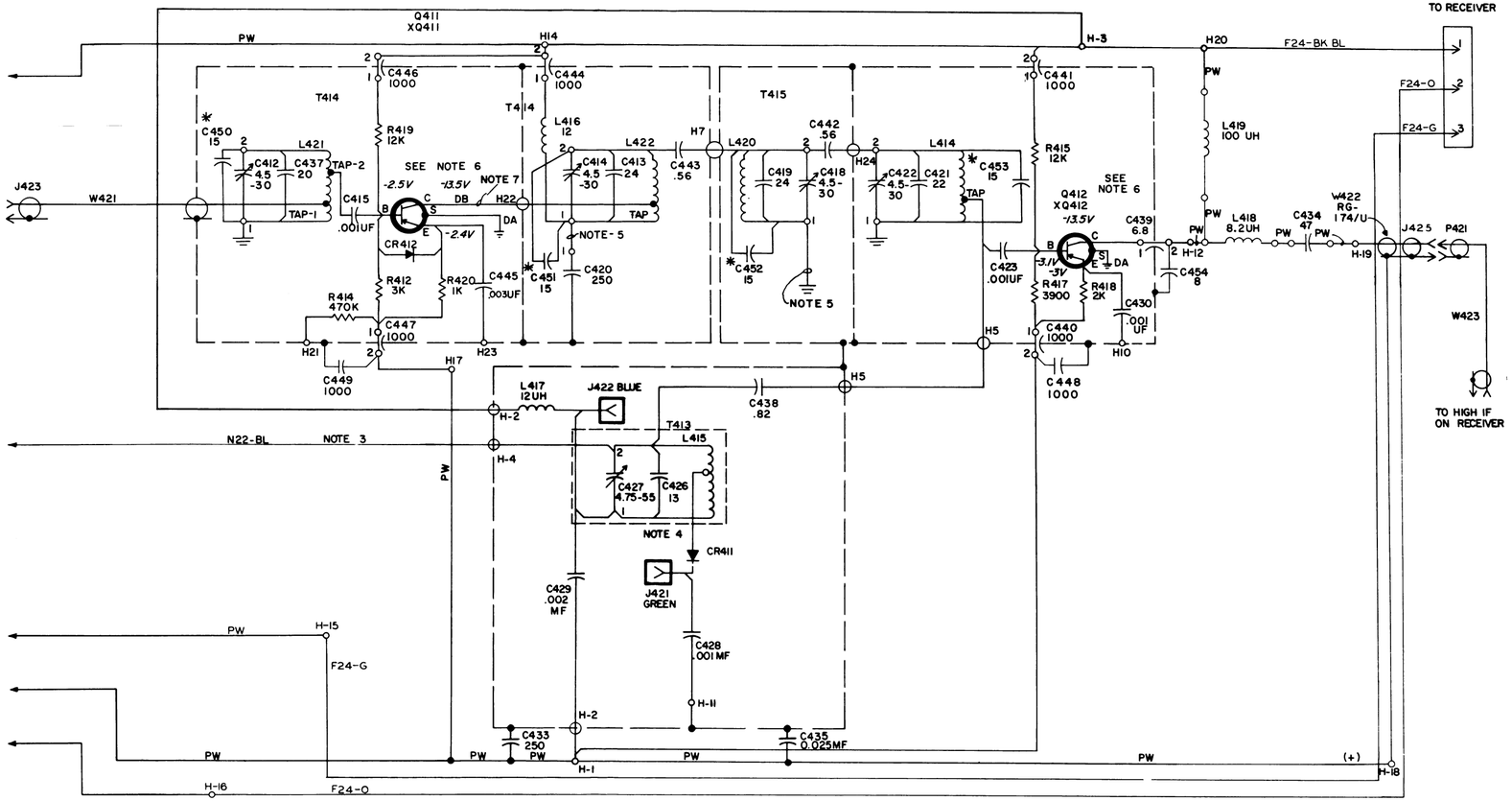
REV. B (Model 4EG12A12 only)
REV. C (Model 4EG12A10,11,13 only)

To provide for mounting of transistor with 4 leads, (one lead is dummy). XQ1 and XQ2 changed.









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.

NOTES

1: FOR WIRING INSTRUCTIONS SEE A4031623.
2: DIODE ORIENTATION AS SHOWN ANODE → CATHODE
3: LET HANG FROM C427-2.
4: L415 TAP ← CR411 → J421
5: STRAP BHB3A9 .005 THK X .125 X .50LG
6: VOLTAGE READINGS WITH RESPECT TO +BUS (J422) ± 20% 20000Ω/VOLT METER.
7: USE TEFLON SLEEVING.

DESIGNATES REFERENCE BUS (POSITION SUPPLY VOLTAGE) AND IS NOT NECESSARILY GROUND.

TERMINAL LUG.

* C450, C451, C452, AND C453 ARE USED IN THE 25-29, 33-37, AND 42-46 MC FREQ. RANGES. SEE FREQ. RANGE MODIFICATION INSTRUCTION PLI98205085G1,2,3.

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
4EF28B10	E

Denotes Solder Side

Denotes Component Side

(19D402220, Rev. 4)
(19C300009, Sh. 1, Rev. 3)
(19C300009, Sh. 2, Rev. 4)

(19D402149, Rev. 7)

2244

Service Sheet

RF BOARD LOW BAND
DUAL FRONT END
MODEL 4EF28B10; REV. E

(RC-970A)

PARTS LIST

RF ASSEMBLY
(DUAL FRONT END) LOW BAND
MODEL 4EF28B10
PL-5498180G2

SYMBOL	G-E PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C412*	7484389-P13	Variable, ceramic: 4.5 to 30 pfd -100% +50% 500 VDCW. Sim to Erie Style 503 In Models earlier than REV. E:
	7484389-P8	Variable, ceramic: 4.75 to 55 pfd -100% +50%, 500 VDCW, -500 temp coef: Sim to Erie Style 503.
C413*	5496218-P248	Ceramic disc: 24 pf ±5%, 500 VDCW: temp - coef -80 PPM In Models earlier than REV. E:
	5496218-P913	Ceramic disc: 22 pf ±10%, 500 VDCW: temp - coef +100 PPM.
C414*	7484389-P13	Variable, ceramic: 4.5 to 30 pf -100% +50% 500 VDCW. Sim to Erie Style 503 In Models earlier than REV. E:
	7484389-P8	Variable, ceramic: 4.75 to 55 pf -100% +50%, 500 VDCW. temp - coef -500 PPM. Sim to Erie Style 503.
C415	5494481-P12	Fixed ceramic disc: 1000 pf ±10%, 500 VDCW: sim to RMC JF.
C418*	7484389-P13	Variable, ceramic: 4.5 to 30 pf -100% +50%, 500 VDCW. Sim to Erie Style 503. In Models earlier than REV. E:
	7484389-P8	Variable, ceramic: 4.75 to 55 pf -100% +50%, 500 VDCW. -500 temp - coef. Sim to Erie Style 503.
C419*	5496218-P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp - coef -80 PPM. In Models earlier than REV. E:
	5496218-P913	Ceramic disc: 22 pf ±10%, 500 VDCW, temp -coef +100 PPM.
C420	7484398-P3	Fixed mics: 250 pf ±10%, 500 VDCW: sim to Underwood J-1-HF.
C421*	5496218-P[illegible]	Ceramic disc: 22 pf ±5%, 500 VDCW, temp - coef -80 PPM.
	5496218-P913	In Models earlier than REV. E: Ceramic disc: 22 pf ±10%, 500 VDCW, temp -coef +100 PPM.
C422*	7484389-P13	Variable, ceramic: 4.5 to 30 pf -100% +50%, 500 VDCW. Sim to Erie Style 503. In Models earlier than REV. E:
	7484389-P8	Variable, ceramic: 4.75 to 55 pf -100% +50%, 500 VDCW, temp - coef -500 PPM. Sim to Erie Style 503.
C423	5494481-P12	Fixed ceramic disc: 1000 pf ±10%, 500 VDCW: sim to RMC JF.
C426*	5496218-P243	Ceramic disc: 13 pf, ±5%, 500 VDCW, temp -coef -80 PPM. In Models earlier than REV. E:
	7774646-P45	Ceramic disc: 18 pf ±5%, 500 VDCW, temp -coef 0.
C427	7484389-P8	Variable, ceramic trimmer: 4.75 to 55 pf -100% +50%, 500 VDCW, -500 temp coef: sim to Erie 503.
C428	5494481-P12	Fixed ceramic disc: 1000 pf ±10%, 500 VDCW: sim to RMC JF.
C429	5494481-P14	Fixed ceramic disc: 2000 pf ±10%, 500 VDCW: sim to RMC JF.
C430	5494481-P12	Fixed ceramic disc: 1000 pf ±10%, 500 VDCW: sim to RMC JF.
C433	7484398-P3	Fixed mica: 250 pf ±10%, 500 VDCW: sim to Underwood J-1-HF.
C434	5496218-P[illegible]	Fixed silver mica: 47 pf ±5%, 500 VDCW: sim to Electromotive Mfg DM15.
C435	7491827-P6	Fixed ceramic disc: .025 pf +80% -20%, 50 VDCW: sim to Sprague 29C187.
C437*	5496218-P246	Ceramic disc: 20 pf ±5%, 500 VDCW, temp -coef -80 PPM. In Models earlier than REV. E:
	7774846-P12	Ceramic disc: 19 pf ±10%, 500 VDCW, temp -coef 0.
C438	7130348-P12	Fixed, molded: 0.82 pf ±5%, 500 VDCW, 0 temp coef: sim to Jeffers JM-5/32.
C439	5493392-P9	Feed-thru: 6.8 pf ±10%, 500 VDCW: sim to Allen-Bradley FA5C.
C440 and C441	5493392-P7	Feed-thru: 1000 pf +100% -0%, 500 VDCW: sim to Allen-Bradley FA5C.
C442 and C443	5491601-P115	Fixed, molded: 0.56 pf ±5%, 500 VDCW: sim to Quality Components MC.
C444	5493392-P7	Feed-thru: 1000 pf +100% -0%, 500 VDCW: sim to Allen-Bradley FA5C.
C445*	5494481-16	Fixed ceramic disc: 3000 pf ±10%, 500 VDCW. Sim to RMC JF. In Models earlier than REV. C:
	5494481-P12	Fixed ceramic disc: 1000 pf ±10%, 500 VDCW: sim to RMC JF.
C446 and C447	5493392-P7	Feed-thru: 1000 pf +100% -0%, 500 VDCW: sim to Allen-Bradley FA5C.
C448 and C449	5494481-P12	Fixed ceramic disc: 1000 pf ±10%, 500 VDCW: sim to RMC JR.
C450 through C453	5496218-P244	Ceramic disc: temp -comp., radial leads, 15 pf ±5%, 500 VDCW, temp -coef, -80 PPM.
		- - - - - - - - - RECTIFIERS - - - - - - - - -
CR411	7777146-P3	Germanium.
CR412	4038642-P1	Germanium.
		- - - - - - JACKS AND RECEPTACLES - - - - - - -
J421	4033567-P4	Jack, test, stake-in: green molded nylon: sim to Alden Products 110SMI.
J422	4033567-P6	Jack, test, stake-in: blue molded nylon: sim to Alden Products 110SMI.
J423		(Part of W421).
J424	5496809-P2	Receptacle: 3 cont, phenolic: sim to Molex Products 1055R3.
J425		(Part of PL-4036082-G1).
		- - - - - - - - - INDUCTORS - - - - - - - - -
L414	PL-4031073-G7	Coil asm, 7 turns at 10 turns per in., with link 2-1/2 turns from bottom, right hand wound.
L415	PL-4031073-G9	Coil asm, 8 turns at 12 turns per in, with link 6-3/4 turns from bottom, right hand wound.
L416 and L417	7488079-P17	Choke, RF: 12 µh ±10%, 0.57 amp, 1 ohm: sim to Jeffers 10102-34.
L418	7488079-P15	Choke, RF: 8.2 µh ±10%, 0.85 amp, 0.45 ohm: sim to Jeffers 10102-30.
L419	7127925-P4	Choke, RF: 100 µh ±10%, 33 ma, 6 ohms-green: sim to National R-33.
L420	4031009-P4	Coil: 7 turns at 10 turns per in., right hand wound.
L421	PL-4031073-G11	Coil asm, 7 turns at 10 turns per in., with links 1-7/8 and 2-5/8 turns from bottom, right hand wound.
L422	PL-4031073-G10	Coil asm, 7 turns at 10 turns per in., with link 1-7/8 turns from bottom, left hand wound.
		- - - - - - - - - PLUGS - - - - - - - - -
P421		(Part of W423).
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
Q411*	19A115413-P1	Germanium, PNP. Sim to Type 2N2996. In Models earlier than REV. B:
	19C300037-P4	Germanium, MADT, PNP.
Q412*	19A115413-P1	Germanium, PNP: Sim to Type 222996 In Models earlier than REV. B;
	19B200131-P2	Germanium, PNP.
		- - - - - - - - - RESISTORS - - - - - - - - -
R412	3R152-P302J	Fixed composition: 3000 ohms ±5%, 1/4 w.
R414	3R152-P474K	Fixed composition: 0.47 megohm ±10%, 1/4 w.
R415	3R152-P123J	Fixed composition: 12,000 ohms ±5%, 1/4 w.
R417	3R152-P392J	Fixed composition: 3900 ohms ±5%, 1/4 w.
R418	3R152-P202J	Fixed composition: 2000 ohms ±5%, 1/4 w.
R419	3R152-P123K	Fixed composition: 12,000 ohms ±10%, 1/4 w.
R420	3R152-P102K	Fixed composition: 1000 ohms ±10%, 1/4 w.
T413		Consists of the following: C426 and C427 L415
T414	Consists of the	Consists of the following: C412 and C437 L421
T415		Consists of the following: C413, C414, C418, C419, C421, C422, C442, and C443, L414, L420 and L422.
		- - - - - - - - - CABLES - - - - - - - - - -
W421	5491689-P37	Cable asm: includes 17.5" of RG-174/U cable with phono connector (J423) molded on one end.
W422		Coaxial: vinyl jacket, 2". Type RG-174/U.
W423		(Part of PL-4036082-G1).
		- - - - - - - - - SOCKETS - - - - - - - - - -
XQ411* and XQ412	4038139-P1	Transistor, 4 contacts low-loss mica filled phenolic. Sim to Elco 3308. In Models earlier than REV. A:
	4036353-P1	Transistor, 4-pin: PW, stand-off, low-loss mica-filled phenolic: sim to Elco 3308.
		- - - - - - - - - SUBASSEMBLIES - - - - - - - - -
		SUPPORT PL-4036082-G1
		- - - - - - JACKS AND RECEPTACLES - - - - - - -
J425	7104941-P5	Jack, phono: ceramic and XXXP phenolic: sim to Cinch 14H18331.
		- - - - - - - - - - CABLES - - - - - - - - - -
W423	5491689-P35	Cable asm: includes 14.75" of RG-174/U cable with phono connector (long plug) (P421) molded on one end.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PRODUCTION CHANGES

(Refer to Parts List for description of parts effected by these revisions).

REV. A

Purpose - To provide standardized sockets for transistors.
Change - Changed part number of XQ411 and XQ412.

REV. B

Purpose - To provide greater protection against burn-out under R.F. overload.
Change - Changed Q411 and Q412.

REV. C

Purpose - To reduce possibility of oscillations in the R.F. amplifier.
Change - Changed C445.

REV. D

Purpose - To improve receiver operation under high signal conditions.
Change - Changed Q412.

REV. E

Purpose - To improve temperature compensation of R.F. circuits.
Change - Changed C412, C413, C414, C418, C419, C421, C422, C426, C437, and added C450 through C453.

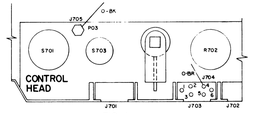


FIG. 1

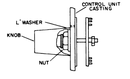


FIG. 2

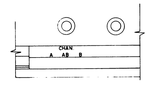


FIG. 3

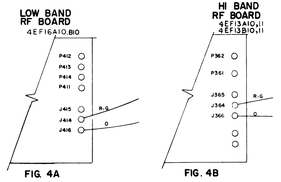


FIG. 4A

FIG. 4B

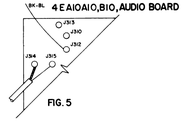


FIG. 5

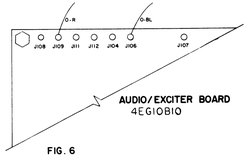


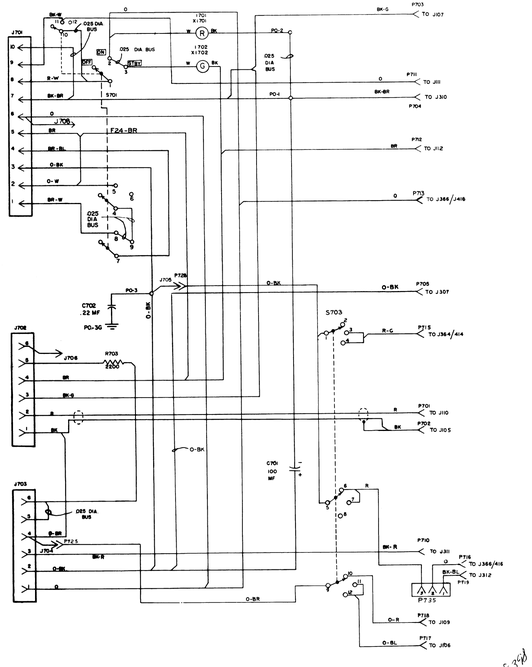
FIG. 6

WIRING TABLE

CONNECT	FROM	TO	FIG.
BK-BL	P735-1	J312	5
O	P735-2	J366/J416	4
R-G	S703-3,4	J364/J414	4
O-BK	S703-1,5	J705	1
O-BL	S703-11,12	J106	6
O-R	S703-10	J109	6
O-BR	S703-9	J704	1

1. REMOVE KNOB AND SHAFT FROM ACCESSORY POSITION ON CONTROL UNIT.
2. MOUNT SWITCH ASSEMBLY IN ACCESSORY POSITION AS SHOWN IN FIG. 2.
3. IF ONLY TRANSMITTER OR ONLY RECEIVER IS EQUIPPED TO TWO FREQUENCY USE CLIP AND AND REMOVE UNUSED WIRES FROM S703
4. WIRE ACCORDING TO WIRING TABLE.

(19C300698, Rev. 1)

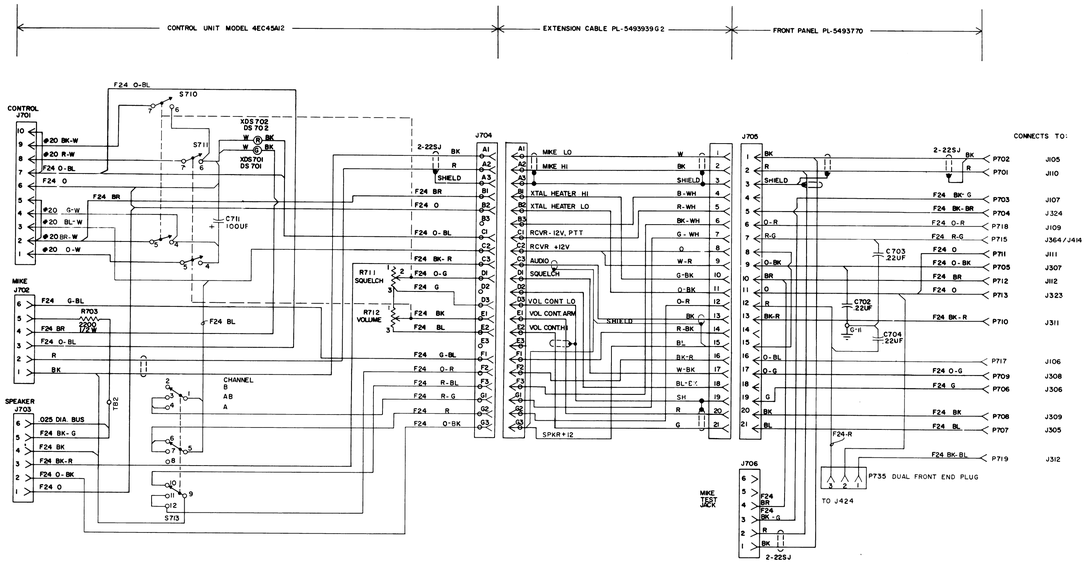


(D-5499797, Rev. 2)

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.

Front Mount Installation FOR DUAL FRONT END (RC-740E)

5244



Rear Mount Installation

FOR DUAL FRONT END

(RC-858E)

(19D400445, Rev. 4)

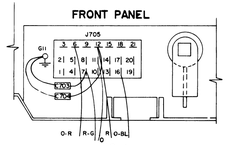


FIG. 1

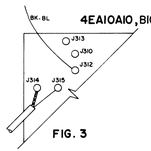


FIG. 3

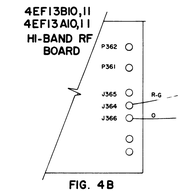


FIG. 4B

WIRING TABLE

CONNECT	FROM	TO	FIG.
BK - BL	P735 - 1	J312	3, 2
O	P735 - 2	J366/J416	4, 2
R	P735 - 3	J705 - 12	1, 2
R - G	J705 - 7	J364 / J414	4, 1
O - BL	J705 - 6	J106	5, 1
O - R	J705 - 16	J109	5, 1

1. WIRE ACCORDING TO WIRING TABLE.
2. SOME WIRES MAY GO TO JACKS THAT HAVE EXISTING WIRES AND PLUGS. REMOVE EXISTING PLUGS, INSERT TERMINAL PROVIDED IN KIT AND CONNECT ORIGINAL PLUG TO TOP OF NEW TERMINAL.

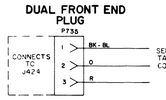


FIG. 2

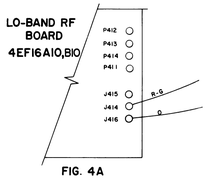


FIG. 4A

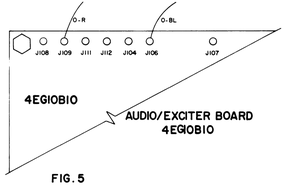


FIG. 5

(19C300697, Rev. 6)

PRODUCTION CHANGES

Control Unit Model 4EC45A12

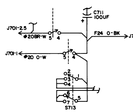
(Refer to Parts List for description of parts affected by these revisions.)

REV A - To turn filaments off by ON-OFF switch. (Positive ground hook-up.
Remove wire between S710-6 and S711-7. Reconnect it between S710-6 and S711-6

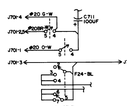
REV B - To make 4EC45A12 compatible with the General Electric 28/12 converter
Delete F24 O-B wire from J704-C2 to S711-4.
Delete wire from S711-4 to S713-5.
Add #20 BL-W wire from J704-C2 to J701-3.
Add #F24 BL wire from S713-5 to J704-C2.
Add #20 O-W wire from S710-4 to J701-4.

Elementary Diagram Change.

From:



To:



LB1-3362B

PARTS LIST

CONTROL UNIT MODEL 4EC45A12, REV. B

SYMBOL	G-E PART NO.	DESCRIPTION
		CAPACITORS
C711*	7489483-P18	Electrolytic, 85°C operation; 100 mf +100% -10% 25 VDCW; sim to Sprague 30D1084A1. Added by Rev. B.
		INDICATING DEVICES
DS701 and DS702	G-E #53k	Lamp, incandescent; (Miniature base); design volts 14.5V, design current 0.12 amps. (Uses G-3-1/2 size bulb). Sim to G.E. 53.
		JACKS AND RECEPTACLES
J701	5493545-P2	Connector, plug; Black phenolic insulation; 10-male contacts (brass), max rating 1,000 VDC (contact to contact), max current 5 amps; sim to Component Mfg. 6601-CM10.
J702	5493545-P3	Connector, socket; Black phenolic insulation; 6-female contacts (brass), max rating 1,000 VDC (contact to contact), max current 5 amps; sim to Component Mfg. 6601-CF6.
J703	5493545-P4	Connector, socket; Black phenolic insulation; 6-female contacts (brass), max rating 1,000 VDC (contact to contact), max current 5 amps; sim to Component Mfg. 6601-CF6A.
J704*	5496809-P17	Pin, brass, (spring temper) sim to MOLEX PRODUCTS 1381-T.
	5496809-P114	Connector, receptacle; phenolic, 21 circuits; sim to Molex 1053821.
		RESISTORS
R711	C-5496870-P6	Potentiometer, carbon film; 15,000 ohms ±20%, linear taper, DPST switch (push-pull). Sim to Mallory LC15KP06A2.
R712	C-5496870-P5	Potentiometer, carbon film; 2,500 ohms ±20%, linear taper, DPST switch (rotary). Sim to Mallory LC15MP.
R703	3877-P222K	Fixed composition; 2,200 ohms ±10%, 1/2 w.
		SWITCHES
S713	5495454-P10	Rotary; non-shorting contacts, 1-section, 3-poles 3-position, contact rating 2 amps at 25 VDC, or 1 amp at 110 VAC. Sim to Oak "A".
		SOCKETS
XDS701 and XDS702	4032220-P1	Socket, lamp; Min bayonet base; plastic insulating sleeve, 6-inch leads. Sim to Drake N517.
		MISCELLANEOUS MECHANICAL PARTS
	198200008-P1	Control housing, steel, 2.428 x 2.75 inches dia.
	4032248-P1	Clip, mounting; spring steel; annealed carbon.
	4035746-P1	Jewel, red, #2444 plexiglass, 0.250 dia. x .1.051g.
	4035746-P2	Jewel, green, #2092 Plexiglass.
	4039182-G1	Knob, Butyrate (Tenite 11); red-orange color, for use with flatted shaft. Sim to Eastman 32599.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.