AIR-GROUND RADIO PRIVATE SYSTEMS ERCO 362-R RECEIVER DESCRIPTION

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1. GENERAL

1.01 This section covers the Erco type 362-R UHF radio receiver, which is a base station receiver used in military, amplitude-modulated, radio systems operating in the range of 225 to 400 megacycles.

1.02 This section is reissued to provide a description and operating principles of the preamplifier, receiver muting and carrier operated relay units. Included are diagrams and photographs of the preamplifier, receiver muting and carrier operated relay units. Marginal arrows have not been used to indicate changes.

1.03 The 362-R is a single-frequency, crystal-controlled, double conversion receiver with a stability of 0.005%, complete with power supply and is designed for mounting in a standard 19-inch rack and requires a space of 5-1/4 inches. Normally, the receiver is mounted in the Erco 361-TB transmitter cabinet. The weight of the receiver is 33 pounds net.

1.04 The power supply transformer has dual primary windings for either 120- or 240-volt 50/60 cycle supply. The power demand is 85 volt-amperes.

1.05 A coaxial fitting is provided to connect a 50- to 75-ohm transmission line from the antenna or the preamplifier where used.

1.06 The audio output is arranged to provide 2 watts into 4 to 8 ohms or a balanced 500- to 600-ohm center tapped line. A 20 db H pad is provided for use with the 600-ohm output when connected to a low-level telephone line. The H pad is used where it is desired to maintain a high audio signal-to-noise ratio on the line. Direct current control of the transmitter-receiver combination may be obtained over a common telephone line through the use of the center tapped transformer in conjunction with the proper terminal units.

1.07 The audio response is uniform within ±3 db between 200 and 4000 cycles, referred to 1 kc.

1.08 Spurious responses are down 60 db or more.

1.09 The adjustable squelch control will mute the receiver output over the range of 1 to 1000 microvolts input.

1.10 The first IF is between 36 and 49 megacycles depending upon carrier frequency. The second IF is 9 megacycles. One crystal is used for control.

1.11 The receiver will provide a minimum of 50 milliwatts output with a 10 db signal plus noise-to-noise ratio for an input of 3 to 5 microvolts modulated 30%. The 362-RPA preamplifier will provide 8 to 10 db gain over this figure.

1.12 The selectivity is greater than 100 kc at 6 db down and less than 300 kc 60 db down.

1.13 The audio output is within 3 db for inputs between 15 microvolts and 1 volt with a recovery time of less than 0.1 second.

1.14 Noise limiting is provided by clipping signals at levels above 75% modulation for input carriers above 20 microvolts.

2. CIRCUIT DESCRIPTION

2.01 A block diagram of the receiver is shown in Fig. 1. A complete schematic is shown in Fig. 2. Component locations are shown in Figs. 3, 4 and 5.

A. Preamplifier

2.02 The 362-RPA preamplifier consists of a single tube (EC86/6CM4) in a grounded-grid amplifier circuit which provides a gain of approximately 8 to 10 db. The untuned input is designed to properly terminate a 50-ohm transmission line. The plate circuit is adjustable to resonate at the operating frequency and is inductively coupled to the 50-ohm output. Operating voltages are supplied by a self-contained power supply which is transformer-powered and protected by a fuse. Rectification and filtering are accomplished through the use of a silicon diode and an RC network.

2.03 The input cavity (ANT) of the preselector MUST be tuned for maximum signal together with the TUNE adjustment of the preamplifier to insure that a proper match is obtained.

B. Preselector, 1st Mixer & 1st IF Amplifier

2.04 The preselector consists of three tuned lines. The input is coupled to the antenna or preamplifier. The first mixer uses a diode (1N21B) which is connected to the third tuned line at a point which matches its input impedance. The output of the diode mixer terminates in a low-inductance capacitor which bypasses all but the desired frequency to ground. The output is coupled to the grid of the first IF amplifier V-1 (6AK5) by a Pi-Network C-5, T-1 and the capacity of the crystal holder. V-1 is coupled to the second mixer by a single tuned circuit T-2. The first IF amplifier is AVC controlled but is not dependent on the setting of the RF GAIN control. The first IF operational frequency is the crystal frequency plus 9.0 megacycles.

C. Oscillator and Multipliers

2.05 The oscillator and first multiplier V-9 (6BQ7A) is a dual triode-type tube using an overtone crystal with output in the 27- to 40-megacycle range connected between the two cathodes. The plate of one section is tuned by L-2, C-20 to the crystal frequency and is link-coupled to the grid of the second mixer V-2 through L-5, C-21 to provide injection. The other section of V-9 is tuned to three times (81 to 120 Mc) the crystal frequency by L-1, C-11 which is connected to the grid of multiplier V-8 (6AK5). The output of V-8 is shunt-connected to the first mixer (1N21B) and is tuned to two times the drive frequency (162 to 240 Mc) by C-4. For frequencies above 290 megacycles the second harmonic of 162 to 240 megacycles is used. Pin-type jacks TP-1 and G are provided on the chassis to measure the drive voltage at the second multiplier grid.

D. Crystal Frequencies

2.06 The correct crystal output frequency for any carrier frequency in the range of 225 to 400 megacycles can be calculated from the following formulas:

For carrier frequencies from 225 to 290 megacycles, crystal frequency (Mc) =

$$\frac{\text{carrier frequency (Mc)} - 9.0 \text{ Mc}}{7.0}$$

For carrier frequencies from 290 to 400 megacycles, crystal frequency (Mc) =

$$\frac{\text{carrier frequency (Mc)} + 9.0 \text{ Mc}}{11.0}$$

E. 2nd Mixer

2.07 A miniature pentode-type tube V-2 (6AK5) is used as the second mixer, receiving grid injection from the oscillator. Mixing is produced by the first IF frequency and the crystal frequency with an output frequency of 9.0 megacycles. V-2 is not controlled by AVC or the RF GAIN control.

F. 2nd IF Amplifier

2.08 The second IF amplifier uses 6SK7 remote cutoff pentode-type tubes V-3, V-4 and V-5 in a three-stage amplifier operating at 9.0 megacycles. IF transformers are arranged in an over-coupled, tuned, capacity-coupled stabilized circuit. The grids of V-3 and V-4 receive full AVC voltage. The grid of V-5 receives about four-fifths of the full AVC voltage. The RF GAIN control, which varies the common cathode bias voltage, controls the bias for all three tubes. The bandwidth is 100 kilocycles at 6 db points.

2.09 A modification of the receiver provides positive muting by opening the grid returns of V-3, V-4 and V-5 when the associated 361-TB transmitter is keyed. Refer to the Maintenance Methods section of this practice.

G. AVC Amplifier

2.10 The IF amplifier voltage at the plate of V-4 is coupled to the grid of V-7 (6SF7) by C-37. This voltage is amplified and returned through TF-9 to the diode within V-7 which rectifies it, producing an amplified AVC voltage across the diode load resistor combination R-35, R-36, and R-37. Resistors R-31 and R-32 in the cathode circuit of V-7 provide a small voltage to the diode section which is negative with respect to the cathode producing delayed AVC by making the diode section inoperative for small signals.

H. Detector

2.11 One half of the diode-type tube V-6 (6H6) (pins 5 and 8) operate as an ordinary audio detector. The plate is connected directly to the IF tuned circuit TF-8. The rectified output developed across the load resistors R-44, R-45, and R-46 consists of dc component which is positive with respect to ground and the superimposed audio component, a part of which is applied to the grid of the first audio tube V-13.

I. First Audio and Audio Output

2.12 The first audio uses one half of V-13 (6SL7) and when a signal is applied to the grid the signal is amplified across the plate load resistor R-49 which is fed through the audio gain control R-54 to the grid of the audio output tube V-12 (6AU5) with the output terminated by transformer T-3 which has three secondary windings providing outputs of 8 ohms, 600 ohms balanced or center tapped. Resistor combination R-58 through R-63 comprises a balanced 600-ohm H pad with 20 db attenuation which may be used when the output is connected to a low level telephone line. See Paragraph 1.06 of this section.

J. Squelch

2.13 The squelch circuit consists of three tubes: V-6 (1/2-6H6) squelch detector, V-14 (6SL7) squelch delay and squelch dc amplifier and V-15 (1/2-6H6) squelch dc restorer. The squelch circuit controls the bias of the first audio tube V-13 which causes this tube to be cut off for signals below a usable magnitude. Receivers manufactured after serial No. 6941 contain a modification of the squelch circuit. This modification provides a variable squelch control. Refer to the Maintenance Methods section of this practice.

K. Noise Limiter

2.14 The noise limiter is automatic in operation and consists of two tubes: V-15 (1/2-6H6), and V-13 (1/2-6SL7) which controls the bias for V-15. The circuit is designed to start conducting when the noise level approaches 75% modulation.

L. Power Supply

2.15 The power transformer T-4 has two primary windings which may be connected in parallel for 120-volt operation or in series properly phased for 240-volt operation. The secondary has two windings, one supplying 350 volts center tapped which is connected to the plates of V-10 and V-11 (6X5GT) tubes each operating as a full-wave rectifier connected in parallel providing dc output through a capacitor input filter consisting of C-60B, CH-1, and C-57B. The other secondary winding supplies the heaters of all tubes in the receiver. Where V-10 and V-11 have been replaced by a silicon rectifier unit, it is necessary to add an 80-ohm, 10-watt resistor in series with pin 8 of the rectifier.

M. Receiver Muting Unit

2.16 In certain applications of the receiver, where the 361-TB transmitter and the 362-R receiver are used in relay service, a modification has been made to provide more positive muting of the receiver. This modification is shown in Fig. 12 and consists of a wiring change which opens the grid return for tubes V-3, V-4 and V-5 and shorts the audio output when the associated transmitter is keyed.

N. Carrier Operated Relay Units

2.17 One of two types of relay units are provided where a remote signal is required in the presence of a carrier. Addition of either unit requires minor circuit changes. The changes and a schematic diagram of the units are shown in Figs. 1, 2, 9 and 10.

(a) The 2016-LL unit uses a 6C4 triode with a low-current relay in the plate circuit and is connected in parallel with V-13. When no carrier is received a positive potential of approximately 30 volts is applied to the 6C4 grid. The cathode is held about 50 volts positive resulting in a negative grid voltage which cuts off the tube. The relay is not energized and the relay contacts present an open circuit. When a carrier is received, the grid bias becomes zero causing a plate current of approximately one milliampere to flow, which operates the relay and closes the external circuit.

(b) The 2016-LLM unit uses a 12AU7 dual-triode in a dc coupled circuit with a heavy-duty relay in the plate circuit of the second triode section. A potentiometer is provided to adjust the sensitivity of the unit. The relay is held operated when no carrier is received. With carrier, the change in AVC voltage is amplified resulting in an increase in positive voltage input to the first triode section of the 12AU7. This change causes plate current to increase extinguishing the neon lamp. This in turn cuts off the second triode section and causes release of the relay. Release of the KCP-11 relay closes the external circuit. This provides a fail-safe feature where loss of power to the 2016-LLM unit actuates the external signal.

3. DRAWINGS AND PHOTOGRAPHS

3.01 The following drawings and photographs form a part of this section.

Fig. 1 Block Diagram — 362-R Receiver. (including Preamplifier)

Fig. 2 Schematic Diagram — 362-R Receiver. (including Modifications)

Fig. 3 Photograph — 362-R Receiver. (bottom view)

Fig. 4 Photograph — 362-R Receiver. (top view)

Fig. 5 Photograph — 362-R Receiver. (front view)

Fig. 6 Schematic Diagram — 362-RPA Preamplifier.

Fig. 7 Photograph — 362-RPA Preamplifier. (front view)

Fig. 8 Photograph — 362-RPA Preamplifier. (interior view)

Fig. 9 Schematic Diagram — 2016-LL Carrier Operated Relay.

Fig. 10 Schematic Diagram — 2016-LLM Carrier Operated Relay.

Fig. 11 Schematic Diagram — 2026 Receiver Muting Unit.

Fig. 12 Interconnections for 2026 Receiver Muting Unit.

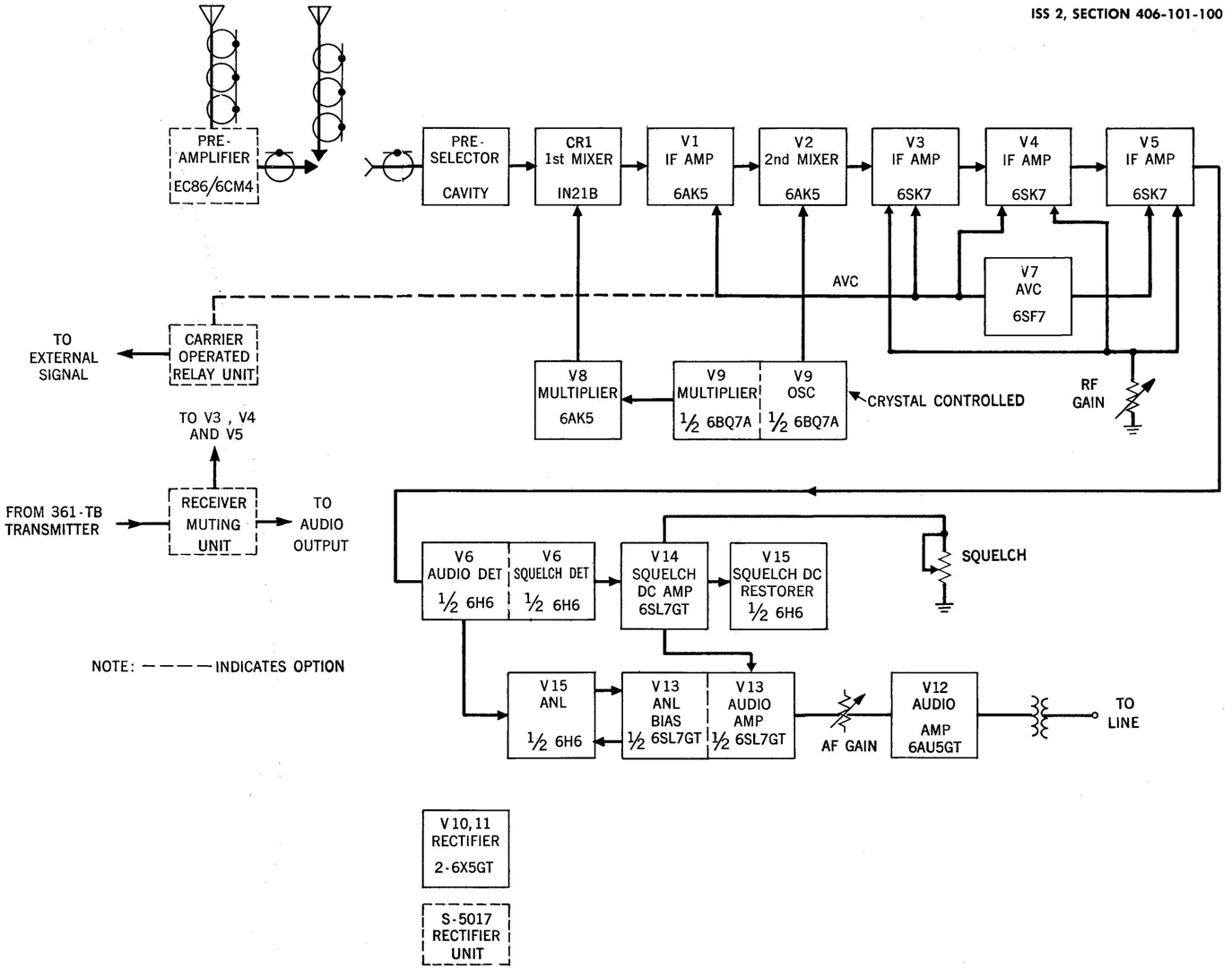


Fig. 1 – Block Diagram Erco Type 362-R Radio Receiver (including modifications and options)

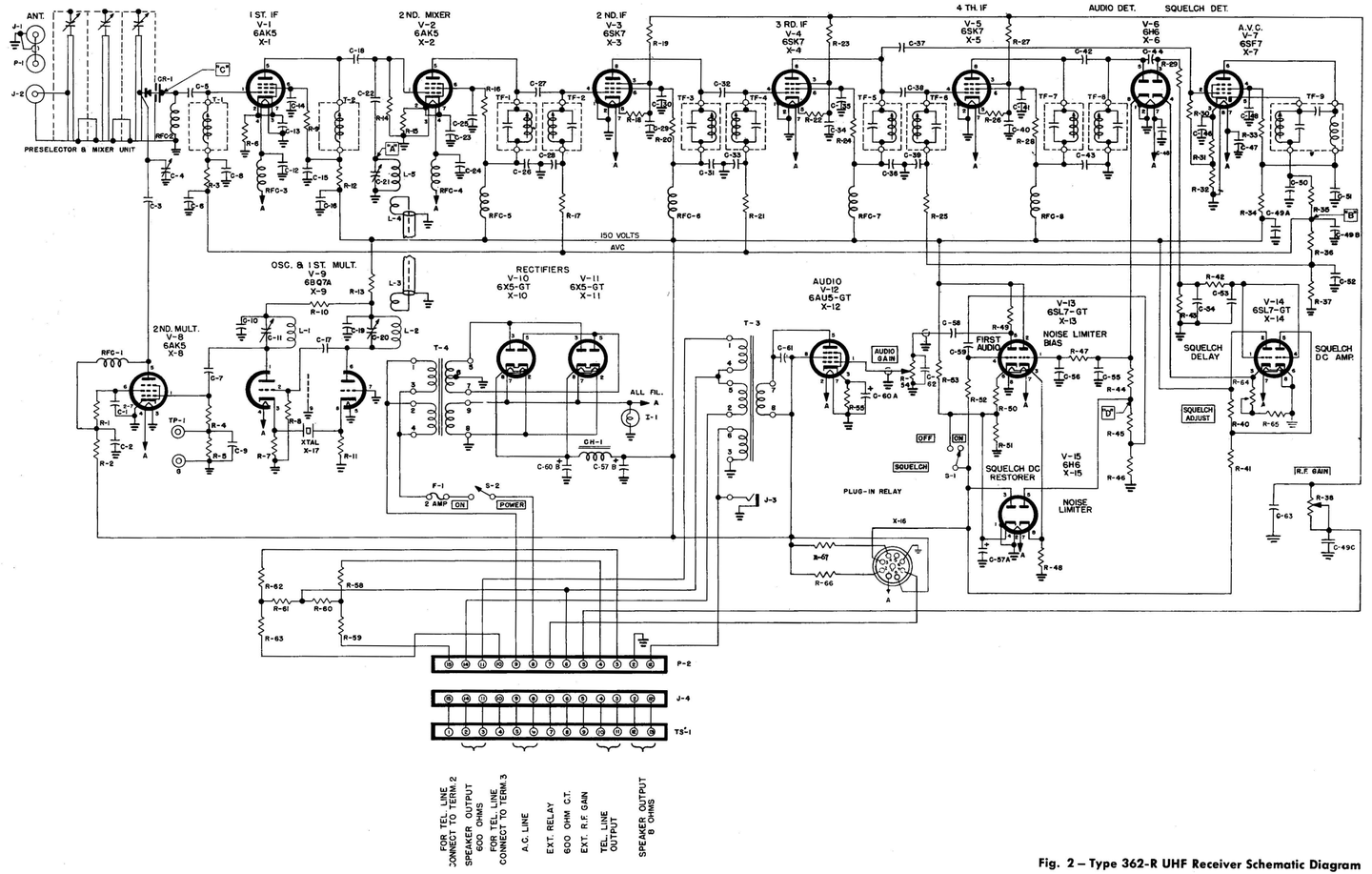


Fig. 2 – Type 362-R UHF Receiver Schematic Diagram

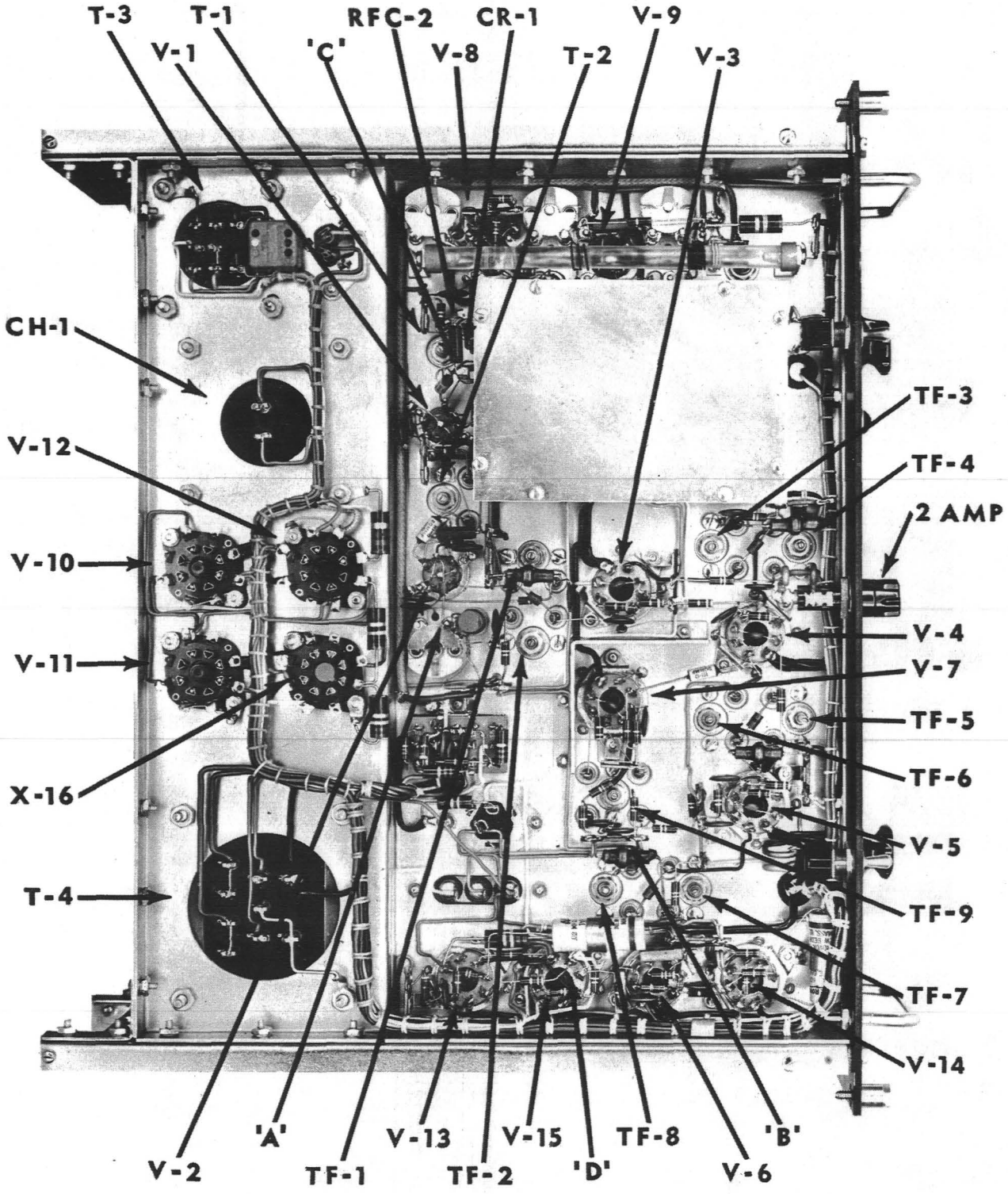


Fig. 3 – 362-R Receiver — Bottom View

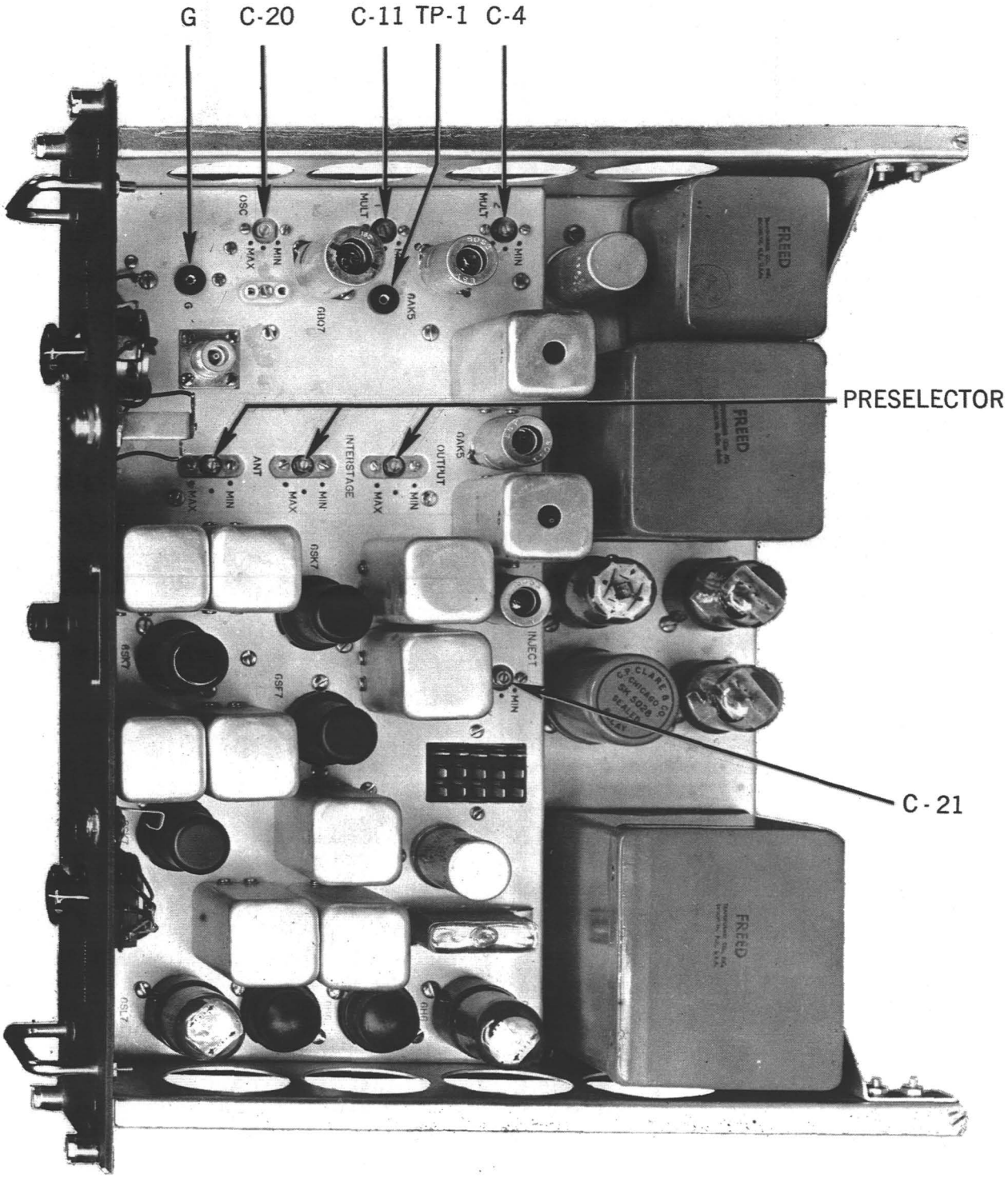


Fig. 4 – 362-R Receiver — Top View

Fig. 5 – 362-R Receiver — Front View

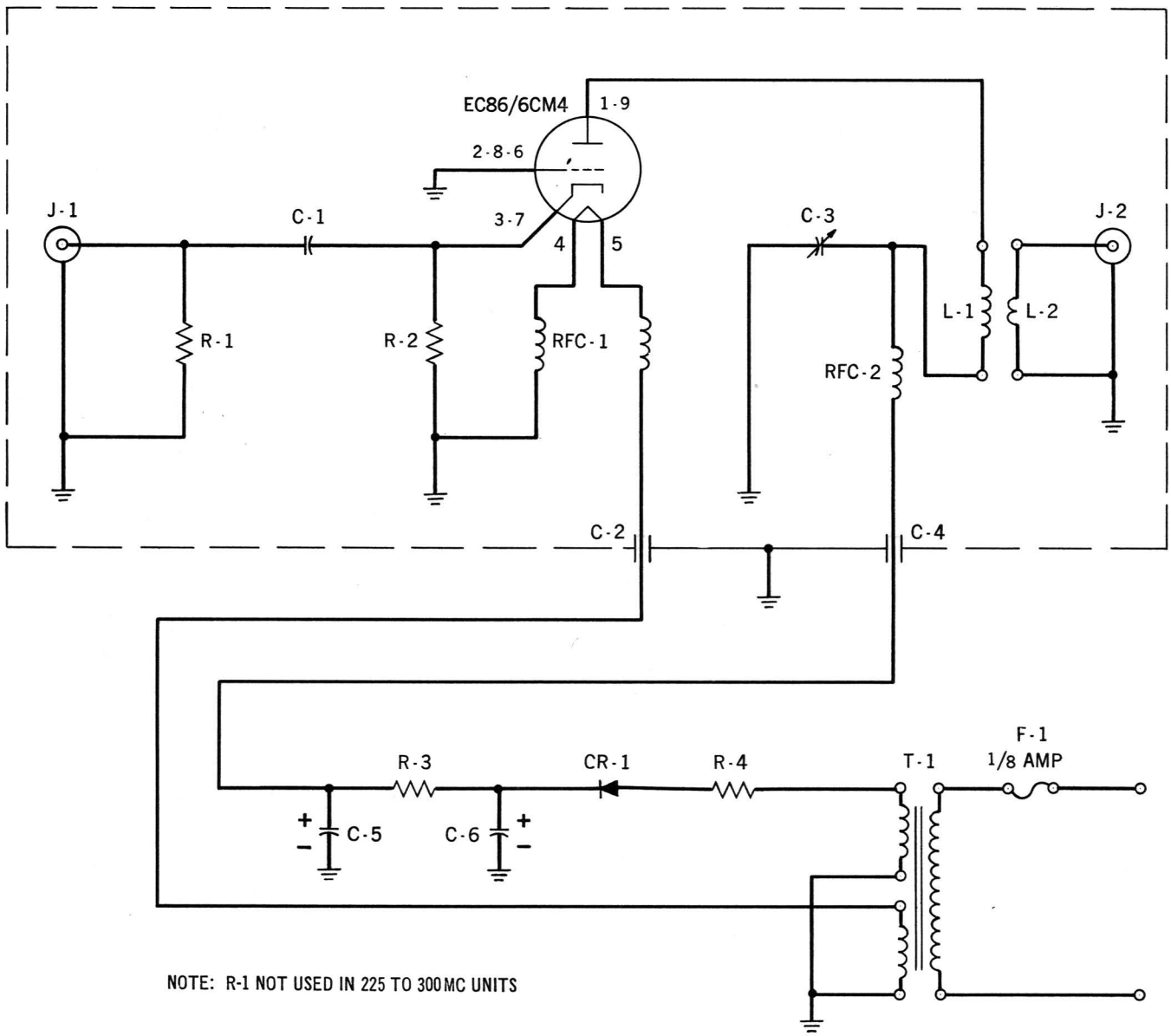


Fig. 6 – Schematic Diagram — 362-RPA Preamplifier

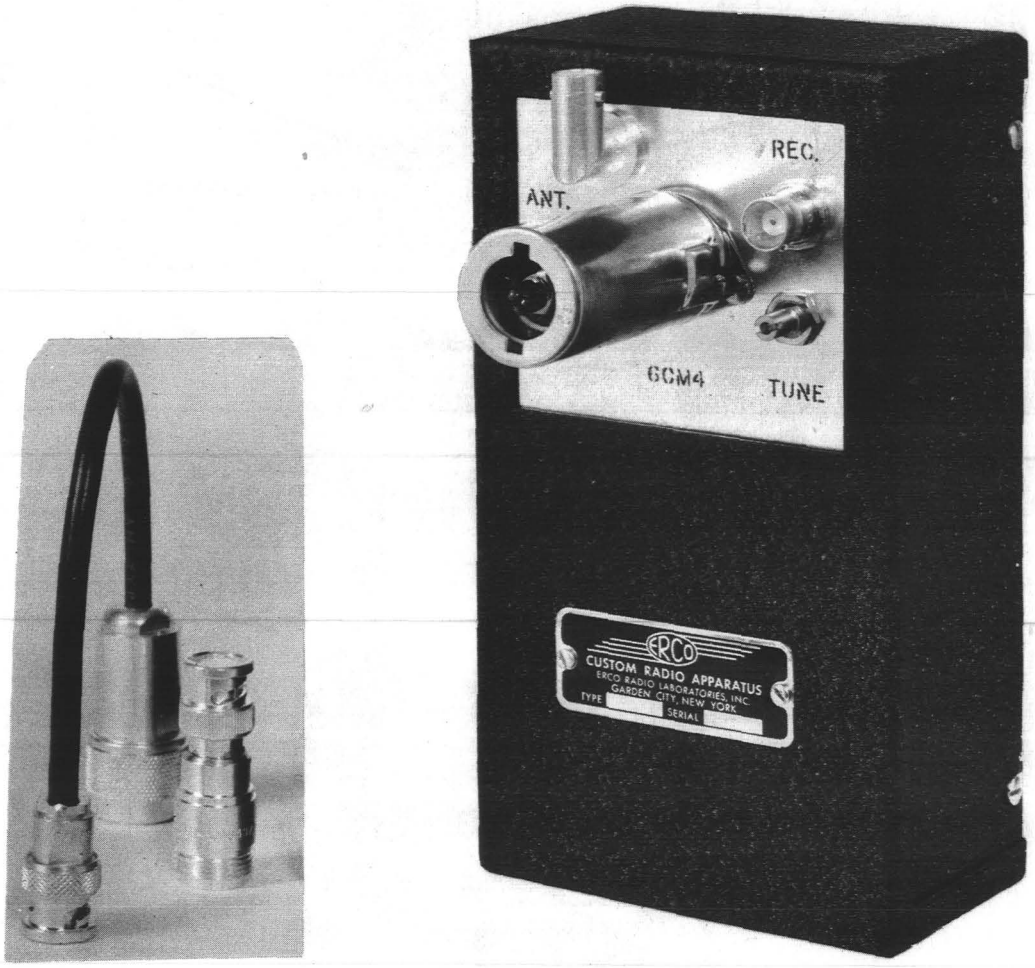
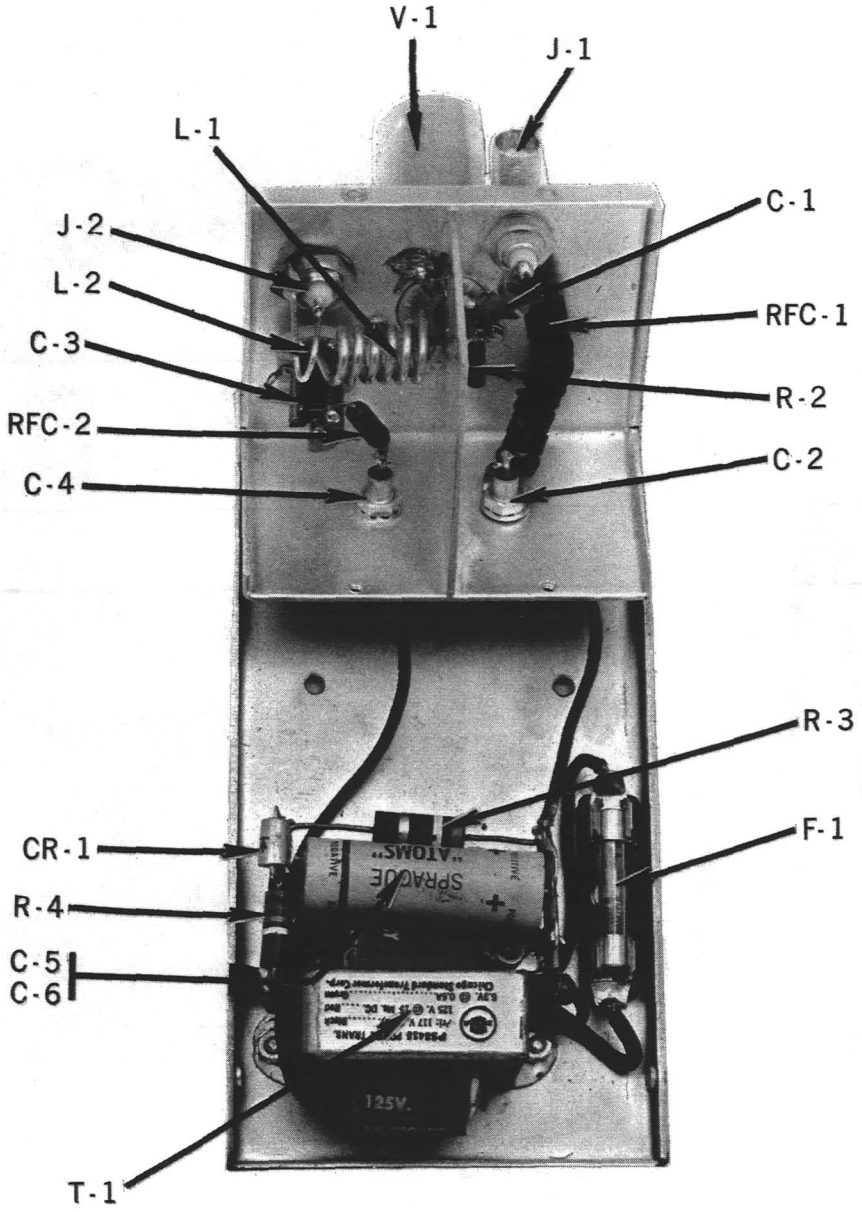


Fig. 7 – Photograph — 362-RPA Preamplifier (front view)



NOTE: R-1 NOT SHOWN

Fig. 8 – Photograph — 362-RPA Preamplifier (interior view)

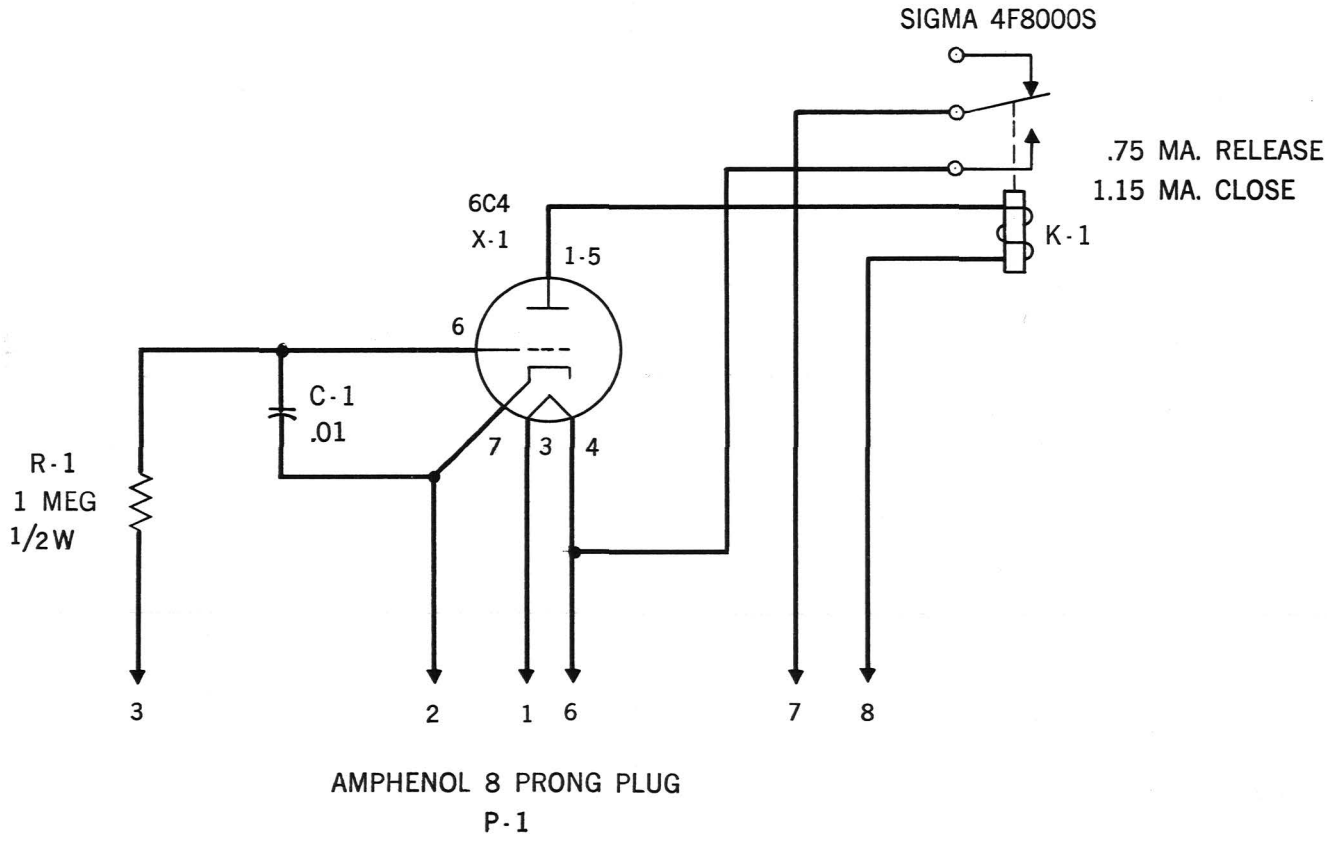


Fig. 9 – Schematic Diagram — 2016-LL Carrier Operated Relay

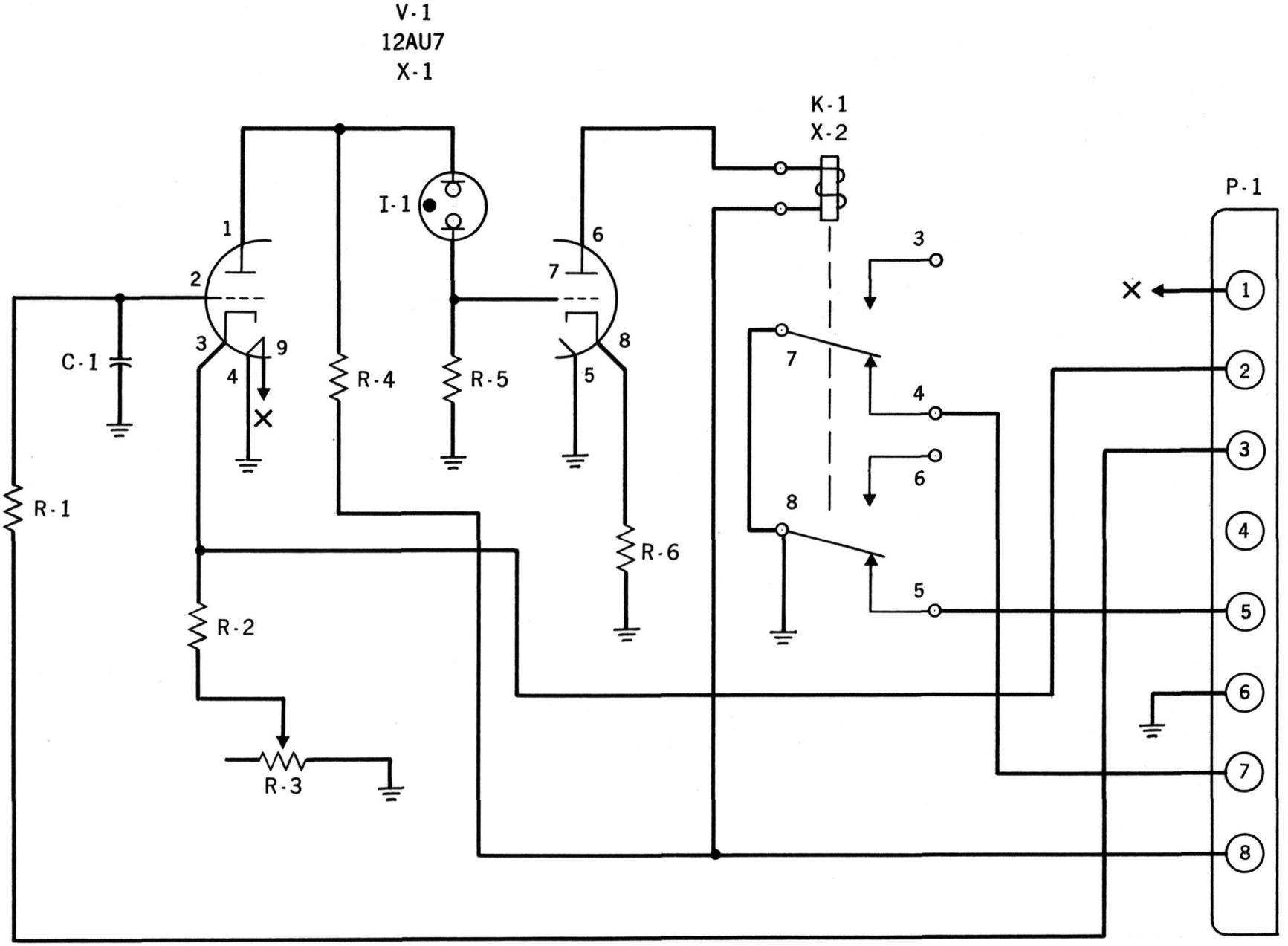


Fig. 10 – Schematic Diagram — 2016-LLM Carrier Operated Relay

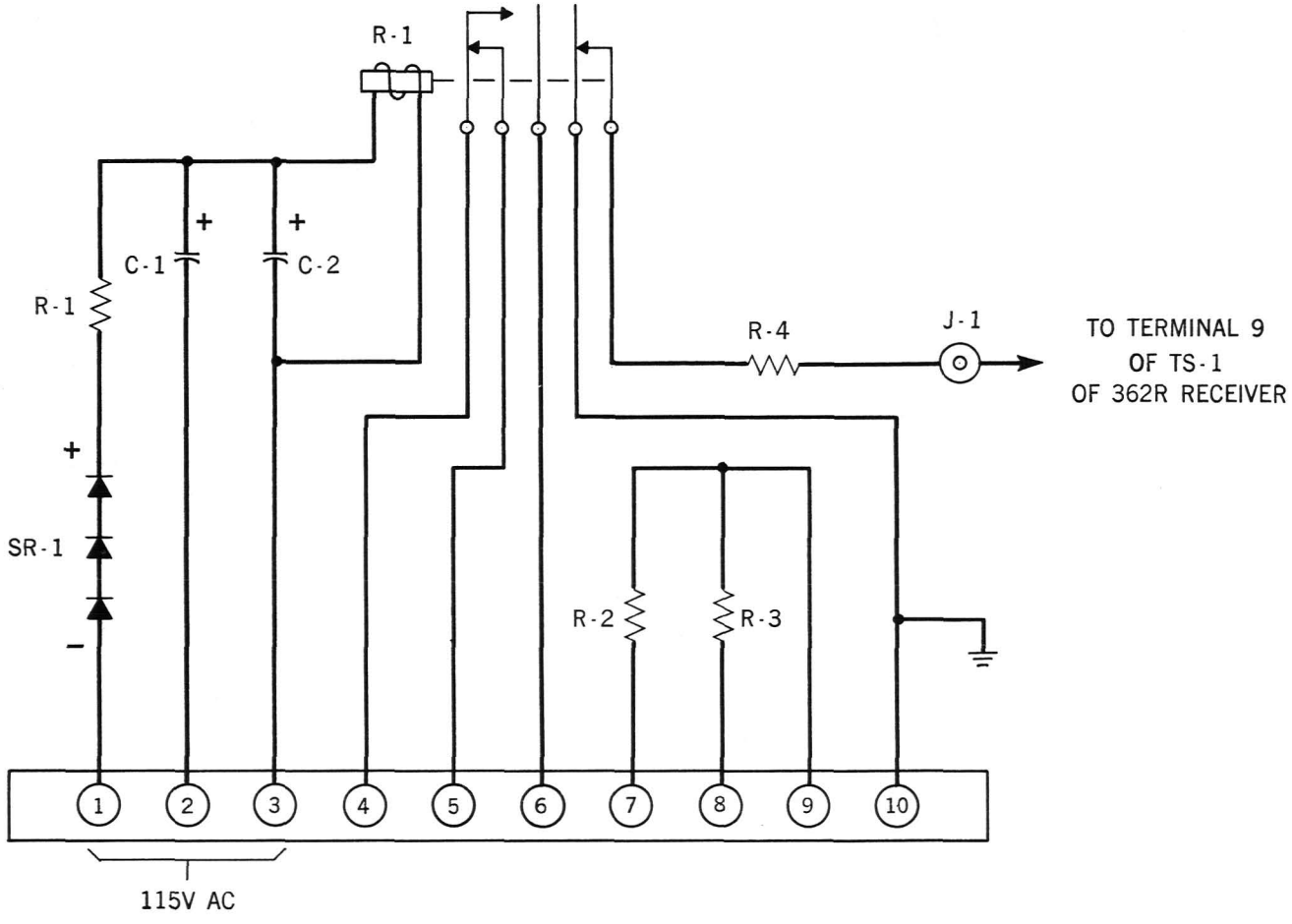


Fig. 11 – Schematic Diagram — 2026 Receiver Muting Unit

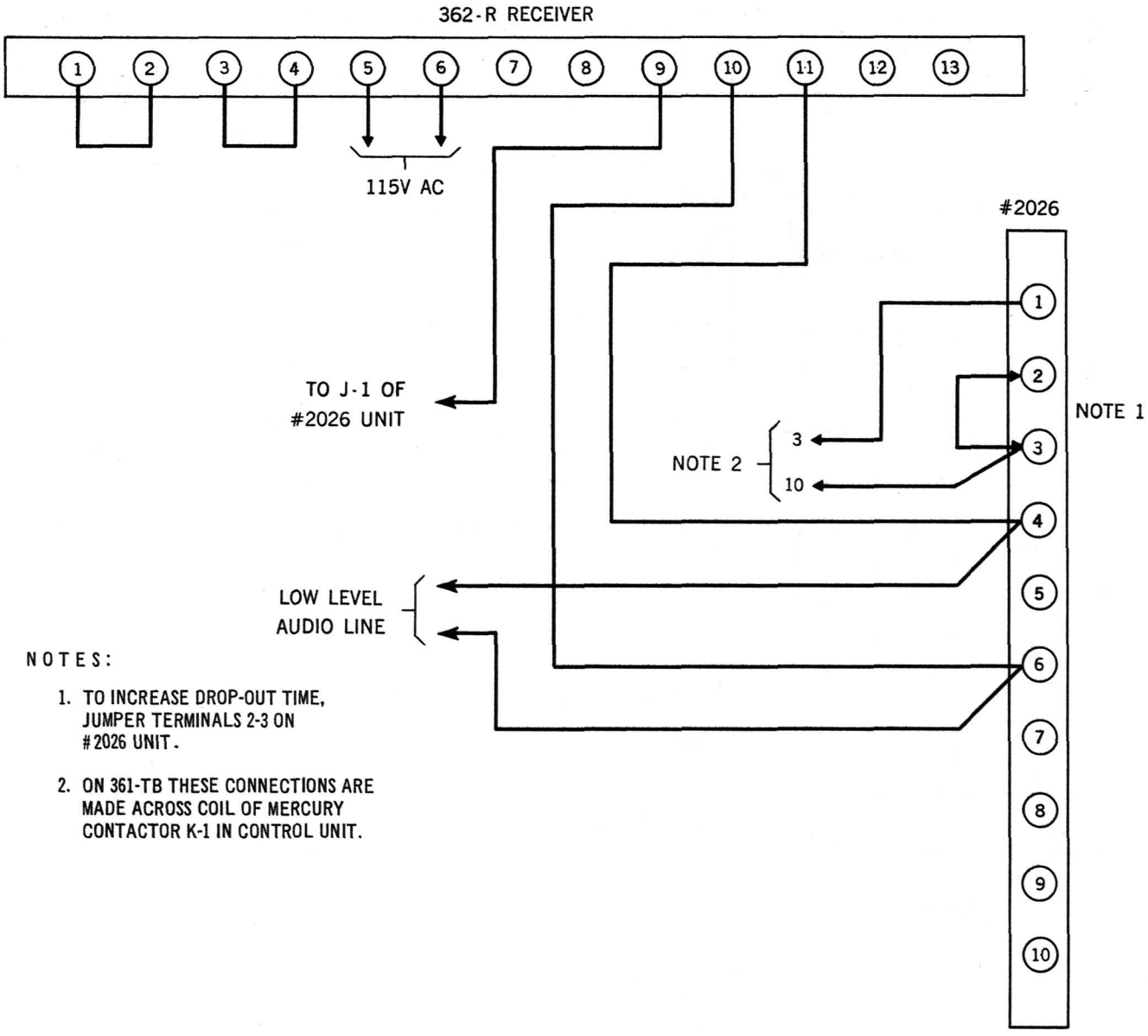


Fig. 12 – Interconnections for 2026 Receiver Muting Unit