

knight-kit®



FM MONITOR RECEIVER
KG-221A KG-220

SPECIFICATIONS

TUNING RANGE	KG-220	30-50 mc
	KG-221A	152-174 mc
BANDWIDTH		100 kc at 6 db down
SENSITIVITY		10 μ v at $\pm$ 5 kc deviation
LONG TERM OSCILLATOR STABILITY		$\pm$ 50 kc
I.F. FREQUENCY		10.7 mc
NUMBER OF TUNED I.F. STAGES		Two
SQUELCH		Variable
SQUELCH SENSITIVITY		Opens for signals as small as 5 μ v.
AUDIO OUTPUT		1 watt
SPEAKER		3" x 5" PM oval
ANTENNA IMPEDANCE		50-75 ohms
ACTIVE ELEMENTS		5 tubes, 1 transistor 8-tube performance
RECTIFIER		Silicon diode
POWER REQUIREMENTS		110-130 volts AC, 60 cycles, 30 watts

CONSTRUCTION HINTS

You are preparing to build a high quality, FM Monitor receiver. This manual covers the construction and operation of the high and low band receivers. Since the wiring involves Radio Frequency circuits, the components and wires must be positioned as illustrated. Keep all leads as short as possible.

UNPACKING

This step is important because it gives you a chance to become familiar with the parts used in your kit.

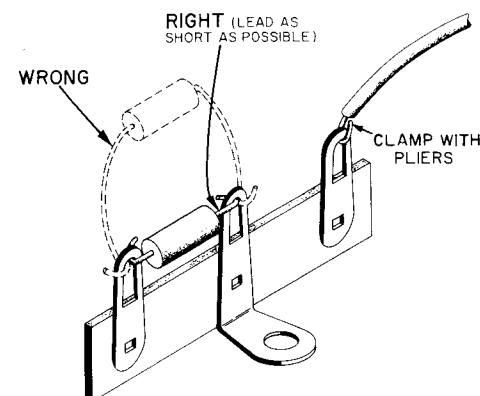
- ☐ Carefully unpack all the parts. Be especially careful with the pre-wired assembly mounted on the chassis.
- ☐ Check the contents of your kit against the PARTS LIST. If you are unable to identify some of the parts by sight, locate them on the illustrations. The controls are too large to mount on the resistor cards, so these spaces have been left vacant.
- ☐ Assort hardware by size. See the HARDWARE identification illustration on a separate sheet. A plastic ice-cube tray or muffin baking pan is very handy for keeping small parts and hardware separate. It will also prevent misplacement.

NOTE: Since hardware is weighed rather than counted, you will find you have extra screws, nuts and lockwashers. Also, we have given you extra wire in case you should need some.

WIRING HINTS

Follow the step-by-step instructions exactly. Do not attempt to wire your FM Monitor from only the schematic or pictorials.

As you wire, make good mechanical connections before soldering. Loop wires around terminals and clamp tightly with your pliers. When you mount resistors and capacitors, pull the leads through the terminals so the part is tightly mounted. Keep all leads short.



REMEMBER THE MOST IMPORTANT PART OF CONSTRUCTION IS SOLDERING.

We suggest you spend some time studying the soldering instructions and pictures on page 3 before you proceed. A completed solder connection should have a shiny metallic finish. If it is not shiny, reheat it and add a little solder.

Take your time and work slowly—we know you will enjoy building this kit and are sure you will be very pleased with the completed unit.

THIS KIT MUST BE PROPERLY SOLDERED!

USE ENOUGH HEAT

This is the main idea of good soldering. Apply enough heat to the metal surfaces you are joining to make the solder spread freely, until the contour (shape) of the connection shows under the solder.

AN ELECTRONIC UNIT WILL NOT WORK . . . unless it is properly soldered. Read these instructions carefully to understand the basic ideas of good soldering.

Enough heat must be used so the solder can actually penetrate the metal surfaces, making an unbroken path over which electricity can travel. You are not using enough heat if the solder barely melts and forms a rounded ball of rough, flaky solder.

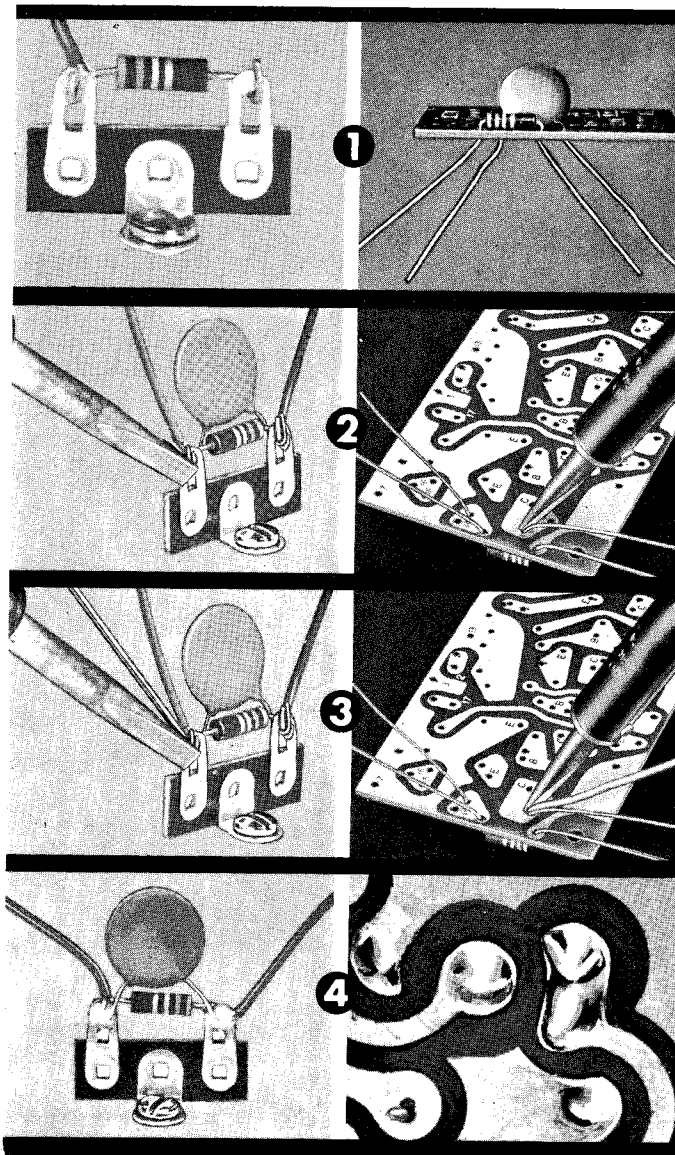
Use the Right Soldering Tool

A soldering iron in the 27-40 watt range is recommended. Any iron in this range with a clean, chisel-shaped tip will supply the correct amount of heat to make a good solder connection.

Keep the iron or gun tip brightly coated with solder. When necessary, wipe the hot tip clean with a cloth. If you are using an old tip, clean it before you start soldering.

Use Only Rosin Core Solder

We supply the right kind of solder (*rosin core solder*). Do not use any other kind of solder! Use of Acid Core Solder, Paste, or Irons Cleaned on a Sal Ammoniac Block will ruin any Electronic Unit and will Void the Guarantee.



HERE'S HOW TO DO IT . . .

1. Join bare metal to bare metal; insulation must be removed. Make good mechanical connections and keep resistor and capacitor leads as short as possible, unless otherwise specified.

2. Coat the tip of a hot iron with solder. Then **Firmly Press the Flat Side of the Tip** against the parts to be soldered together. Keep the iron there while you . . .

3. Apply the solder between the metal to be soldered and the iron tip. Use only enough solder to flow over all surfaces of the connection, and all wires in the connection. Remove the iron.

Do Not Move Parts Until the Solder Hardens. If you accidentally move the wires as the solder is hardening, apply your iron and reheat.

4. Compare your soldering with the pictures on this page. You have a good connection if your solder has flowed over all surfaces to be connected, following the shape of the surfaces. It should appear smooth and bright and all wires in the connection should be well-soldered.

You Have Not Used Enough Heat: If your connection is rough and flaky-looking, or if the solder has formed a round ball instead of spreading.

The difference between good soldering (enough heat) and poor soldering (not enough heat) is just a few extra seconds with a hot iron firmly applied. **REMEMBER, LARGER METAL SURFACES TAKE A LONGER TIME TO HEAT.**

FIRST PARTS MOUNTING ON THE BOTTOM OF THE CHASSIS

SEE FIGURE 1.

- ☐ Carefully remove the protective covering from the sub-assembly mounted on the chassis.
- ☐ Remove the three 6-32 screws, lockwashers and nuts holding the sub-assembly. Save this hardware as it will be used later to re-mount the assembly.

CAUTION: DO NOT squeeze the coils or alter the position of the wiring on the sub-assembly. If the coils or wiring is moved, the factory alignment will be upset and your receiver will not operate properly.

- ☐ Carefully lift the sub-assembly from the chassis and set it in the protective container; it will be remounted later after the wiring has been completed.
- ☐ Place the chassis in front of you as shown in Figure 1.
- ☒ Two large grommets. Press into holes A and B.
- ☒ Four small grommets. Press into holes C, D, E and F.
- ☐ Mark the tube numbers, grommet hole letters and transformer numbers on the chassis with a soft pencil or crayon. This will help you to identify terminals and tube sockets quickly later on as you wire your receiver.
- ☒ S-2, 3-terminal slide switch. Mount from the inside of the chassis so the terminals are farther away from the chassis. Fasten with two 6-32 x 1/4" screws, lockwashers and nuts.

NOTE: Lockwashers should always be placed directly under the nut, not under the screw-head.

- ☐ J-1, Phone jack. Place a 3/8" internal tooth lockwasher over the bushing; then install in the chassis and secure with a 3/8" nut. Position the jack terminals as shown.
- ☒ TR-1, 3-pin transistor socket. This socket can be mounted either way. Fasten with two 2-56 x 1/4" screws and nuts. Ignore any other markings that may appear on the socket.
- ☒ TS-1, 11-terminal strip and #8 solder lug. Mount with two 6-32 x 1/4" screws, lockwashers and nuts. At the end near grommet A, place a solder lug under the lockwasher before fastening with the nut.
- ☐ TS-2, 3-terminal strip. Mount with a 6-32 x 1/4" screw, lockwasher and nut.

- ☒ TS-3, 1-terminal vertical strip. Mount with a 6-32 x 1/4" screw, lockwasher and nut.
- ☐ V-5, 7-pin tube socket without center pin. Be sure to position the the socket so the keyway is as shown. Mount with two 4-40 x 1/4" screws, lockwashers and nuts.
- ☒ V-4, 9-pin tube socket. Position the socket so the keyway is as shown. Mount with two 4-40 x 1/4" screws, lockwashers and nuts.
- ☐ V-3, 7-pin tube socket with center pin. Position the socket so the keyway is as shown. Mount with two 4-40 x 1/4" screws, lockwashers and nuts.
- ☐ V-2, 7-pin tube socket with center pin. Position the socket so the keyway is as shown. Mount with two 4-40 x 1/4" screws, lockwashers and nuts.
- ☒ T-3, I.F. transformer with five terminals. Mount the transformer so the side with three terminals is positioned as shown. Fasten with a "U" shaped clip as shown in figure 2.

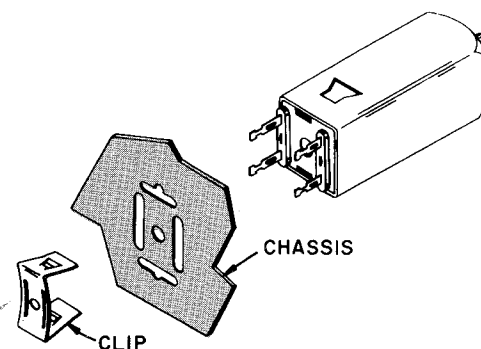


FIGURE 2.

- ☐ T-2, I.F. transformer with four terminals. Position the color dot as shown. Mount with a "U" clip as above.
- ☒ Two clip nuts. Snap over the holes in the side of the chassis—with the raised edge of the clip facing in toward the chassis.
- ☒ Bend the ground lugs on each tube socket away from the socket pins. Also, bend the tube socket pins slightly outward to provide more spacing between pins.
- ☒ Before going on, check to be sure that each screw is tightened securely. This is important because many of the screws provide a mechanical and electrical connection for the ground circuits when the wiring is added.

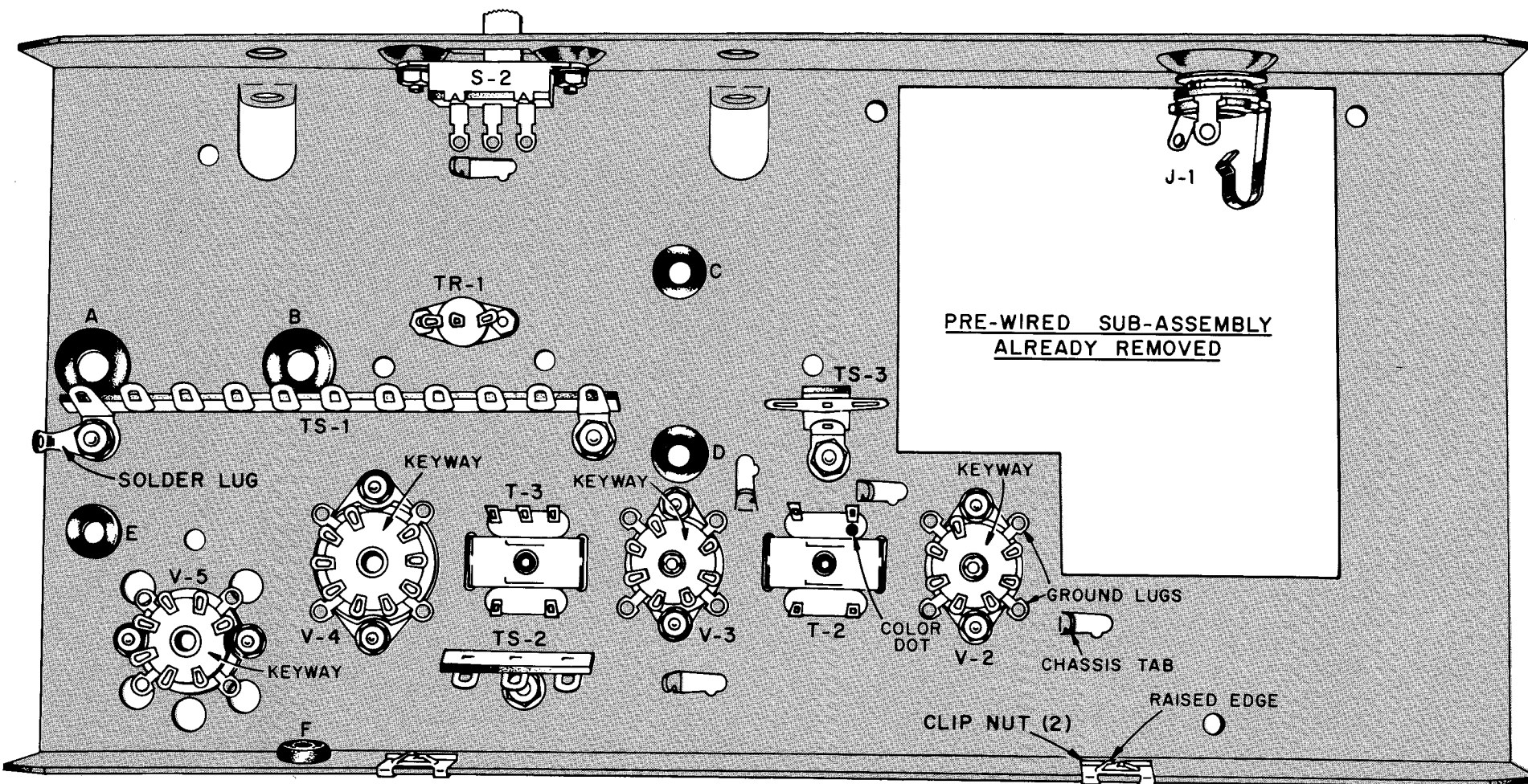


FIGURE 1. FIRST PARTS MOUNTING ON THE BOTTOM OF THE CHASSIS

PARTS MOUNTING AND WIRING ON THE TOP OF THE CHASSIS

SEE FIGURE 3.

- ☒ Turn the chassis over and position it as shown.
- ☒ Mount the remaining grommets and two eyelets in the speaker mounting tabs as shown in Figure 4.
- ☒ Transistor label. Remove the protective backing from the label. Carefully mount the label to the chassis as shown in Figure 3.
- ☒ Speaker. Be careful when handling the speaker so as not to puncture the black paper cone. Mount on the chassis as shown in Figure 4. Fasten with two 6-32 x 7/16" screws, lockwashers and nuts.
- ☒ Pilot lamp window. Peel the clear plastic from its backing being careful not to remove the center portion as shown in Detail. Affix to the inside of the front panel so the center portion is over the pilot lamp hole.
- ☒ Front panel. Position the panel for mounting to the front of the chassis. Fasten with a 3/8" dress nut over the "PHONES" jack.

NOTE: Be very careful so you do not bend the panel when the other components are being mounted.

- ☒ #47 pilot lamp. Install in socket I-1.
- ☒ I-1, pilot lamp socket. Mount as shown. Fasten with a 6-32 x 1/4" screw, lockwasher and nut. Be careful so your screwdriver does not slip and scratch the front of the panel.
- ☐ Move terminal 1 of I-1 so it is positioned as shown.
- ☒ T-4 audio transformer and #6 internal tooth solder lug. Position T-4 so the side with the red and blue leads is facing grommet D. Insert the red lead through grommet D and the blue lead through grommet E. From the length of small tubing supplied, cut a 3 1/4" piece and slip over one of the bare leads. Insert this lead through grommet C. Mount T-4 and the solder lug as shown with two 6-32 x 1/4" screws, lockwashers and nuts.
- ☐ T-5 power transformer. Position T-5 so the side with one green/white and two green leads is facing the edge of the chassis. Insert these leads through the grommet at the edge of the chassis. Insert the red and black leads through the grommet near TR-1 socket. Fasten with two 6-32 x 1/4" screws, lockwashers and nuts.

IMPORTANT INSTRUCTIONS

THE INSTRUCTION CONNECT MEANS: Connect the wire or lead to the given point. Make a firm mechanical connection BUT DO NOT SOLDER AT THIS TIME. Later another wire(s) will be connected to this point.

THE INSTRUCTION SOLDER MEANS: Connect the wire or lead to the given point and then solder the connection and all wires in it. If there is more than one wire in the connection, the number will be stated—for example (2 wires). After soldering a connection, trim all wire ends as close as possible to the terminal.

You are about to start the most important part of your construction—SOLDERING. Carefully study the pictures and instructions given on page 3 before you go on. Take your time and be sure each solder connection is well made.

Also, IT IS EXTREMELY IMPORTANT THAT YOU:

1. Route all wires exactly as shown.
2. Keep all leads and wires as short as possible.
3. Position all resistors and capacitors as shown.

If these three important rules are not followed, your receiver will not operate as efficiently as it is designed to operate.

- ☒ Brown wire. Solder one end to I-1 pilot lamp socket. Insert the other end through grommet C; it will be connected later.
- ☒ Blue wire. Solder one end to terminal 1 of the speaker. Insert the other end through grommet C.
- ☒ 2 1/2" bare wire. Cut from the length of bare wire supplied. Solder one end to terminal 2 of the speaker. Connect the other end to the solder lug.

NOTE: In most cases we are specifying excess lengths of bare wire for ease of handling. After the wire is in, clip off excess wire ends.

- ☒ Bare wire lead from audio transformer T-4. Solder to the solder lug (2 wires).
- ☐ Now is a good time to take a rest. You will enjoy building your kit even more if you are not tired.

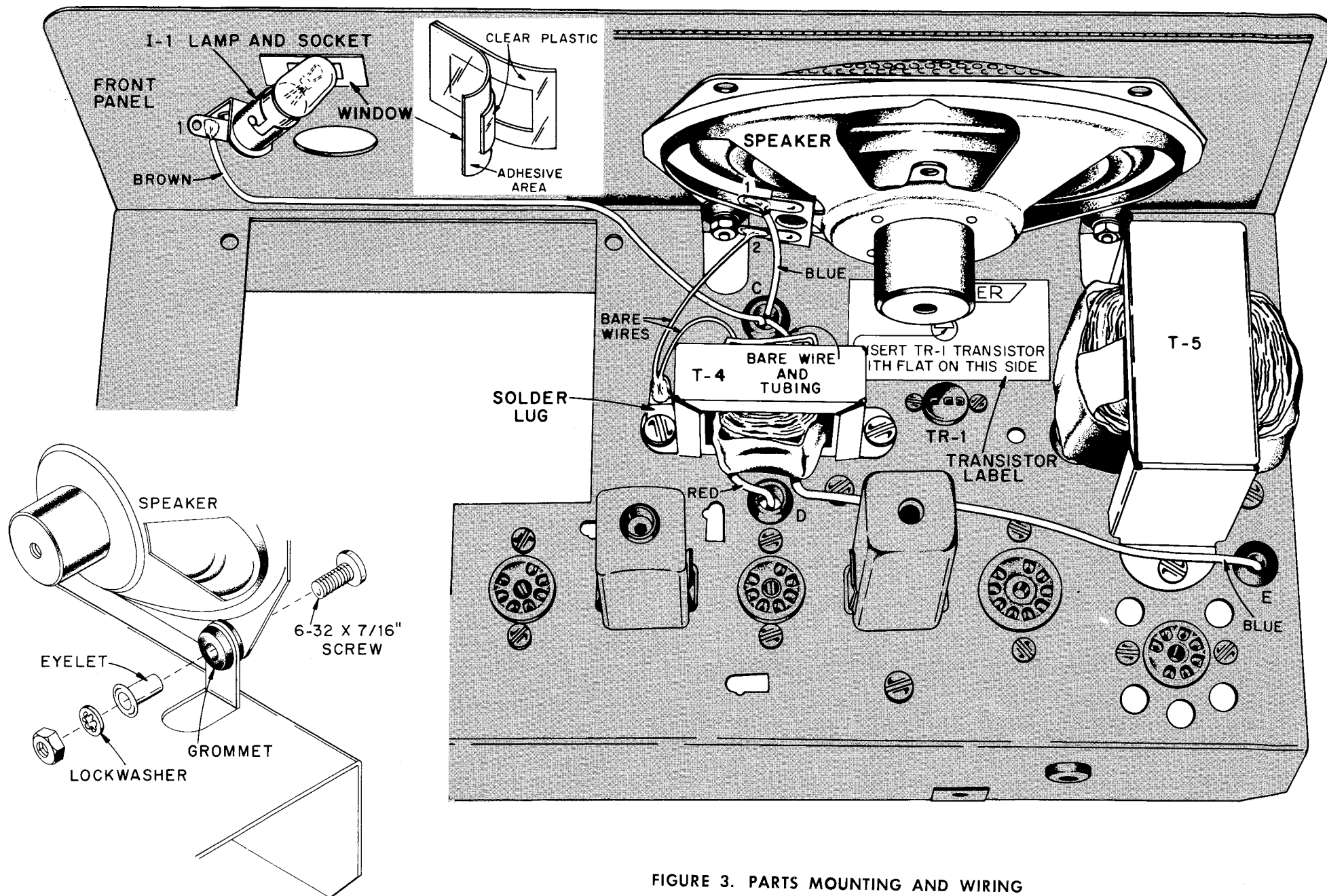


FIGURE 3. PARTS MOUNTING AND WIRING

FIGURE 4.

FIRST WIRING ON THE BOTTOM OF THE CHASSIS

SEE FIGURE 5.

- ☐ Turn the chassis over and position it as shown in Figure 5.
- ☐ R-12, 50K control. Place a $\frac{3}{8}$ " lockwasher over the shaft of the control and mount it to the chassis. Fasten with a $\frac{3}{8}$ " flat washer and nut. Position the terminals as shown.
- ☐ R-9, 1 meg control. Place a $\frac{3}{8}$ " lockwasher over the shaft. Position the terminals as shown. Mount to the chassis as in the previous step.
- ☐ Orange wire. Solder one end to terminal 2 of R-12. Connect the other end to pin B of TR-1.
- ☐ Blue wire coming up through grommet C. Solder to terminal 1 of S-2.
- ☐ Bare wire with tubing coming up through grommet C. Solder to terminal 2 of S-2.
- ☐ Brown wire coming up through grommet C. Connect to terminal 7 of TS-1.
- ☐ Short green lead coming up through grommet A. Connect to terminal 1 of TS-1.
- ☐ Long green lead coming up through grommet A. Connect to pin 3 of V-5.
- ☐ Green/white lead coming up through grommet A. Connect to terminal 7 of TS-1.
- ☐ Long black lead coming up through grommet B. Connect to terminal 1 of TS-2.
- ☐ Short black lead coming up through grommet B. Solder to terminal 1 of S-1.
- ☐ Either red lead coming up through grommet B. Connect to terminal 1 of TS-1.

- ☐ Remaining red lead coming up through grommet B. Connect to terminal 2 of TS-1.
- ☐ Green wire. Connect one end to pin C of TR-1. Connect the other end to pin 3 of V-4. Ignore any other markings which may appear on TR-1 socket.
- ☐ Orange wire. Solder one end to pin E of TR-1. Connect the other end to the chassis tab near S-2.

NOTE: BE SURE to make good mechanical connections when wiring to the chassis tabs. These tabs provide grounds for the circuits and MUST be wired correctly.

- ☐ Blue lead coming up through grommet E. Connect to pin 5 of V-5.
- ☐ Blue wire. Solder one end to pin 3 of V-5 (2 wires). Connect the other end to pin 3 of V-3.
- ☐ Orange wire. Solder one end to pin 4 of V-5. Connect the other end to terminal 7 of TS-1.
- ☐ Red wire. Connect one end to pin 6 of V-5. Connect the other end to terminal 3 of TS-1.
- ☐ Blue wire. Connect one end to pin 6 of V-5. Connect the other end to terminal 1 of TS-3.
- ☐ Orange wire. Solder one end to pin 3 of V-3 (2 wires). Connect the other end to pin 4 of V-2.
- ☐ Red lead coming up through grommet D. Connect to terminal 5 of TS-1.
- ☐ Go back and check your work, step by step. Compare your wiring of the chassis with the illustration to be sure that your wiring is correct. Carefully inspect all soldered terminals to be sure that solder has flowed over all wires in the terminal.

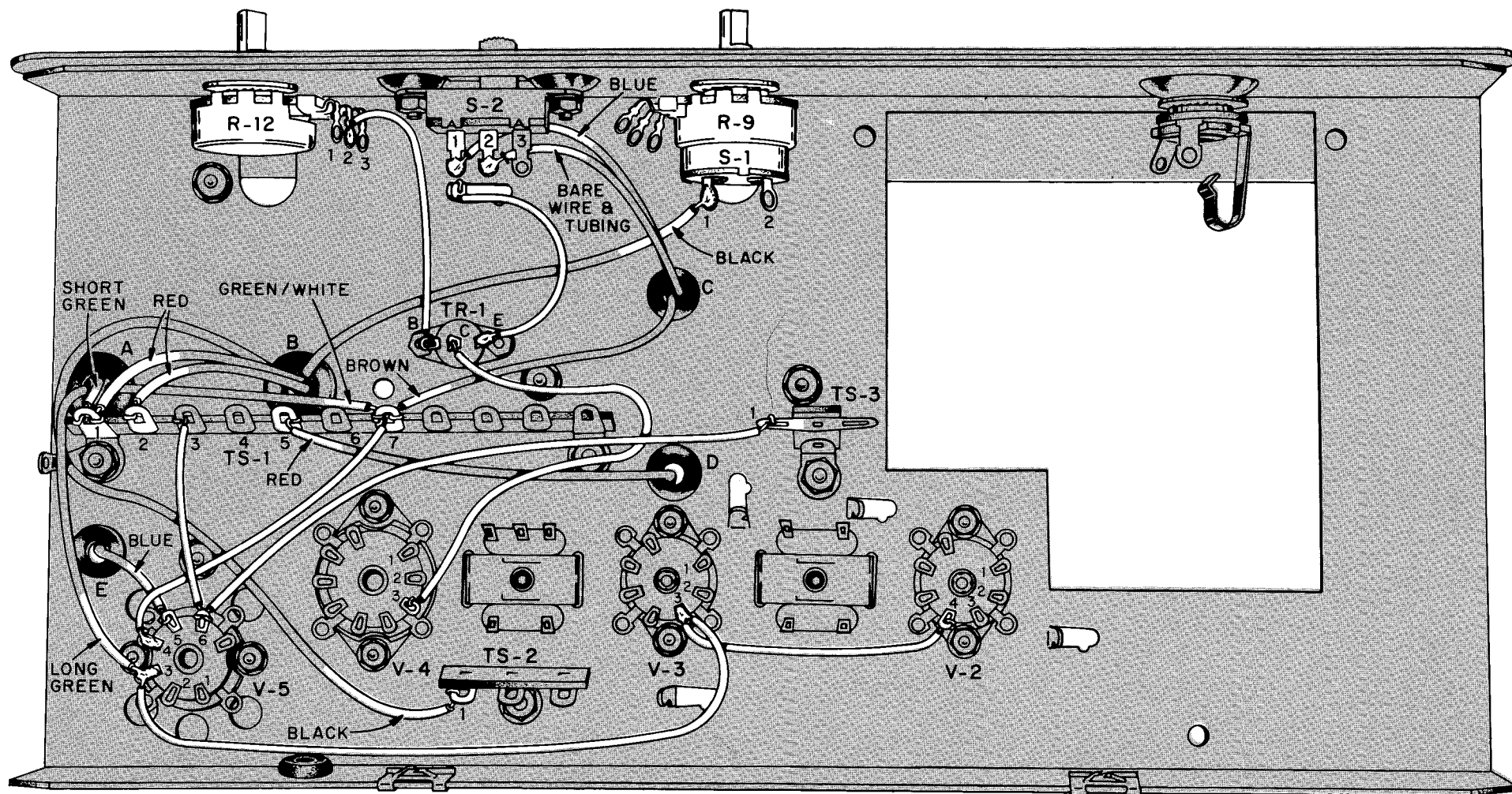


FIGURE 5. FIRST WIRING ON THE BOTTOM OF THE CHASSIS

SECOND WIRING ON THE BOTTOM OF THE CHASSIS

SEE FIGURE 6.

- ☐ Is your soldering iron tip clean? Remember to wipe it clean frequently.

NOTE: Previous wiring has been purposely left out for clarity.

- ☒ Prepare the red and gray shielded cables as shown in Figure 7. With your cutters, remove the spiral shield at one end of each cable.

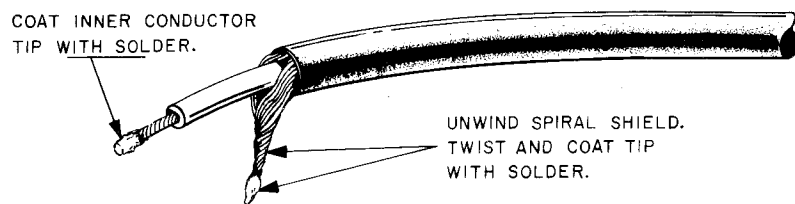


FIGURE 7.

- ☒ Gray shielded cable. At one end, connect the shield to terminal 1 of R-12. Solder the inner conductor to terminal 3 of R-12. At the other end, slip a 1/2" length of large tubing over the inner conductor and connect to terminal 9 of TS-1.
- ☒ Red shielded cable. At one end connect the shield to terminal 3 of R-9. Solder the inner conductor to terminal 2 of R-9. At the other end slip a 1/2" length of large tubing over the inner conductor and connect to terminal 8 of TS-1.
- ☐ 2" bare wire. Solder one end to terminal 1 of R-12. (2 wires). Connect the other end to the chassis tab.
- ☒ 2" bare wire. Solder one end to terminal 3 of R-9 (2 wires). Connect the other end to the chassis tab.
- ☒ CR-1 diode. Notice that one end is marked with a band, or by its bullet shape. This diode must be wired in the circuit with the marked end as shown. Slip 3/4" of tubing over each lead. Connect the lead from the marked end to terminal 5 of TS-1. Solder the other lead to terminal 2 of TS-1 (2 wires).
- ☒ R-14, 4,700Ω resistor banded with yellow, violet, and red stripes. Solder one lead to ground lug D of V-4. Connect the other lead to terminal 6 of TS-1.

NOTE: The fourth color band on the resistors will not be noted unless it is gold, which indicates a 5% tolerance resistor.

- ☒ 1 1/4" bare wire and 3/4" of tubing. Slip the tubing over the wire and solder one end to pin 9 of V-4. Solder the other end to terminal 7 of TS-1 (4 wires).

- ☒ R-23, 330Ω resistor (orange, orange, brown). Slip a 1/2" length of tubing over one lead and connect to pin 2 of V-5. Connect the other lead to ground lug C of V-5.

IMPORTANT! ELECTROLYTIC CAPACITORS must be mounted correctly, with the + end positioned as illustrated or the receiver will not work.

- ☒ C-14, 2 μf (or mfd) electrolytic capacitor. Slip 1/2" of tubing over the (+) positive lead. Solder this lead to pin 2 of V-5 (2 wires). Connect the other lead to ground lug C of V-5.

NOTE: When soldering, be careful so you do not burn the insulation off of nearby wires.

- ☒ C-15, .01 μf disc capacitor. Solder one end to ground lug C of V-5 (3 wires). Solder the other lead to pin 5 of V-5 (2 wires).

- ☒ 1" bare wire. Thread through pin 5 of V-4, through pin 4 of V-4 and solder to ground lug B. Solder pins 4 and 5.

- ☒ R-11, 27K resistor (red, violet, orange). Slip 3/4" length of tubing over one lead and connect to terminal 4 of T-3. Solder the other lead to terminal 9 of TS-1 (2 wires).

- ☒ 1 1/4" bare wire. Solder one end to terminal 4 of T-3 (2 wires). Connect the other end to terminal 3 of TS-2.

- ☒ C-18, .001 μf disc capacitor (May be marked 1000). Solder one lead to terminal 11 of TS-1. Connect the other lead to terminal 1 of TS-3.

- ☒ 1" bare wire. Solder one end to terminal 3 of T-3. Connect the other end to pin 6 of V-3.

- ☒ 1" bare wire. Solder one end to terminal 5 of T-3. Solder the other end to pin 5 of V-3.

- ☒ 1 1/2" bare wire. Thread one end through pin 4 of V-3, through the center pin, and connect to the chassis tab. Solder the center pin and pin 4. Do not solder the chassis tab.

- ☒ 1 1/4" bare wire. Slip 1/2" of tubing over the wire and connect one end to pin 2 of V-3. Connect the other end to the chassis tab.

- ☐ One last check before you turn the page—is capacitor C-14 and Diode CR-1 wired in place correctly? Are the marked ends positioned as shown.

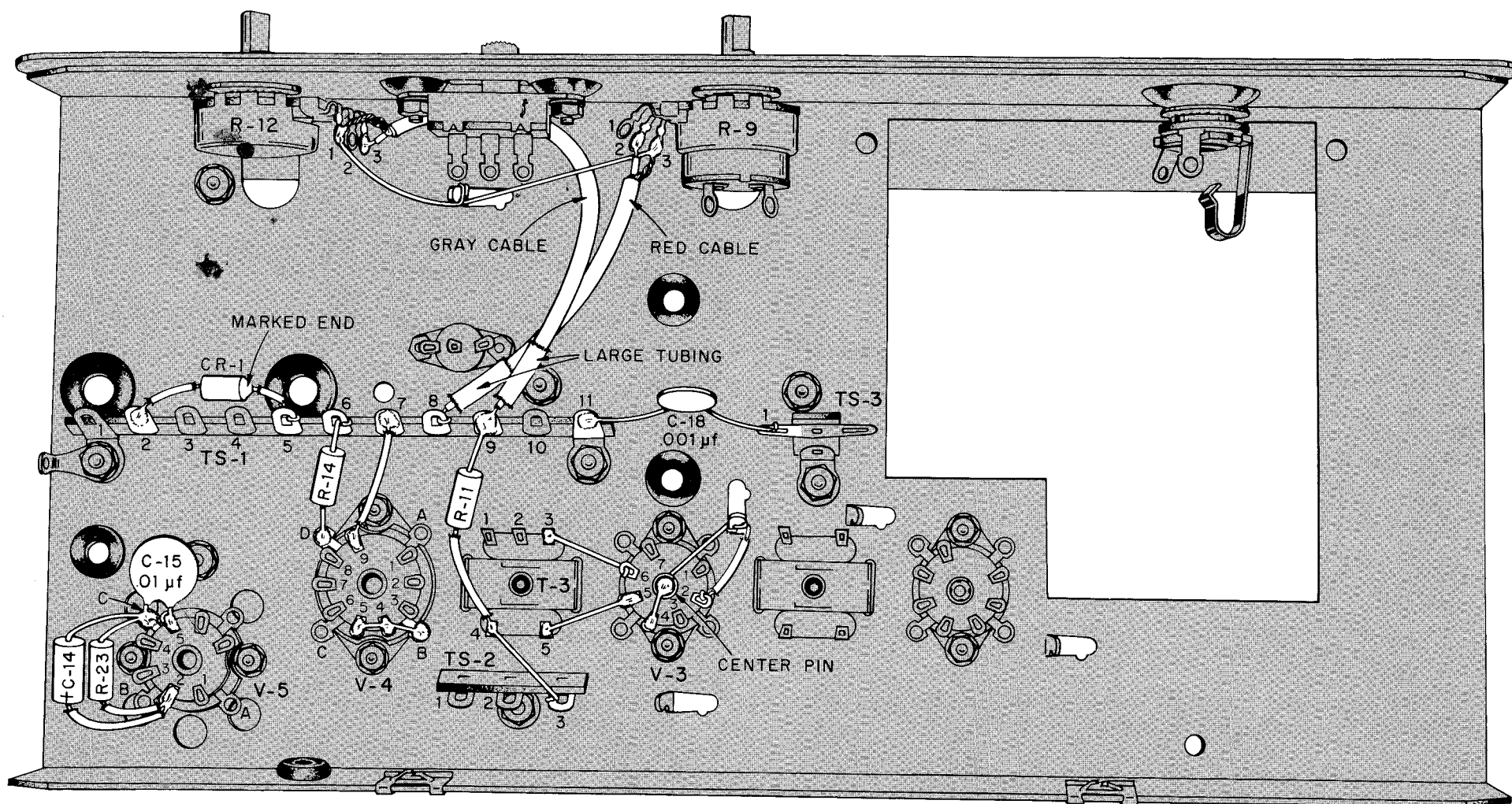


FIGURE 6. SECOND WIRING ON THE BOTTOM OF THE CHASSIS

THIRD WIRING ON THE BOTTOM OF THE CHASSIS

SEE FIGURE 8.

- ☒ C-7, .001 μ f disc capacitor (May be marked 1000). Slip $\frac{3}{4}$ " of tubing over one lead and connect to terminal 1 of R-9. Solder the other lead to the chassis tab (4 wires).

NOTE: BE SURE to use plenty of heat when soldering the chassis tabs. Make sure solder flows over all of the wires in the connection.

- ☒ R-17, 4700 Ω resistor (yellow, violet, red). Connect one lead to terminal 3 of TS-1. Connect the other lead to terminal 4 of TS-1.
- ☒ R-16, 47K resistor (yellow, violet, orange). Connect one lead to terminal 4 of TS-1. Connect the other lead to terminal 6 of TS-1.
- ☒ R-18, 220K resistor (red, red, yellow). Slip $\frac{3}{4}$ " of tubing over one lead and connect to pin 1 of V-4. Connect the other lead to terminal 4 of TS-1.
- ☒ R-20, 15K resistor (brown, green, orange). Connect one lead to ground lug D of V-5. Connect the other lead to pin 8 of V-4.
- ☒ C-33, .22 μ f mylar capacitor. Solder one lead to pin 8 of V-4 (2 wires). Connect the other lead to ground lug D of V-5.
- ☒ R-19, 2.2 meg resistor (red, red, green). Solder one lead to ground lug D of V-5 (3 wires). Connect the other lead to pin 7 of V-4.
- ☒ R-22, 470K resistor (yellow, violet, yellow). Solder one lead to pin 1 of V-5. Solder the other lead to ground lug C of V-4.
- ☒ R-10, 10 meg resistor (brown, black, blue). Connect one lead to pin 2 of V-4. Connect the other lead to terminal 2 of TS-2.
- ☒ C-6, 100 μ f disc capacitor. Connect one lead to terminal 10 of TS-1. Connect the other lead to terminal 1 of T-3.
- ☒ 1 $\frac{1}{2}$ " bare wire. Slip 1" of tubing over the wire and solder one end to terminal 2 of TS-2 (2 wires). Solder the other end to terminal 1 of T-3 (2 wires).
- ☒ R-6, 82 Ω resistor (gray, red, black). Connect one lead to terminal 10 of TS-1. Solder the other lead to terminal 2 of T-3.
- ☒ R-8, 47K resistor (yellow, violet, orange). Connect one lead to terminal 3 of TS-2. Connect the other lead to the chassis tab.

- ☒ C-8, .001 μ f disc capacitor (May be marked 1000). Connect one lead to terminal 3 of TS-2. Connect the other lead to the chassis tab.
- ☒ Are you keeping the leads of resistors and capacitors short? They should be!
- ☒ C-4, 3300 μ f disc capacitor. (May be marked .0033). Connect one lead to pin 7 of V-3. Connect the other lead to the chassis tab. Position the capacitor down near the chassis.
- ☒ R-4, 82 Ω resistor (gray, red, black). Solder one lead to pin 7 of V-3 (2 wires). Solder the other lead to the chassis tab (4 wires).
- ☒ 1" bare wire. Solder one end to terminal 2 of T-2. Connect the other end to pin 6 of V-2.
- ☒ 1" bare wire. Slip $\frac{1}{2}$ " of tubing over the wire and solder one end to pin 1 of V-3. Solder the other end to terminal 1 of T-2.
- ☒ 1" bare wire. Solder one end to terminal 3 of T-2. Connect the other end to pin 2 of V-3.
- ☒ 1" bare wire. Solder one end to pin 5 of V-2. Solder the other end to terminal 4 of T-2.
- ☒ C-3, 3300 μ f disc capacitor. (May be marked .0033). Connect one lead to the chassis tab. Connect the other lead to pin 6 of V-2. Position the capacitor down near the chassis.
- ☒ R-2, 82 Ω resistor (gray, red, black). Solder one lead to the chassis tab (2 wires). Connect the other lead to pin 7 of V-2.
- ☐ Is the tip of your soldering iron clean? Remember to keep it clean and brightly coated with solder. See page 3 for instructions on keeping your soldering iron clean.
- ☒ C-16, 220 μ f disc capacitor. Connect one lead to pin 4 of V-2. Connect the other lead to the chassis tab.
- ☒ 1 $\frac{1}{4}$ " bare wire. Thread one end through the center pin, through pin 3 of V-2 and connect to the chassis tab. Solder pin 3. Do not solder the center pin or the chassis tab.
- ☐ You have now completed the Third wiring sequence on the bottom of the chassis. Now sit back, relax and take a little rest.

FOURTH WIRING ON THE BOTTOM OF THE CHASSIS

SEE FIGURE 9.

- ☐ C-17, three section electrolytic capacitor. Mount on the chassis with a 6-32 x 1/4" screw, lockwasher and nut.

Electrolytic capacitor C-17 will be connected in the following steps.

- ☒ Red lead. Connect to terminal 5 of TS-1.
- ☒ Green lead. Solder to terminal 4 of TS-1 (4 wires).
- ☒ Yellow lead. Connect to terminal 3 of TS-1.
- ☒ Black lead. Solder to terminal 1 of TS-1 (3 wires).
- ☒ R-13, 150K resistor (brown, green, yellow). Solder one lead to pin B of TR-1 (2 wires). Connect the other lead to terminal 6 of TS-1.
- ☒ R-15, 27K resistor (red, violet, orange). Solder one lead to pin C of TR-1 (2 wires). Solder the other lead to terminal 6 of TS-1 (4 wires).
- ☒ C-10, .01 μ f disc capacitor. Slip 1/2" of tubing over one lead and solder to pin 2 of V-4 (2 wires). Solder the other lead to terminal 8 of TS-1 (2 wires).
- ☒ C-12, .01 μ f disc capacitor. Solder one lead to pin 7 of V-4 (2 wires). Solder the other lead to pin 1 of V-4 (2 wires).
- ☒ R-21, 470K resistor (yellow, violet, yellow). Solder one lead to pin 6 of V-5 (3 wires). Connect the other lead to pin 6 of V-4.
- ☒ C-13, 470 μ f disc capacitor. Solder one lead to pin 7 of V-5. Solder the other lead to pin 6 of V-4 (2 wires).
- ☒ C-11, 10 μ f electrolytic capacitor. Slip 3/4" of tubing over the (+) positive lead and solder to pin 3 of V-4 (2 wires). Solder the other lead to ground lug A of V-5.
- ☒ C-9, 2 μ f electrolytic capacitor. Solder the (+) positive lead to terminal 3 of TS-2 (4 wires). Solder the other lead to the chassis tab (3 wires).
- ☒ C-5, 3300 μ f disc capacitor. (May be marked .0033). Slip 1/4" of tubing over each lead. Connect one lead to pin 6 of V-3. Solder the other lead to pin 2 of V-3 (3 wires).
- ☒ R-5, 470 Ω resistor (yellow, violet, brown). Slip a 1/2" of tubing over one lead and solder it to pin 6 of V-3 (3 wires). Solder the other lead to terminal 1 of TS-3 (3 wires).
- ☒ R-3, 470 Ω resistor (yellow, violet, brown). Connect one lead to terminal 1 of TS-3. Solder the other lead to pin 6 of V-2 (3 wires).
- ☒ C-2, 3300 μ f disc capacitor. (May be marked .0033). Solder one lead to pin 7 of V-2 (2 wires). Thread the other lead through pin 2 and the center pin. Solder pin 2 and the center pin (2 wires).
- ☐ Carefully check your work for correct wiring and good solder connection. This is a good time to relax. Don't try to do too much at any one time.

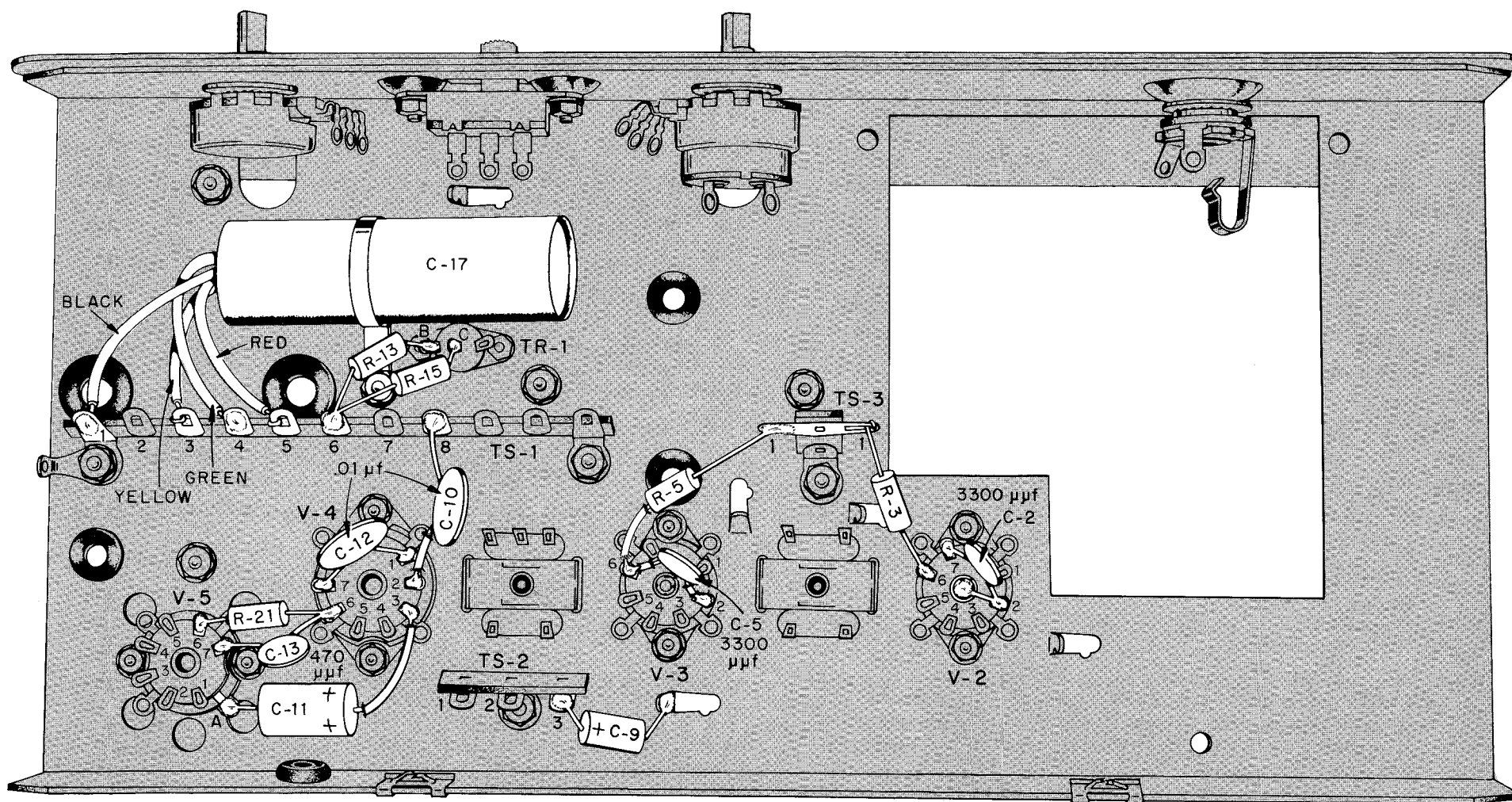


FIGURE 9. FOURTH WIRING ON THE BOTTOM OF THE CHASSIS

FINAL WIRING ON THE BOTTOM OF THE CHASSIS

SEE FIGURE 10.

- ☒ Blue wire. Solder one end to terminal 3 of S-2. Connect the other end to terminal 1 of J-1.
- ☒ R-24, 4.7 Ω resistor (yellow, violet, gold, gold). Solder one lead to terminal 2 of J-1. Solder the other lead to terminal 1 of J-1 (2 wires).
- ☒ R-25, 1000 Ω 2-watt resistor (brown, black, red). Slip $\frac{1}{2}$ " of tubing over each lead. Solder one lead to terminal 3 of TS-1 (4 wires). Solder the other lead to terminal 5 of TS-1 (4 wires).
- ☒ R-7, 180K resistor (brown, gray, yellow). Solder one lead to terminal 10 of TS-1 (3 wires). Solder the other lead to terminal 1 of R-9 (2 wires).
- ☒ Line cord. Thread the line cord through grommet F. Separate the ends of the cord back 12" and tie into a knot. Solder one lead to terminal 2 of S-1. Cut the other lead to 2"; strip $\frac{1}{4}$ " of insulation from the lead and solder to terminal 1 of TS-2 (2 wires). Bend the solder lug fastened to TS-1 to hold the wires in place.

THE PRE-WIRED SUB-ASSEMBLY WILL BE CONNECTED IN THE FOLLOWING STEPS:

- ☒ Remove the pre-wired sub-assembly from its protective container. Carefully move the green lead and resistor in toward the center of the assembly so that they do not get in the way when you mount the assembly. *Be very careful not to touch or alter the position of any other components or wires.*
- ☒ Mount the sub-assembly on the chassis with three 6-32 x $\frac{1}{4}$ " screws, lockwashers and nuts. Be sure to tighten these nuts securely.
- ☒ Rear panel. Position over the rear of the chassis. Fasten with three 6-32 x $\frac{7}{16}$ " screws and #6 flatwashers. Place the washer over the screw before fastening. The position of the third screw is above the 2-screw terminal strip. The rear panel should be left on whenever you service or check your unit.
- ☒ Green wire from pin 4 of V-1. Route on the bottom of the chassis. Solder to pin 4 of V-2 (3 wires).

If your unit is a Low Band (30-50mc), do the following step.

- ☒ R-1, 1000 Ω resistor (brown, black, red) from terminal 3 of T-1. Solder to terminal 1 of TS-3 (2 wires).

The following two steps are only for the High Band units (152-174mc).

- ☐ R-30, 27K resistor (red, violet, orange) from terminal 3 of T-1. Connect to terminal 1 of TS-3.
- ☐ L-2, RF coil from pin 6 of V-1. Solder to terminal 1 of TS-3 (3 wires).

- ☒ Bare wire from terminal 4 of T-1. Solder to pin 1 of V-2.
 - ☒ Bare wire from chassis tab of sub-assembly. Solder to the chassis tab near V-2 (3 wires).
 - ☒ You have now completed the wiring and soldering of your receiver.
- Before you go on, very carefully check all of your work.

1. Does each connection have a shiny, metallic finish? If not, reheat the connection and add a little solder if necessary. By now all connections should be soldered.
2. Can you move wires in the solder connection? This indicates a "cold" solder connection and must be reheated and a little solder added.
3. Are there any short pieces of wire or blobs of solder touching between adjacent terminals or to the chassis? Remove any such material before going on.
4. Check the shield portions of the shielded cables. Be sure no strands of the shields are touching adjacent terminals or the inner conductors. Check for single strands, too.
5. As a final check, be sure that no pins on the tube sockets are touching each other or the ground lugs.

INSTALLING TUBES AND TRANSISTOR

SEE FIGURE 11.

- ☐ Install the tubes in the sockets as shown. NOTE: the tube types may be 12BA6 or 12BA6A, etc.
- ☐ Transistor TR-1. Cut the leads to $\frac{1}{2}$ " in length. Install in socket TR-1 with the flat side positioned as shown.

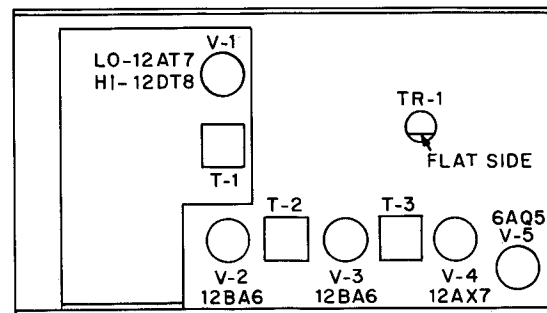


FIGURE 11. INSTALLING TUBES AND TRANSISTOR

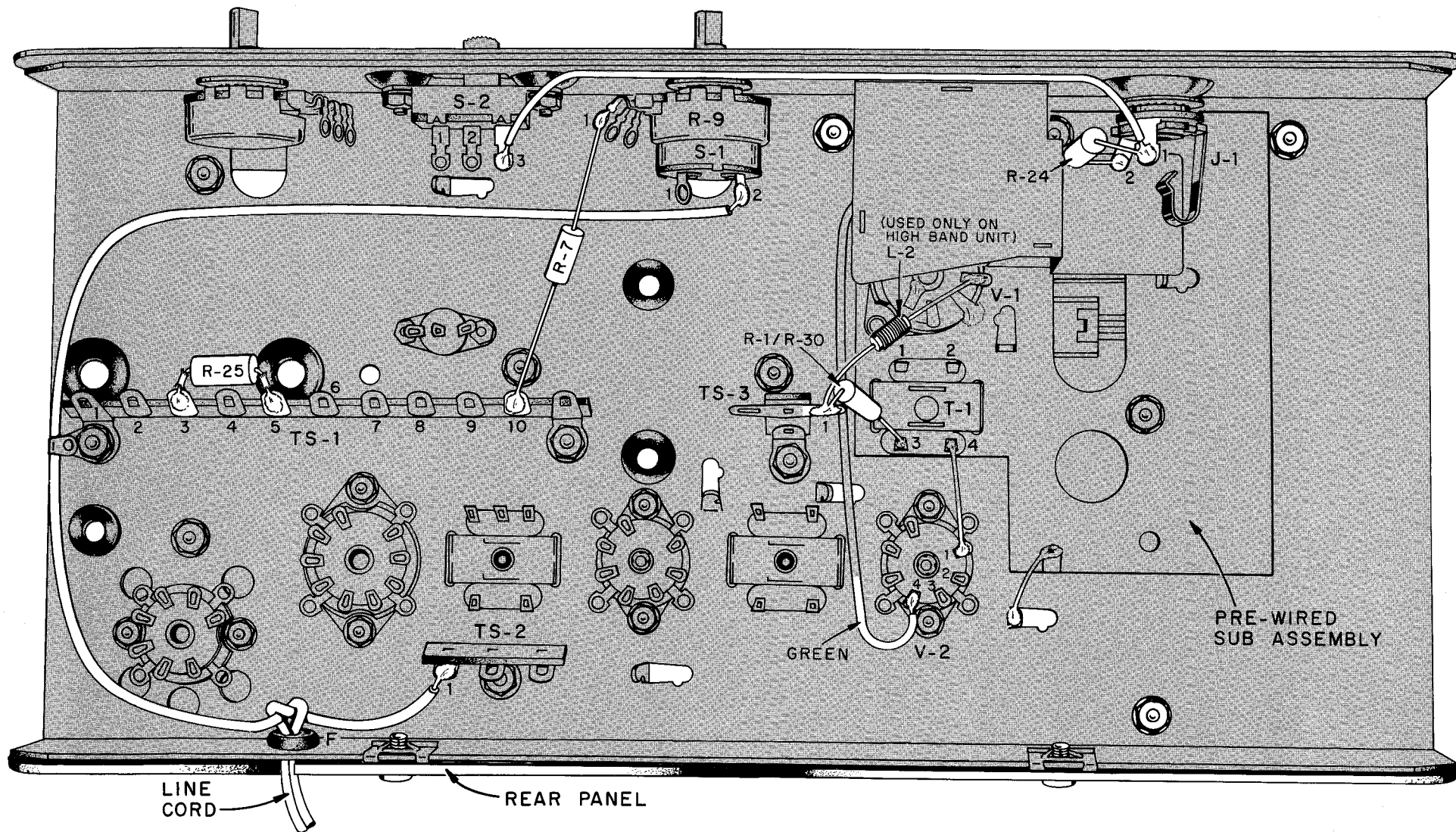


FIGURE 10. FINAL WIRING ON THE BOTTOM OF THE CHASSIS

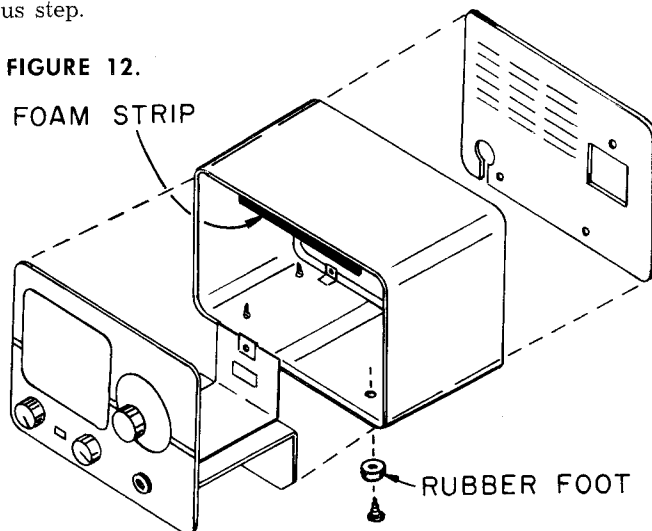
FINAL ASSEMBLY AND CHASSIS INSTALLATION

SEE FIGURE 12.

- ☐ Tuning dial. Insert a set screw into the tuning dial. Slip the dial over the tuning capacitor with the set screw facing the flat of the shaft. Position the dial until it is almost flush with the front panel. Tighten the set screw. The tightened set screw should be centered on the flat of the shaft.
- ☐ Large knob. Place over the tuning shaft and tighten the set screw.
- ☐ Two small knobs. Place over the remaining control shafts and tighten the set screws.
- ☐ Four rubber feet. Fasten to the bottom of the cabinet with four #4 x 1/4" self-tapping screws.
- ☐ Plastic foam strip. Carefully remove the paper backing and apply to the flange at the top of the cabinet.
- ☐ Remove the rear panel from the chassis.
- ☐ Slide the chassis into the cabinet so the two clip nuts line up with the tabs at the rear of the cabinet. Lift the chassis slightly as you slide it to clear the screws holding the feet. Fasten the chassis and rear panel with the three 6-32 x 7/16" screws and #6 flatwashers removed in the previous step.

FIGURE 12.

FOAM STRIP



RUBBER FOOT

HEADPHONES

Any communications type headphone of high or low impedance with standard 1/4" phone plug will work with your receiver. Plug into the jack marked "PHONES" and set the front panel switch to "PHONES".

ANTENNAS

SEE FIGURE 13.

For optimum performance of your receiver, a roof mounted "ground plane" antenna covering the frequency band of your unit should be used. This type of antenna will give best reception of signals from all directions. Mount the antenna at least 10 feet above the structure on which it is to be mounted and in an area free from large nearby obstructions. The higher you can mount the antenna the better reception you can expect, but not over 100 ft.

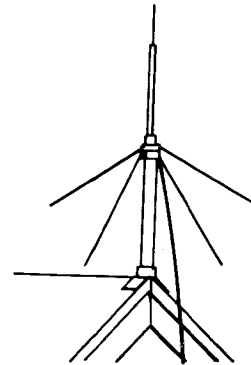


FIGURE 13.

The antenna input of both receivers is designed to accept antenna impedances between 50 and 75 ohms, however, best performance will be obtained with a nominal 52 ohm input. The antenna lead-in should be kept to less than 100 ft. and should be a good quality coaxial cable such as RG/58U for the KG-220 and RG/8U for the KG-221A.

To test your unit and for reception of strong local signals, a temporary antenna can be made from ordinary hook-up or bell wire. For the low band unit (30-50 mc), attach a 6 ft. length of wire to the screw terminal marked "A" on the rear of the receiver. The high band unit (152-174mc) comes supplied with a 15" length of wire. Connect it in the same manner as the low band unit. For maximum pickup with either unit, the antenna should be positioned so it is pointing straight up.

CONTROL FUNCTIONS

TUNING — tunes the receiver to the desired frequency as indicated on the dial.

VOLUME/AC OFF — varies the loudness or volume of the signal being received. Turns the power to the receiver on and off.

SPEAKER/PHONES — selects speaker or headphone operation.

SQUELCH — varies the "silencing" point of the receiver. When used properly, this control will keep the receiver silent unless a signal is being received. This control is adjustable for different signal strengths. As you adjust this control toward maximum in a counterclockwise direction, it will take a stronger incoming signal to overcome the squelch action.

OPERATING INSTRUCTIONS

The KG-220 and KG-221A FM Monitor receivers cover a band of frequencies allotted by the Federal Communications Commission (FCC) for Industrial, Land Transportation, Public Safety, and Domestic public services. All of these services are classed as **LAND TRANSPORTATION RADIO SERVICES**.

A station operating in this service is limited in its range due to the low power transmitter which is usually in the 30 to 60 watt range. Your reception of signals, is going to depend upon your antenna height, and location. These two factors will determine the amount of activity which can be expected.

For example: a person living in a rural area will probably receive little or no reception on the frequencies covering Taxicab and Industrial. Much activity could be expected on the frequencies covering Forestry Conservation and Highway Maintenance.

In large cities more two-way services will be operating; however, tall buildings and other obstructions will have an effect on the range of these signals. For example in the Chicago area over 20 taxicab companies are using the 152 to 153 mc portion of the band. Since the average band-width of a station is usually 5 kc, an overcrowded condition does not exist.

As you tune in the different services you will notice a great difference in the strength of the Base station signals as compared to the Mobile units. This happens because the BASE STATION has a permanent antenna mounted on a large tower which blankets the area of its use. The MOBILE unit is limited to the height of the vehicle in which it is mounted.

In some cases a "repeater" is employed for more reliable communications between other radio stations over ranges in excess of the direct communications range. This station receives the MOBILE signals and re-transmits them over a centrally located tower.

The transmission of messages are sporadic because of the nature of service carried on the LAND TRANSPORTATION RADIO SERVICES bands. Tune slowly across the band. If no transmission can be heard on a certain frequency, wait for a while and try again.

The following is a partial listing of some of the services found on the high and low bands. These services and frequencies will vary in different localities. A complete list can be obtained from the Government Printing Office, Washington, D.C.

Service	KG-220 Frequency	KG-221A Frequency
Business	33, 35, 42mc	151mc
Fire	33, 45, 46mc	154mc
Forestry Conservation	30, 31, 45mc	151, 159mc
Highway Maintenance	33, 37, 47mc	150, 156, 158mc
Industrial	30, 35, 43mc	151mc
Petroleum	48mc	153 mc
Police	37, 39, 44, 45mc	153, 156, 158mc
Power Maintenance	37, 47mc	152, 174mc
Telephone Maintenance	35mc	151mc

☐ Connect an antenna to the antenna terminals on the rear of the receiver. Connect center conductor to screw terminal "A" and the shield to screw terminal "G".

☐ Plug the power cord into a 110-130 volt AC 60 cycle outlet.

☐ Turn the power on (on VOLUME control) the pilot lamp should light.

☐ Turn the SQUELCH control fully clockwise.

☐ Rotate the VOLUME control to about 9 o'clock. A rushing sound should be heard in the speaker as the VOLUME control is advanced.

☐ Tune to the desired station with the TUNING control.

NOTE: Be patient! No one may be transmitting on the frequency you are listening to. Transmissions are sporadic and subject to the amount of activity in your area.

☐ Once a station has been received, set the VOLUME for a comfortable listening level.

NOTE:

At high volume and signal levels there is a possibility of acoustic feedback (howl) in the speaker. This howl occurs when speaker vibrations are coupled into the amplifying circuits.

If your particular application requires high volume levels, we suggest that you use an external 3.2Ω speaker. Attach a standard ¼" phone plug to the speaker lead and plug into the PHONES jack. For additional volume, remove the headphone loading resistor R-24.

☐ Rotate the SQUELCH control counterclockwise until the background noise becomes inaudible.

NOTE: The setting of the SQUELCH control determines the point at which a signal will pass through the receiver. Set the SQUELCH control to eliminate unwanted background noise when no signals are being received.

IMPORTANT NOTICE

The parts supplied with your receiver have been carefully aligned on precision factory equipment and require no further adjustment. **DO NOT** attempt to make any adjustments. The alignment instructions provided on page 20 are intended only for a professional serviceman in the event a tuned circuit component must be replaced.

ALIGNMENT WITH TEST EQUIPMENT

The I.F. transformers, coils and trimmer capacitors have been preset very carefully at the factory and require no further adjustment. The following information is intended for future reference should your receiver require servicing and re-alignment. *These adjustments may be performed by only a qualified person with proper test instruments.*

IF AND DETECTOR ALIGNMENT

- ☐ Connect the output cable of an RF generator to the antenna terminals of the KG-221A. For the KG-220, connect the cable from C-26B to ground. Set the generator for an unmodulated 10.7 mc signal.

SEE FIGURE 14.

- ☐ Temporarily solder two 100K 1%, ½ watt resistors in series between pin 4 of T-3 and ground.

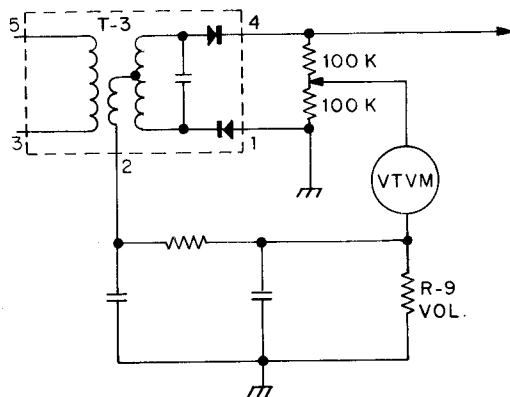


FIGURE 14.

- ☐ Connect a DC VTVM between the two resistors and pin 1 of R-9.
 - ☐ Turn the equipment on and let it warm up for at least 20 minutes.
- NOTE: Always keep the output of the generator at the lowest level that will produce a usable output on the VTVM.
- ☐ Adjust the top slug of T-3 for 0 volts.
 - ☐ Turn the monitor off. Disconnect the VTVM and remove the resistors.
 - ☐ Connect the VTVM between pin 4 of T-3 and ground.
 - ☐ Turn the monitor back on.

SEE FIGURE 15.

- ☐ Adjust the IF can slugs in the following order for a peak reading on the VTVM:

Bottom of T-3, top of T-2, bottom of T-2, top of T-1, bottom of T-1.

FRONT END ALIGNMENT

The alignment procedure below covers the high and low band units. Alignment frequencies and adjustment points for the low band unit are shown in parenthesis.

- ☐ Connect an AC VTVM across the output of the audio transformer.
- ☐ Connect the output cable of a RF generator to the antenna terminals.
- ☐ Adjust the frequency of the generator for a 174 mc (50mc) signal modulated ± 5 kc at 1000 cycles.
- ☐ Tune the monitor to 174 mc (50mc)
- ☐ Turn on all the units and let them warm up for at least 20 minutes.
- ☐ Adjust oscillator trimmer C-27 (C-26C) for a maximum indication on the VTVM.
- ☐ Adjust the frequency of the monitor and generator to 152 mc (30mc).
- ☐ Adjust oscillator coil L-4 (adjust L-6) for a maximum indication on the VTVM.
- ☐ Repeat the last six steps until no change is noted on the VTVM.
- ☐ Adjust the frequency of the monitor and generator to 174 mc (50mc).
- ☐ Adjust C-24 (C-26A, C-26B) for a maximum indication on the VTVM.

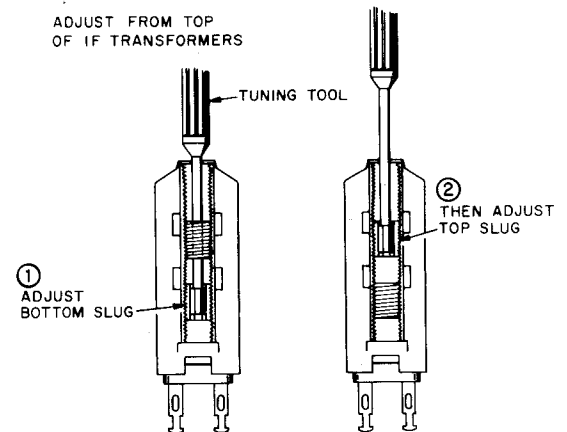


FIGURE 15.

- ☐ Adjust the frequency of the monitor and generator to 152 mc (30mc).
- ☐ Squeeze or stretch RF Coil L-3 (L-4, L-5) for a maximum indication on the VTVM.
- ☐ Repeat the last four steps until no change is noted on the VTVM.

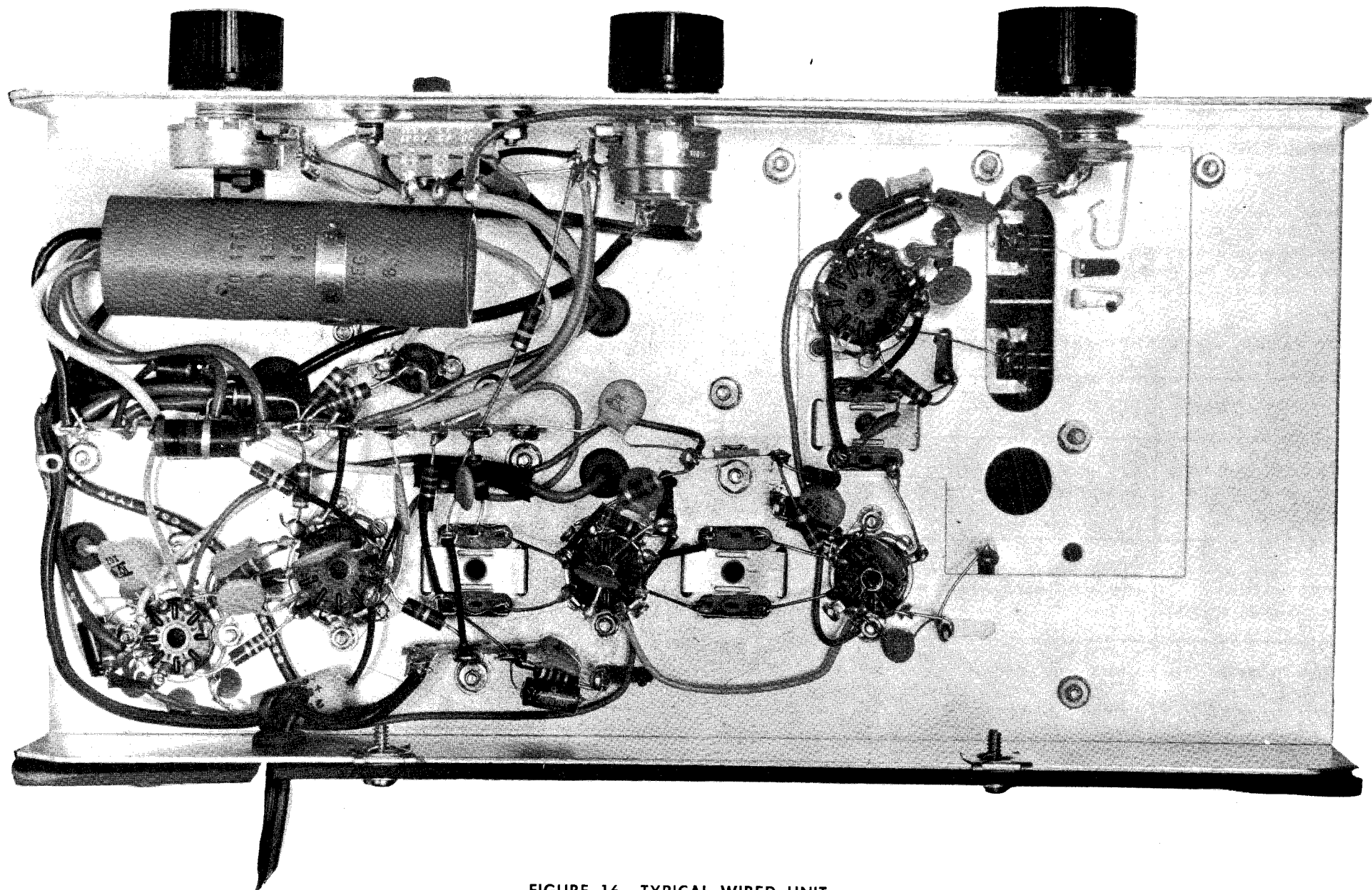


FIGURE 16. TYPICAL WIRED UNIT

TROUBLESHOOTING HINTS

If your receiver does not operate properly when you complete the construction, we suggest you very carefully re-check your wiring. Compare it against the pictorial diagrams and the photo of the completed unit. Also check all solder connections. Each connection should have a shiny, metallic appearance—it should not be dull and flaky. Also, each wire in the connection should be tightly held by the solder; try to move the wires in each connection, if any move, the soldering is improper. **FOR THESE TWO CONDITIONS**,—reheat the connection with your hot soldering iron, adding a little solder if necessary.

Look at all the terminal strips, tube sockets and transformer pins to be sure that no solder, short pieces of wire are touching between adjacent terminals, or the terminal and the chassis. Also be sure that excess solder has not run down a terminal to touch the chassis. All bare wires and part leads should touch only the terminal to which they are connected.

The following chart lists some specific symptoms and the service procedure.

SYMPTOM	SERVICE PROCEDURE
Receiver dead; tubes and pilot lamp do not light.	Unplug your unit and check the wiring of the line cord, switch S-1 and power transformer T-5.
Tubes and pilot lamp light, no sound from speaker.	Check wiring of diode CR-1. Check wiring of switch S-2 and speaker.
Hum in speaker, no rushing noise or stations.	Check your antenna. Check the setting of the SQUELCH control. Place in maximum clockwise position. Check to be sure TR-1 is installed correctly in its socket. Check the two shielded cables for shorts between the shield and center conductor.
Rushing noise in speaker, no stations.	Check your antenna, it may not be adequate for your installation. Be patient! Transmission on two way radio is very sporadic, and it is possible that no one is transmitting on the frequency you are tuned to.

CIRCUIT DESCRIPTION

RF Section KG-220

The RF section of the KG-220 consists of a dual-triode, V-1, 12AT7. One triode section of this tube functions as a Hartley oscillator. The oscillator signal is tuned by C-26C which is part of the main tuning capacitor. Coupling of this signal to the mixer is accomplished by a common cathode connection between (cathode injection) both sections of the tube. The mixer half of the 12AT7 is supplied with the desired station signal thru a double-tuned, top-coupled tank circuit consisting of L-4, tuning capacitor C-26A, B, C-25 and L-5. This circuit provides good selectivity and spurious signal rejection on the 30 to 50 mc band.

RF Section KG-221A

The RF section of the KG-221A consists of a dual-triode, V-1, 12DT8. One triode section V-1A, functions as a grounded grid amplifier. Capacitor C-25A tunes the RF stage and coil L-3 acts as the RF amplifier plate coil. Capacitor C-22 couples the RF signals to the mixer stage. Triode section V-1B functions as an autodyne converter that provides its own oscillator injection by oscillating and mixing. Transformer T-1 couples the 10.7 mc output to the first IF amplifier.

IF Section

The output of the mixer-oscillator is coupled to V-2, 10.7 mc IF amplifier. This tube (12BA6) amplifies the signal and couples it to the next stage thru IF transformer T-2. Tube V-3 provides additional amplification prior to detection by ratio detector transformer T-3.

Squelch Circuit

The squelch circuit functions as a switch to turn the first stage of audio amplification (V-4A) on and off. When a signal is being received, a DC voltage is developed at pin 4 of T-3. This DC voltage is equivalent to the strength of the signal being received. Variable resistor R-12 controls the amount of the DC voltage fed to the base of TR-1. When a signal is being received by the unit, a DC voltage is developed and fed to the base of TR-1. The transistor conducts, and provides a path for electrons to flow in the cathode circuit of V-4A. When no signal is present, TR-1 does not conduct, and C-11 blocks the flow of current in V-4A. The squelch control R-12 is set to eliminate background noise when no signal is being received.

PARTS LIST

CAPACITORS

Symbol	Description	Part No.
C-2	3300 μmf (or .0033 μf), disc	276-337
C-3	3300 μmf , disc	276-337
C-4	3300 μmf , disc	276-337
C-5	3300 μmf , disc	276-337
C-6	100 μmf , disc	276-017
C-7	.001 μf (or 1000 μmf), disc	276-016
C-8	.001 μf , disc	276-016
C-9	2 μf , 50 volt, electrolytic	222-020
C-10	.01 μf , disc	276-015
C-11	10 μf , 25 volt, electrolytic	201-100
C-12	.01 μf , disc	276-015
C-13	470 μmf , disc	276-478
C-14	2 μf , 50 volt, electrolytic	222-020
C-15	.01 μf , disc	276-015
C-16	220 μmf , disc	276-228
C-17	80/50/20 μf , 175/150/150 volt, electrolytic	216-356
C-18	.001 μf , disc	276-016
C-33	.22 μf , mylar	299-083

NOTE: Electrolytic capacitors may be supplied with voltage ratings higher than those given.

RESISTORS

R-2	82 Ω	301-820
R-3	470 Ω	301-471
R-4	82 Ω	301-820
R-5	470 Ω	301-471
R-6	82 Ω	301-820
R-7	180K	301-184
R-8	47K	301-473
R-9	1 meg control; volume/switch	392-215
R-10	10 meg	301-106
R-11	27K	301-273
R-12	50K control; squelch	392-216
R-13	150K	301-154
R-14	4700 Ω	301-472
R-15	27K	301-273
R-16	47K	301-473
R-17	4700 Ω	301-472
R-18	220K	301-224
R-19	2.2 meg	301-225
R-20	15K	301-153
R-21	470K	301-474
R-22	470K	301-474
R-23	330 Ω	301-331
R-24	4.7 Ω , 5%, 2 watt wire wound	307-478
R-25	1K, 2-watt	307-102

TRANSFORMERS

T-2	10.7 mc I.F.	113-283
T-3	Ratio detector	113-284
T-4	Audio	102-209
T-5	Power	107-298

SWITCHES

S-1	On volume control R-9	
S-2	SPDT	437-126

TERMINAL STRIPS

TS-1	11-terminal	440-903
TS-2	3-terminal	440-301
TS-3	1-terminal, vertical	442-992

TUBES

V-2	12BA6	610-041
V-3	12BA6	610-041
V-4	12AX7	611-012
V-5	6AQ5	610-036

TRANSISTOR & DIODE

Symbol	Description	Part No.
TR-1	NPN transistor, (commercial type 2N3393)	660-117
CR-1	Silicon diode, (commercial type 1N2483)	630-061

MISCELLANEOUS

Description	Quantity	Part No.
Cabinet	1	702-104
Chassis	1	463-628
Dial, tuning (KG-221A)	1	040-199
(KG-220)	1	040-198
Eyelet	2	554-064
Front end (KG-221A) pre-wired	1	040-263
(KG-220) pre-wired	1	040-206
Feet, rubber	4	833-952
Grommet, rubber 3/16"	6	830-003
Grommet, rubber 5/16"	2	830-006
Jack, phone	1	509-094
Knob, large	1	765-092
Knob, small	2	765-074
Label, chassis	1	752-011
Lamp, #47	1	640-002
Line cord	1	802-001
Panel, front (KG-221A)	1	463-595
(KG-220)	1	463-587
Panel, rear	1	850-183
Plastic foam strip	1	860-167
Socket, lamp	1	501-730
Socket, 7-pin	1	501-172
Socket, 7-pin, with center pin	2	509-056
Socket, 9-pin	1	501-190
Socket, transistor	1	509-077
Speaker	1	734-076
U Clip	2	532-008
Window, pilot lamp	1	870-175

HARDWARE

Screws		
6-32 x $\frac{1}{8}$ "	5	560-345
6-32 x $\frac{1}{4}$ "	15	560-342
4-40 x $\frac{1}{4}$ "	8	560-222
#4, self-tapping, $\frac{1}{4}$ "	4	562-292
2-56 x $\frac{1}{4}$ "	2	560-002
Set screw	1	569-006
Nuts		
$\frac{3}{8}$ " x 32	3	570-840
$\frac{3}{8}$ " x 32, dress	1	579-754
6-32	17	570-340
4-40	8	570-221
2-56	2	570-000
Clip nut	2	531-009
Washers		
$\frac{3}{8}$ " flat	2	580-702
$\frac{3}{8}$ " lock	3	582-701
#6 flat	3	580-301
#6 lock	17	582-300
#4 lock	8	582-200
Solder lug, #8	1	553-002
Solder lug, #6	1	553-005

WIRE, SOLDER AND TUBING

2" red	1	807-022
3" orange	4	807-023
5" green	1	807-025

Description	Quantity	Part No.
6" blue	4	807-026
10" brown	1	807-021
Gray shielded	5"	809-114
Red shielded	4"	808-028
Bare wire, #20 gauge	26"	806-000
Solder	10'	930-005
Tubing small	22"	812-031
Tubing large	2"	812-100
Bare wire, #14 gauge (temporary antenna for KG-221A)	15"	807-044

ADDITIONAL PARTS FOR KG-221A (152-174mc)

Symbol	Description	Part No.
C-19	100 μmf disc	297-014†
C-20	.001 μf disc	297-010†
C-21	47 μmf disc	296-067†
C-23	Tuning capacitor	287-101†
C-24	5-4 μmf trimmer	286-107†
C-25	10 μmf disc	270-009†

RESISTORS

R-1	270 Ω	301-271†
R-26	27K	301-273†
R-30	27K	301-273†

TRANSFORMERS & COILS

T-1	10.7 mc I.F. transformer	113-282†
L-1	Input Choke	162-198†
L-2	Plate Choke	162-190†
L-3	RF Coil	152-164†
L-4	Oscillator Coil	142-155†
L-5	Mixer Choke	162-195†

MISCELLANEOUS

Shield, tube	510-004†
Terminal strip, 2-screw	441-201†
Tube V-1, 12DT8	614-351†
†Part of prewired sub-assembly—part number 040-263	

ADDITIONAL PARTS FOR KG-220 (30-50mc)

Symbol	Description	Part No.
C-1	.005 μf , disc	296-000*
C-25	.5 μmf , tubular ceramic	278-064*
C-26	Tuning capacitor	286-100*
C-27	.005 μf , disc	296-000*
C-28	25 μmf , disc	276-259*
C-29	150 μmf , mica	296-065*

RESISTORS

R-1	1K	301-102*
R-27	68 Ω	301-680*
R-28	1K	301-102*
R-29	10K	301-103*

TRANSFORMERS & COILS

L-4	Antenna coil primary	152-162*
L-5	Antenna coil secondary	152-163*
L-6	Oscillator coil	142-097*
T-1	10.7 mc I.F.	113-282*

MISCELLANEOUS

Shield, tube	510-004*
Terminal strip, 2-screw	441-201*
Tube V-1, 12AT7	611-013*
*Part of prewired sub-assembly—part number 040-206	

HARDWARE

SCREWS



2-56
X 1/4"



4-40
X 1/4"



#4 SELF
TAPPING



6-32
X 1/4"



6-32
X 7/16"



SET
SCREW

NUTS



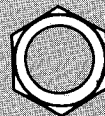
2-56



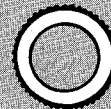
4-40



6-32



3/8"



3/8"
DRESS

WASHERS



#4
LOCK



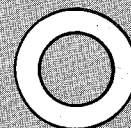
#6
LOCK



3/8"
LOCK



#6
FLAT



3/8"
FLAT



CLIP NUT



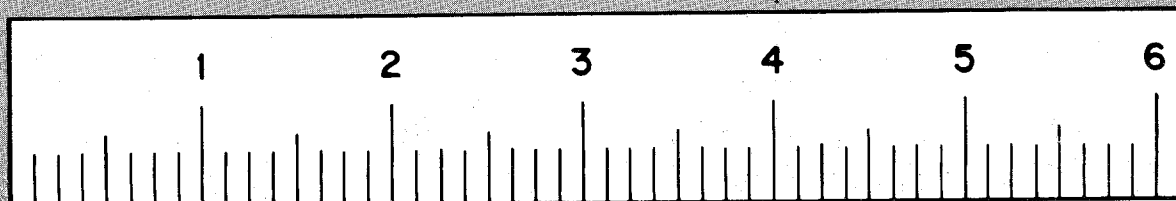
EYELET



#6
SOLDER
LUG



#8
SOLDER
LUG



knight-kit**KITS****VHF RECEIVERS**

Near Exciting Communications With VHF-FM Monitor Receiver Kits

**KG-221A for
152-174 MHz****\$49.95**

\$5 monthly

**KG-220 for
30-50 MHz****\$44.95**

\$5 monthly

FREQUENCY ALLOCATIONS

KG-221A (152-174 MHz). Police, fire, CD, forestry, conservation, utilities, Weather Bureau, railroads, taxis, trucks, private mobile telephone.

KG-220 (30-50 MHz). Police, fire, CD, forestry, conservation, utilities, industrial highway maintenance crews and control points, radio paging services, private mobile telephone.

Frequency allocations may differ in your area. Check with authorities to determine specific frequencies used by the various services operating in your community.

KG-221A 152-174 MHz VHF-FM Receiver Kit

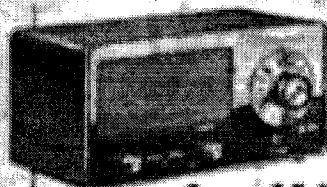
Pulls in emergency and other communications. Monitor police calls, fire alarms, civil defense, Weather Bureau, taxis, private mobile radio-telephones in your area. Features RF stage for high sensitivity. Front-end is fully assembled and aligned. Deluxe circuit has two IF stages with ratio detector for top-notch selectivity. Solid-state all-electronic squelch with front-panel control silences receiver between calls. Velvet-smooth vernier tuning. One-watt output circuit and built-in 3x5" speaker for room-filling sound. Front-panel switch selects speaker for headphone reception. Pilot light; volume control; screw terminals for antenna connection. Transformer power supply. Blue metal case, 5 1/2" x 11 1/2" x 5 3/4". Charcoal gray and silver panel. With step-by-step instructions. 110-130 V, 60 Hz AC. From Japan. Shpg. wt., 10 lbs. **22 C 3452 X. \$6 Monthly** **49.95**

KG-220 30-50 MHz VHF-FM Receiver Kit. Similar to KG-221A, but for 30-50 MHz and without RF stage. Monitors many of same services; information at left. **22 C 3311 X. Japan. Shpg. wt., 10 lbs. \$5 Monthly** **44.95**

KG-221A AND KG-220 SPECIFICATIONS

FM Tuning Range: KG-221A, 152 to 174 MHz; KG-220, 30-50 MHz. **Bandwidth:** 100 kHz at 6 dB down. **Sensitivity:** KG-221A, 6 μ V = 5 kHz deviation, KG-220, 10 μ V at = 5 kHz deviation. **Squelch:** solid-state, with variable front-panel control. **Squelch Sensitivity:** opens for signals as small as 5 μ V. **IF Frequency:** 10.7 MHz. **Number of IF Amplification Stages:** 2. **Active Elements:** 6 vacuum tubes plus transistor for equivalent 8-tube performance; silicon diode rectifier in power supply. **Antenna Impedance:** 50 to 75 ohms. **Power Consumption:** 30 watts, normal.

KG-221A Outfit

**Save \$5.00****\$57.85**

\$5 monthly

Complete VHF-FM Receiver Outfits

Separately, \$87.85. **KG-221A Receiver Outfit:** KG-221A Monitor Receiver Kit, Hy-Gain SPG-2 144-174 MHz $\frac{1}{4}$ -wave Ground Plane Antenna, for best reception with the KG-221A receiver. 14" high. With mtg. clamp for masts up to 1 1/2" dia.; 50' of RG-8/U Coaxial Cable. For lead-in to receiver from antenna. Shpg. wt., 14 lbs. **22 C 0653 LX. \$5 Monthly** **57.85**

Separately, \$85.40. **KG-220 Receiver Outfit:** KG-220 Monitor Receiver Kit, Hy-Gain GP-50 30-50 MHz $\frac{1}{4}$ -Wave Ground Plane Antenna, for best reception with the KG-220. 14" high. Mtg. clamp; 50' RG-8/U Coaxial Cable. **22 C 0319 LX. Shpg. wt., 18 lbs. \$5 Monthly** **60.40**

KG-220 Outfit

**Save \$5.00****\$60.40**

\$5 monthly