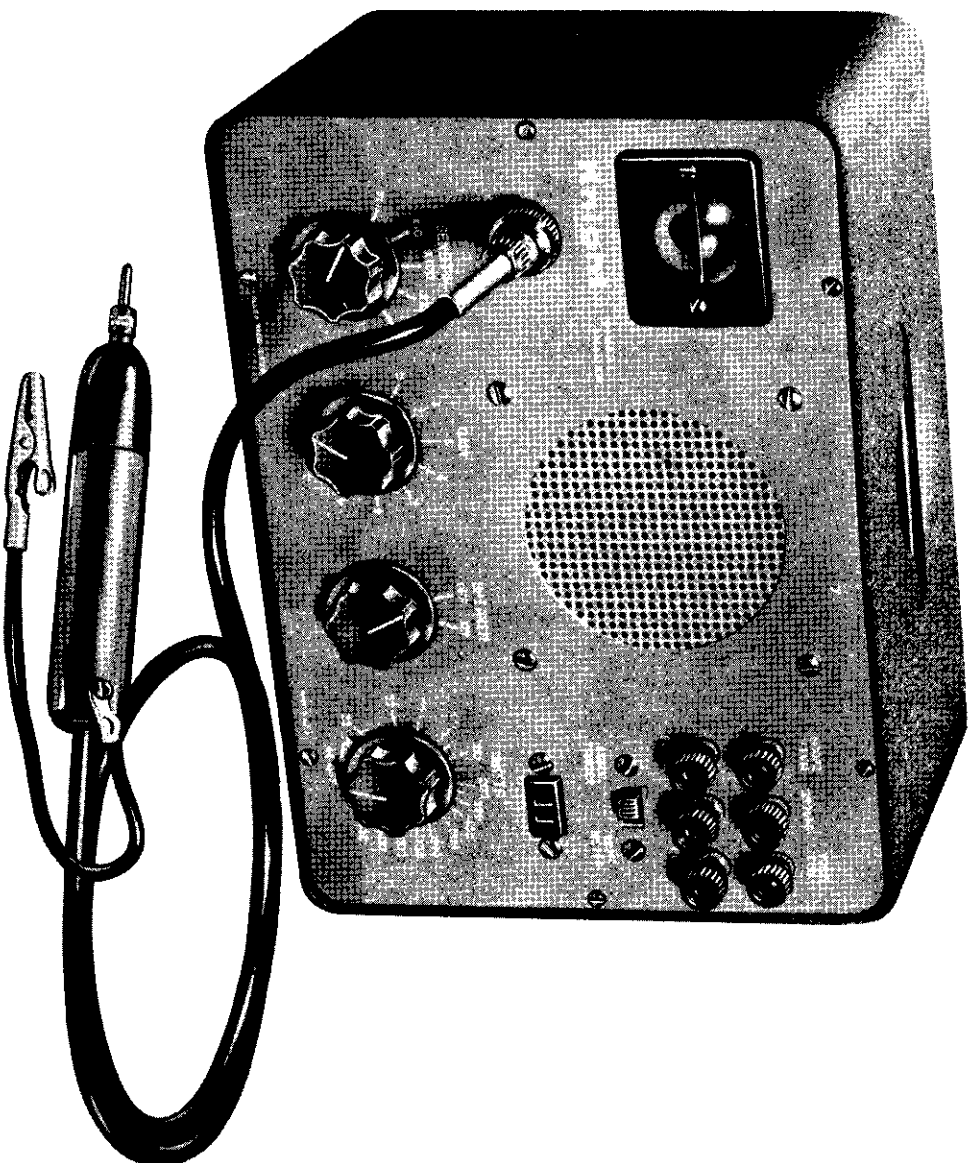


# Allied knight-kit<sup>®</sup> SIGNAL TRACER

83Y135



**ALLIED RADIO**  
CORPORATION



100 N. WESTERN AVE. • CHICAGO 80, ILL. HAYMARKET 1-6800

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## SPECIFICATIONS

GAIN .....	91,000 AT MAXIMUM
PROBE INPUT	SENSITIVITY
CAPACITY .....	6 MMFD
TUBES .....	6AU6 HIGH GAIN AMPLIFIER 6AV6 AMPLIFIER AND WATTMETER RECTIFIER 6V6GT POWER AMPLIFIER 6ES5 MAGIC EYE 6X4 FULL-WAVE RECTIFIER
CABINET SIZE.....	10" WIDE, 7" HIGH, 5" DEEP
POWER SOURCE.....	105 TO 125 VOLTS 50 TO 60 CYCLES AC
SHIPPING WEIGHT.	13 POUNDS

## FEATURES AND APPLICATIONS

High gain circuits for both RF and audio explorations.  
Noise locator circuit.  
Wattmeter circuit.  
Demodulator probe and preamplifier for oscilloscope applications.  
Demodulator probe and preamplifier for VTVM applications.  
Utility audio amplifier.  
Substitution test output transformer.  
Substitution test speaker.  
Output indicator.  
B+ source for test purposes.

## INTRODUCTION

You made an excellent choice when you decided to purchase a KNIGHT Signal Tracer. The addition of this instrument to your test bench will greatly reduce the time required to troubleshoot a receiver.

The high gain amplifiers (a voltage gain of 91,000 is possible at maximum sensitivity) permit visual and aural signal tracing all the way back to the antenna of a radio receiver. The noise locator circuit will help you to quickly locate noisy controls and resistors, faulty transformers, and intermittent capacitors. Many additional features and

applications of your KNIGHT Signal Tracer are described in the "How to Use Your KNIGHT Signal Tracer" portion of this manual. But now, let's build the Signal Tracer from the following, simplified, step-by-step instructions.

## HOW TO BUILD THE KNIGHT SIGNAL TRACER

Before starting to build your KNIGHT Signal Tracer check each part against the Parts List on page 27. If you are unable to identify some of the parts by sight, locate them on the pictorial diagrams. Capacitor and resistor values, if not printed on the part, can be found with the aid of the color code chart.

Hardware is listed in the last part of the Parts List. To keep our kits at the lowest possible price, we frequently weigh hardware rather than count it. Therefore, do not be concerned if more nuts and machine screws, for example, are supplied than are specified in the Parts List.

The only tools required for building your KNIGHT Signal Tracer are: long-nose pliers, diagonal cutters, screwdriver, set-screwdriver, and a soldering iron. A good set of tools is listed at the end of the Parts List.

Study the pictorial diagrams and note how the parts are mounted. These pictorial diagrams show the actual location of all parts and wiring. The schematic diagram shows how the parts are connected electrically and is helpful in understanding how the circuits function.

The step-by-step instructions were prepared by a skilled technician while actually building the KNIGHT Signal Tracer. They are the best and fastest way of assembling this unit. May we suggest that you check off each step after you have completed it. Some builders also put a pencil mark on the wiring views along the wires and parts that they have just installed. Both of these methods are good and will assure quick and accurate wiring.

## BUILDING YOUR KNIGHT SIGNAL TRACER

Begin building your KNIGHT Signal Tracer by mounting some of the major parts on the chassis.

### SEE FIGURE 1.

Place the chassis upside down with the four holes across the front of the chassis facing away from you.

(✓) From the inside of the chassis, mount two of the small 7-pin wafer-type sockets for V-2 and V-5, as shown in Figure 1. The keyway, or wide space between two of the pins, must be toward the upper right. Use two of the small machine screws and nuts to mount each socket.



### FIGURE 1. HOW TO MOUNT PARTS INSIDE THE CHASSIS

- (✓) From the inside of the chassis, mount the remaining 7-pin socket for V-1, as shown in Figure 1. The keyway must be toward the lower left. Use two small machine screws and nuts to mount the socket.
- (✓) From the inside of the chassis, mount the large 8-pin socket for V-3, as shown in Figure 1. The keyway, the notch in the large center hole, must be toward the lower left.
- (✓) From the inside of the chassis, mount the filter capacitor mounting plate in the large hole near the lower left side of the chassis. Use two small machine screws and nuts.
- (✓) From the top of the chassis, insert the mounting lugs of the filter capacitor (C-3) through the four holes in the filter capacitor mounting plate. From the inside of the chassis, twist these lugs so that the filter capacitor is held securely in place.
- (✓) Insert the three large grommets into the three  $\frac{1}{2}$  inch holes on the chassis.
- (✓) Insert the five small grommets into the five  $\frac{3}{8}$  inch holes. One of the holes is located on the rear of the chassis.
- (✓) Mount terminal strip 1 (TS-1), the 4-terminal strip, near the left side of the chassis, with the mounting tab toward the left. Use a small machine screw and nut.
- (✓) Mount terminal strip 2 (TS-2), a 3-terminal strip, near the center of the chassis. Use a small machine screw and nut.
- (✓) Place the front panel against the front of the chassis so that the four large holes in the panel line up with the four holes in the chassis.
- (✓) Put one of the large nuts and a lockwasher on the Sensitivity Switch (S-1). Insert the shaft of the switch through the first hole from the left in the chassis and panel. Position the switch so that the blank space between terminals 1 and 11 is toward the bottom of the chassis. Secure the switch in position to the chassis and front panel with another large nut. See Figure 2.
- (✓) In the same manner, mount the Gain Control (R-10) in the hole next to S-1. Position R-10 so that the terminals are toward the bottom of the chassis.
- (✓) Mount the Speaker Switch (S-2) in the hole next to R-10. Use the same method that was used to mount the two previous controls. Position the terminals as shown in Figure 1.
- (✓) Mount the Watts Control (R-26), with attached ON-OFF switch (S-3), in the same manner that the three previous controls were

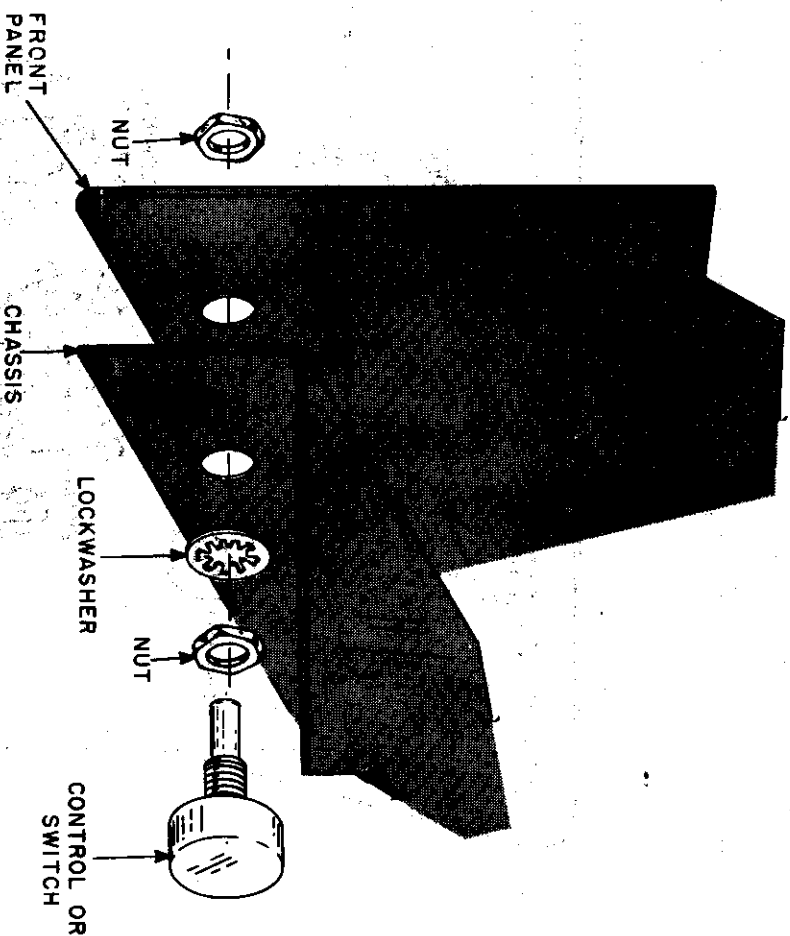


FIGURE 2. HOW TO MOUNT A CONTROL

mounted. The terminals of R-26 must be toward the right edge of the chassis.

### SEE FIGURE 3.

- (✓) From the top of the chassis, push the Power Transformer (T-2) leads through the two large grommets located near the left rear corner of the chassis. The two black leads, the two green leads, and the green-yellow lead go through the grommet nearest the left edge of the chassis. The two red leads and the red-yellow lead go through the other grommet.
- (✓) Mount T-2 in position with four machine screws and nuts. From the inside of the chassis, mount terminal strip 3 (TS-3), a 3-terminal strip, on the right front mounting screw. Position the terminal strip as shown in Figure 1.
- (✓) From behind the front panel, mount the Watt Receptacle (J-2) in the rectangular hole just above S-1. Use two machine screws and nuts.
- ( ) Mount the Signal Tracer—Watt Meter Switch (S-4) above J-2. Use two machine screws and nuts.

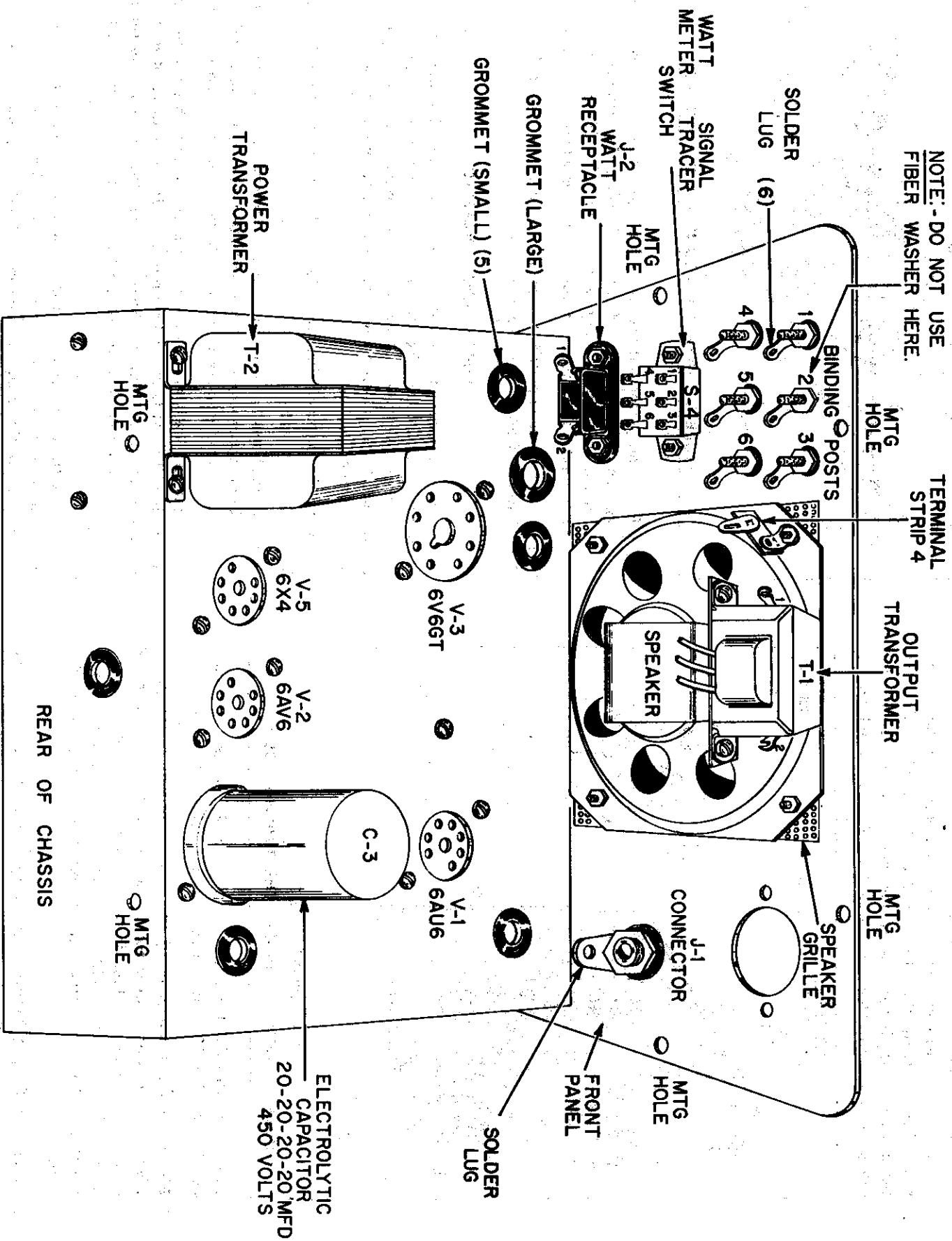


FIGURE 3. HOW TO MOUNT PARTS ON TOP OF THE CHASSIS

- (✓) Mount the five RED Binding Posts (numbered 1, 3, 4, 5, and 6). Each of the binding posts is mounted as follows: Place one of the shouldered fiber washers over the threaded portion of the binding post. Then, insert the threaded section through a hole in the front panel. Place a small flat fiber washer and a solder lug over the threaded section. Attach a nut and tighten it securely. See Figure 4.

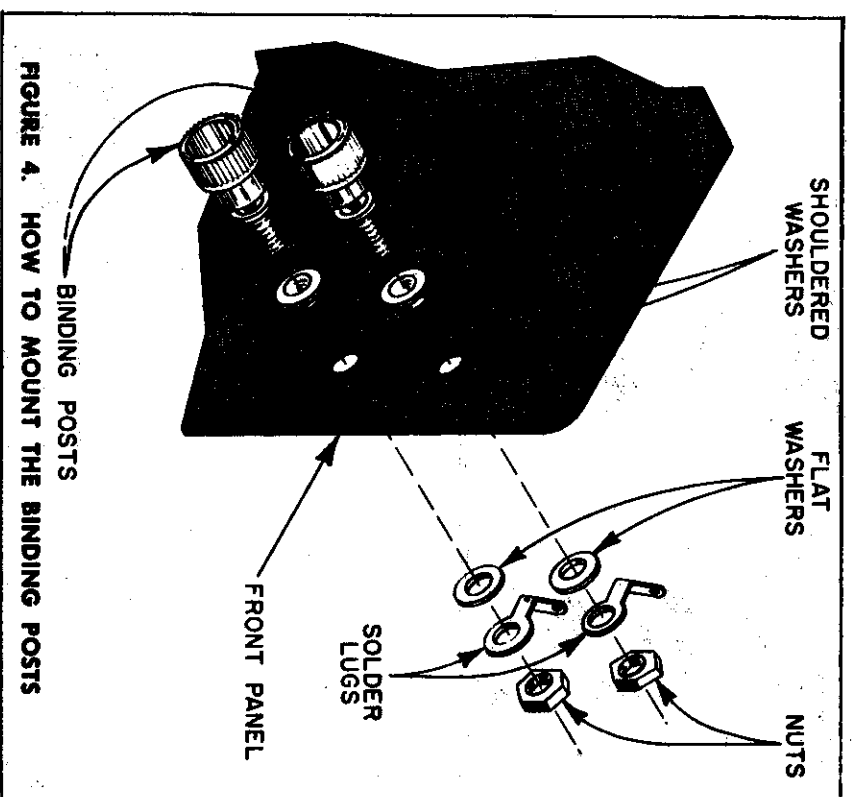


FIGURE 4. HOW TO MOUNT THE BINDING POSTS

- (✓) Mount the BLACK Binding Post (number 2) in the same manner. DO NOT USE a fiber washer on the inside of the panel.
- (✓) Mount the input connector (J-1) on the right side of the panel. Place a fiber washer over the threaded section and insert the connector through the hole from the front of the panel. Place another fiber washer, a solder lug, and a flat metal washer over the threaded section. Attach a nut and tighten it securely. See Figure 5.
- (✓) Mount the Output Transformer (T-1) to the speaker with two machine screws and nuts. The enameled leads must face the speaker cone.

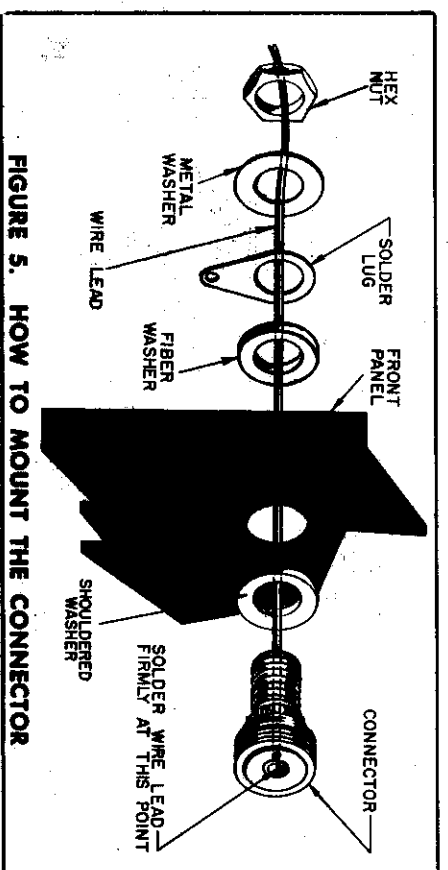


FIGURE 5. HOW TO MOUNT THE CONNECTOR

- (✓) Place the perforated speaker grille (grey side toward the front) against the rear of the front panel. Place the speaker assembly against the grille. Mount terminal strip 4 (TS-4), a 1-terminal strip under the upper left nut. Use four machine screws and nuts. You have now completed the preliminary parts mounting. The Watts Transformer (T-3) will be mounted later.

### WIRING AND SOLDERING

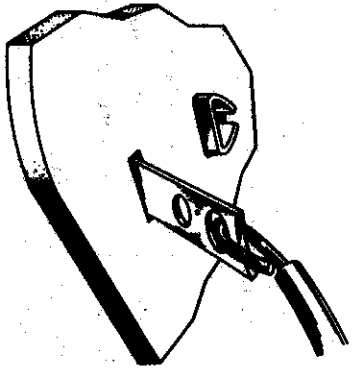
How well a piece of electronic equipment works depends upon the quality of workmanship. For this reason the following suggestions are given. These wiring and soldering hints are mainly for the beginner in electronics, however, even the advanced technicians may benefit from a brief review.

Follow the pictorial diagrams closely. The unit will work best that way.

Make good mechanical connections at joints, clean metal to clean metal. Loop wires around socket and other connection terminals and clamp tight in order to assure good mechanical connections. See Figure 6.

Pull the end leads of resistors and capacitors through the connection terminals so the parts are tightly mounted. If the connection terminals are widely spaced, it may be necessary to use the full length of the end leads. After you have soldered the end leads, clip off the extra length. See Figure 7.

The soft tubing supplied is called "spaghetti." Spaghetti is used to cover the bare end leads of some of the parts. Whenever it is necessary to use some of this spaghetti, the exact length is given. The spaghetti must cover the entire lead where there is a chance it will touch another lead, a connection, or the chassis.



**FIGURE 6. CONNECTING A WIRE TO A TERMINAL**

Place the long wires close to the chassis. Do your best to position the wires and parts as shown in the diagrams.

**USE ONLY ROSIN CORE SOLDER.** Use the rosin core solder supplied with the kit. KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX WILL SOON CORRODE AND WILL NOT WORK LONG. SUCH KITS ARE NOT ELIGIBLE FOR REPAIR OR SERVICE.

The soldering iron tip must be properly tinned. First, clean the tip with a piece of steel wool, or a fine file, until the bright copper surface is seen. Allow the tip to heat until it melts solder. Apply solder to all surfaces of the tip until they are covered with a thin layer of solder. Wipe off the excess solder with a rag. The tip should now be "shiny." Re-tin the tip whenever it becomes covered with a layer of scale.

Make sure the soldering iron is hot enough to allow an even flow of solder.

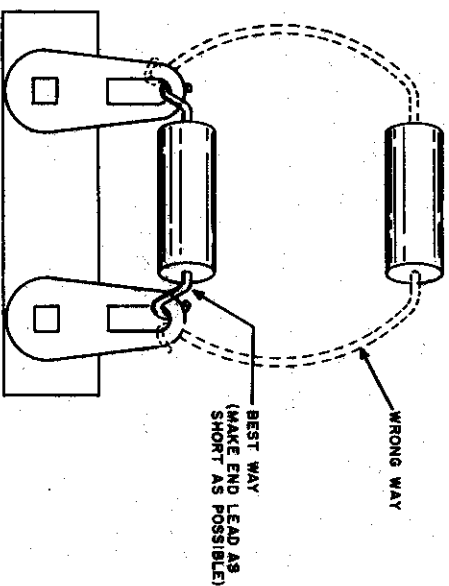
Pre-heat the connection before applying solder. Place the solder on the pre-heated connection rather than on the tip of the iron. Use only enough solder to fill the crevices between the wires and cover the joint. Do not solder any connection until all wires have been attached to that point. When soldering the contacts of the switches use care so that the flux from the core of the solder does not flow out around the contacts on to the bakelite and cause a leakage path. Also, do not bend the contacts of the switches or the spring pressure of the switch contact will be reduced.

Check the wiring as you complete each section of it. A few extra minutes spent in careful checking may save hours of trouble shooting.

You are now ready to begin wiring your KNIGHT Signal Tracer. Remember, **USE ONLY THE ROSIN CORE SOLDER** supplied.

**SEE FIGURE 8.**

- (✓) Insert an 8 inch length of the shielded wire through a 7 inch length of the large spaghetti. Unravel the braided shielding  $\frac{3}{4}$  inch back from one end of the wire. Twist the unraveled shielding tightly together and coat it with solder. Remove the insulation from about  $\frac{1}{4}$  inch of the inner conductor. Twist these wires together and coat them with solder.
- (✓) Solder the inner conductor to pin 1 of V-2. Connect but do not solder the shield lead to pin 5 of V-5. Position the lead as shown in Figure 8. Push the other end through the  $\frac{1}{2}$  inch grommet located to the left of R-26, the Watts Control. This end will be connected later.
- (✓) Unravel about  $\frac{1}{2}$  inch of the braided shielding from a  $6\frac{1}{2}$  inch length of shielded wire. Twist the unraveled shielding tightly together, and coat it with solder. Remove  $\frac{1}{4}$  inch of insulation from the inner conductor. Twist these wires together and coat them with solder.
- (✓) Solder the inner conductor to terminal 2 of R-10, the Gain Control. Connect but do not solder the shield lead to terminal 3 of R-10. Position the lead as shown in Figure 8. Push the other end through the same grommet that the previous shielded lead went through. This end will be connected later.
- (✓) Solder either of the red leads from T-2, the Power Transformer, to pin 1 of V-5.



**FIGURE 7. THE BEST WAY TO CONNECT RESISTORS AND CAPACITORS**

- (✓) Solder the other red lead to pin 6 of V-5.
- (✓) Connect but do not solder the red-yellow lead of T-2 to terminal 2 of TS-3.
- (✓) Connect but do not solder either of the green leads of T-2 to pin 2 of V-3.
- (✓) Connect but do not solder the other green lead to pin 7 of V-3.
- (✓) Connect but do not solder the green-yellow lead of T-2 to terminal 2 of TS-3.
- (✓) Connect but do not solder either of the black leads of T-2 to terminal 1 of TS-3.
- (✓) Connect but do not solder the other black lead to terminal 3 of TS-3.
- (✓) Solder one end of a yellow wire to pin 7 of V-3. Connect but do not solder the other end to pin 3 of V-5.
- (✓) Solder one end of a yellow wire to pin 2 of V-3. Connect but do not solder the other end to pin 4 of V-5.
- (✓) Twist a red and an orange wire together. Solder one end of the red wire to pin 3 of V-5. Solder the same end of the orange wire to pin 4 of V-5.
- (✓) Connect but do not solder the other end of the red wire to pin 3 of V-2. Connect but do not solder the other end of the orange wire to pin 4 of V-2.
- (✓) Twist two yellow wires together. Connect but do not solder one end of either wire to pin 3 of V-2. Connect but do not solder the same end of the other wire to pin 4 of V-2.
- (✓) Solder the other end of either wire to pin 3 of V-1. Solder the other end of the remaining yellow wire to pin 4 of V-1.
- (✓) Solder one end of a yellow wire to pin 3 of V-3. Push the other end through the grommet located to the right of S-2, the Speaker Switch. This end will be connected later.
- (✓) Connect but do not solder one end of a yellow wire to pin 4 of V-3. Push the other end through the grommet located to the right of S-2. This end will be connected later.
- (✓) Connect but do not solder one end of a green wire to pin 5 of V-3. Push the other end through the grommet to the right of S-2. This end will be connected later.
- (✓) Solder one end of a violet wire to terminal 1 of S-2. Push the

- other end through the grommet to the right of S-2. This end will be connected later.
- (✓) Solder one end of a grey wire to terminal 2 of S-2. Push the other end through the grommet to the right of S-2. This end will be connected later.
- (✓) Connect but do not solder one end of a blue wire to terminal 3 of TS-2. Push the other end through the grommet located to the right of S-2. This end will be connected later.
- (✓) Solder an orange wire to terminal 1 of TS-3. Connect but do not solder the other end to terminal 2 of S-3, the AC switch.
- (✓) Slide a 2½ inch length of spaghetti over the 3 inch heavy bare wire. Solder one end of the heavy bare wire to terminal 2 of S-3. Push the other end through the grommet located to the right of S-3. This end will be connected later.
- (✓) Connect but do not solder a yellow wire to terminal 2 of R-26, the Watts Control. Push the other end through the ½ inch grommet located to the left of R-26.
- (✓) Connect but do not solder a white wire to terminal 2 of TS-3. Connect but do not solder the other end to the ground lug on C-3, the electrolytic capacitor.
- (✓) Solder one end of a yellow wire to pin 7 of V-5. Connect but do not solder the other end to terminal 3 of C-3.
- (✓) Solder one end of an orange wire to pin 5 of V5. Connect but do not solder the other end to terminal 2 of TS-2.
- (✓) Connect but do not solder one end of an orange wire to pin 6 of V-2. Connect but do not solder the other end to terminal 1 of TS-2.
- (✓) Connect but do not solder one end of a blue wire to terminal 4 of C-3. Solder the other end to pin 4 of V-3.
- (✓) Connect but do not solder one end of a yellow wire to terminal 2 of C-3. Connect but do not solder the other end to terminal 1 of S-1.
- (✓) Connect but do not solder one end of a red wire to terminal 1 of TS-1. Connect but do not solder the other end to terminal 11 of S-1.
- (✓) Connect but do not solder an orange wire to terminal 1 of TS-1. Push the other end through the grommet directly under S-1. This end will be connected later.
- (✓) Solder one end of a yellow wire to terminal 2 of S-1. Push the other end through the grommet below S-1. This end will be connected later.



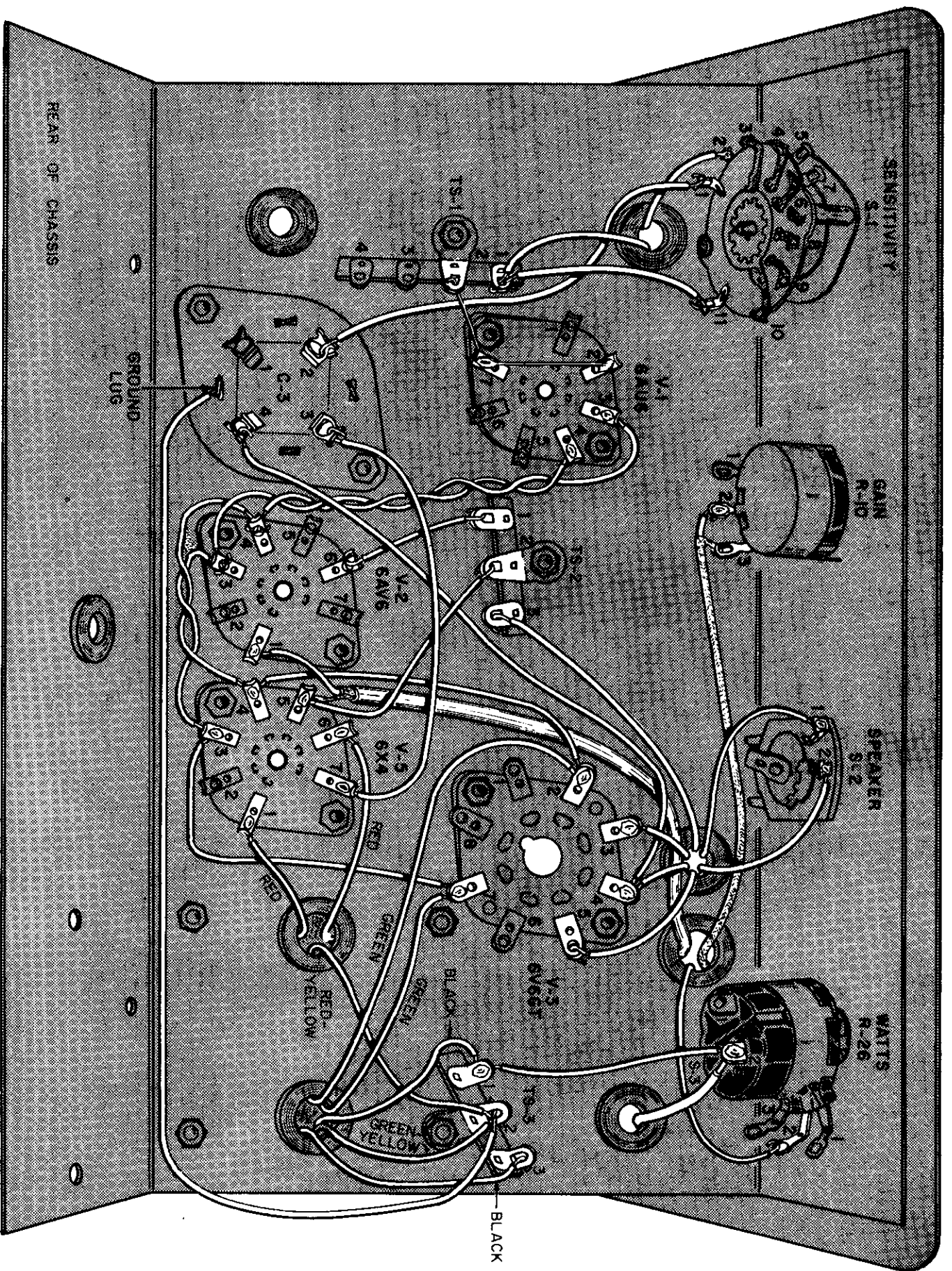


FIGURE 8. FIRST WIRING VIEW INSIDE THE CHASSIS

- (✓) Solder one end of a 2 inch bare wire to pin 2 of V-1. Pass the other end through pin 7 of V-1 and connect it to terminal 2 of TS-1. Solder pin 7, but do not solder terminal 2 of TS-1.

#### SEE FIGURE 9.

The 6-pin socket supplied with this kit is for the "magic eye" tube, V-4. The keyway of this socket is represented by a raised dot between two of the pins. First, make all wiring connections to the socket. Then connect the other ends of the wires.

- (✓) Solder a gray wire to pin 1 of V-4.
- (✓) Solder a blue wire to pin 3 of V-4.
- (✓) Connect but do not solder a green wire to pin 4 of V-4.
- (✓) Solder a violet wire to pin 5 of V-4.
- (✓) Solder a gray wire to pin 6 of V-4.
- (✓) Solder one end of R-16, a 1 megohm resistor, marked with the color bands brown, black, and green, to pin 2 of V-4. Solder the other end to pin 4 of V-4.
- (✓) From the top of the chassis push all five wires through the grommet located to the right of C-3.
- (✓) Solder either of the gray wires coming from V-4 to pin 3 of V-2.
- (✓) Solder the other gray wire to pin 4 of V-2.
- (✓) Connect but do not solder the green wire from V-4 to terminal 4 of TS-1.
- (✓) Connect but do not solder the blue wire from V-4 to terminal 3 of TS-1.
- (✓) Solder the violet wire to the ground lug on C-3.
- (✓) Mount T-3, the Watts Transformer, on the (inside) rear of the chassis. The green and yellow leads must be toward the open bottom edge of the chassis. Use two machine screws and nuts.
- (✓) Connect but do not solder the white lead of T-3 to terminal 1 of R-26.
- (✓) Connect but do not solder the black lead of T-3 to terminal 2 of TS-3.
- (✓) Connect but do not solder the green lead of T-3 to terminal 3 of TS-3.
- (✓) Push the yellow lead of T-3 through the grommet located to the right of R-26. This end will be connected later.

#### BLUE, RED, & BROWN

- (✓) Connect, but do not solder, one end of R-27, a 620 ohm resistor (yellow, violet, brown), to terminal 3 of R-26. Connect, but do not solder, the other end to terminal 2 of TS-3. **E, R, B**
- (✓) Solder one end of R-20, a 470,000 ohm resistor (yellow, violet, yellow), to pin 5 of V-3. Connect but do not solder the other end to terminal 2 of TS-3.
- (✓) Place C-6A,B in position between TS-2 and R-10. The end with the two leads must be toward the right of the chassis.
- (✓) Connect but do not solder the black lead of C-6A,B to terminal 2 of TS-2.
- (✓) Connect but do not solder either of the red leads of C-6A,B to pin 8 of V-3.
- (✓) Connect but do not solder the other red lead to pin 2 of V-2.
- (✓) Connect but do not solder one end of R-17, a 220,000 ohm resistor (red, red, yellow), to terminal 3 of TS-2. Solder the other end to terminal 1 of TS-2.
- (✓) Connect but do not solder the black banded end of C-8, a .05 MFD, 400 V capacitor, to pin 7 of V-2. Pass the other end through pin 1 of V-3 and connect it to terminal 3 of TS-2. Solder both connections.
- (✓) Place a 1 inch length of spaghetti over one end of R-13, a 3,300 ohm resistor (orange, orange, red). Solder this end of R-13 to pin 2 of V-2. Connect but do not solder the other end to terminal 2 of TS-2.
- (✓) Connect but do not solder one end of R-7, a 470,000 ohm resistor (yellow, violet, yellow), to pin 5 of V-1. Connect but do not solder the other end to terminal 2 of C-3.
- (✓) Connect but do not solder one end of R-9, a 2.2 megohm resistor (red, red, green), to pin 6 of V-1. Connect but do not solder the other end to terminal 2 of C-3.
- (✓) Solder one end of R-23, a 1,000 ohm, 2 watt resistor (brown, black, red), to terminal 3 of C-3. Connect, but do not solder, the other end to terminal 4 of C-3.
- (✓) Solder one end of R-22, a 10,000 ohm resistor (brown, black, orange), to terminal 4 of C-3. Connect but do not solder the other end to terminal 1 of C-3.
- (✓) Solder one end of R-11, a 22,000 ohm resistor (red, red, orange), to terminal 2 of C-3. Connect but do not solder the other end to terminal 1 of C-3.

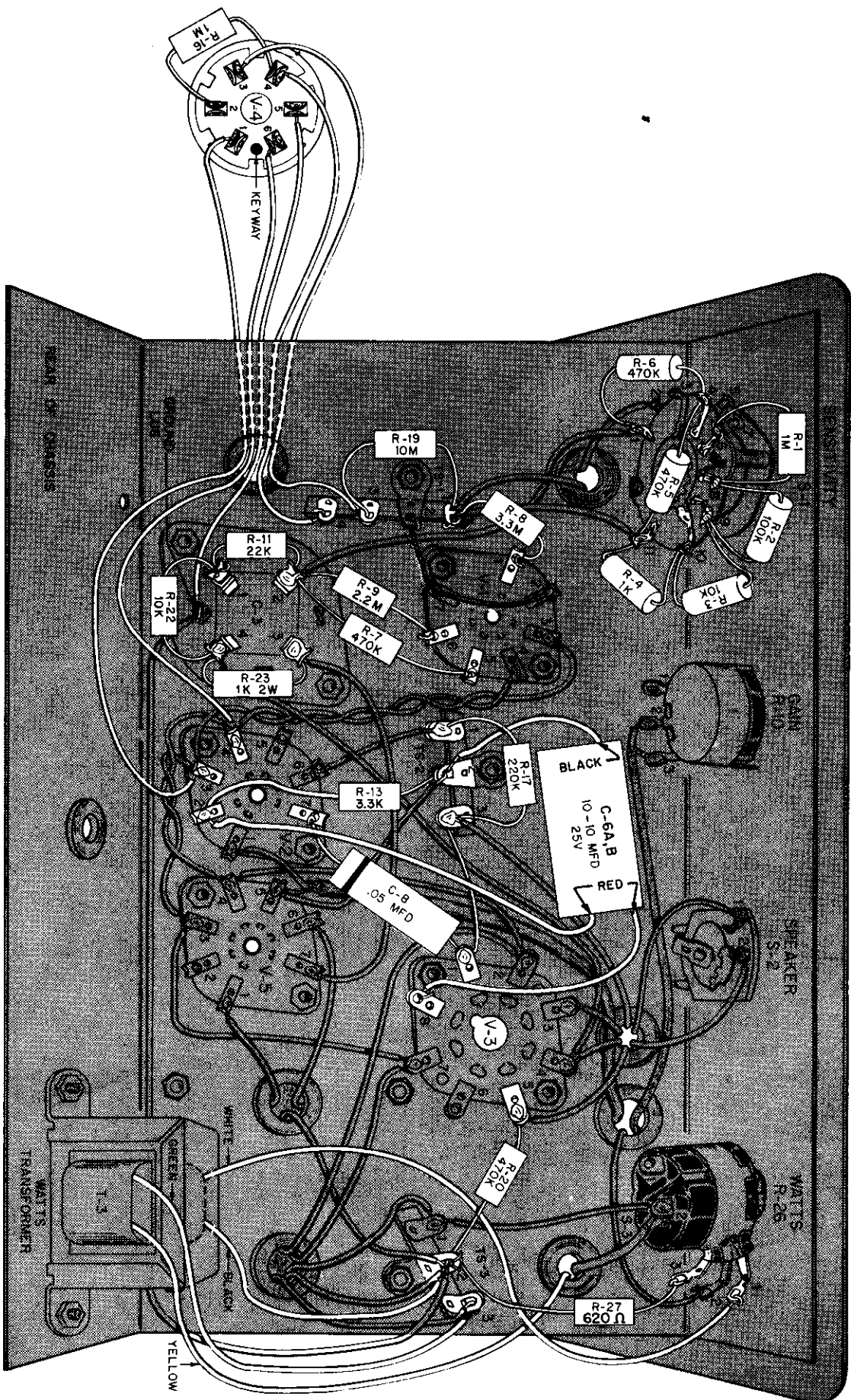


FIGURE 9. SECOND WIRING VIEW INSIDE THE CHASSIS





- (✓) Connect but do not solder one end of R-19, a 10 megohm resistor (brown, black, blue), to terminal 1 of TS-1. Connect but do not solder the other end to terminal 3 of TS-1.
  - (✓) Connect but do not solder one end of R-8, a 3.3 megohm resistor (orange, orange, green), to terminal 1 of TS-1. Connect but do not solder the other end to pin 1 of V-1.
  - (✓) Solder one end of R-6, a 470,000 ohm resistor (yellow, violet, yellow), to terminal 1 of S-1. Connect but do not solder the other end to terminal 4 of S-1.
  - (✓) Solder one end of R-1, a 1 megohm resistor (brown, black, green), to terminal 6 of S-1. Connect but do not solder the other end to terminal 8 of S-1.
  - (✓) Solder one end of R-2, a 100,000 ohm resistor (brown, black, yellow), to terminal 8 of S-1. Connect but do not solder the other end to terminal 9 of S-1.
  - (✓) Solder one end of R-3, a 10,000 ohm resistor (brown, black, orange), to terminal 9 of S-1. Connect but do not solder the other end to terminal 10 of S-1.
  - (✓) Solder one end of R-4, a 1,000 ohm resistor (brown, black, red), to terminal 10 of S-1. Connect but do not solder the other end to terminal 11 of S-1.
  - (✓) Solder one end of R-5, a 470,000 ohm resistor (yellow, violet, yellow), to terminal 4 of S-1. Solder the other end to terminal 11 of S-1.
- SEE FIGURE 10.**
- (✓) Solder one end of R-28, a 7,500 ohm resistor (violet, green, red), to terminal 3 of R-26. Solder the other end to terminal 2 of R-26.
  - (✓) Solder one end of R-25, a 47 ohm, 1 watt resistor (yellow, violet, black), to terminal 1 of R-26. Solder the other end to terminal 2 of TS-3.
  - (✓) Solder one end of R-21, the large 470 ohm, 2 watt resistor (yellow, violet, brown), to pin 8 of V-3. Connect, but do not solder, the other end to terminal 2 of TS-2.
  - (✓) Solder one end of an orange wire to terminal 2 of TS-2. Solder the other end to terminal 3 of R-10. Pass the wire over the top of C-6.
  - (✓) Solder the black banded end of C-4, a .05 MFD, 400 V capacitor, to pin 5 of V-1. Solder the other end to terminal 1 of R-10.
  - (✓) Solder the unmarked end of C-2, a .05 MFD, 400 V capacitor, to pin 6 of V-1. Pass the other end through terminal 2 of TS-1 and

then connect it to terminal 1 of TS-1. Solder the connection at terminal 2.

- (✓) Place a 1 inch length of spaghetti on one end of R-18, a 1 megohm resistor (brown, black, green). Pass this lead through pin 5 of V-2 and connect it to pin 6 of V-2. Solder both connections. Connect but do not solder the other end to terminal 3 of TS-1.
- (✓) Connect but do not solder one end of R-15, 47,000 ohm resistor (yellow, violet, orange), to terminal 1 of C-3. Solder the other end to terminal 4 of TS-1.
- (✓) Place a 1 inch length of spaghetti on each end of R-12, a 470,000 ohm resistor (yellow, violet, yellow). Solder one end to pin 7 of V-2. Solder the other end to terminal 1 of C-3.
- (✓) Solder the black banded end of C-7, a .05 MFD, 400 V. capacitor, to terminal 1 of TS-1. Solder the other end to terminal 3 of TS-1.
- (✓) Solder the black banded end of C-1, a .05 MFD, 400 V capacitor, to terminal 3 of S-1. Solder the other end to pin 1 of V-1.
- (✓) Pass the end of the line cord through the grommet on the chassis rear. Tie a knot in the line cord about five inches from this end. Split the two leads of the line cord back about three inches.
- (✓) Solder one of the leads of the line cord to terminal 1 of S-3.
- (✓) Solder the other lead to terminal 3 of TS-3.

**CAUTION:** Do not plug the line cord into the AC outlet until you have finished all wiring.

You have now completed wiring the inside of the chassis. Turn the chassis over and wire the top side.

**SEE FIGURE 12.**

- (✓) There is a yellow wire coming through the large grommet. Solder this wire to terminal 4 of S-4, the Signal Tracer-Wattmeter Switch.
- (✓) There is a yellow wire coming through the first grommet from the left edge of the chassis. Solder this wire to terminal 2 of J-2, the Watts Receptacle.
- (✓) There is a heavy bare wire with spaghetti coming through the same grommet. Solder this wire to terminal 1 of J-2.
- ( ) There are two shielded cables coming through the large grommet. Place a one inch length of spaghetti on the cable that does not already have spaghetti. Remove 1/4 inch of insulation from the inner conductor of this cable. Solder the inner conductor to terminal 6 of S-4.

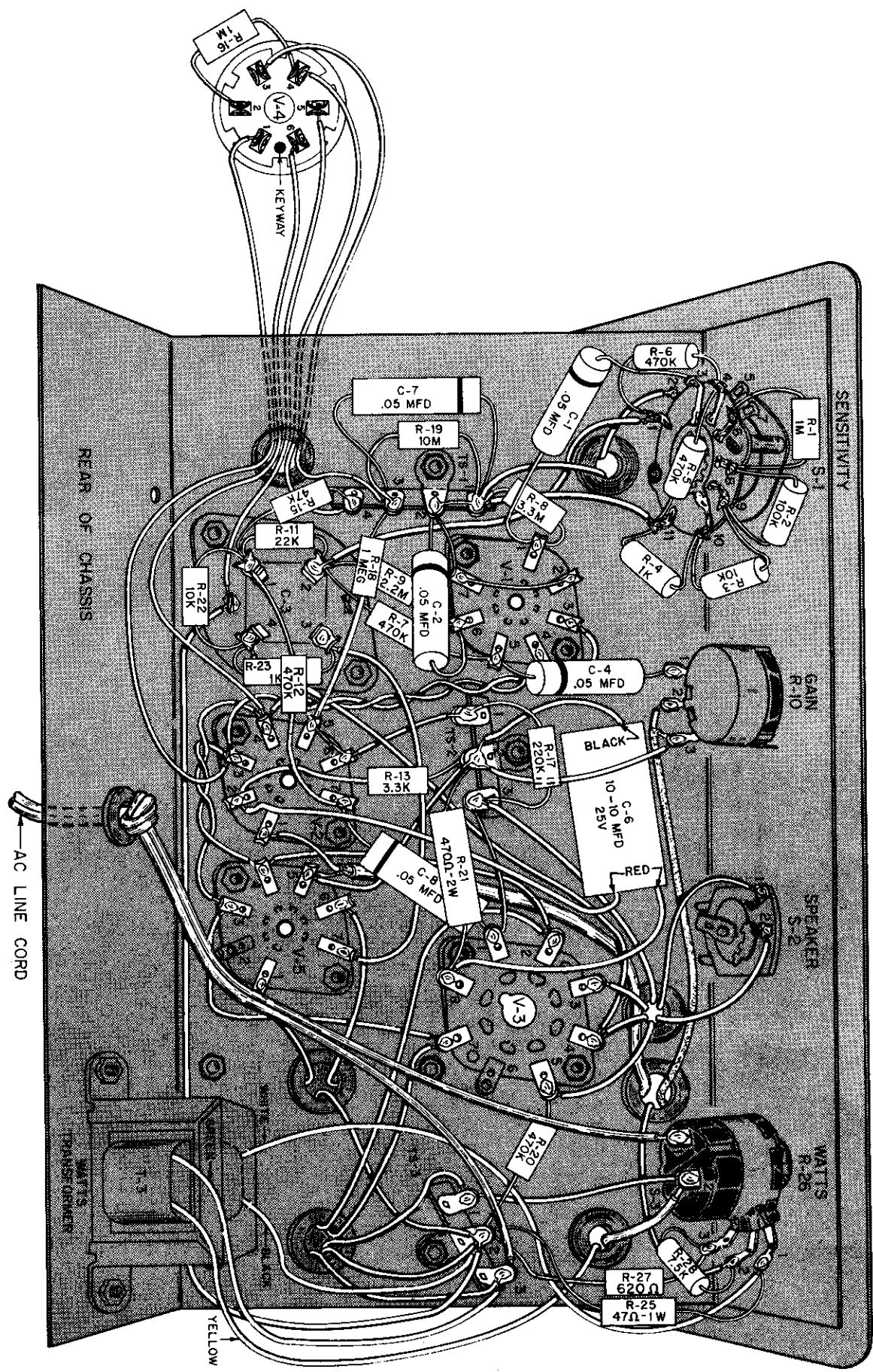


FIGURE 11. COMPLETED WIRING VIEW

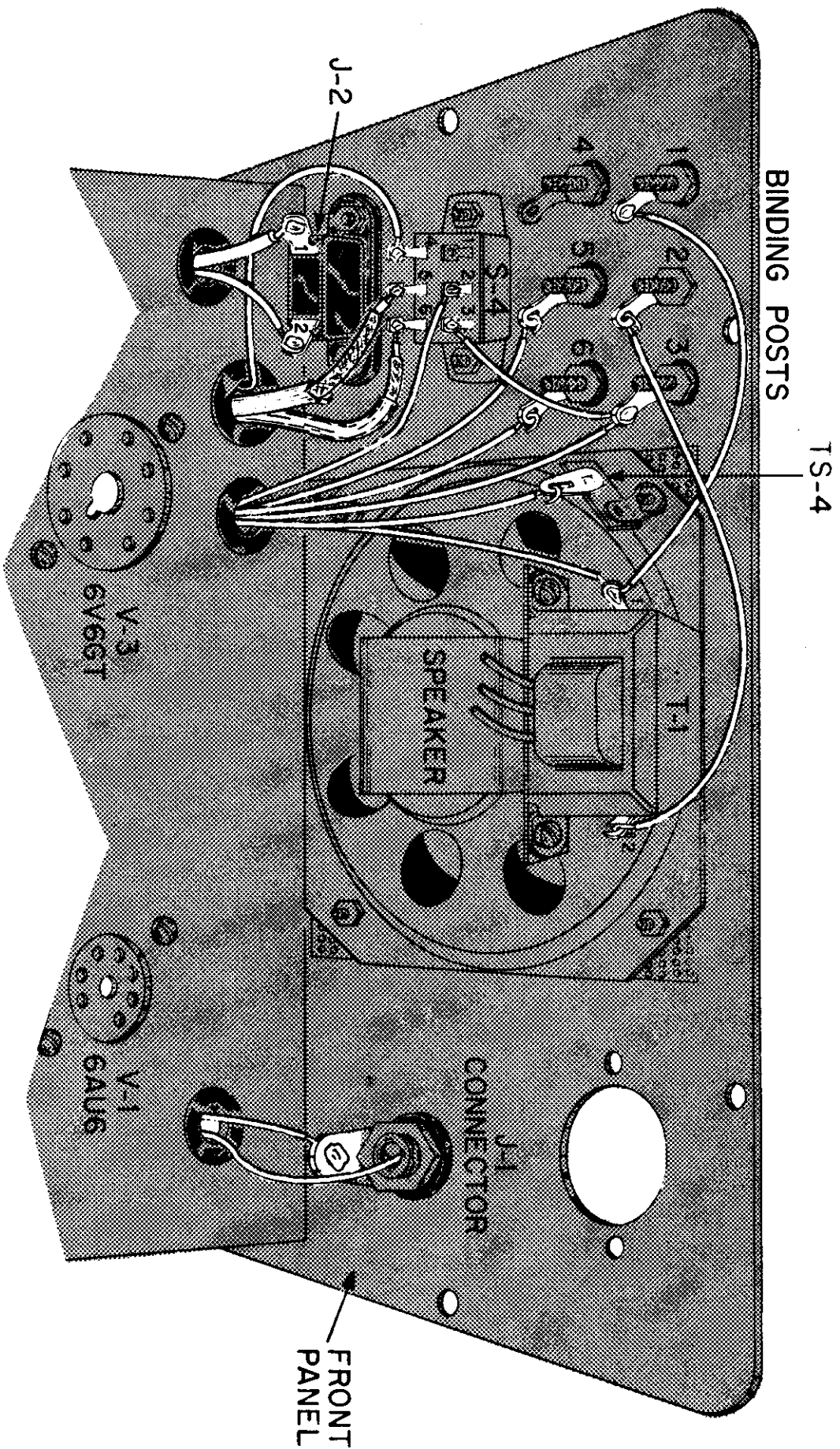


FIGURE 12. FIRST TOP WIRING VIEW



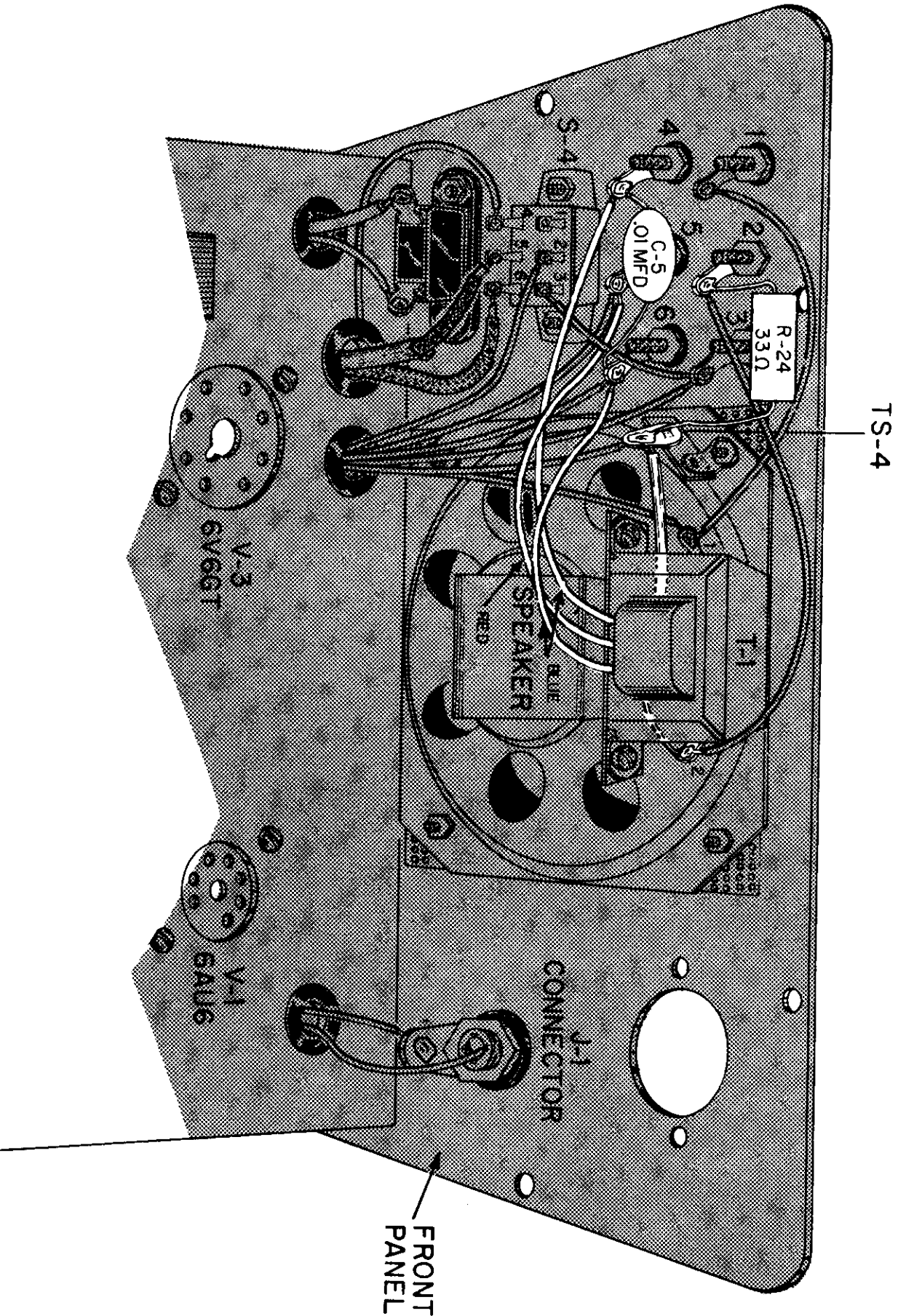


FIGURE 13. SECOND TOP WIRING VIEW



- (✓) Remove  $\frac{1}{4}$  inch of insulation from the inner conductor of the other shielded cable. Solder the inner conductor to terminal 5 of S-4.
- (✓) There is a blue wire coming through the third grommet from the left edge of the chassis. Solder this wire to terminal 2 of S-4.
- (✓) There are two yellow wires coming through the third grommet from the left edge of the chassis. Connect but do not solder the one coming from pin 3 of V-3 to binding post 6.
- (✓) Connect but do not solder the other yellow wire to binding post 5.
- (✓) Connect but do not solder the green wire coming through the same grommet to binding post 3.
- (✓) Connect but do not solder the violet wire coming through the grommet to the terminal on TS-4.
- (✓) Connect but do not solder the gray wire coming through the grommet to terminal 1 of the speaker.
- (✓) Solder one end of a red wire to binding post 3. Solder the other end to terminal 3 of S-4.
- (✓) Solder one end of a green wire to binding post 1. Solder the other end to terminal 1 of the speaker.
- (✓) Connect but do not solder one end of a green wire to binding post 2. Connect but do not solder the other end to terminal 2 of the speaker.
- (✓) There are an orange wire and a yellow wire coming through the grommet on the right side of the chassis. Solder the orange wire to the solder lug under J-1, the Input Connector.
- (✓) Push the yellow wire through the connector and solder it to the eyelet in front of the connector. See Figure 5.

#### SEE FIGURE 13.

- (✓) Connect but do not solder either of the blue leads of T-1, the Output Transformer, to binding post 6.
- (✓) Solder the red lead of T-1 to binding post 5.
- (✓) Connect but do not solder the remaining blue lead of T-1 to binding post 4.
- (✓) Solder one end of C-5, a .01 MFD ceramic disc capacitor, to binding post 4. Solder the other end to binding post 6.
- (✓) Solder one end of R-24, a 33 ohm resistor (orange, orange, black), to binding post 2. Connect but do not solder the other end to the

terminal of TS-4.

- (✓) Solder the enameled lead on the right side of T-1 to terminal 2 of the Speaker.
- (✓) Place a 1- $\frac{3}{4}$  inch length of spaghetti on the other enameled lead and solder it to the terminal of TS-4.

#### SEE FIGURE 14.

- (✓) Hold the "magic eye" escutcheon in position on the front panel with the cutout toward the bottom. Place the "magic eye" retaining bracket in position on the rear of the front panel, with the mounting legs up. Secure the escutcheon and bracket to the panel with two small sheet metal screws. Mount the "magic eye" retaining clip to the mounting bracket with the thumb screw. The edge of the clip should be even with the rear edge of the mounting bracket.

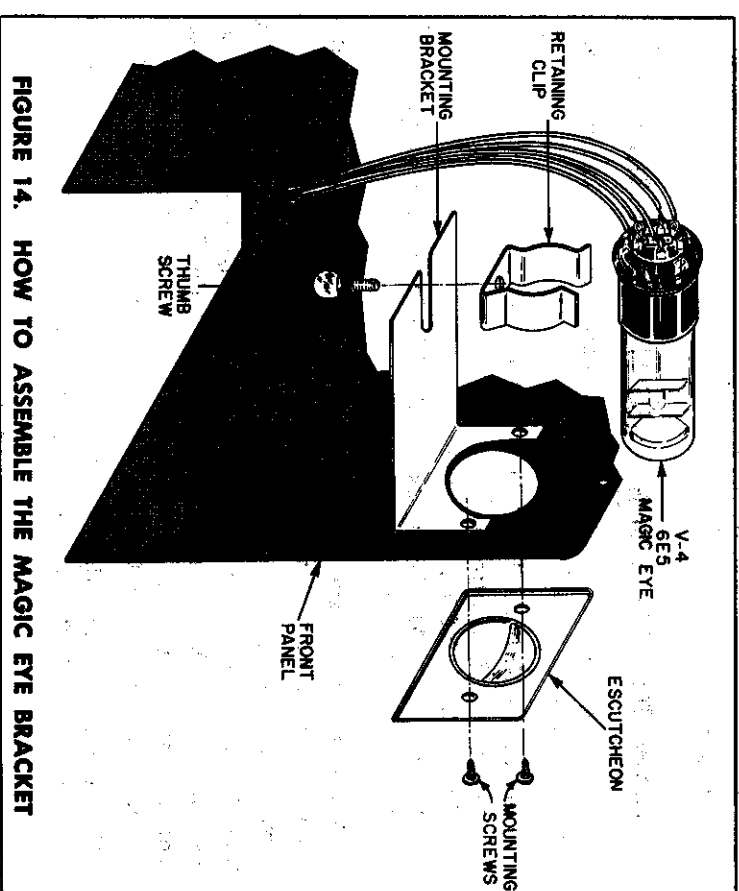


FIGURE 14. HOW TO ASSEMBLE THE MAGIC EYE BRACKET

- (✓) Plug the "magic eye" tube (V-4) into its socket and insert the socket and tube into position in the retaining clip and mounting bracket.
- (✓) Insert the 6AU6, 6AT6, 6C4, and 6V6GT tubes into their sockets. See Figure 3.

- ( ) Before proceeding any farther in the assembly of your KNIGHT Signal Tracer, check all wiring and solder connections.
- (✓) Place a knob over the shaft of the Sensitivity Switch so that the set screw will tighten against the flat portion of the shaft. Tighten the set screw. Turn the knob fully to the left (counterclockwise). The white line on the knob must point to the X1 position.
- (✓) Turn the gain control fully to the left. Place a knob on the shaft so that the white line on the knob points to the "0" calibration mark. Tighten the set screw.
- (✓) Place a knob over the shaft of the Speaker Switch so that the set screw will tighten against the flat portion of the shaft. Tighten the set screw. Turn the knob fully to the left. The white line on the knob must point to the OFF position.
- (✓) Turn the Watts control fully to the left. Place a knob on the shaft so that the white line on the knob points to the AC OFF position. Tighten the set screw.

## HOW TO TEST YOUR KNIGHT SIGNAL TRACER

- Turn the Signal Tracer "ON" (turn Watts control clockwise) and wait a few minutes until it warms up.
- Set the SENSITIVITY Control to X1.
- Set the GAIN Control to 10.
- Set the SPEAKER Switch to ON.
- Set the SIGNAL TRACER-WATTMETER switch to SIGNAL TRACER.

Rotate the "magic eye" tube until the unilluminated portion of the eye is visible in the center of the lower half of the escutcheon.

Touch your finger to the center terminal of the Input Connector. A hum should be heard from the speaker and the "magic eye" should close. Repeat for X10, X100, and X1000 settings of the Sensitivity Control. The hum should get louder and the "magic eye" should close for each setting of the Sensitivity Control.

If the Signal Tracer does not function as described above refer to the SERVICE HINTS section of this manual.

## SEE FIGURE 15.

## PROBE ASSEMBLY

- (✓) Twist one of the leads of R-14, a 1 megohm resistor (brown, black, green), with one of the leads of R-30, a 22,000 ohm resistor (red, red, orange). Solder and clip the excess leads. (Point "A" of Figure 15A.)

- (✓) Connect the lead from the banded end (cathode) of CR-1, the crystal diode, to point "B". See Figure 15A.
- (✓) Connect the other end of CR-1 to point "C". See Figure 15A.
- (✓) Position R-29, a 15,000 ohm resistor (brown, green, orange), as shown in Figure 15A. Solder one lead of R-29 to point "B". Cut off the excess leads from R-14, CR-1 and R-29 close to this soldered connection.
- (✓) Cut off  $\frac{3}{4}$  of an inch from the other lead of R-29.
- (✓) Position the assembled parts on C-9, a 400 MMFD mica capacitor, as shown in Figure 15B. Solder one lead of C-9 to point "C". Clip the excess capacitor lead. Clip the lead from the other end of the capacitor, leaving an  $\frac{1}{8}$  inch lead.
- (✓) Mount the metal ground strap to the 3-pin socket with the small screw, as shown in Figure 15B.
- (✓) Position the assembled parts, as shown in Figure 15B. The short lead (point "A") between R-14 and R-30 must be directly under the small hole in the end of the metal strap.
- (✓) Place a  $\frac{1}{2}$  inch length of spaghetti on the unsoldered lead of R-29. Solder this lead to terminal 2 of the 3-pin socket.
- (✓) Solder the long lead of R-30 to terminal 3 of the 3-pin socket.
- (✓) Place a 1 inch length of spaghetti on a 6 inch length of bare wire. Solder this end of the bare wire to terminal 1 of the 3-pin socket.
- (✓) Wrap the bare wire (just above the length of spaghetti) once around the short lead of C-9 (point "D") and solder it.
- (✓) Solder the ground strap to the junction between R-14 and R-30. (Point "A".)
- (✓) Bend the ground strap over the edge of the 3-pin socket, as shown. Remove the screw that retains the ground strap. See Figure 15D.
- (✓) Place a piece of hookup wire at the creased point. Fold the end of the ground strap (around the hookup wire) back under itself. See Figure 15E. Remove the piece of hookup wire.
- (✓) Insert the assembled parts into the probe head. The small hole in the side of the 3-pin socket must line up with the hole in the probe head. Tighten the small screw into this hole. See Figure 15C.
- (✓) Remove the knurled nut from the probe tip. Pass the bare wire through the small hole in the probe tip and then press the tip into the end of the probe head. Wrap the wire once around the shoulder of the probe head.

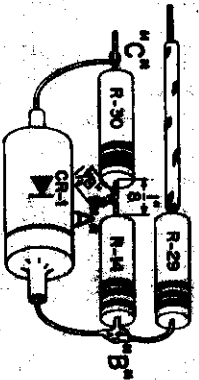


FIGURE 15A

R-30 - 22,000 OHM  
 R29 - 15,000 OHM  
 CR-1 - 400 MFD  
 R14 - 1 MEG.

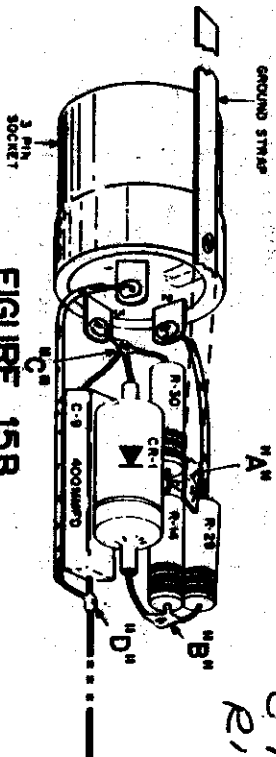


FIGURE 15B

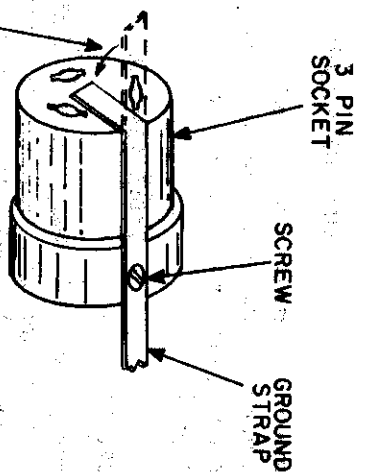


FIGURE 15D

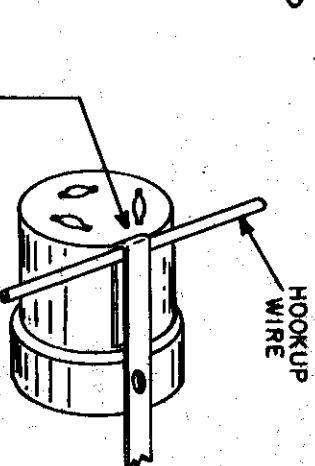


FIGURE 15E

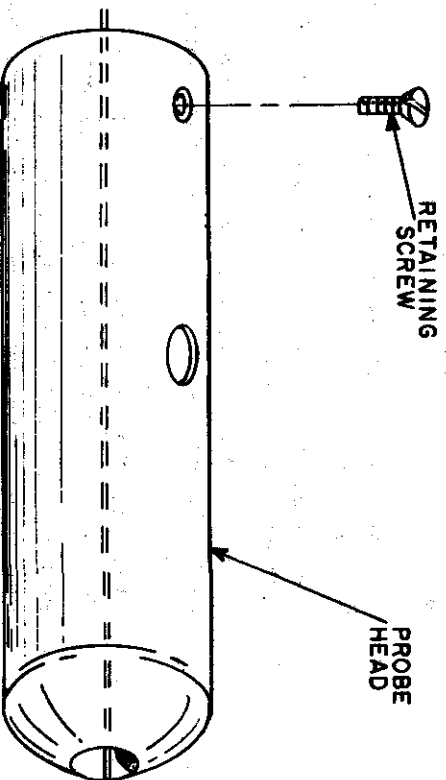


FIGURE 15C

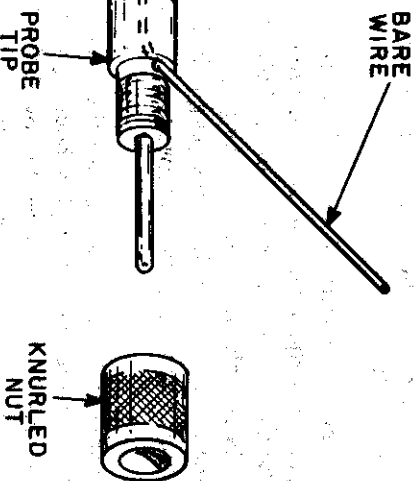


FIGURE 15. PROBE ASSEMBLY

der of the probe tip. Cut off the excess wire and replace the knurled nut.

### PROBE DISASSEMBLY

To remove the parts from the probe head, first remove the retaining screw. Then remove the knurled nut from the probe tip and remove the tip. Insert a long slender screwdriver through the hole in the probe head and push gently.

### SEE FIGURE 16.

### CABLE ASSEMBLY

(✓) Remove the small set-screw from the cable plug and remove the spring from the plug. Slide the spring, large hole first, over one end of the shielded cable. Remove  $\frac{1}{2}$  inch of the outer insulation from the cable. Unravel the braid and bend it back over the spring. Remove  $\frac{1}{8}$  inch of the insulation from the inner conductor. Twist the stranded leads together and coat them with solder. Insert the cable and spring into the open end of the plug. The inner conductor must fit into the small hole of the plug. The braid and spring should fit into the plug so that the set screw will tighten on the spring. Tighten the set screw. Solder the inner conductor to the eyelet. See Figure 16A.

(✓) Place the cable and plug housing on the other end of the cable. Remove  $1\frac{1}{4}$  inch of the outer insulation from the cable. Unravel the braided shielding. Wrap the unraveled shielding around the end of the cable's outer insulation and coat it with solder. Coat the ground strap with solder for about  $\frac{1}{2}$  inch from one end. Wrap this end of the ground strap once around the solder coated shielding. Solder the ground strap to the shielding. Do not apply too much heat or the insulation around the inner conductor will melt. See Figure 16B.

(✓) Remove  $\frac{3}{4}$  inch of insulation from the inner conductor. Insert the pin of the plug over the inner conductor and solder. Slide the cable and plug housing down over the plug. Pull the ground strap through the large hole in the side of the housing. Rotate the plug until the small hole in the side of the plug is in line with the hole in the housing. Tighten a small screw into this hole. See Figure 16C.

(✓) Insert the cable and plug housing into the probe shield. Line up the small hole in the cable and plug housing with the small hole in the probe shield. Place a solder lug over this hole and secure the parts in place with a small sheet metal screw. See Figure 16D.

(✓) Remove  $\frac{1}{2}$  inch of insulation from both ends of a 10 inch length of black test lead wire. Solder one end of this wire to the solder

lug on the probe shield. Connect the other end of the wire under the screw of the battery type clip. The two small lugs on the end of the clip are clamped down over the wire's insulation. See Figure 16D.

### FINAL PROBE ASSEMBLY

Insert the probe head assembly into the probe shield. The pin on the plug inside the shield must fit into one of the holes of the receptacle on the probe head. Only the two holes corresponding to the DIRECT and RF positions marked on the probe head are used. The probe position in use is indicated in the slot on the probe shield. To change the probe function, pull out the probe head and rotate it until either the DIRECT or RF position is indicated in the slot. The DIRECT position is used for audio signal tracing. The RF position is used for RF and IF signal tracing.

### TEST LEAD ASSEMBLY

( ) Remove about  $\frac{1}{2}$  inch of insulation from both ends of the red and black flexible test leads. Pass one end of the red lead through the small hole of the red clip insulator and connect it under the screw of one of the battery type clips. The two small lugs on the end of the clip are clamped down over the wire's insulation. Connect the other end of the lead under the screw of the red banana plug. Pass one end of the black lead through the black clip insulator and connect it to the remaining battery type clip. Connect the other end of the lead under the screw of the black banana plug.

### SEE FIGURE 17.

### FINAL ASSEMBLY

(✓) Lay the handle in the handle well on the top of the case. Turn the case on edge.

(✓) Place a flat washer, a coil spring, and another flat washer over each leg of the handle.

(✓) Insert one of the cotter pins through the hole in one leg of the handle. Spread the two sections of the cotter pin so that it cannot fall out.

(✓) Insert the other cotter pin through the hole in the other leg of the handle. Spread the two sections of this cotter pin also.

(✓) Push the line cord through the hole in the rear of the cabinet. Lift up the handle to clear the electrolytic capacitor. Set the completed Signal Tracer into the case. Match the 6 holes in the front panel and the 2 holes on the rear of the chassis with the small holes in the case. Fasten the completed Signal Tracer in the case securely with the 8 self-tapping screws supplied.

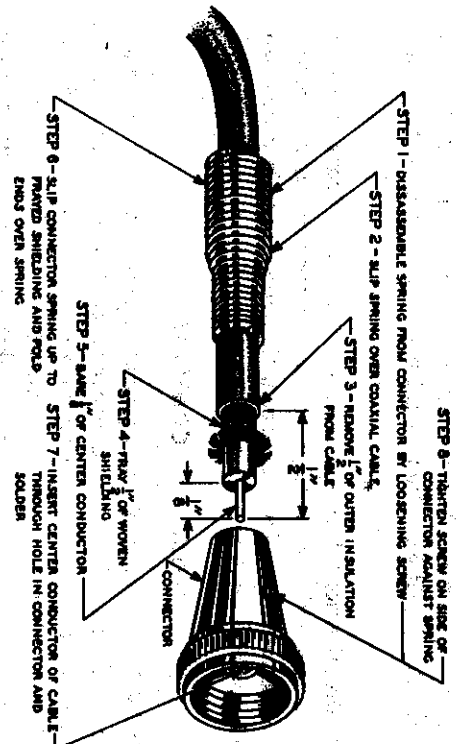


FIGURE 16A

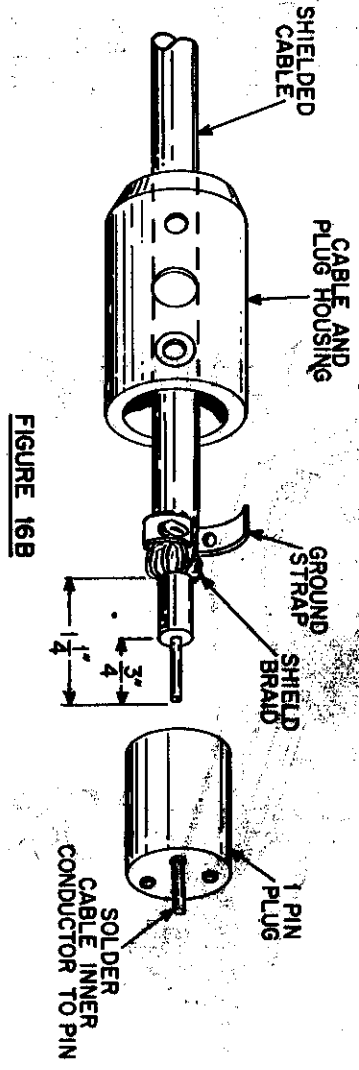


FIGURE 16B

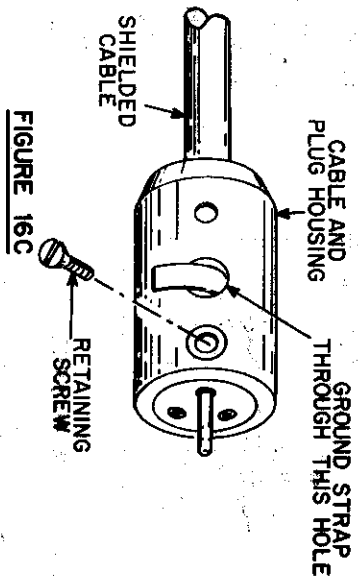


FIGURE 16C

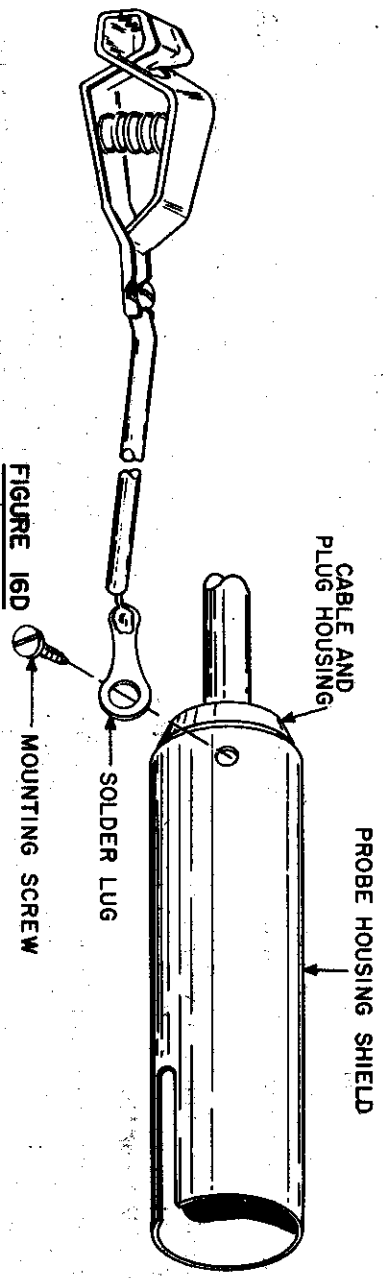
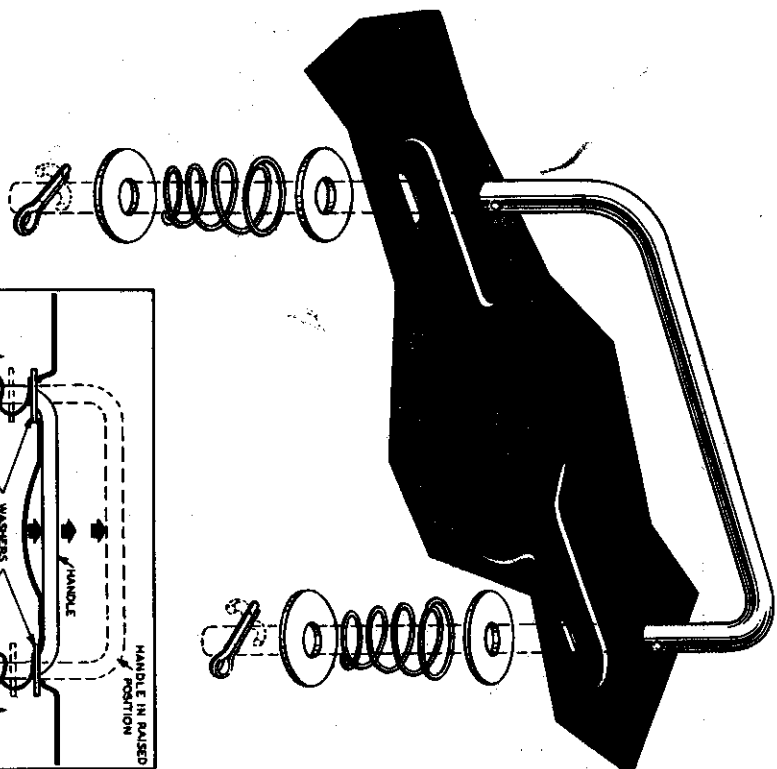


FIGURE 16D

FIGURE 16. CABLE ASSEMBLY



**FIGURE 17. HOW TO ASSEMBLE THE HANDLE**

## HOW TO USE YOUR KNIGHT SIGNAL TRACER

### CIRCUIT DESCRIPTION

This Signal Tracer is basically a high gain audio amplifier which permits visual observation and aural indication of a modulated RF or audio signal.

The sensitivity is controlled by a voltage divider network, which consists of four resistors R-1 (1 meg) R-2 (100K) R-3 (10K) and R-4 (1K), in the grid circuit of V-1 (6AU6).

The 6AU6 (V-1) tube functions as a high gain voltage amplifier. The output of V-1 is fed through R-10, which is a "vernier" gain control, to the grid of V-2 (6AV6), the second voltage amplifier. The diode sections of V-2 are tied together. A portion of the AC output of V-2 is applied to the diode sections and rectified. This rectified voltage is used to operate V-4 (6E5) the "magic eye" tube.

The wattmeter circuit consists of a receptacle so connected that a device being checked is connected in series with the watts transformer (T-3) and the line. The voltage developed across the secondary of T-3 is amplified and then rectified. The rectified voltage is applied to the grid of the "magic eye" tube. The amount of voltage required to close the eye is controlled by R-26, which is calibrated in watts on the front panel.

Fundamentally, the noise locating feature of the signal tracer permits the application of a DC test voltage to any component in a receiver circuit and the action of the DC voltage in the component is picked up and amplified by the signal tracer's circuit.

### OPERATING CONTROLS

**SENSITIVITY:** This control determines the sensitivity of the Signal Tracer to weak signals. When the Sensitivity control is in the X1000 position, the signal tracer is most sensitive to weak signals. The Sensitivity control also switches in the noise circuit of the signal tracer. To place the noise circuit in operation just switch the Sensitivity control to "NOISE".

**GAIN:** This control is a "vernier" gain control and is used in conjunction with the Sensitivity control to adjust the signal level for a pleasing volume.

**SPEAKER:** This control switches the speaker in or out of the circuit.

**WATTS:** The Watts control is calibrated directly in watts on the front panel. When an electrical device is plugged into the Watts receptacle and the Watts control is adjusted to close the "magic eye", the power consumption of the device is indicated by the pointer of the Watts control. The ON-OFF switch is also operated with the Watts control.

**SIGNAL TRACER-WATTMETER:** This switch selects either the signal tracer or wattmeter circuit of this instrument.

## SIGNAL TRACER APPLICATIONS

### TO SIGNAL TRACE A RECEIVER

To trace the signal through a receiver set the signal tracer controls as follows:

**SENSITIVITY** control to X1000.

**GAIN** control to 10.

**SPEAKER** to ON.

**SIGNAL TRACER-WATTMETER** to SIGNAL TRACE.

**PROBE** in RF position.

Turn the Signal Tracer on (turn Watts control clockwise) and wait

a few minutes until the tubes reach operating temperature. Connect the Signal Tracer ground lead to the receiver's chassis.

1. Place the RF probe on the antenna lead or the antenna loop lead of the receiver. Several stations should be heard.

2. Advance the probe to the grid of the RF amplifier (or mixer if the set has no RF stage) and tune in a station.

3. Advance the probe to the plate of the stage—the signal should be stronger. Follow through all RF, mixer, and IF stages from grid to plate of each stage. The signal should get stronger as you advance, stage by stage. Reduce the Sensitivity as required to keep the signal level to a pleasing listening volume.

Note: due to a slight loading effect of the probe the signal at the grid of a tube may appear weaker than it did on the plate of the preceding stage.

4. After the RF and IF stages have been checked the probe is rotated to the DIRECT position and the audio stages are checked in a similar manner.

5. If the signal is not heard at one of the check points, the trouble lies in this locality and can be pinpointed with voltage and resistance measurements.

#### HOW TO USE THE WATTMETER

Turn the Signal Tracer on and set the SIGNAL TRACER-WATTMETER switch to WATTMETER. Plug an electrical device (rated at 1000 watts or less) to be checked into the WATTS receptacle and turn the Watts control until the "magic eye" just closes. The power consumption of the device is indicated by the pointer on the Watts control.

#### HOW TO USE THE NOISE LOCATOR

To use the noise locator feature of your KNIGHT Signal Tracer set the controls as follows:

Set the SENSITIVITY control to NOISE.

Set the GAIN control to 10.

Set the SPEAKER switch to ON.

Set the SIGNAL TRACER-WATTMETER switch to SIGNAL TRACER.

Rotate the probe to the DIRECT position. NEVER USE THE RF PROBE FOR NOISE TESTS AS THE CRYSTAL DIODE WILL BE DAMAGED. Disconnect the receiver from the AC power line as all tests are made with an inoperative receiver.

Clip the Signal Tracer ground lead to the B-plus lead of the receiver's power supply. Touch the probe tip to the plate of one of the receiver's tubes. A sharp click should be heard from the Signal Tracer's speaker. A good, sharp, clean click indicates proper circuit continuity and operation. A frying or crackling sound would indicate a defective component in the circuit. The probe can be moved along the circuit toward the ground lead connection, checking each component until the part causing the noise is found.

Noisy resistors, cold or rosin solder joints, or shorted transformer turns will cause a buzzing or crackling sound to be heard from the Signal Tracer's speaker. Volume controls, fixed capacitors, and variable capacitors can also be checked for erratic operation. To check an individual component just clip the ground lead to one end of the part and the probe to the other end.

#### HOW TO USE THE BINDING POSTS

The six binding posts will accommodate banana plugs, alligator clips, spade lugs, or ordinary hookup wire. A VTVM can be connected to the binding post marked VTVM-SCOPE (set VTVM function switch to AC) for precise readings during alignment procedure and for gain calculations. This same terminal can also be used for connection to the vertical input of an oscilloscope.

To use the Signal Tracer speaker as a test speaker just connect the output transformer of the receiver or the amplifier being serviced to the VC and GND binding posts of the Signal Tracer.

To use the Signal Tracer output transformer as a substitute transformer just connect to the B+ and P binding posts for single ended circuits or to P — B+ — P binding posts for push-pull circuits.

#### SIGNAL TRACER USED AS A SUBSTITUTE AUDIO AMPLIFIER

To use the Signal Tracer as a substitute audio amplifier, just connect a microphone, record changer, FM-AM tuner, or musical instrument pickup to the input connector of the Signal Tracer.

#### OUTPUT INDICATOR

The Signal Tracer can be used as an output indicator by connecting the DIRECT probe to some point in the audio circuit of a receiver and regulating the amount of Signal Tracer gain to permit usable action of the "magic eye" indicator. Then while performing checks the amount of gain or loss will be indicated by the opening and closing of the "magic eye".

## SERVICE HINTS

**NOTE: USE EXTREME CAUTION** when you use the screwdriver to touch the individual grids of the tubes. Be very careful that you touch only the one pin and do not short two pins together.

If you have followed all of the assembly and wiring instructions carefully, your Signal Tracer should perform well. If it does not, however, here are several hints that you can follow:

If the Signal Tracer is dead and the tubes do not light up, check the wiring to pins 3 and 4 of the 6AU6, 6AV6, and 6X4 tubes, to pins 2 and 7 of the 6V6, and pins 1 and 6 of the 6E5. If the wiring is correct, and one of the tubes does not light up the filament may be burned out. Replace the tube with one of the same type.

If the tubes light up, touch the individual grids of the tubes with a screwdriver starting with V-3, the 6V6 tube. Touch pin 5 of this tube. If a hum is heard in the speaker this stage is correct. If no hum is heard, check all of the wiring to V-3, or replace the tube.

Repeat the above procedure on pin 1 of V-2 the 6AV6 tube, and pin 1 of the 6AU6 tube.

If the Signal Tracer still does not function make voltage and resistance checks with a VTVM or a VOM. Refer to the voltage and resistance charts.

It is often helpful to have someone else check the wiring, preferably someone with radio experience.

### ALLIED'S SERVICE FACILITIES

In the event that the kit does not operate properly, we recommend the following:

Please write our Kit Department with full details, and include the stock number and the date of purchase of the kit. We may be able to determine any wiring error or replace a component which may be at fault.

This wired KNIGHT kit may be returned for inspection within 1 year after purchase. The kit will be placed in proper operating condition for \$5.00. Any faulty parts will be replaced without charge unless damage was caused in construction or because of a wiring error.

**PLEASE NOTE: KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX ARE NOT ELIGIBLE FOR REPAIR OR SERVICE AND WILL BE RETURNED NOT REPAIRED AT YOUR EXPENSE.**

Allied's facilities primarily provide an inspection and trouble-shooting service. Kits not completed, which require extensive work, will be returned collect with a letter of explanation.

If you must return this kit, pack it well. Do not use the original packing carton to return the completed kit. Use a strong carton with cushioning material. Send the kit prepaid and insured. We will return the repaired kit to you C.O.D. as soon as repairs are completed. If you wish to save C.O.D. fees, your advance remittance may be enclosed for standard repair charges plus transportation costs. Any excess remittance will be refunded.

### ALLIED'S GUARANTEE ON KNIGHT KITS

The designs and components selected for KNIGHT kits represent over a quarter of a century of experience in kit development. KNIGHT kits are easy to assemble even for the beginner. Instructions are complete, panels are drilled, the chassis is punched and formed, and every last part is included as listed.

Allied extends these firm guarantees on KNIGHT kits:

We guarantee that the circuits on all KNIGHT kits have been carefully engineered and tested.

We guarantee that only high-quality components are supplied.

All parts are covered by the standard RETMA 90-day warranty.

Any faulty component will be replaced prepaid and without charge if reported to us within the warranty period. We reserve the right to request the return of defective parts.

If your kit has been shipped by parcel post and is received in a damaged condition, please write us at once describing the state in which the shipment was received. If your kit was part of a Railway Express shipment that was damaged in transit, please notify the Railway Express agent at once and then write us.

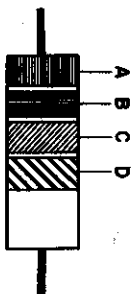
The efficiency engineered KNIGHT kits are moderately priced. When you buy a KNIGHT kit you get best design, best quality, and best value. Recommend KNIGHT kits to your friends.



# CAPACITOR AND RESISTOR COLOR CODE

RESISTOR-MICA CAPACITOR COLOR CODE				
Color	Significant Figures	Multiplier	Tolerance %	Voltage Rating*
Black	0	1	±20*	—
Brown	1	10	±1*	100
Red	2	100	±2*	200
Orange	3	1,000	±3*	300
Yellow	4	10,000	±4*	400
Green	5	100,000	±5*	500
Blue	6	1,000,000	±6*	600
Violet	7	10,000,000	±7*	700
Gray	8	100,000,000	±8*	800
White	9	—	±9*	900
Gold	—	—	±5	1,000
Silver	—	—	±10	2,000
None	—	—	±20	500

\* Applies to capacitors only

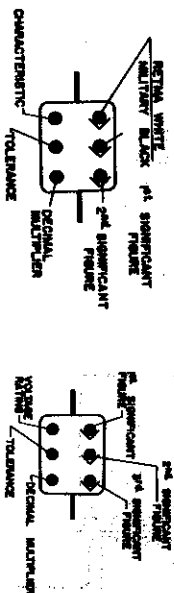


## HOW TO DETERMINE THE VALUE OF A RESISTOR

- A — First significant figure (digit) of resistance in ohms.
- B — Second significant figure.
- C — Decimal multiplier (number of zeros to be added).
- D — Tolerance of resistor in percent. No color is 20%.

### EXAMPLE:

A resistor has the following color bands: A, yellow; B, violet; C, yellow; and D, silver. The significant figures are 4 and 7 (47) and the multiplier is 10,000. The value of resistance is 470,000 ohms and the tolerance is ±10%.

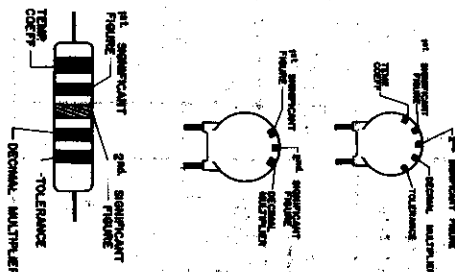


## HOW TO DETERMINE THE VALUE OF A MICA CAPACITOR

### EXAMPLES:

A capacitor with a 6 dot code (new RETMA standard REC-115A and military MIL-C-38A) has the following markings: Top row, left to right, white, green, brown; bottom row, right to left, brown, red, red. The first color white indicates mica. The significant figures are 5 and 1 (51), and the decimal multiplier is 10. So the capacitance is 510  $\mu$ fd. Tolerance is ±3%. For most general applications the characteristic can be ignored.

A capacitor with a 6 dot code has the following markings: Top row, left to right, brown, orange, red; bottom row, right to left, brown, red, green. Since the first dot is neither black or white, this is the obsolete RETMA code. The significant figures are 1, 3, and 2 (132), and the decimal multiplier is 10. So the capacitance is 1320  $\mu$ fd. Tolerance is ±2%. Voltage rating is 500 V DC.



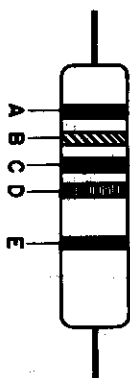
## HOW TO DETERMINE THE VALUE OF A CERAMIC CAPACITOR

### EXAMPLES:

A ceramic tubular capacitor has the following color bands: Black, red, red, green. The significant figures are 2 and 2 (22), and the decimal multiplier is 100. The capacitance is, therefore, 2200  $\mu$ fd. Tolerance is ±5%. Temperature coefficient is 0. Voltage rating is always 500 V.

A ceramic disc capacitor has the following 5-dot code: Red, brown, green, red, green. The significant figures are 1 and 5 (15), and the decimal multiplier is 100. The capacitance is, therefore, 1500  $\mu$ fd. The tolerance is ±5%. The temperature coefficient is —75. Voltage rating is always 500 V.

A ceramic disc capacitor has the following 3-dot code: Green, brown, brown. The significant figures are 5 and 1 (51), and the decimal multiplier is 10. Therefore, the capacity is 510  $\mu$ fd. Voltage rating is always 500 V and the tolerance is always —0.



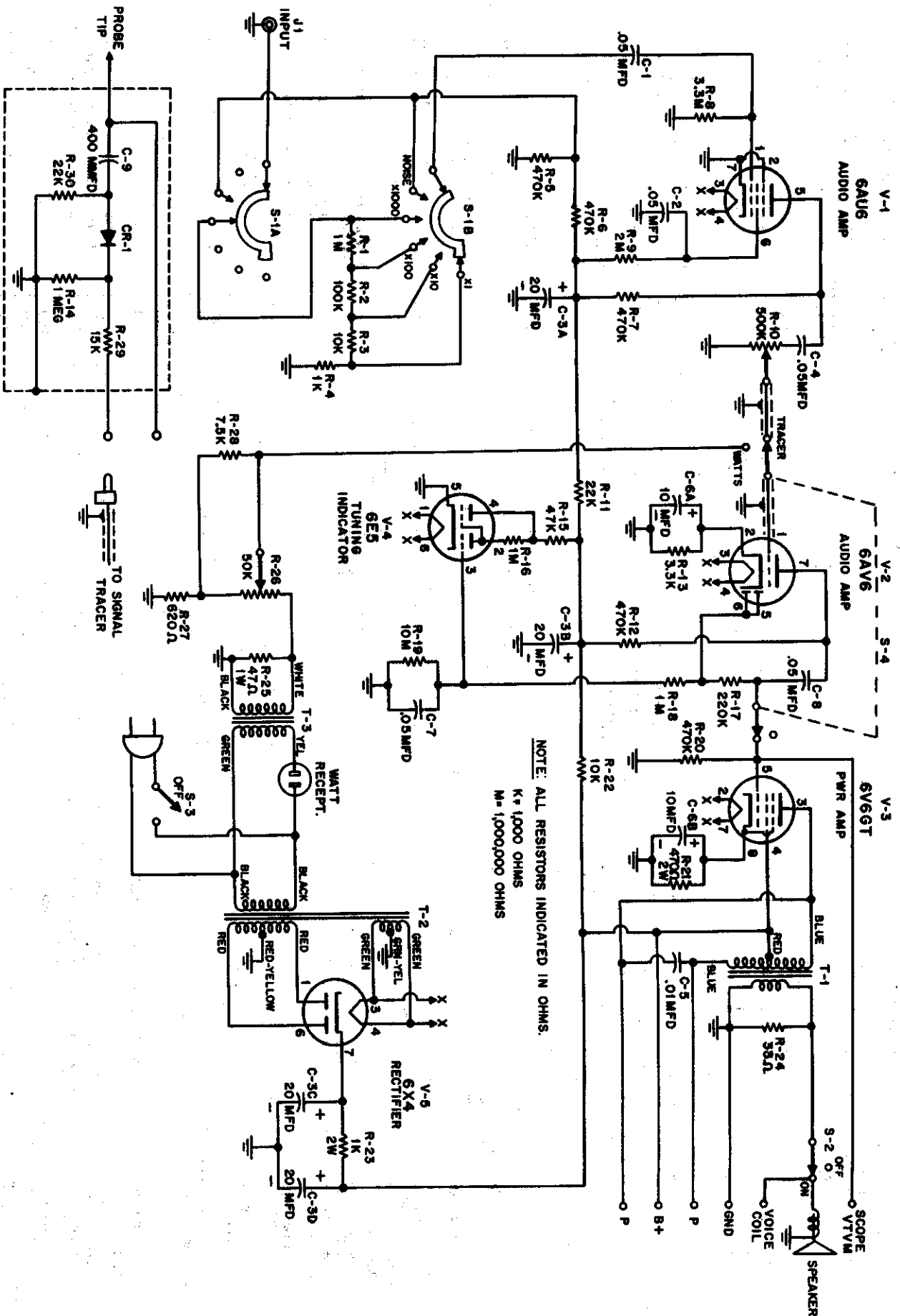
## HOW TO DETERMINE THE VALUE OF A PAPER TUBULAR CAPACITOR

- A — First significant figure (digit) of capacitance in  $\mu$ fd.
- B — Second significant figure.
- C — Decimal multiplier (number of zeros to be added).
- D — Tolerance of capacitor in percent.
- E — Voltage rating.

### EXAMPLE:

A paper tubular capacitor has the following color bands: A, brown; B, green; C, orange; D, black; and E, yellow. The significant figures are 1 and 5 (15) and the decimal multiplier is 1,000. The value of capacitance is 15,000  $\mu$ fd. The tolerance is ±20%. The voltage rating is 400 V DC.

CERAMIC CAPACITOR COLOR CODE					
Color	Significant Figures	Decimal Figures	Tolerance		Temp. Coef. (Parts per million per °C.)
			10 $\mu$ fd or less ( $\mu$ fd)	Over 10 $\mu$ fd (%)	
Black	0	1	±2.0	±20	0
Brown	1	10	±0.1	±1	—33
Red	2	100	—	±2	—75
Orange	3	1,000	—	±2.5	—150
Yellow	4	10,000	—	—	—220
Green	5	—	±0.5	±5	—350
Blue	6	—	—	—	—470
Violet	7	—	—	—	—750
Gray	8	0.01	±0.25	—	+150 to —1500
White	9	0.1	±1.0	±10	+100 to —750
Gold	—	—	—	—	—



**FIGURE 18. SCHEMATIC DIAGRAM OF THE KNIGHT SIGNAL TRACER**

## VOLTAGE CHART

All measurements made with a VTVM from point indicated to chassis. Control Settings: gain control fully clockwise; sensitivity control 5X1000; watts control fully clockwise; signal tracer-wattmeter switch in signal tracer position.

		PIN NUMBER							
TUBE	1	2	3	4	5	6	7	8	
V-1									
6AV6	-9	0	3.2 AC	3.2 AC	120	27	9		
V-2									
6AV6	0	1.2	3.2 AC	3.2 AC	-45	-45	130		
V-3									
6V6GT	-45	3.2 AC	275	280	0	0	3.2 AC	14	
V-4									
6E5	3.2 AC	20	0	150	0	3.2 AC			
V-5									
6X4	280 AC		3.2 AC	3.2 AC	0	280 AC	320		

## RESISTANCE CHART

K=1,000 ohms; M=1,000,000 ohms. \*Signal tracer-wattmeter switch in wattmeter position.

		PIN NUMBER							
TUBE	1	2	3	4	5	6	7	8	
V-1									
6AV6	3.3 M	0	0	0	700 K	2.5 M	0		
V-2									
6AV6	500 K	0*	3.3 K	0	700 K	700 K	700 K		
V-3									
6V6GT	500 K	0	700K	700 K	450 K		0	470 ohm	
V-4									
6E5	0	1.4 M	10M *	150 K	0	0			
V-5									
6X4	350 ohm		0	0	0	350 ohm	750 K		

## PARTS LIST

Symbol No.	Description	Part No.	Symbol No.	Description	Part No.
C-1	Capacitor, paper, .05 $\mu$ fd, 400V	245055	TS-1	4-terminal strip	440401
C-2	Capacitor, paper, .05 $\mu$ fd, 400V	245055	TS-2	3-terminal strip	440301
C-3	Capacitor, electrolytic, 20-20-20 $\mu$ fd, 450V	235402	TS-3	3-terminal strip	440301
C-4	Capacitor, paper, .05 $\mu$ fd, 400V	245015	TS-4	1-terminal strip	440101
C-5	Capacitor, disc, .01 $\mu$ fd, ceramic	276015			
C-6	Capacitor, electrolytic, 10-10 $\mu$ fd, 25V	211201	V-1	6AV6 tube	610013
C-7	Capacitor, paper, .05 $\mu$ fd, 400V	245055	V-2	6AV6 tube	610013
C-8	Capacitor, paper, .05 $\mu$ fd, 400V	245055	V-3	6V6GT tube	610022
C-9	Capacitor, mica, 400 $\mu$ fd, 600V	266408	V-4	6E5 tube	610017
CR-1	Crystal diode	630003	V-5	6X4 tube	610023
R-1	Resistor, 1 meg, $\frac{1}{2}$ watt	301105			
R-2	Resistor, 100K, $\frac{1}{2}$ watt	301104	✓	Speaker 4" PM	730002
R-3	Resistor, 10K, $\frac{1}{2}$ watt	301103			
R-4	Resistor, 1K, $\frac{1}{2}$ watt	302102			
R-5	Resistor, 470K, $\frac{1}{2}$ watt	300474			
R-6	Resistor, 470K, $\frac{1}{2}$ watt	300474			
R-7	Resistor, 470K, $\frac{1}{2}$ watt	300474			
R-8	Resistor, 3.3 meg, $\frac{1}{2}$ watt	300474			
R-9	Resistor, 2.2 meg, $\frac{1}{2}$ watt	300474			
R-10	Gain Control, 500K, linear taper	301223			
R-11	Resistor, 22K, $\frac{1}{2}$ watt	300474			
R-12	Resistor, 470K, $\frac{1}{2}$ watt	300332			
R-13	Resistor, 3.3K, $\frac{1}{2}$ watt	301105			
R-14	Resistor, 1 meg, $\frac{1}{2}$ watt	301105			
R-15	Resistor, 47K, $\frac{1}{2}$ watt	300473			
R-16	Resistor, 1 meg, $\frac{1}{2}$ watt	300224			
R-17	Resistor, 220K, $\frac{1}{2}$ watt	301105			
R-18	Resistor, 1 meg, $\frac{1}{2}$ watt	301106			
R-19	Resistor, 10 meg, $\frac{1}{2}$ watt	300474			
R-20	Resistor, 470K, $\frac{1}{2}$ watt	307471			
R-21	Resistor, 470K, $\frac{1}{2}$ watt	300103			
R-22	Resistor, 10K, $\frac{1}{2}$ watt	301302			
R-23	Resistor, 1K, $\frac{1}{2}$ watt	301302			
R-24	Resistor, 330, $\frac{1}{2}$ watt	304470			
R-25	Watt Control, 50K, reverse log taper, includes S-3 ON-OFF switch	390300			
R-26	Resistor, 680K, $\frac{1}{2}$ watt, 5%	302152			
R-27	Resistor, 7.5K, $\frac{1}{2}$ watt, 5%	300753			
R-28	Resistor, 15K, $\frac{1}{2}$ watt, 5%	301223			
R-29	Resistor, 22K, $\frac{1}{2}$ watt	432115			
R-30	Resistor, 22K, $\frac{1}{2}$ watt	432115			
S-1	Sensitivity Switch, 5-position	431901			
S-2	Speaker Switch, 5-position	102205			
S-3	ON-OFF Switch, part of R-26	101302			
S-4	Signal Tracer-Wattmeter Switch, DPDT slide	101202			
T-1	Output transformer				
T-2	Power transformer				
T-3	Wattmeter transformer				

Description	Quantity	Part No.
Receptacle, AC	1	502226
Screw, 6-32 x $\frac{1}{2}$	28	560345
Screw, self-tapping: #4 x $\frac{1}{2}$	9	562292
Screw, self-tapping: #6 x $\frac{1}{2}$	2	562296
Set-screw, probe	2	563230
Socket, tube: 7-prong	1	501070
Socket, tube: 8-prong	1	501081
Socket, tube: 6-prong	1	501160
Spring, handle mtg.	2	470040
Washer, handle mtg.	4	580301
Washer, shoulder: fiber	6	591401
Washer, flat: fiber	5	590400
Washer, locking: $\frac{3}{8}$ "	4	582701
Washer, shouldered: fiber: $\frac{3}{8}$ "	1	801003
2" red wire	3	801003
3" orange wire	7	801003
4" yellow wire	10	801004
5" green wire	4	881005
6" blue wire	3	881006
7" violet wire	3	881007
8" grey wire	3	881008
9" white wire	3	801009
14" shielded wire	1	803008
4" shielded cable	1	803001
5" black test lead	1	804025
4" red test lead	1	804020
12" small spaghetti	1	812001
3" medium spaghetti	1	812002
12" large spaghetti	1	930001
36" rosin core solder	1	894016
3" heavy bare wire	1	806006
10" #20 bare wire	1	750035
Instructional manual	1	

## TOOLS NEEDED FOR CONSTRUCTION

Altoid No.	Description	Price*
47N095	47 $\frac{1}{2}$ watt soldering pencil	\$3.67
46N499	6" side-cutting long-nose pliers	1.26
45N796	6" screwdriver	.72

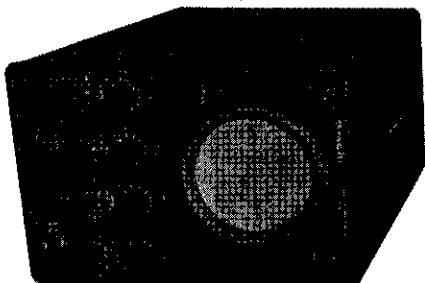
## TOOLS THAT WILL MAKE YOUR CONSTRUCTION EASIER

46N431	5" diagonal cutting pliers	1.55
43N831	Setcrew-driver	.27

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### SPECIFICATIONS

#### VERTICAL AMPLIFIER

Sensitivity:  
Frequency response:  
Input impedance:  
Calibration:

.025 V rms per inch  
3 db down at 700 kc (1000 cps reference)  
3.3 megohms shunted by  $45 \mu\text{fd}$   
1 V P-P  $\pm 7\%$  square wave, regulated calibrating voltage internally injected by front panel push switch

#### HORIZONTAL AMPLIFIER

Sensitivity:  
Frequency response:  
Input impedance:

.07 V rms per inch  
3 db down at 200 kc (1000 cps reference)  
2.2 megohms shunted by  $30 \mu\text{fd}$

#### SWEEP GENERATOR

Range:  
Blanking:  
Synchronization:

15 cps to 150 kc in four ranges  
Retrace blanking on all ranges  
Internal negative, internal positive, and external

#### TUBE COMPLEMENT:

6UB6 vertical amp., 12BH7 push-pull vertical output, 6AU6 horizontal sweep oct., 6C4 horizontal amp., 12AU7 push-pull horizontal output, 5CP1 CRT, 1V2 hi-voltage rect., and 6X4 low-voltage rect.

#### POWER SOURCE:

110-120 volts, 50-60 cycle AC

#### DIMENSIONS:

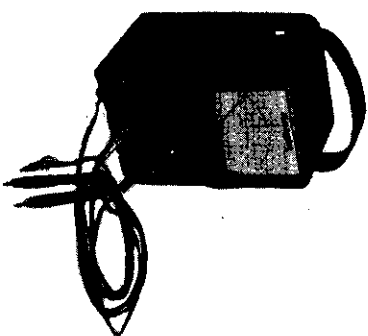
$9\frac{1}{4} \times 13\frac{3}{4} \times 17\frac{3}{4}$ " deep

#### SHIPPING WEIGHT:

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83 Y 125



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- Large, Easy-to-Read Meter
- 1% Precision Multiplier Resistors
- Seven Continuous Voltage Ranges
- Read Peak-to-Peak Voltages Directly
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With all parts, tubes, pre-cut wire, test leads, solder, and instruction manual.

### SPECIFICATIONS

#### DC VOLTMETER

Ranges:  
Input resistance:  
Circuit:  
Accuracy:

0-1.5, 5, 15, 50, 150, 500 and 1500 volts, full scale.  
11 megohms (1 megohm in probe) on all ranges  
Push-pull balanced bridge with 12AU7 twin triode  $\pm 3\%$  full scale

#### AC VOLTMETER

RMS ranges:  
Accuracy:  
Peak-to-peak ranges:

0-1.5, 5, 15, 50, 150, 500 and 1500 volts, full scale  
 $\pm 5\%$  full scale  
0-4, 14, 40, 140, 400, 1400 and 4000 volts

#### OHMMETER

Ranges:  
Battery:

Center scale at 10 with multipliers X1, X10, X100, X1000, X10K, X100K, and X1M $\Omega$   
1.5 volt "C"

#### METER:

$4\frac{1}{2}$ " 200  $\mu\text{A}$  movement

#### MULTIPLIERS:

1% precision type

#### TUBE COMPLEMENT:

12AU7 twin-triode meter bridge, 6AU5 twin-diode full wave rectifier

#### POWER SOURCE:

105-125 volts, 50-60 cycle AC

#### DIMENSIONS:

$7\frac{3}{4} \times 5\frac{1}{4} \times 4\frac{3}{8}$ "

#### SHIPPING WEIGHT:

6 lbs.

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