knight-kits

Allied knight®-kit
SPACE SPANNER
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38K187
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THE KNIGHT SPACE SPANNER

Your KNIGHT Space Spanner is a highly efficient regenerative radio receiver. It covers the Broadcast Band from 540 to 1700 kilocycles, and the Short-Wave Band from 6.5 to 17 megacycles. This Short-Wave Band coverage includes the 40 and 20 meter Amateur Bands, the 49, 41, 40, 31, 25, 20 and 19 meter International Bands, and Station WWV at 10 and 15 megacycles. Either the built-in speaker or a headset may be used to listen to the Space Spanner.

CHECKING YOUR KIT

Before starting to build your KNIGHT Space Spanner receiver, check each part against the Parts List on page 23. 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, may 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.

CONSTRUCTION HINTS

The only tools and materials required for building your KNIGHT Space Spanner are: Long-nose pliers, diagonal cutters, medium-size screwdriver, setscrew driver, a soldering iron, hookup wire, and rosin core solder. A good set of tools and supplies 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 wires. The schematic diagram shows how the parts are connected electrically and is helpful in understanding how the circuits work.

The step-by-step instructions were prepared while a skilled technician was actually building the KNIGHT Space Spanner. 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. Each wiring view is duplicated on a separate, folded sheet of paper for this purpose. Both of these methods are good and will assure speedy and correct wiring.

MOUNTING THE PARTS ON THE CHASSIS

Begin building your KNIGHT Space Spanner by mounting the parts on the chassis.

SEE FIGURE 1.

☐ Turn the chassis upside-down so the bent edges are pointing up. The edge with the printing on the outside is the REAR of the chassis.

☐ Three large and four small rubber grommets are supplied with this kit. Insert a large grommet into each of the three 3/8" holes in the chassis by pushing them into the holes until the groove around the outer edge of each grommet "locks" into the hole in the chassis. Figure 1 shows the grommets mounted in their proper holes.

☐ Three tube sockets are supplied with this kit. Two of them have seven pins and the third has nine pins. One of the 7-pin sockets (labeled V-2 in Figure 1) is to be mounted over the large hole near the right rear edge of the chassis. There are three different sized screws furnished. One size is very short, one is medium length, and one is long and thin. Mount the 7-pin socket using two medium length screws and two nuts that fit the screws. The screws must be inserted from the outside of the chassis, and the socket must be **mounted inside the chassis.** Notice that there is a wide open space between two of the pins on the socket. This wide space is known as the "keyway", and must be positioned as shown in the figure.

☐ Mount the other 7-pin socket (V-3 in Figure 1) over the large hole near the socket just mounted with two medium length screws and nuts. Notice that a 2-terminal strip (TS-2 in Figure 1) is mounted on top of the socket under the front socket mounting nut. Be sure to position the socket keyway as shown.

☐ Mount the 9-pin socket (V-1) over the largest hole in the chassis. A solder lug (a short, flat piece of metal with a large hole in one end and a smaller hole in the other) must be mounted **between the socket and the chassis.** The keyway on the socket must be toward the left side of the chassis as shown. Use two medium length screws and nuts to mount the socket and the solder lug.

☐ Next, mount the filter choke (L-4) on the OUTSIDE of the chassis using two medium length screws and nuts. The position of the filter choke is indicated by a broken (dashed) line in Figure 1. If you do not know what the filter choke looks like, see Figure 3 on page 5. After L-4 is mounted, push its two wires through the grommet between V-2 and V-3 so they can be connected inside the chassis.

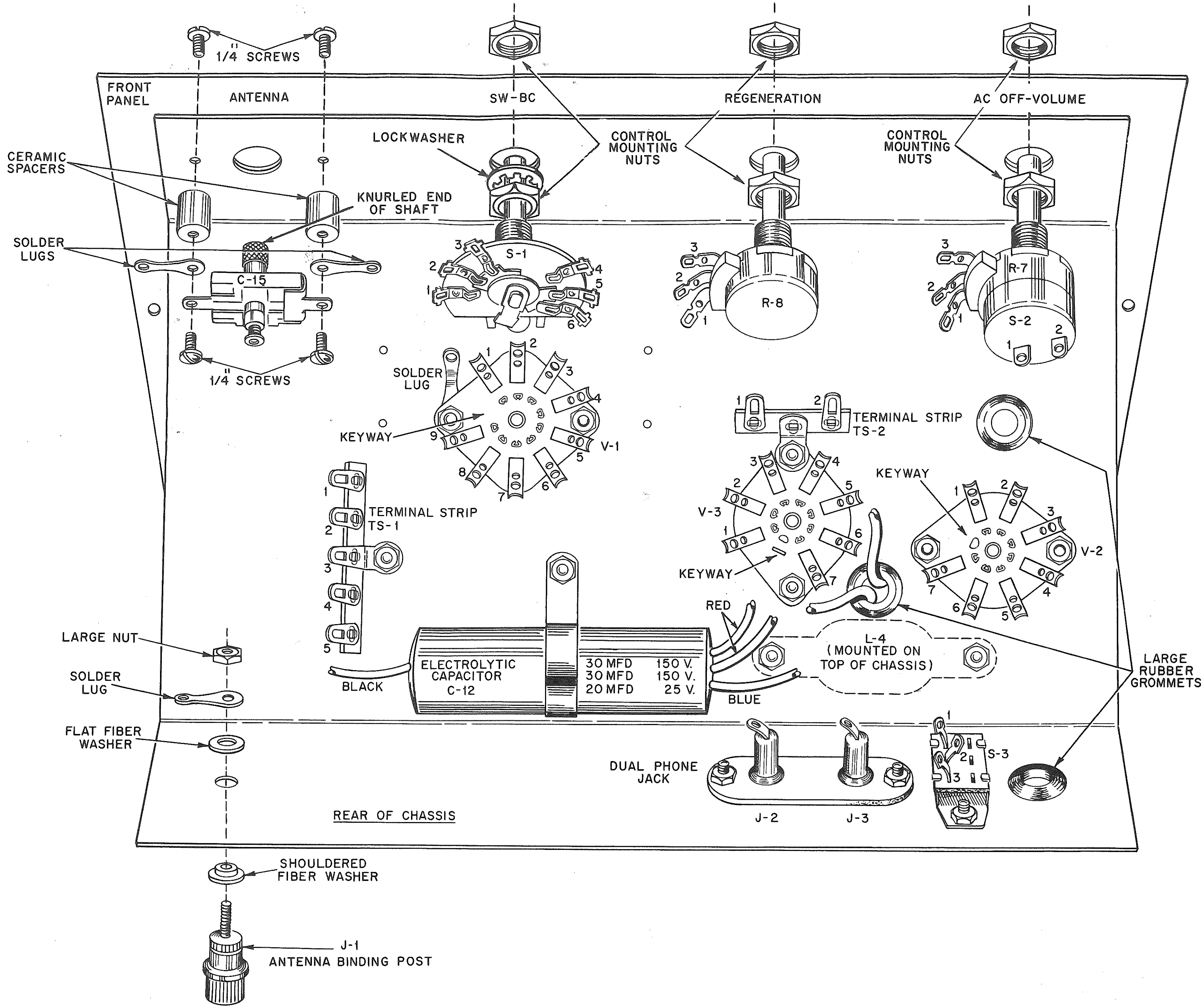


FIGURE 1. HOW TO MOUNT THE PARTS ON THE CHASSIS

☐ Mount the dual phone jack (J-2 and J-3) **inside the rear of the chassis** with two medium length screws and nuts in the position shown in Figure 1.

☐ Mount slide switch (S-3) inside the rear of the chassis as shown in Figure 1. Use two medium length screws and nuts to mount S-3.

☐ C-12 is a large electrolytic capacitor with a black lead on one end, and two red leads and a blue lead on the other. It also has a metal mounting strap around its body. Mount C-12 with one medium length screw through the chassis and the end of the mounting strap so that the black lead is toward the left side of the chassis, as shown in Figure 1. Use a nut that fits the screw to secure C-12 to the chassis.

☐ Mount the 5-terminal terminal strip (TS-1) **in the position shown** with a medium length screw and nut.

☐ J-1 is the Antenna binding post. This binding post must be mounted with a shouldered fiber washer, a flat fiber washer, a solder lug, and a large nut. To mount J-1, first place the shouldered washer on the threaded portion of the binding post. Next, from outside the rear of the chassis, insert the threaded portion of J-1 through the hole marked ANTENNA so that the shouldered part of the shouldered washer fits in the hole. From the inside of the chassis place the flat fiber washer on the binding post. Now, place a solder lug on J-1. Finally, secure the whole assembly by tightening a large nut onto the threaded portion of the binding post.

☐ You are now ready to mount the front panel to the chassis. Notice that the four holes on the bottom of the front panel match the four holes in the front of the chassis. Remove the volume control from your supply of parts. This is the control marked R-7 and S-2 in Figure 1. Screw one of the very large nuts onto the threaded bushing of the control. Now, from the inside of the chassis, insert the shaft on the volume control through the extreme right hand hole in the front of the chassis **AND** the extreme right hand hole in the front panel. Finally, secure the panel to the chassis, and the volume control to both, by loosely tightening another very large nut onto the threaded bushing on the volume control **from the outside of the front panel.** The three terminals on one side of the control must be positioned so that they point toward the center of the front of the chassis, as shown in Figure 1.

☐ In the same manner, mount the Regeneration control (marked R-8 in Figure 1) in the hole marked REGENERATION on the front panel. The three terminals on the side of this control also must point toward the center of the front of the chassis.

☐ Mount the Short Wave-Broadcast switch (marked S-1 in Figure 1) in the hole marked SW-BC on the front panel. This switch is mounted the same way as the volume and regeneration controls, except that an internal-tooth lockwasher must be placed on the shaft before it is inserted into its mounting hole. The flat side of this switch must be toward the bend in the front of the chassis, as shown in Figure 1.

☐ The antenna trimmer capacitor (C-15 in Figure 1) is to be mounted next. This capacitor must be mounted with 4 medium length screws, 2 ceramic spacers, and 2 solder lugs. First, insert two screws through the small holes on either side of the hole marked ANTENNA on the front panel so that the threaded part of each extends through to the inside of the chassis. Now, screw one of the ceramic spacers onto each screw. **BE VERY CAREFUL. THE SPACERS MAY CRACK IF THE SCREWS ARE TIGHTENED TOO SECURELY.** A solder lug must be placed between the terminals of C-15 and the other end of the spacers before the other screws are inserted. Secure C-15 to the other end, with the other two screws, so that the knurled end of the shaft extends through the hole marked ANTENNA.

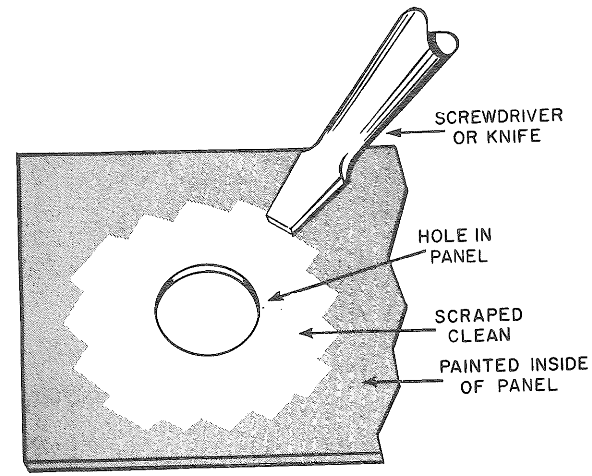


FIGURE 2. HOW TO SCRAPE PAINT AWAY FROM A HOLE

☐ Securely tighten the outside nuts on the SW-BC switch, the REGENERATION control, and the VOLUME control.

SEE FIGURE 3.

☐ Turn the chassis over and position it as shown in Figure 3.

☐ Remove the speaker from your supply of parts. **BE VERY CAREFUL NOT TO PUNCTURE THE PAPER CONE IN THE SPEAKER.** There is a $\frac{1}{4}$″ mounting hole in each corner of the metal speaker frame. Insert one of the small rubber grommets into each of these

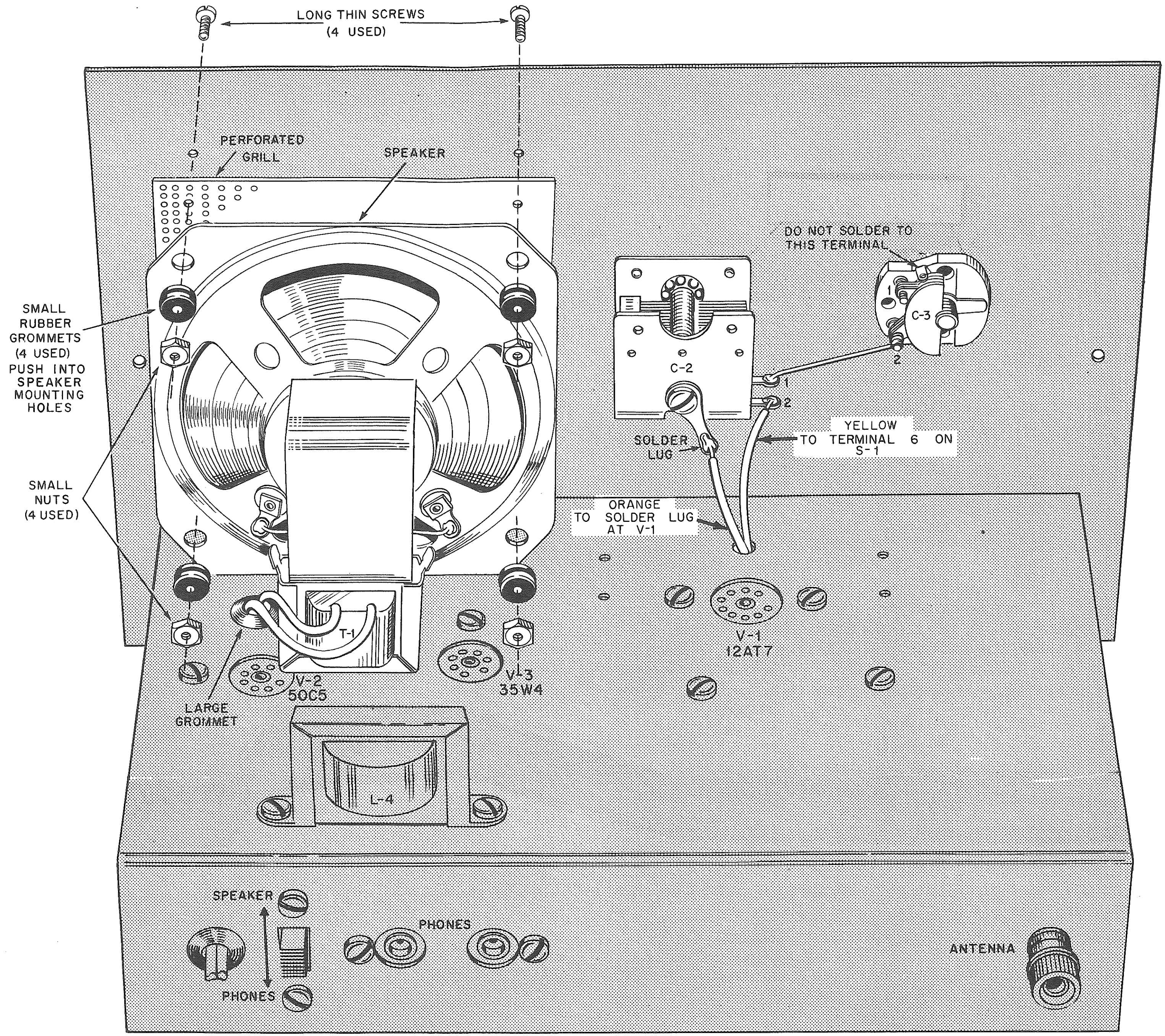


FIGURE 3. HOW TO MOUNT THE PARTS ON THE FRONT PANEL

holes. Remove the square, perforated, gray fiber board, and the four long, thin screws, and the small nuts that fit them, from your supply of parts. Mount the perforated fiber board (labeled PERFORATED GRILL in Figure 3) and the speaker to the Front Panel. To do this, insert one of the screws through each of the 4 small holes at the corners of the square cutout, **from the outside of the Front Panel.** Next, from the inside of the Front Panel, place the perforated grill over the square cutout so that the threaded part of the screws extend through the large holes in the grill. Now, mount the speaker in such a manner that the screws extend through the rubber grommets in the corners of the speaker, and the output transformer on the speaker (labeled T-1 in Figure 3) is toward the chassis. Finally, secure the speaker and the grill to the Front Panel by tightening one of the small nuts onto each of the long, thin screws. Push the red and blue wires on the speaker through the large grommet below the speaker so they can be connected inside the chassis later.

☐ There are three small holes around the large hole labeled MAIN TUNING on the Front Panel. These are the holes through which three very short screws are inserted to mount the main tuning capacitor (labeled C-2 in Figure 3). Scrape the paint away from these holes **on the rear of the panel,** as shown in Figure 2. Mount the main tuning capacitor behind the front panel by inserting the shaft of C-2 through the large hole and screwing one of the very short screws into each of the three threaded holes in the main tuning capacitor.

☐ Mount a solder lug on the rear of C-2 with the other very short screw, as shown in Figure 3.

☐ Scrape the paint away from the rear of the hole labeled BAND-SPREAD. Mount the bandspread capacitor (labeled C-3 in Figure 3) behind the front panel so that its shaft extends through the hole. Mount C-3 with the nut supplied with it. Place the large flat metal washer on the threaded bushing **outside the front panel,** and tighten the large nut over it. When the bandspread capacitor is mounted, its two solder terminals should be toward C-2 as shown in the figure.

You have finished mounting most of the parts on the chassis and front panel. The two coils that are wound on the fiber tubes will be mounted after some of the wiring is completed. This procedure makes the wiring much simpler.

WIRING AND SOLDERING

How well a piece of electronic equipment works often depends on the quality of workmanship used in its construction. For this reason we strongly urge you to read the following paragraphs very thoroughly before proceeding with the building of your KNIGHT Space Spanner. Be especially attentive to the phrases, sentences, and paragraphs in heavy type.

The insulated wire furnished with this kit is cut to length and the ends are stripped. Each different colored wire is a certain length, so be sure to use the color specified in each of the wiring steps.

Whenever a piece of bare wire is to be used, the exact length is given in the wiring step. Measure the wire on a straight edge (ruler) before cutting it to be sure it is the proper length.

The proper way to connect a wire to a terminal is shown in Figure 4. To connect the wire, first bend a hook in the end with your long-nose pliers. Then pass the end of the hook through the hole in the terminal. Last, squeeze the wire onto the terminal so that it is solidly mounted. **All connections must be mechanically strong BEFORE solder is applied. Solder must NOT be used to supply mechanical strength—its ONLY purpose is to assure a good ELECTRICAL connection.** Before connecting a wire to a terminal, be sure the terminal and the wire are clean. If necessary, scrape off any foreign material, such as wax, with a pocket knife. Be careful not to nick the wire with the knife or it may break when it is bent.

The proper way to connect a component (resistor, capacitor, choke, etc.) is illustrated in Figure 5. Pull the end leads of the part being mounted through the holes in the mounting terminals so that the part is tightly mounted. After the part is mounted, bend the leads (the wires on the part) around the mounting terminals and cut off the excess wire with your diagonal cutters. If the mounting terminals are widely spaced it may be necessary to use the full length of the leads.

The soft tubing supplied is called "spaghetti". Spaghetti is used to cover the bare end leads on some of the parts. Whenever it is necessary to use some of the spaghetti, the exact length is given in the step. Cut off the length with your diagonal cutters and slide it over the lead specified until it touches the body of the part. After the lead is soldered to the terminal, push the spaghetti until it touches the soldered connection.

Before soldering a connection, you must prepare your soldering iron. Use an iron rated at approximately 50 watts with a medium sized tip. Clean the tip of the iron with steel wool or a fine file until the bright copper surface is seen. Plug the iron into a power outlet and allow it to heat until solder melts when it is held against the tip.

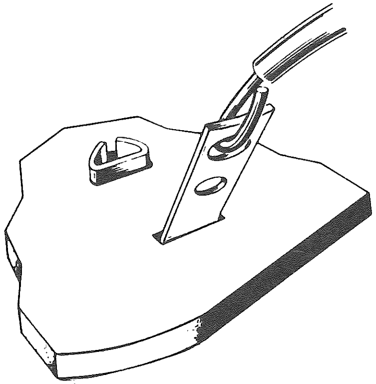


FIGURE 4. HOW TO CONNECT A WIRE TO TERMINAL

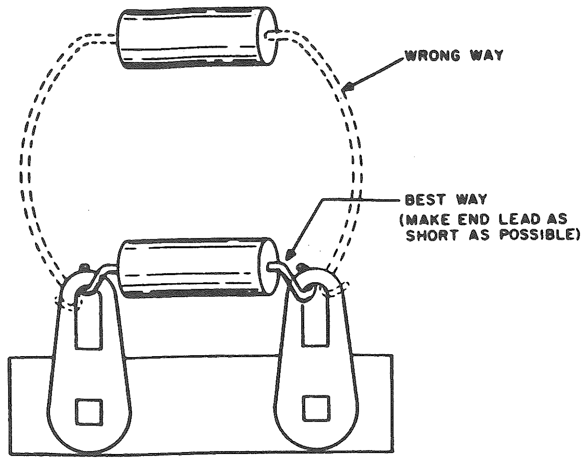


FIGURE 5. THE BEST WAY TO MOUNT A COMPONENT

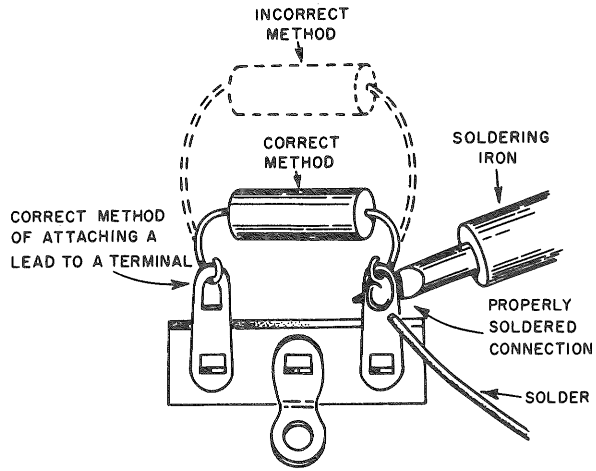


FIGURE 6. HOW TO SOLDER

USE ONLY ROSIN CORE SOLDER

USE THE ROSIN CORE SOLDER SUPPLIED IN THE KIT. KITS WIRED WITH ACID CORE SOLDER OR PASTE FLUX WILL SOON CORRODE AND WILL NOT OPERATE LONG. THE USE OF ANY FORM OF CORROSIVE FLUX VOIDS OUR GUARANTEE.

Coat the entire tip of the iron with a thin layer of solder. While the iron is still hot, wipe the tip with a soft rag to remove the excess solder. The tip should now have a "shiny" appearance. What you have just done is called "tinning" the iron. Re-tin the iron whenever it becomes covered with a layer of scale (flakes of gray matter).

To solder a connection, hold the tip of the iron against the connection until the **connection** is hot enough to melt solder. Apply solder to the **connection, NOT** to the tip of the iron. Allow just enough solder to flow onto the connection to fill the crevices between the wires and the terminal. After enough solder is on the connection, remove the solder and the iron. Place the iron on its stand. **DO NOT DISTURB THE SOLDERED CONNECTION UNTIL THE SOLDER HAS HARDENED. IF THE CONNECTION IS DISTURBED YOU WILL HAVE WHAT IS KNOWN AS A "COLD SOLDER JOINT".** Cold solder joints are not good electrical connections. Cold solder joints have a dull, crystalline appearance. Should you accidentally cause a cold solder joint, re-heat the connection and apply another very small amount of solder to it. See Figure 6 and refer to the enclosed "How-to-Solder" booklet.

Do your best to position all of the parts and wires as shown in the wiring diagrams. When you do this, all the wire lengths specified in the steps will be exactly correct. Place all long wires as close to the chassis as possible.

You are now ready to wire your KNIGHT Space Spanner. Remember, **USE ONLY ROSIN CORE SOLDER.**

WIRING THE REAR OF THE FRONT PANEL

SEE FIGURE 3.

- [x] Cut off a 1¾" piece of bare wire. Solder one end of the wire to terminal 2 on C-3. Solder the other end to terminal 1 on C-2.

NOTE: IN THIS MANUAL, WHEN THE WORD "SOLDER" APPEARS, IT MEANS TO CONNECT THE WIRE OR LEAD TO THE TERMINAL, AND THEN TO SOLDER IT AND ALL OTHER WIRES CONNECTED TO THE TERMINAL TOGETHER. WHEN THE WORDS "CONNECT, BUT DO NOT SOLDER" APPEAR, SOLDER IS NOT TO BE USED BECAUSE THERE ARE OTHER WIRES TO BE CONNECTED TO THE TERMINAL. ONLY SOLDER WHEN THE WORD "SOLDER" APPEARS.

- [x] Solder one end of a yellow wire to terminal 2 of C-2. Insert the other end through the hole below C-2.

- [x] Solder one end of an orange wire to the solder lug on the rear of C-2. Insert the other end through the hole below C-2.

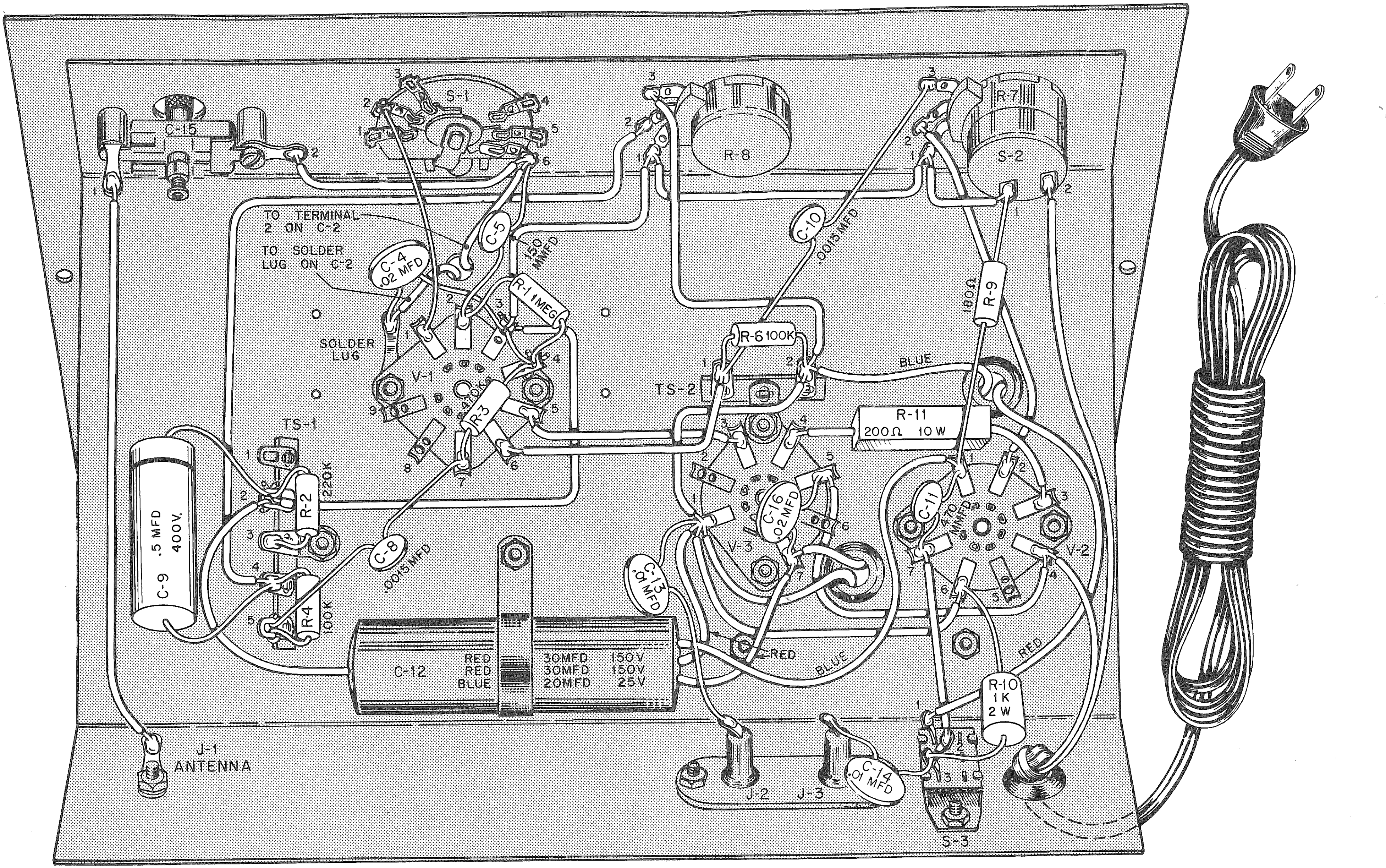


FIGURE 7. FIRST CHASSIS WIRING VIEW

WIRING THE CHASSIS

TURN THE CHASSIS UPSIDE DOWN AND REFER TO FIGURE 7.

- [ ] Connect, but do not solder, one end of a green wire to pin 4 of V-2. Connect, but do not solder, the other end to pin 5 of V-3. **NOTE:** The terminals on the tube sockets are called pins.

- [ ] Connect, but do not solder, one end of a yellow wire to pin 6 of V-2. Connect, but do not solder, the other end to pin 1 of V-3.

- [ ] Connect, but do not solder, one end of a red wire to pin 7 of V-2. Solder the other end to terminal 2 of S-3.

- [ ] Solder one end of an orange wire to terminal 2 of R-7. Solder the other end to pin 2 of V-2.

- [ ] Place ½″ of spaghetti on one of the end leads of R-11, the large resistor with 200 ohms, 10 watts printed on its body. Solder this lead to pin 4 of V-3. Place ¾″ of spaghetti on the other end lead. Solder this lead to pin 3 of V-2.

- [ ] Solder one end of an orange wire to pin 5 of V-1. Solder the other end to pin 3 of V-3.

- [ ] Connect, but do not solder, one end of an orange wire to terminal 2 of TS-2. Connect, but do not solder, the other end to pin 1 of V-3.

- [ ] There are red and blue wires coming out of the grommet in front of V-2. Cut just enough off the blue wire so that it can be connected to terminal 2 of TS-2. Remove ¼″ of insulation from the end of the blue wire. Connect, but do not solder, it to terminal 2 of TS-2.

- [ ] Cut just enough off the red wire so that it can be connected to terminal 1 of S-3. Remove ¼″ of insulation from the end of the red wire. Solder it to terminal 1 of S-3.

- [ ] Cut just enough off the end of the blue wire on C-12, the large electrolytic capacitor, so that it can be connected to pin 1 of V-2. Remove ¼″ of insulation from the end of the blue wire. Connect, but do not solder, it to pin 1 of V-2.

- [ ] Cut just enough off the end of either of the red wires on C-12 so that it can be connected to pin 7 of V-3. Remove ¼″ of insulation from the end of this wire. Connect, but do not solder, it to pin 7 of V-3.

- [ ] Cut just enough off the other red wire on C-12 so that it can be connected to pin 1 of V-3. Remove ¼″ of the insulation from the end of this wire. Connect, but do not solder, it to pin 1 of V-3.

- [ ] Cut just enough off the end of either of the black wires coming through the grommet between V-2 and V-3 so that it can be connected to pin 7 of V-3. Remove ¼″ of insulation from the end of this wire. Connect, but do not solder, it to pin 7 of V-3.

- [ ] Cut just enough off the end of the other wire in this grommet so that it can be connected to pin 1 of V-3. Remove ¼″ of insulation from the end of this wire. Connect, but do not solder, it to pin 1 of V-3.

- [ ] Connect, but do not solder, the yellow wire in the hole in front of V-1 that comes from terminal 2 of C-2 to terminal 6 of S-1.

- [ ] Connect, but do not solder, the orange wire in the same hole to the solder lug under the left side of V-1.

- [ ] Cut just enough off the black wire on C-12 so that it can be connected to terminal 2 of TS-1. Remove ¼″ of insulation off the end of this wire. Connect, but do not solder, it to terminal 2 of TS-1.

- [ ] The line cord is the long wire with a plug on one end. From outside the chassis, insert the end of the line cord with the bare wire ends through the grommet in the rear of the chassis. Inside the chassis, tie a knot in the cord 4″ from the bare wire ends. Grasping one of the bare ends in each hand, pull them apart so the cord splits all the way back to the knot. Solder either of the bare ends to terminal 2 of S-2.

- [ ] Cut just enough off the other wire of the line cord so that it can be connected to pin 4 of V-2. Strip ¼″ of insulation off the end of this wire. Solder it to pin 4 of V-2.

CAUTION: NEVER TOUCH ANY PART OF THE WIRING WHILE THIS RECEIVER IS PLUGGED INTO A POWER OUTLET. NEVER USE OR TEST THE SPACE SPANNER ON OR NEAR A GROUNDED METAL BENCH, RADIATOR, SINK, OR OTHER GROUNDED METAL OBJECT.

- [ ] Solder one end of R-10, the large 1K ohm resistor with brown, black, and red colored bands on its body, to pin 6 of V-2. Connect, but do not solder, the other end to terminal 3 of S-3. **PLEASE NOTE:** Some of the resistors in this kit may have a fourth color band, either silver or gold. Pay no attention to this band.

NOTE: Disc capacitors may be marked in more than one way. An example: An .01 MFD may also be marked 10K or 10,000; an .0015 may be marked 1500 or 1.5K; a 150 MMFD may be .00015.

- [ ] Solder one end of C-14, a disc-shaped capacitor with .01 MFD printed on its body, to J-3. Solder the other end to terminal 3 of S-3.

- [x] Solder one end of C-13, another .01 MFD disc capacitor, to J-2. Solder the other end to pin 1 of V-3.

- [x] Solder one end of C-16, a .02 MFD disc capacitor, to pin 7 of V-3. Solder the other end to pin 5 of V-3.

- [x] Solder one end of C-11, a 470 MMFD disc capacitor, to pin 7 of V-2. Connect, but do not solder, the other end to pin 1 of V-2.

- [x] Solder one end of R-9, a 180 ohm resistor (brown, gray, brown), to pin 1 of V-2. Connect, but do not solder, the other end to terminal 1 of S-2.

- [x] Solder one end of a red wire to terminal 1 of S-2. Connect, but do not solder, the other end to terminal 1 of R-7.

- [x] Solder one end of a yellow wire to terminal 1 of R-7. Connect, but do not solder, the other end of terminal 1 of R-8.

- [x] Solder one end of C-10, a .0015 MFD disc capacitor, to terminal 3 of R-7. Connect, but do not solder, the other end to terminal 1 of TS-2.

- [x] Connect, but do not solder, one end of R-6, a 100K ohm resistor (brown, black, yellow), to terminal 1 of TS-2. Connect, but do not solder, the other end to terminal 2 of TS-2.

- [x] Solder one end of an orange wire to terminal 1 of TS-2. Solder the other end to pin 6 of V-1.

- [x] Solder one end of a yellow wire to terminal 1 of R-8. Connect, but do not solder, the other end to pin 3 of V-1.

- [x] Solder one end of a gray wire to terminal 2 of R-8. Connect, but do not solder, the other end to terminal 4 of TS-1.

- [x] Solder one end of a yellow wire to terminal 2 of TS-2. Solder the other end to terminal 3 of R-8.

- [x] Solder one end of C-4, a .02 MFD disc capacitor, to the solder lug under the left side of V-1. Connect, but do not solder, the other end to pin 3 of V-1.

- [x] Pass one end of a green wire through pin 3 of V-1. Connect it to pin 4 of V-1. Do not solder either terminal. Connect, but do not solder the other end to terminal 2 of TS-1.

- [x] Connect, but do not solder, one end of an orange wire to terminal 6 of S-1. Solder the other end to the right solder lug on C-15 (labeled 2 in Figure 7).

- [x] Solder one end of C-5, a 150 MMFD disc capacitor, to terminal 6 of S-1. Connect, but do not solder, the other end to pin 2 of V-1.

- [x] Solder one end of R-1, a 1 megohm resistor (brown, black, green), to pin 2 of V-1. Connect, but do not solder, the other end to pin 4 of V-1.

- [x] Solder one end of a 2″ bare wire to terminal 2 of S-1. Solder the other end to pin 1 of V-1.

- [x] Connect, but do not solder, one end of R-3, a 470K ohm resistor (yellow, violet, yellow), to pin 4 of V-1. Connect, but do not solder, the other end to pin 7 of V-1.

- [x] Connect, but do not solder, one end of R-2, a 220K ohm resistor (red, red, yellow), to terminal 2 of TS-1. Solder the other end to terminal 3 of TS-1.

- [x] Connect, but do not solder, one end of R-4, a 100K ohm resistor (brown, black, yellow), to terminal 4 of TS-1. Connect, but do not solder, the other end to terminal 5 of TS-1.

- [x] Solder one end of C-8, a .0015 MFD disc capacitor, to pin 7 of V-1. Connect, but do not solder, the other end to terminal 5 of TS-1.

- [x] Connect, but do not solder, the black banded end of C-9, a .5 MFD, 400 V paper capacitor, to terminal 2 of TS-1. Solder the other end to terminal 4 of TS-1.

- [x] Solder one end of a yellow wire to terminal 1 of C-15 (the left solder lug). Solder the other end to the solder lug on the antenna binding post (J-1).

REFER TO FIGURE 8 FOR THE FOLLOWING STEPS:
DO NOT MIX L-1 and L-2

- [x] Mount L-1, the coil with few turns of heavy wire, in the position shown in Figure 8 by inserting its threaded mounting studs through the coil mounting holes in the chassis. The terminals on one side of the coil must face V-1. Secure L-1 with one nut on each stud on the outside of the chassis.

- [x] Mount L-2, the coil with many turns of fine wire, on the other side of V-1 with two nuts. Its terminals must also face V-1.

- [x] Solder one end of an orange wire to terminal 1 of L-2. Connect, but do not solder, the other end to pin 3 of V-1.

- [x] Solder one end of R-5, a 270 ohm resistor (red, violet, brown), to pin 3 of V-1. Solder the other end to pin 8 of V-1.

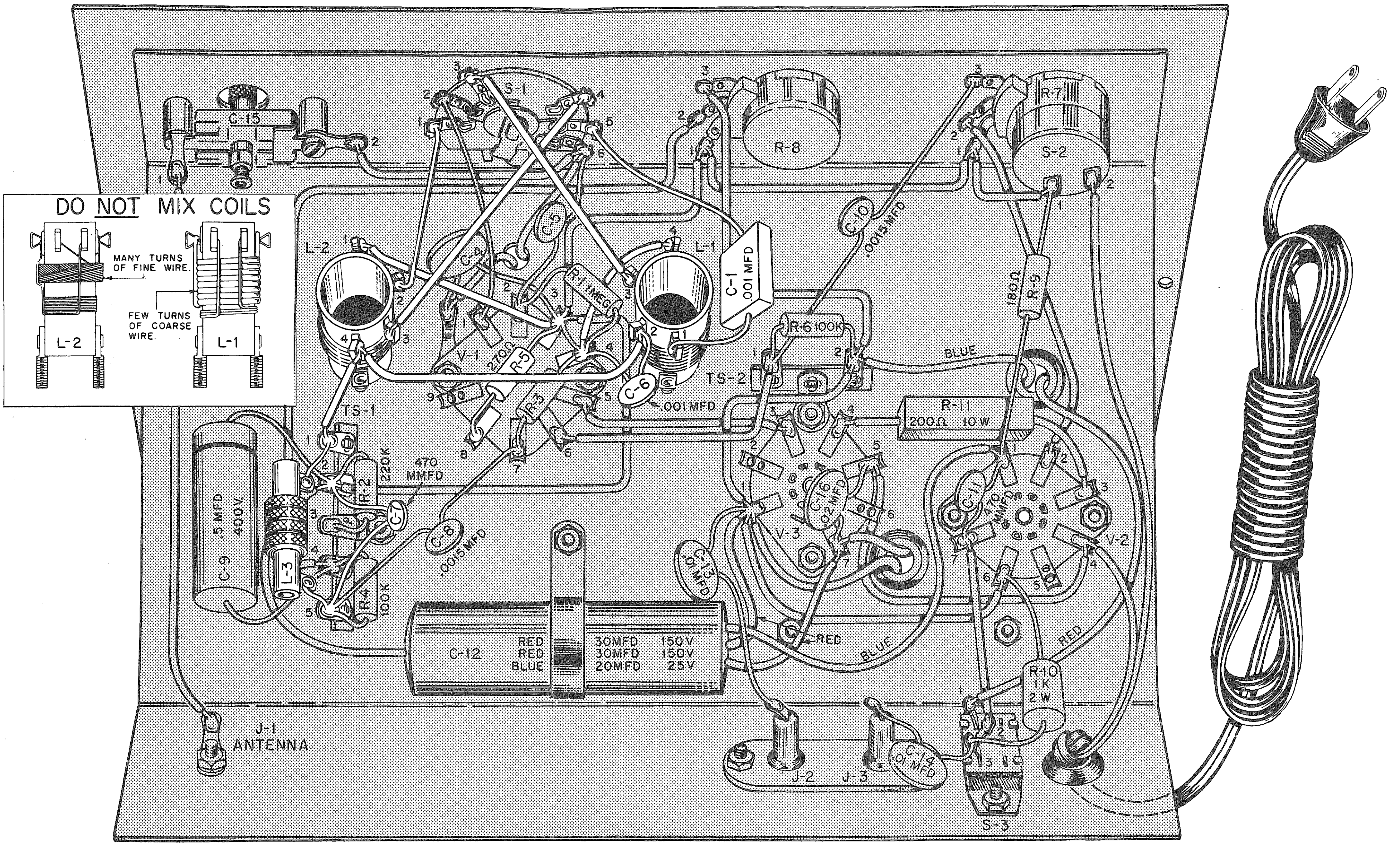


FIGURE 8. SECOND CHASSIS WIRING VIEW

- [ ] Solder one end of a 1½″ bare wire to terminal 2 of L-2. Solder the other end to terminal 1 of S-1.

- [ ] Solder one end of an orange wire to terminal 3 of L-2. Solder the other end to terminal 4 of S-1.

- [ ] Connect, but do not solder, one end of a red wire to pin 4 of V-1. Solder the other end to terminal 4 of L-1.

- [ ] Solder one end of a red wire to terminal 3 of S-1. Solder the other end to terminal 3 of L-1.

- [ ] Solder one end of C-1, the .001 MFD (1000 MMFD) rectangular mica capacitor, to terminal 5 of S-1. Solder the other end to terminal 1 of L-1.

- [ ] Connect, but do not solder, one end of C-6, a .001 MFD disc capacitor, to terminal 2 of L-1. Solder the other end to pin 4 of V-1.

- [ ] Solder one end of an orange wire to terminal 2 of L-1. Connect, but do not solder, the other end to terminal 4 of L-2.

- [ ] Solder one end of a red wire to terminal 4 of L-2. Connect, but do not solder, the other end to terminal 1 of TS-1.

- [ ] Solder one end of C-7, a 470 MMFD disc capacitor, to terminal 2 of TS-1. Connect, but do not solder, the other end to terminal 5 of TS-1.

- [ ] Solder one end of L-3, the RF choke, to terminal 1 of TS-1. Solder the other end to terminal 5 of TS-1.

- [ ] You have finished wiring your KNIGHT Space Spanner. All connections should be soldered. Check each of them. If any are not soldered, check to see if you have skipped a step. Remember, a few minutes spent in careful checking now may save hours of troubleshooting later.

- [ ] Rotate the **BANDSPREAD** control shaft until the plates of C-3 are closed (fully meshed), as shown in Figure 3. While holding C-3 in this position, place one of the large knobs on the shaft so that the white line on the skirt of the knob points to "O". Secure the knob to the shaft by tightening the small screw in the knob against the shaft.

- [ ] Rotate the **MAIN TUNING** control shaft until the plates of C-2 are closed, as shown in Figure 3. While holding C-2 in this position, place the other large knob on the shaft so that its white line points to the right hand end of the scale. Secure this knob to the shaft by tightening the small screw.

- [ ] Turn the **VOLUME** control shaft to its extreme counterclockwise position until a "click" is heard. Mount one of the small knobs on this shaft so its white line points to "AC OFF". Secure the knob to the shaft.

- [ ] Turn the **REGENERATION** control shaft to its extreme counterclockwise position. Mount a small knob on this shaft so its white line points to the extreme left hand mark on the scale. Secure the knob to the shaft.

- [ ] Mount another small knob on the **SW-BC** switch by tightening its screw against the flat side of the shaft.

- [ ] If desired, the last small knob may be mounted on the shaft of the **ANTENNA** control. While not absolutely necessary, this knob will be handy, especially when receiving short wave, since turning the bare shaft with your hand may affect the tuning of the Space Spanner. To mount the knob on this shaft, first remove the screw from the knob, then **GENTLY** force the knob onto the shaft.

UNDERSTANDING YOUR RECEIVER

What Is Radio?

The term **radio** is used to describe the sending and receiving of signals between two or more places without the use of wires. The signals are sent from the sending, or **transmitting**, station in the form of **radio waves**. A more technical term for radio waves is **electromagnetic radiation.**

Figure 9 shows a typical broadcasting and receiving system. As the announcer talks, his voice is changed into a weak **audio frequency (AF)** electrical signal by the microphone. The weak AF signal is fed into a **speech amplifier**, where it is made many times stronger. The strong AF signal from the speech amplifier is then fed into the **transmitter**, where it is changed into a strong **radio frequency (RF)** signal. The RF signal is then sent up the **transmitting antenna**, where it is sent out "over the air" in the form of radio waves, or, more technically, electromagnetic radiation.

The KNIGHT Space Spanner

At the receiver, the **receiving antenna** "picks up" a small part of all the transmitted signals in the air. These signals are fed to the **RF Tuned Circuit** (see Figure 10) where the one desired signal is passed on to the

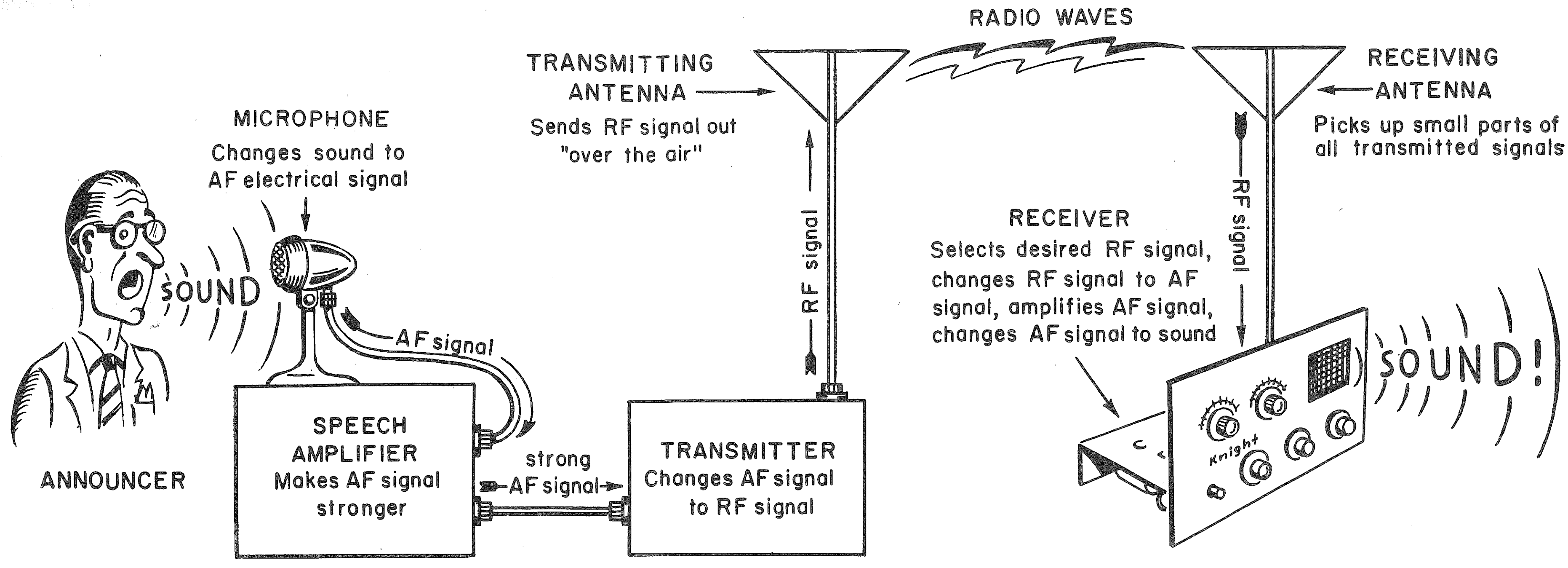


FIGURE 9. HOW RADIO MESSAGES ARE SENT AND RECEIVED

rest of the receiver, while the unwanted signals are "blocked out". The **Detector** changes the selected RF signal to an AF signal. The **First and Second Audio Amplifiers** make the weak AF signal strong enough to "drive" the **speaker.** The strong AF signal out of the Second Audio Amplifier is coupled to the **speaker** through the **Output Transformer**. The speaker changes the AF electrical signal back into sound.

The History of Radio

Radio had its beginning way back in 1873, when Ulysses S. Grant was President of the United States. In this year an Englishman by the name of **James C. Maxwell** made a prediction that electromagnetic waves, or, as he called them, "ether" waves, could be sent from one place to another through the air, just as light rays were. However, Maxwell died without ever having tested his idea.

A young German scientist, **Heinrich Hertz,** worked on Maxwell's idea from 1885 to 1889. One day he announced that he had indeed succeeded in sending electromagnetic waves from one room to another in his laboratory in Karlsruhe, Germany. Hertz, however, did not pursue his discovery.

It remained for a young Italian engineer-inventor by the name of **Guglielmo Marconi** to bring radio communication to the attention of the world. In 1890 he began experiments on his father's estate to test Hertz' theory. His experiments led to the invention of an outfit for sending code messages from one place to another without the need of wires. Code messages were used because no one knew how to transmit voices and music by radio. This outfit, or transmitter, attracted the attention of Sir William Henry Preece, who encouraged Marconi to transfer his experiments to England. In 1899 Marconi came to the United States, where he used his method of communication to report the Presidential election of 1900, the year that Teddy Roosevelt was elected to his first term. In 1902 he succeeded in establishing transatlantic communication with Europe. In 1904 Marconi began a daily news service to ocean liners in the Atlantic.

LEARNING THE CODE

Marconi's method of communication is shown in Figure 11. This method is still the most widely used of all systems. In this system, a transmitter generates an RF signal at one radio frequency. The key, which is worked by the transmitting operator's hand, turns the RF signal on and off according to the International Morse Code. The transmitting antenna sends radio waves out over the air in short and long bursts, according to the way the transmitter is keyed. As shown, a short burst represents a

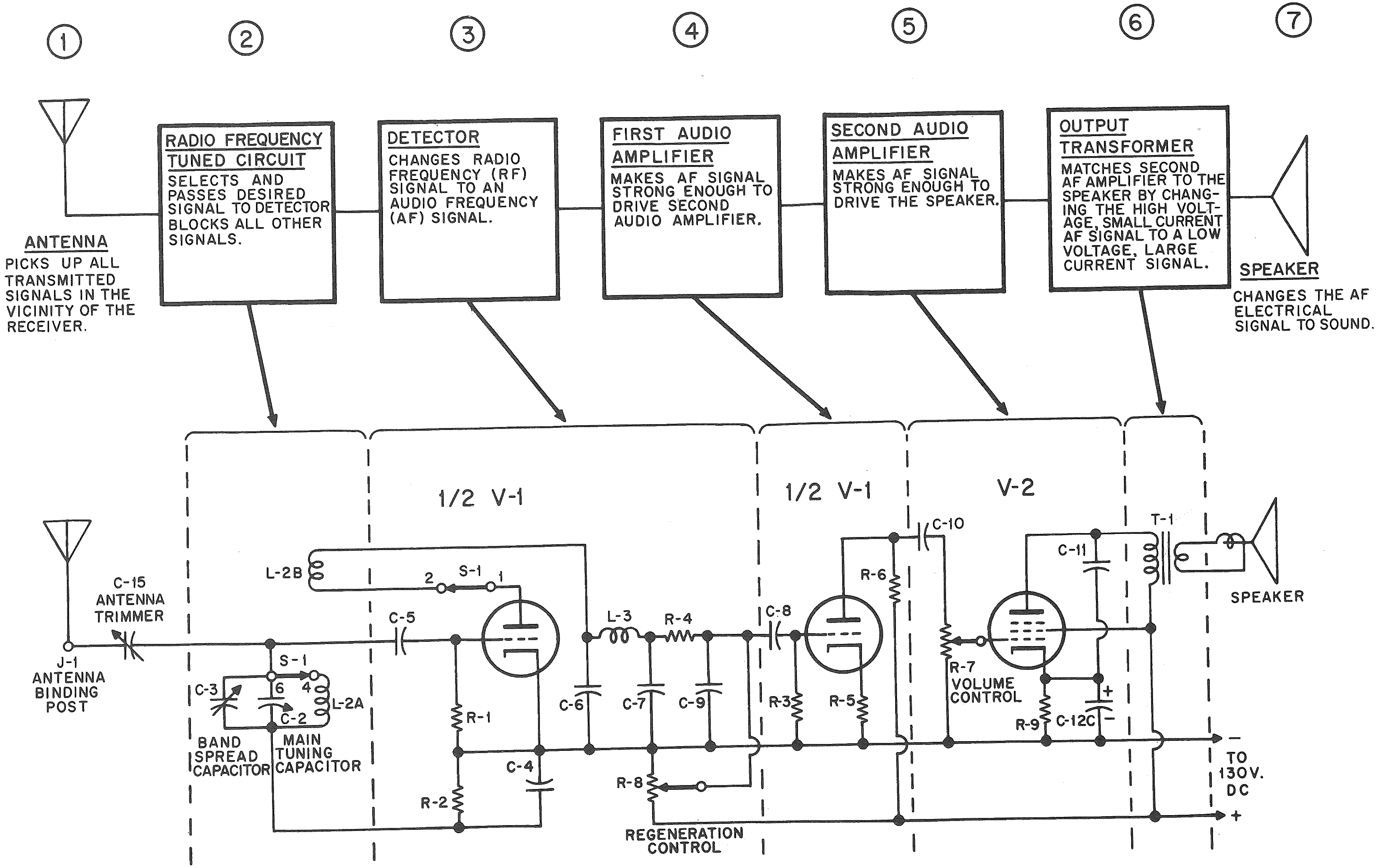


FIGURE 10. HOW YOUR SPACE SPANNER WORKS

dot, and a long burst a dash. The receiving antenna picks up a small part of all transmitted signals. The receiver selects the desired signal, changes it into an AF signal of a single tone, and converts it to sound. A code message sounds like short and long bursts of a musical note.

You should consider the code simply as another means of conveying information. The spoken word is one method, the printed page another. Typewriting and shorthand are additional examples of conveying information. Learning the code is as easy as learning to type.

In order for a person to understand code messages, he must first learn the code. This code is given in the chart on page 20. Although it is possible to learn the code by listening to it on the radio, usually it is more practical to use a Code Practice Oscillator, or Code Records which may be played on your phonograph, since the code heard on your receiver is too fast for a beginner.

Take a few characters at a time. Learn them thoroughly in diDAH language before going on to new ones. If someone who is familiar with code can be found to "send" to you, either by whistling or by means of a Code Practice Oscillator, ask him to help you. Usually he will be more than glad to do so.

OPERATING YOUR SPACE SPANNER

Power Requirements

Your KNIGHT Space Spanner can be operated on any alternating current (AC) or direct current (DC) whose voltage is from 105 to 125 volts.

Antenna Requirements

The importance of a good antenna for satisfactory reception cannot be over-emphasized. For the Broadcast Band (BC) a few feet of wire strung around the room will probably give satisfactory results. For the Short-Wave Band (SW), however, a good outside antenna should be used if long distance reception is expected. Such an antenna should be between 37½ and 75 feet long, and should be mounted as high off the ground as possible. An excellent, inexpensive antenna kit, complete with instructions, is listed under ACCESSORIES in the Parts List.

Working the Controls

Your KNIGHT Space Spanner, while not difficult to operate, requires some practice before peak performance, particularly on short wave, can be realized. The Space Spanner covers the Broadcast Band from 540 to 1700 kilocycles (KC), and the Short-Wave Band from 6 to 17 megacycles (MC). We suggest that you learn to operate this receiver on the Broadcast Band before attempting to receive short-wave signals.

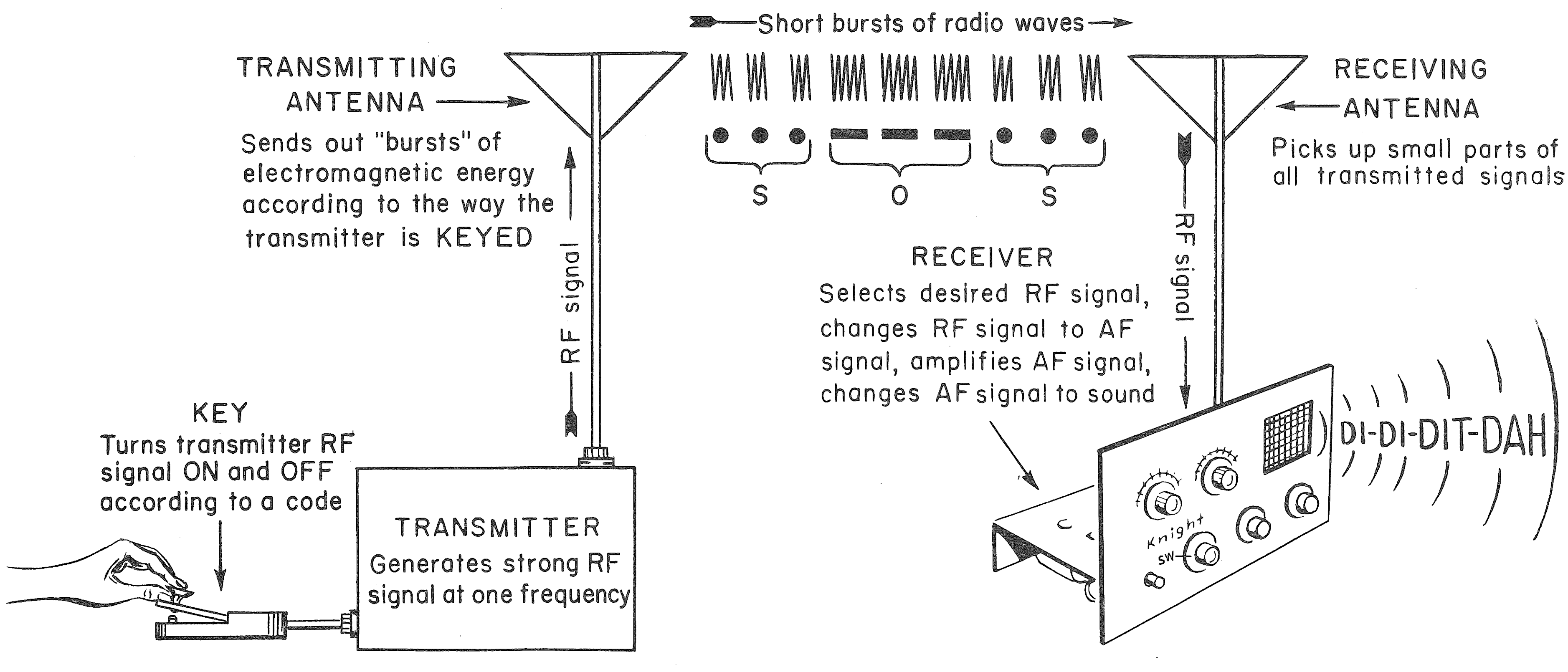


FIGURE 11. RADIO COMMUNICATION USING CODE

Plug the tubes into their respective sockets, as shown in Figure 3. Mount your Space Spanner in the cabinet with two #4x¼″ self-tapping screws. Turn the **VOLUME** control fully counterclockwise until a "click" is heard. Plug the line cord into a power outlet.

CAUTION: NEVER TOUCH ANY PART OF THE WIRING WHILE THIS RECEIVER IS PLUGGED INTO A POWER OUTLET. NEVER USE OR TEST THE SPACE SPANNER ON OR NEAR A GROUNDED METAL BENCH, RADIATOR, SINK OR OTHER GROUNDED METAL OBJECT. SERIOUS BODILY INJURY OR PROPERTY DAMAGE MAY RESULT IF THIS WARNING IS NOT HEEDED.

The regenerative detector in your KNIGHT Space Spanner is capable of extremely high **selectivity** (selectivity is the ability of a receiver to pass only one station and reject all others). The selectivity of this receiver is affected by the following factors:

1. Antenna length
2. Antenna coupling to the receiver
3. Amount of regeneration
4. Inductance to capacity ratio of the RF Tuned Circuit

Items 2, 3, and 4 in the above list are controllable from the front panel. The **ANTENNA** control varies the coupling between the antenna and the receiver. The **REGENERATION** control varies the amount of regeneration. The **MAIN TUNING** and **BANDSPREAD** controls vary the inductance to capacity ratio of the RF Tuned Circuit.

Since each of these controls interacts with the other, when the receiver is tuned with the **MAIN TUNING** and **BANDSPREAD** controls, the **ANTENNA** and **REGENERATION** controls will have to be changed.

A typical tuning procedure for receiving a Broadcast Band station is as follows:

SEE FIGURE 12.

Set the **SPEAKER-PHONES** switch on the rear of the chassis in the **SPEAKER** (up) position. Connect the antenna to the **ANTENNA** binding post on the rear of the chassis. Turn the **REGENERATION** control to its extreme clockwise position. Set the **SW-BC** switch to the **BC** position. Turn the **ANTENNA** control clockwise until it is all the way "in", then turn it counterclockwise two full turns. Set the **BANDSPREAD** control at 50. Turn the **VOLUME** control to its extreme clockwise position. Allow the Space Spanner to "warm up" for a few minutes.

After the receiver is warmed up, rotate the **MAIN TUNING** control throughout its range. You should hear indications of signals being received. These ordinarily are loud whistles. **PLEASE NOTE:** If the power being used by you is direct current (DC), you may not hear these whistles. Should this happen, pull the plug out of the power outlet, reverse it, and plug it back in. If you rotate the **MAIN TUNING** control very slowly, the whistle will start at a high pitch, fall to an increasingly lower pitch, pass through zero (no sound at all), and again rise toward a high pitch as you tune past a particular signal.

Set the **MAIN TUNING** control to one of the whistles, so that the whistle is at a low pitch. The pitch may be difficult to control with the **MAIN TUNING** control. If so, lower the pitch by rotating the **BANDSPREAD** control to the right or left.

Reduce the setting of the **REGENERATION** control to about "3 o'clock" (point "A" in Figure 12). If the whistle disappears when the **REGENERATION** control is set at 3 o'clock, **slowly** turn the **ANTENNA** control counterclockwise until the whistle **just** re-appears. Now, **very slowly** rotate the **ANTENNA** control clockwise until the whistle **just disappears.**

During this tuning procedure you may reduce the setting of the **VOLUME** control so that the sound is at a pleasing level. The setting of the **VOLUME** control has no effect on the tuning of the receiver.

If the whistle does not disappear when the **REGENERATION** control is set at 3 o'clock, **very slowly** turn the **ANTENNA** control clockwise until it just disappears.

If you cannot make the whistle disappear after turning the **ANTENNA** control clockwise one full turn, return the **ANTENNA** control to its original position. Reduce the setting of the **REGENERATION** control to less than 3 o'clock, but not so much that the whistle disappears completely. Eliminate the whistle with the **ANTENNA** control. It may be necessary to re-adjust the **MAIN TUNING** control after properly adjusting the **ANTENNA** control.

The Space Spanner now is adjusted for best voice and music reception. If the program sounds "mushy", reduce the setting of the **REGENERATION** control **very slightly.**

The point to remember when tuning the Space Spanner is this: If the **ANTENNA** control is turned too far clockwise, the antenna will load the receiver excessively. This will result in decreased selectivity, perhaps even to the extent where you will hear more than one station at a time. If the **ANTENNA** control is turned too far counterclockwise the received signal will be weak.

The setting of the **ANTENNA** control will not be the same across the Broadcast Band. It should be adjusted for any station so that best reception is obtained with the **REGENERATION** control set between 12 and 3 o'clock.

Short-wave reception is more critical, hence more care will have to be

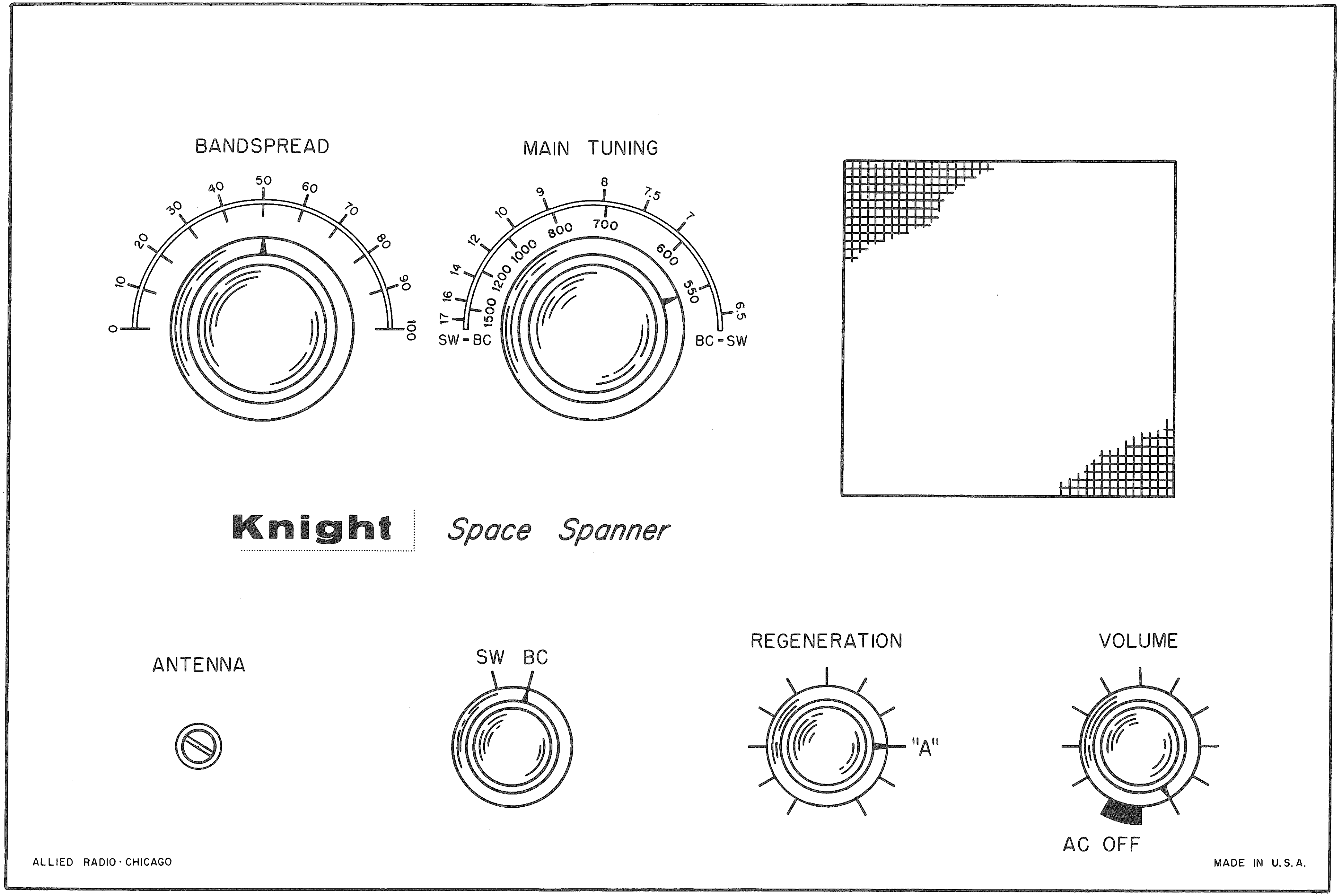


FIGURE 12. FRONT PANEL CONTROLS

exercised when tuning in a station. To receive short-wave signals, set the **SW-BC** switch at **SW.** Once again, set the **REGENERATION** control at about 3 o'clock and adjust the **ANTENNA** control to the point just below the whistling condition for voice reception. For code reception, set the **ANTENNA** control to the point where the code is heard as a series of whistles. Remember, if the **REGENERATION** control is advanced past 3 o'clock, the selectivity of the receiver will be reduced. This setting is especially critical on the Short-Wave Band because the stations are so close together.

It is likely that the antenna used will adversely affect the reception of short-wave signals at one or more points throughout the Short-Wave Band. This will show up as an abrupt stopping of the whistle as the receiver is tuned past a certain point. When this happens, reduce the setting of the **ANTENNA** control slightly, until the whistle again appears. When the receiver is tuned away from this point, the **ANTENNA** control must again be advanced. This condition is quite normal—it is simply the result of the antenna absorbing more energy from the Detector than the Detector can deliver. Reducing the coupling between the receiver and the antenna corrects the condition.

At the high end of the Short-Wave Band, extreme care must be exercised to make certain that the **REGENERATION** control is advanced just far enough to produce the normal whistle. If it is advanced too far, a loud "hiss" will be heard. When this happens, the selectivity and sensitivity of the receiver will be greatly reduced.

If the Space Spanner is used so that it whistles for code (CW) reception, it must be remembered that the antenna becomes an active part of the Detector circuit. If the antenna swings in the wind, the pitch of the received note will vary. This is normal, however, it is important to make sure that the antenna is reasonably clear of all other objects.

Should you wish to listen to your Space Spanner with earphones rather than with the speaker, use phones that have an impedance of 1,000 ohms or more. A good headset is listed in the Parts List under **ACCESSORIES.** To use earphones, merely plug them into the pin jacks on the rear of the chassis and set the **SPEAKER-PHONES** switch at **PHONES** (down).

The Ionosphere and Radio Reception

You may wonder why at some times you can hear a particular station, while at other times it is impossible to hear it. This condition can best be explained by referring to Figure 13.

In the figure, the tower at "A" is the transmitting antenna, while the towers labeled "B" and "C" are receiving antennas. As shown, radio waves go out in all directions from the transmitting antenna. These waves are labeled "a", "b", and "e".

Let's take wave "a" first. This is known as the ground wave because it hugs the ground, and is rapidly absorbed by it. The ground wave is present in the same locations at all times when the transmitter is operating. Any receiver located within the area of the ground wave, such as that at "B", will always receive the transmitted signal. This is why you always receive the programs broadcast by your local radio stations. The ground wave completely disappears after it has traveled a certain distance. A receiver located outside the range of the ground wave, such as that at "C", is not affected by it.

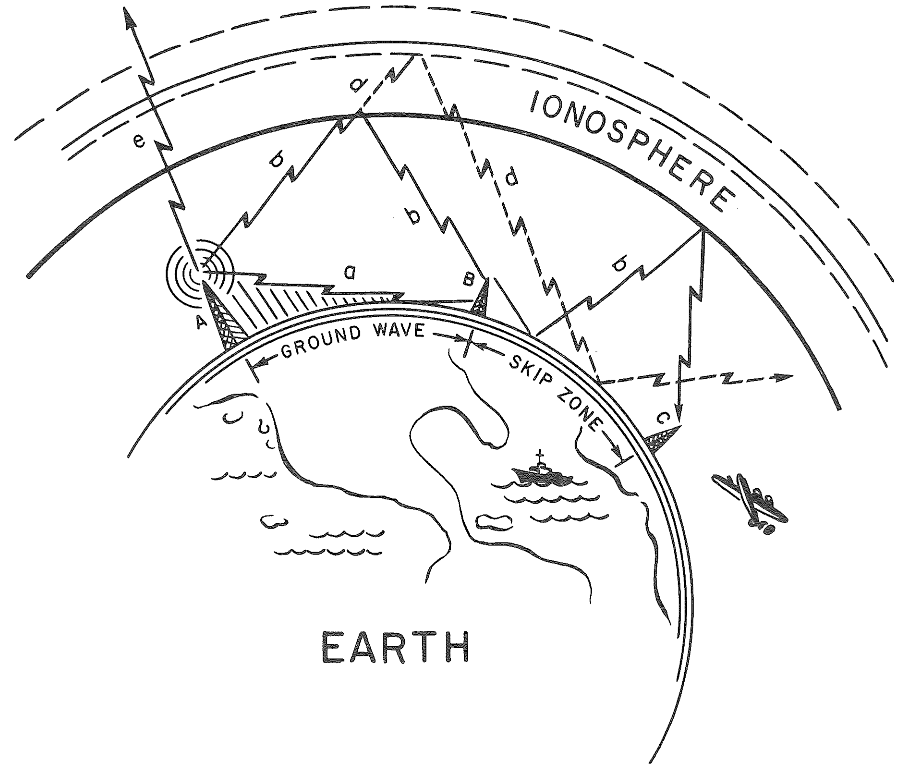


FIGURE 13. EFFECT OF THE IONOSPHERE ON RADIO WAVES

At the same time that the ground wave is being transmitted, other waves, called sky waves, are also being sent out. Referring to sky wave "b", notice that it is transmitted upward, but not straight up. This wave continues on up until it reaches a layer of particles up in the sky called the ionosphere. Here the wave does a peculiar thing. It bounces off the ionosphere back toward the Earth. If it bounces just right, receiver "B" will pick it up. Going a bit further, when this wave hits the Earth, it may bounce right back up toward the ionosphere. When it reaches the ionosphere, it bounces back toward the Earth.

Receiver "C" now picks up the transmitted signal because the sky wave has bounced right on to its antenna. It seems, then, that receiver "C" should always be able to "hear" transmitter "A". This would be true if the ionosphere stayed in one place, as indicated by solid curved lines above the Earth. However, at different times of the day, and at different seasons of the year, the ionosphere shifts up and down. Suppose that the ionosphere shifts up, as indicated by the broken curved lines. Now the sky wave "b" must go higher before it bounces back toward the Earth (broken wave "d"). Consequently, it hits the Earth farther away from the transmitter and misses receiver "B" entirely. However, the ground wave still reaches "B", and it still hears the transmitter. When wave "d" bounces back up toward the ionosphere, it also misses receiver "C". Because the ground wave does not reach "C", he cannot hear the program being transmitted. This explains why you sometimes can, and sometimes cannot, hear a particular station.

Wave "e" shows what happens when a radio wave leaves the antenna straight up. It goes right through the ionosphere and never again reaches the Earth.

When To Listen

Under normal conditions, with patience and practice, it's possible to hear stations from all over the world in a single evening—at times even within a few minutes! All you need is your Space Spanner, a simple antenna, a knowledge of **where** and **when** to listen—plus persistence.

International short-wave radio is glamorous as well as educational. It provides a satisfying hobby. To some, perhaps, it's the feeling of "power" to reach out to the farthermost corners of the earth at the flick of a switch and the twirl of a knob!

Short-wave broadcasts enable you to learn first-hand what people in other countries have to say about current affairs, and what kinds of music and other entertainment they have. Many programs are sent in English for those who know no foreign languages, and in the various local languages for those who want to study languages as they are actually spoken in their respective countries.

Some short-wave enthusiasts are interested in receiving **QSL's** (verifications) from the stations to which they have listened. Others report their results to radio clubs; they get their big thrill from seeing their names in print credited with a fine "catch", perhaps, such as a "first-heard" on a new station. Still others try to build up a long list of stations heard, content that their records show a great amount of reception from all over the world.

Short-wave radio transmitters include land communications stations, maritime stations, aeronautical stations, amateur (ham) stations, and broadcasting stations. Of these, the broadcasting and amateur (ham) stations are of most interest to the **short-wave listener** (SWL). However, there are many other "specialties" to listen to such as code; commercial phones (international telephone and point-to-point communications — standard or inverted — or scrambled — speech); shipping and coastal radio; police, fire, and other local governmental agencies; plane and ground communications; weather station reports and contacts; special expeditions, and other unusual events.

Some SWL's like to listen for DX (distant reception) "the long way around" — which is a form of "freak" reception which is not normally heard.

By international agreement, each type of station is assigned certain bands for operations.

You'll find that the short-wave portions of the dial on your receiver are calibrated (marked off) in megacycles (MC); a megacycle is 1000 kilocycles (KC).

Short-wave stations operate in these megacycle bands — 5.95 to 6.20 MC; 7.10 to 7.30 MC; 7.0 to 7.3 MC amateur band; 9.50 to 9.80 MC; 11.70 to 12.00 MC; 14 to 14.3 MC amateur band; 15.10 to 15.45 MC. Some receivers indicate these bands in meters (m.)—such as the 49, 41, 40, 31, 25, 20, and 19 meter bands respectively. Thus, **megacycles** refer to **frequency**; **meters** refer to **wavelength.**

Reception conditions on each of the short-wave broadcast bands vary a lot at different times of the day and night, and also at different seasons of the year. It's important that you learn when to listen on each band.

In general, for SWL's in North America, the best reception on each of these bands during the fall and spring months should be:

The 6 MC band—Evening for Latin America and Europe.

The 7 MC bands—Late afternoon and **evening** for Europe. **Evening** and **early morning** for amateur stations.

The 9 MC band—Morning (6 to 8 a.m. **your local time**) for Asia and Australia; **afternoon** for Europe and Africa; **evening** for Europe and Latin America.

The 11 MC band—Morning (6 to 9 a.m. **your local time**) for Asia and Australia; **afternoon** for Europe and Africa; **evening** for Latin America.

The 14 MC band—late morning and **afternoon** for amateur stations.

The 15 MC band—Morning and **afternoon** for Europe and North America; **evening** for North and South America.

During the winter months, the best bands for evening reception are lower than during the fall and spring. For instance, the 9 MC band becomes poor for reception from Europe during the evening hours, and the 6 MC band becomes the best band for European reception.

In the summer months, the best evening reception shifts to the higher bands. Evening reception from Europe becomes good in the 11 MC band, although the 9 MC band remains good for reception from that area.

Year-around DX (distant reception) bands are the 9 MC and 11 MC bands, although consideration there must be given to receiving different parts of the world best in summer or winter.

The expected reception just outlined is for normal conditions. The factors which affect long-distance radio transmissions vary from day to day. On some days, for instance, reception will be quite good, but at times, generally for periods of several consecutive days, transmission conditions will be "disturbed" and only the more powerful stations can be heard.

But don't get discouraged because normal conditions will return after the disturbance has ended, and reception will again be good.

Here's a special caution: Short-wave broadcasting stations often change their schedules and/or frequencies with little or no prior notice. Always be on the alert for announcements of such changes.

THE INTERNATIONAL MORSE CODE

The important thing when beginning to study code is to think of it as a language of sound, never as combinations of dots and dashes. It is easy to "speak" code by using "dit" for dots and "DAH" for dashes, so that "A" would be "diDAH". The "t" at the end of "dit" is dropped except at the end of a character. The sound "di" should be sharp; a code character like the number "5" should sound like a machine-gun burst–dididididit! Stress each "DAH" equally; they are capitalized in this chart because they should be slightly accented and drawn out.

Learn the code by **listening** to it. **Don't think about speed to start;** the first requirement is to learn the characters to the point where you can recognize each of them without any hesitation whatsoever. Concentrate on any difficult letters. Learning the code is not hard—it merely requires time and a little effort.

CHARACTER	CODE	PRONUNCIATION OF CODE	PHONETIC LETTER
A	• —	diDAH	Able
B	— • • •	DAHdididit	Baker
C	— • — •	DAHdiDAHdit	Charlie
D	— • •	DAHdidit	Dog
E	•	dit	Easy
F	• • — •	didiDAHdit	Fox
G	— — •	DAHDAHdit	George
H	• • • •	didididit	How
I	• •	didit	Item
J	• — — —	diDAHDAHDAH	John
K	— • —	DAHdiDAH	King
L	• — • •	diDAHdidit	Love
M	— —	DAHDAH	Mike
N	— •	DAHdit	Nan
O	— — —	DAHDAHDAH	Oboe
P	• — — •	diDAHDAHdit	Peter
Q	— — • —	DAHDAHdiDAH	Queen
R	• — •	diDAHdit	Roger
S	• • •	dididit	Sugar
T	—	DAH	Tare
U	• • —	didiDAH	Uncle
V	• • • —	dididiDAH	Victor
W	• — —	diDAHDAH	William
X	— • • —	DAHdidiDAH	X-ray
Y	— • — —	DAHdiDAHDAH	Young
Ƶ	— — • •	DAHDAHdidit	Zebra

CHARACTER	CODE	PRONUNCIATION OF CODE
1	• — — — —	diDAHDAHDAHDAH
2	• • — — —	didiDAHDAHDAH
3	• • • — —	dididiDAHDAH
4	• • • • —	didididiDAH
5	• • • • •	dididididit
6	— • • • •	DAHdididit
7	— — • • •	DAHDAHdididit
8	— — — • •	DAHDAHDAHdidit
9	— — — — •	DAHDAHDAHDAHdit
Ø	— — — — —	DAHDAHDAHDAHDAH
Period (.)	• — • — • —	diDAHdiDAHdiDAH
Comma (,)	— — • • — —	DAHDAHdidiDAHDAH
Question mark (?)	• • — — • •	didiDAHDAHdidit
Double dash (—)	— • • • —	DAHdididiDAH
Fraction bar (/)	— • • — •	DAHdidiDAHdit
Invitation to transmit	— • —	DAHdiDAH
Error	• • • • • • • •	didididididididit
Wait	• — • • •	diDAHdididit
End of message	• — • — •	diDAHdiDAHdit
End of work	• • • — • —	dididiDAHdiDAH

ALLIED'S SERVICE FACILITIES

In the event that the kit does not operate properly, 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 for a special service charge of $2.50. Parts within the standard RETMA 90-day warranty period will be replaced without charge for the parts. An additional charge will be made for parts damaged in construction or because of a wiring error, or for parts which are beyond the 90-day warranty period. After the one-year period, service charges, plus cost of parts, are based on the length of time required to repair the unit.

PLEASE NOTE: KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX ARE NOT ELIGIBLE FOR REPAIR OR SERVICE AND WOULD HAVE TO 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. Use the original packing carton and use cushioning material around the front panel. 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 components 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 was 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 efficiently engineered KNIGHT kits are moderately priced. When you buy a KNIGHT kit you get the best in design, quality, and value. Recommend KNIGHT kits to your friends.

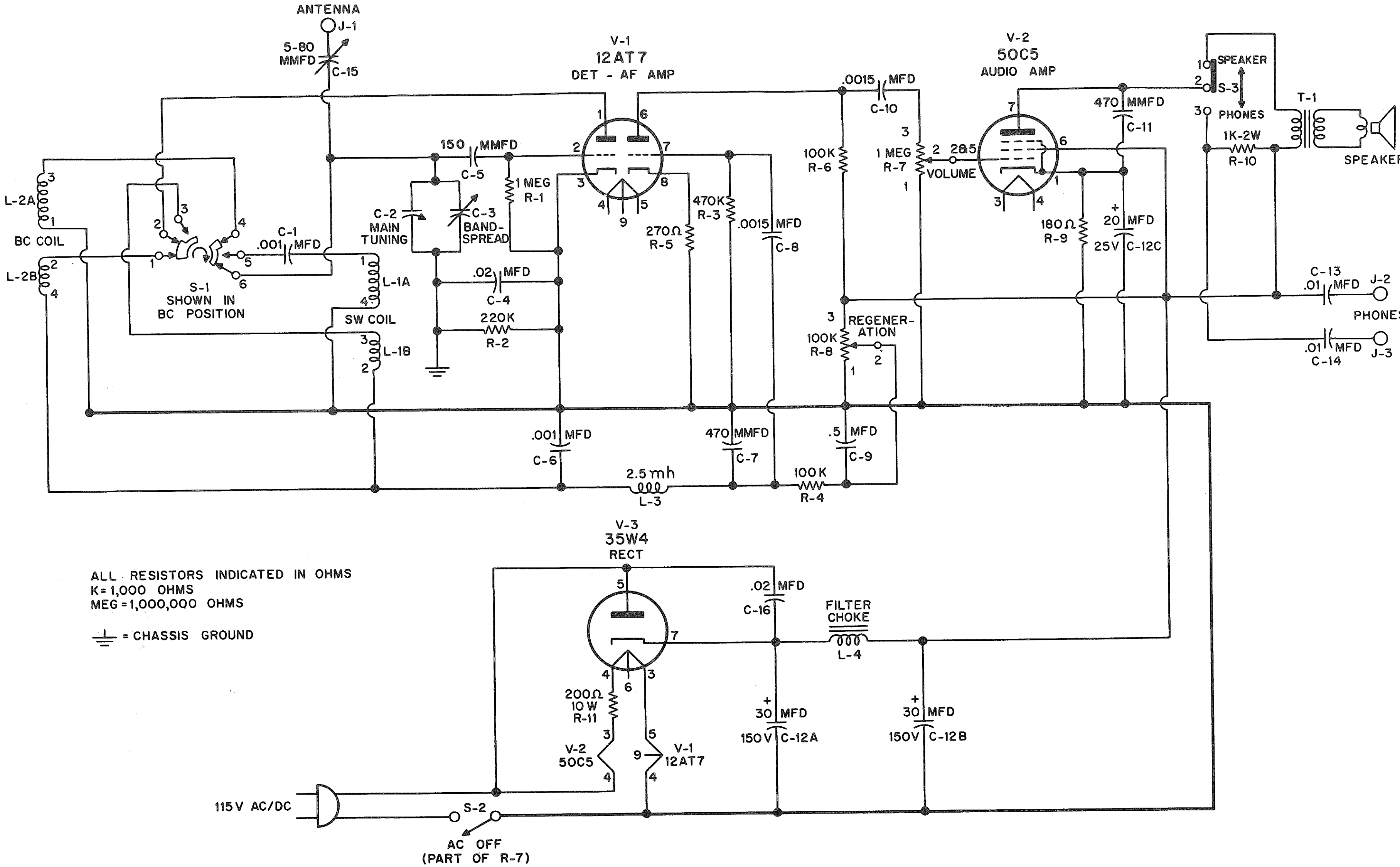


FIGURE 14. SCHEMATIC DIAGRAM, KNIGHT SPACE SPANNER

PARTS LIST FOR THE KNIGHT SPACE SPANNER

Symbol Number	Description	Part No.
C-1	Capacitor, 1,000 MMFD (.001 MFD) ±10%, 500 V, mica	296002
C-2	Capacitor, **MAIN TUNING**, 400 MMFD max. variable	281003
C-3	Capacitor, **BANDSPREAD**, 15 MMFD max. variable	281000
C-4	Capacitor, .02 MFD, 600V, ceramic disc, GMV	296009
C-5	Capacitor, 150 MMFD, 600 V, ceramic disc, ±20%	276158
C-6	Capacitor, .001 MFD, 600 V, ceramic disc, GMV	276016
C-7	Capacitor, 470 MMFD, 600 V, ceramic disc, ±20%	276478
C-8	Capacitor, .0015 MFD, 600 V, ceramic disc, GMV	276157
C-9	Capacitor, 0.5 MFD, 400 V, paper	245054
C-10	Capacitor, .0015 MFD, 600 V, ceramic disc, GMV	276157
C-11	Capacitor, 470 MMFD, 600 V, ceramic disc, ±20%	276478
C-12	Capacitor, electrolytic, 30-30-20 MFD @ 150-150-25 V	213301
C-13	Capacitor, .01 MFD, 600 V, ceramic disc, GMV	276015
C-14	Capacitor, .01 MFD, 600 V, ceramic disc, GMV	276015
C-15	Capacitor, **ANTENNA** trimmer, 5-80 MMFD	283000
C-16	Capacitor, .02 MFD, 600 V, ceramic disc, GMV	296009
J-1	Binding post, black, **ANTENNA** connector	533002
J-2, J-3	Dual pin jack, **PHONE** connector	502227
L-1	Short wave coil	111201
L-2	Broadcast coil	111202
L-3	RF choke, 2.5 mh	151001
L-4	Filter choke	140003

Note: When ordering resistors, give complete description and part number.

Symbol Number	Description	Part No.
R-1	Resistor, 1 megohm, ½ watt	301105
R-2	Resistor, 220K ohms, ½ watt	300224
R-3	Resistor, 470K ohms, ½ watt	300474
R-4	Resistor, 100K ohms, ½ watt	301104
R-5	Resistor, 270 ohms, ½ watt	301271
R-6	Resistor, 100K ohms, ½ watt	301104
R-7	Potentiometer, **AC OFF-VOLUME** control, 1 megohm, log taper with SPST switch attached	390005
R-8	Potentiometer, **REGENERATION** control, 100K ohms, linear taper	390101
R-9	Resistor, 180 ohms, ½ watt	301181
R-10	Resistor, 1,000 ohms, 2 watts	306102
R-11	Resistor, 200 ohms, 10 watts	374001
S-1	**SW-BC** Bandswitch	432101
S-3	**SPEAKER-PHONES** Switch	431101
S-2	**ON-OFF** Switch	Part of R-7
T-1	Output Transformer	Part of speaker
TS-1	Terminal strip, 5-terminal	440501
TS-2	Terminal strip, 2-terminal	440201
V-1	**DETECTOR—1st AUDIO AMP.** tube 12AT7	611013
V-2	**2nd AUDIO AMPLIFIER** tube 50C5	610026
V-3	**RECTIFIER** tube 35W4	610029

Quantity	Description	Part No.
1	Cabinet	702004
1	Chassis	461302
1	Cord, line, with plug	802001
1	Grill, perforated fiber, gray	731002
4	Grommet, rubber, small	830001
3	Grommet, rubber, large	830200
4	Knob, small	764501
2	Knob, large	764301
5	Lug, solder	553002
1	Manual, instruction	750003
4	Nut, 4-36 hex (Small)	570230
18	Nut, 6-32 hex (medium)	570340
1	Nut, 8-32 hex (large)	570440
6	Nut, ⅜" hex, control mtg. (very large)	570840
5	2" red wire	801002
9	3" orange wire	801003
6	4" yellow wire	801004
2	5" green wire	801005
1	8" gray wire	801008
36"	Rosin Core Solder	930036
1	6" Bare wire	806006
1	Panel, front	462202
2	Screw, #4x¼" self-tapping	562292
4	Screw, 4-36 x ⅜" (long, thin)	560234
4	Screw, 6-32 x ⅛" (short)	560340
18	Screw, 6-32 x ¼" (medium)	560342
2	Spacer, ceramic, threaded	940004
1	Spaghetti, 6" length	812001
1	Speaker, 4" PM, with output transformer attached	730003
2	Socket, for 7-pin tube	501070
1	Socket, for 9-pin tube	501090
1	Washer, #8 fiber, flat	590400
1	Washer, #8 fiber, shouldered	591401
1	Washer, ⅜" internal tooth lock	582700

TOOLS NEEDED FOR CONSTRUCTION

Stock No.	Description	Price*
46N852	Soldering pencil	$4.73
46N449	6" longnose pliers with side cutters	1.76
45N796	6" Screwdriver	.72

Tools That Will Make Your Construction Easier

Stock No.	Description	Price*
46N431	5" diagonal cutters	1.55
43N831	setscrew driver	.27

ACCESSORIES YOU MAY WANT

Stock No.	Description	Price*
59J110	Headset, 2,000 ohms impedance	$1.67
83C100	Antenna kit	.81

***All prices subject to change without notice.**

VOLTAGE CHART

All measurements made with a 20,000 ohms-per-volt VOM from terminal 1 of S-2 to point specified. All readings given in DC volts unless otherwise specified. **MAIN TUNING** control set fully clockwise; **BANDSPREAD** at "O"; **SW-BC** switch at "BC"; **REGENERATION** control fully clockwise; **AC OFF-VOLUME** control just turned on (volume at minimum); **SPEAKER-PHONES** switch at SPEAKER; antenna disconnected.

TUBE	PIN 1	2	3	4	5	6	7	8	9
V-1 12AT7	42	—.3	0	0	11AC	38.5	—.2	.25	NC
V-2 50C5	8.5	0	65AC	110AC	NC	120	115		
V-3 35W4	120	NC	11AC	42AC	110AC	NC	135		

RESISTANCE CHART

All controls set as stated in Voltage Chart. **POWER DISCONNECTED.** Readings with (*) taken between point specified and pin 7 of V-3. All other readings taken between point specified and terminal 1 of S-2. All readings given in ohms. K = 1,000 ohms. M = 1,000,000 ohms. NC = No connection.

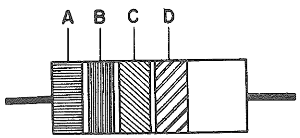
TUBE	PIN 1	2	3	4	5	6	7	8	9
V-1 12AT7	100K*	1.1M	0	0	—	100K*	450K	250	NC
V-2 50C5	180	23	250	300	NC	330*	500*		
V-3 35W4	300*	NC	12	50	300	NC	0*		

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	—	.1	±5	1,000
Silver	—	.01	±10	2,000
None	—	—	±20	500

*Applies to capacitors only

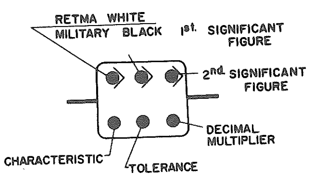


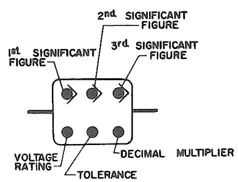
HOW TO DETERMINE THE VALUE OF A RESISTOR

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%.



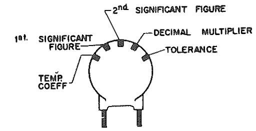


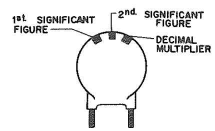
HOW TO DETERMINE THE VALUE OF A MICA CAPACITOR

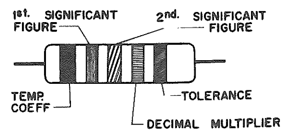
EXAMPLES:

A capacitor with a 6 dot code (new RETMA standard REC-115A and military MIL-C-5A) 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 $\mu\mu$f. Tolerance is ±2%. 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 $\mu\mu$f. Tolerance is ±2%. Voltage rating is 500 V DC.







CERAMIC CAPACITOR COLOR CODE

Color	Significant Figures	Decimal Figures	Tolerance: 10$\mu\mu$f or less ($\mu\mu$f)	Tolerance: Over 10$\mu\mu$f (%)	Temp. Coef. (Parts per million per °C.)
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	−330
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	—	—	—	—	—

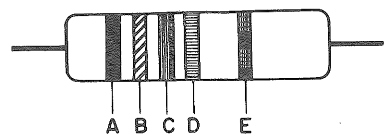
HOW TO DETERMINE THE VALUE OF A CERAMIC CAPACITOR

EXAMPLES:

A ceramic tubular capacitor has the following color bands: Black, red, red, red, green. The significant figures are 2 and 2 (22), and the decimal multiplier is 100. The capacitance is, therefore, 2200 $\mu\mu$f. 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 $\mu\mu$f. The tolerance is ±5%. The temperature coefficients — 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 $\mu\mu$f. 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 $\mu\mu$f.

B — Second significant figure.

C — Decimal multiplier (number of zeroes 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 $\mu\mu$f. The tolerance is ±20%. The voltage rating is 400 V DC.

TUBULAR PAPER CAPACITOR COLOR CODE

Color	Significant Figures	Decimal Multiplier	Tolerance %	Voltage Rating (v d-c)
Black	0	1	±20	—
Brown	1	10	—	100
Red	2	100	—	200
Orange	3	1,000	±30	300
Yellow	4	10,000	—	400
Green	5	—	—	500
Blue	6	—	—	600
Violet	7	—	—	700
Gray	8	—	—	800
White	9	—	—	900
Gold	—	—	—	1,000
Silver	—	—	±10	—