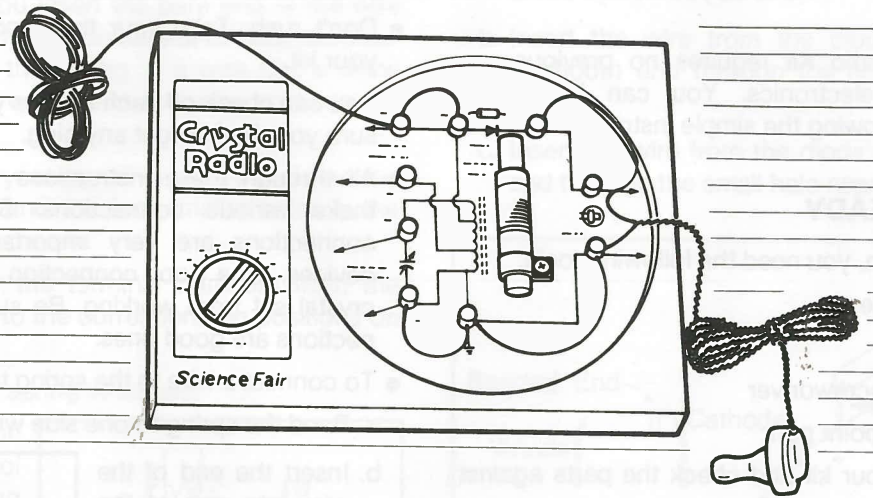
OWNER'S MANUAL

Crystal Radio Kit

Please read before using this equipment



Cat. No. 28-177

Science Fair®

INTRODUCTION

With your "Crystal" Radio Kit you can tune in AM radio stations without using batteries or AC power! This device works on the same principle as the early crystal radio, but the crystal has been replaced with a more reliable modern device called a *diode*.

Your Crystal Radio Kit requires no previous experience with electronics. You can build and operate it by following the simple instructions in this manual.

GETTING READY

Before you begin, you need the following tools:

- Long-nose pliers
- Wire-cutters
- Phillips-type screwdriver
- Pencil or ballpoint pen

Now, unpack your kit and check the parts against the "Parts List" on page 10.

ASSEMBLING YOUR CRYSTAL RADIO

Follow the instructions in the order given, beginning with Step 1.

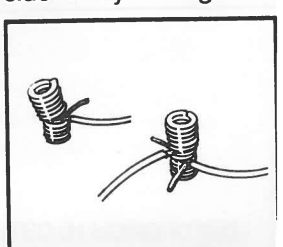
Notes:

- Don't rush. Take your time and enjoy building your kit.
- You can check off each step as you finish it to be sure you don't forget anything.
- All through these instructions you're asked to make various connections. Secure electrical connections are very important in electronic devices. One poor connection can keep your crystal set from working. Be sure all your connections are good ones.
- To connect a wire to the spring terminals:

  a. Bend the spring to one side with your finger.

  b. Insert the end of the wire into one of the gaps in the spring.

  c. Release the spring. It will hold the wire firmly.



Be sure you connect clean, bare wire to each terminal. Some of the wires have insulation that has been stripped off the ends. Other wires have been "tinned" (coated with solder) at the ends so that they can make a good connection.

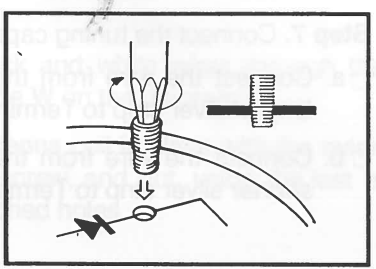
Make sure that you insert the bare end of the wire into the spring terminal. Be careful to keep the insulated part out of the spring. If a wire has a shiny tinned part at the end, insert the shiny part into the spring.

☐ **Step 1.** Using your pencil or pen, punch out the nine larger holes and the four smaller holes in the panel.

☐ **Step 2.** Copy the terminal numbers from the front of the panel to the corresponding positions on the back side.

Step 3. Install the spring terminals:

☐ a. Press the smaller end of each spring terminal into one of the punched holes.



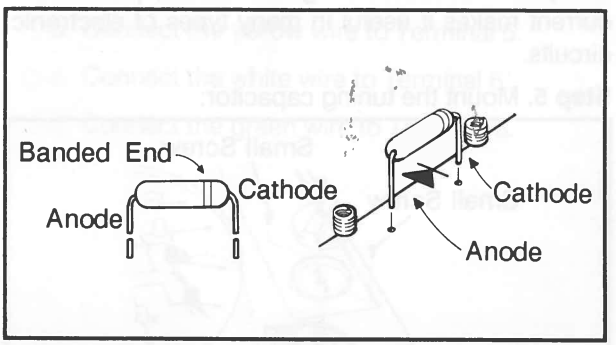
☐ b. Use the pointed end of a pencil to twist each terminal firmly into place.

Step 4. Mount the diode as follows:

☐ a. Use your long-nose pliers to bend each of the diode's two wires as shown.

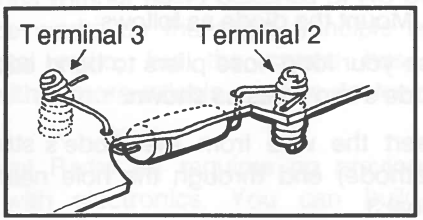
☐ b. Insert the wire from the diode's striped (cathode) end through the hole nearest Terminal 3.

☐ c. Insert the wire from the diode's other (anode) end through the small hole nearest Terminal 2.



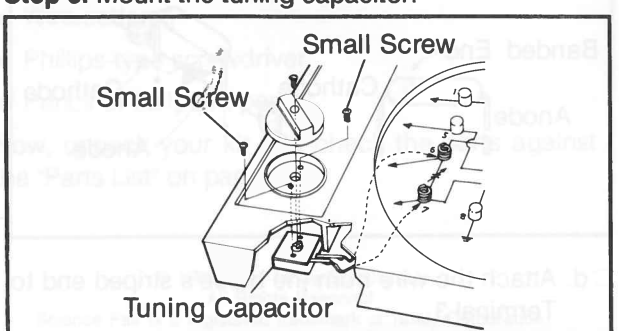
☐ d. Attach the wire from the diode's striped end to Terminal 3.

☐e. Attach the wire from the diode's other end to Terminal 2.



Note: A diode allows current to pass through it in only one direction, from anode to cathode. This ability to block alternating current and pass direct current makes it useful in many types of electronic circuits.

Step 5. Mount the tuning capacitor:



☐a. Position the capacitor beneath the panel opening that is just above the word TUNING.

☐b. The metal shaft of the capacitor should extend through the opening.

☐c. Fasten the capacitor to the panel using the two small screws.

Step 6. Install the tuning capacitor's knob.

☐a. Turn the tuning capacitor's shaft all the way to the left.

☐b. Place the tuning knob on the upper end of the shaft.

c. Line up the dot on the knob with the **0** on the panel.

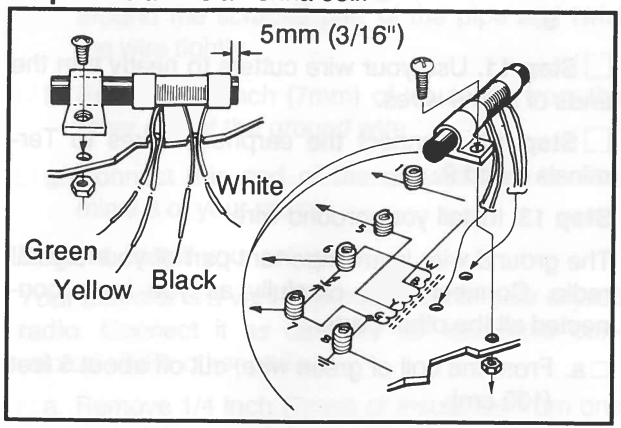
☐d. Fasten the knob in place using the remaining small screw.

Step 7. Connect the tuning capacitor's wires:

☐a. Connect the wire from the tuning capacitor's *longer* silver strip to Terminal 6.

☐b. Connect the wire from the tuning capacitor's *shorter* silver strip to Terminal 7.

Step 8. Install the antenna coil:



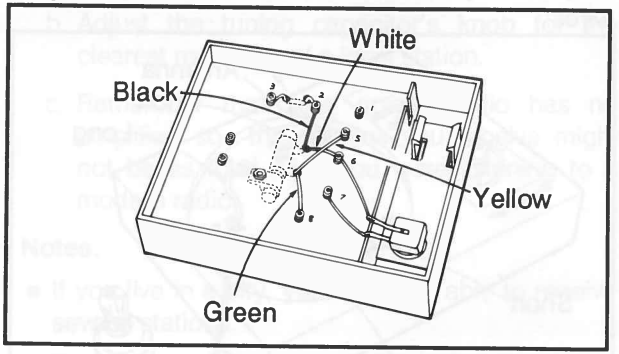
☐ a. Position the antenna coil on the panel near the three remaining small punched holes.

☐ b. Insert the antenna coil's green and yellow wires through the hole nearest the **Y** on the diagram.

☐ c. Insert the black and white wires through the hole nearest the **W** on the diagram.

☐ d. Fasten the antenna coil in place with the nylon clip, medium screw, and nut, using the last of the small punched holes.

Step 9. Connect the antenna coil wires:



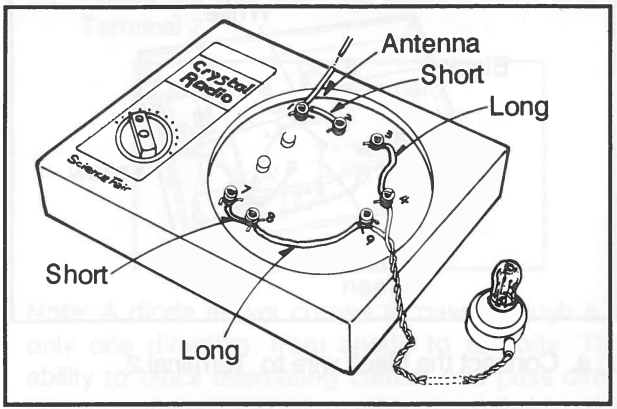
☐ a. Connect the black wire to Terminal 2

☐ b. Connect the yellow wire to Terminal 5.

☐ c. Connect the white wire to Terminal 6.

☐ d. Connect the green wire to Terminal 8.

Step 10. Install the blue and white connecting wires:



These connecting wires can be installed either on the front or the back of the panel. We suggest that you put them on the front, so that you can see how the wiring relates to the diagram on the panel.

☐ a. Connect a short wire between Terminals 1 and 2.

☐ b. Connect a long wire between Terminals 3 and 4.

☐ c. Connect a short wire between Terminals 7 and 8.

☐ d. Connect a long wire between Terminals 8 and 9.

☐ **Step 11.** Use your wire cutters to neatly trim the ends of all the wires.

☐ **Step 12.** Connect the earphone wires to Terminals 4 and 9.

Step 13. Install your ground wire:

The ground wire is an important part of your crystal radio. Connect it as carefully as you have connected all the other parts.

☐ a. From the coil of green wire, cut off about 5 feet (150 cm).

☐ b. Remove about 6 inches (15cm) of insulation from one end of the wire.

☐ c. Find a metal cold water pipe.

☐ d. Scrape any paint or dirt from the pipe until you see bright metal all the way around the pipe.

☐ e. Wrap the bare end of the wire several times around the scraped part of the pipe and twist the wire tightly.

☐ f. Remove 1/4 inch (7mm) of insulation from the other end of the ground wire

☐ g. Connect this end of the ground wire to Terminal 8 of your radio.

Step 14. Install your antenna:

Your antenna is a very important part of your crystal radio. Connect it as carefully as you have connected all the other parts.

☐ a. Remove 1/4 inch (7mm) of insulation from one end of the remaining length of green wire.

☐ b. Connect this end to Terminal 1 of your radio.

☐ c. Extend the antenna wire horizontally to its full length.

You have now completed the building of your crystal radio. If you have followed the instructions carefully, you should be able to tune in one or more AM radio stations right away.

a. Place the earphone in your ear.

b. Adjust the tuning capacitor's knob for the clearest reception of a local station.

c. Remember that your crystal radio has no amplifier, so the stations you receive might not be as loud as if you were listening to a modern radio..

Notes:

- If you live in a city, you might be able to receive several stations.
- If you do not live near a radio station, you might need an outside antenna, 35 to 85 feet (10 to 25 m) long, connected to Terminal 5.
- A complete outdoor antenna kit is available at your local Radio Shack Store.

If your radio does not receive stations well, try connecting the antenna wire to terminal 6 instead of terminal 1 or 5. If rcception is still poor, change the antenna coil connection as follows:

White wire from terminal 6 to terminal 2

Black wire from terminal 2 to terminal 6

HOW YOUR CRYSTAL RADIO WORKS

All radio broadcast stations do basically the same thing. They combine sound, or audio waves, with a radio *carrier* wave. The carrier wave travels great distances, and carries with it information about the strength and pitch of the sound waves.

One method of combining the radio carrier wave and the audio wave is called Amplitude Modulation (AM).

Your AM radio antenna picks up the carrier wave sent by the radio station.

Your crystal radio then does three important things (with some help from you) to allow you to hear the radio program. These are:

- Tuning
- Detection
- Changing of an electrical current to sound waves.

TUNING

When you turn the tuning capacitor's knob, you are adjusting a circuit formed by the tuning capacitor and the antenna coil. This circuit allows only one radio station's carrier wave at a time to enter your radio. By tuning this circuit, you select the carrier wave of the station you want to hear.

DETECTION

The diode gets rid of the carrier wave by sending it to the ground through your cold water pipe. At the same time, it allows a tiny electric current that represents the sound (audio) information to go to the earphone.

CHANGING ELECTRICITY INTO SOUND

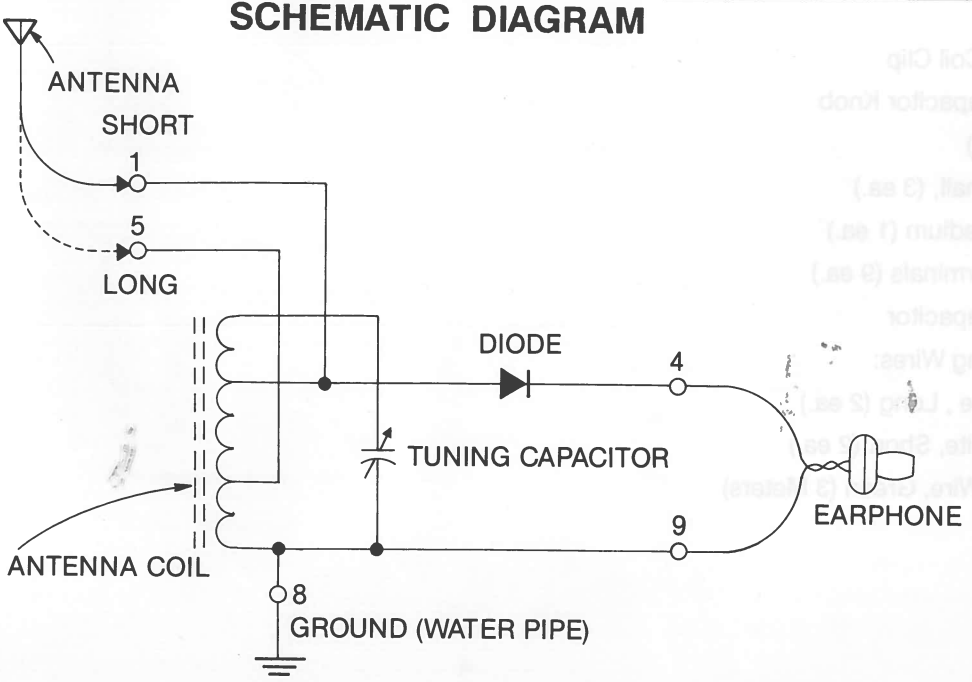
When the electric current reaches the earphone, it causes a small piece of ceramic material to vibrate. The movement of this ceramic material then vibrates the air, creating the sound waves that you hear.

Your crystal radio works very much the same way as the early ones. Of course, the "old-time" crystal sets didn't have diodes. They used a piece of *galena* crystal (lead ore), held in contact with a fine wire called a "cat's whisker."

This earlier type of radio, like yours, had no amplification. Then, as now, more complicated radios amplified the audio waves to vibrate a loudspeaker and produce louder sound.

All radios still use the basic combination of (1) a tuned circuit that selects the carrier wave sent by the radio station, (2) a detector that separates the sound information from the carrier wave and (3) an earphone or loudspeaker to let you to hear the sound.

SCHEMATIC DIAGRAM



PARTS LIST

Antenna Coil

Plastic Case with Labeled Panel

Diode

Earphone

Antenna Coil Clip

Tuning Capacitor Knob

Nut, (1 ea)

Screw, small, (3 ea.)

Screw, medium (1 ea.)

Spring Terminals (9 ea.)

Tuning Capacitor

Connecting Wires:

Blue , Long (2 ea.)

White, Short (2 ea.)

Antenna Wire, Green (3 Meters)

NOTES

The experiments in this kit are designed to comply with FCC rules as long as you follow the instructions and use only the components and materials supplied with the kit.

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

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