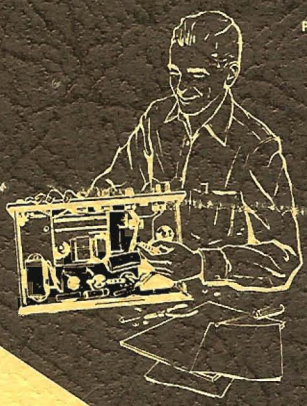
PRICE $1.00



Assembling
and Using Your...

Heathkit

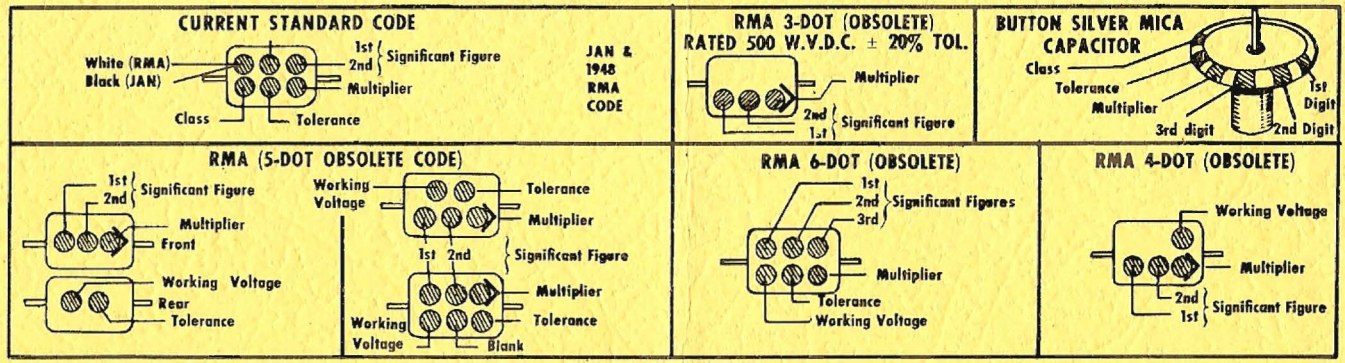
CRYSTAL RECEIVER

MODEL CR-1

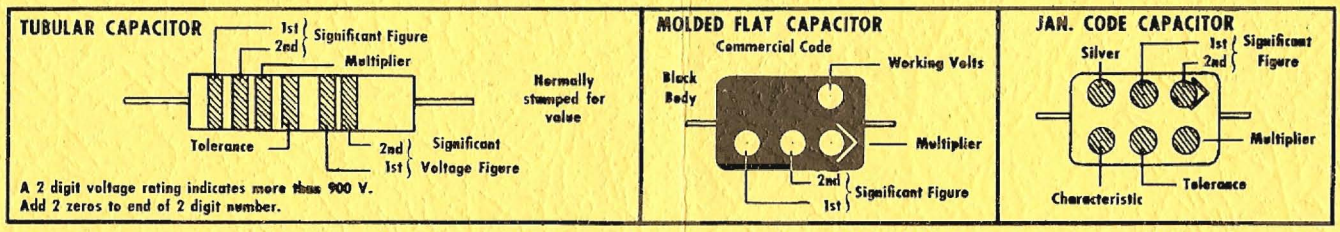
HEATH COMPANY
A Subsidiary of Daystrom Inc.
BENTON HARBOR, MICHIGAN

595-122

MOLDED MICA TYPE CAPACITORS



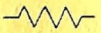
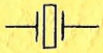
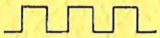
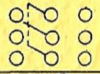
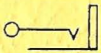
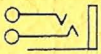
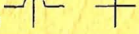
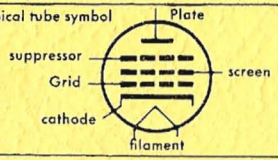
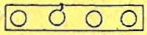
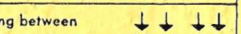
MOLDED PAPER TYPE CAPACITORS



The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 × 100 or 300 volts. Blue = 6 × 100 or 600 volts.

In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.

Courtesy of Centralab

Antenna General 	Resistor General 	Neon Bulb 	Receptacle two-conductor 
Loop 	Resistor Tapped 	Illuminating Lamp 	Battery 
Ground 	Resistor Variable 	Switch Single pole Single throw 	Fuse 
Inductor General 	Potentiometer 	Switch double pole single throw 	Piezoelectric Crystal 
Air core Transformer General 	Thermistor 	Switch Triple pole Double throw 	1000 = K
Adjustable Powdered Iron Core 	Jack two conductor 	Switch Multipoint or Rotary 	1,000,000 = M
Magnetic Core Variable Coupling 	Jack three conductor 	Speaker 	OHM = Ω
Iron Core Transformer 	Wires connected 	Rectifier 	Microfarad = MF
Capacitor General 	Wires Crossing but not connected 	Microphone 	Micro Microfarad = MMF
Capacitor Electrolytic 	A. Ammeter V. Voltmeter 	Typical tube symbol 	Binding post  Terminal strip 
Capacitor Variable 	G. Galvanometer MA. Milliammeter uA. Microammeter, etc.		Wiring between like letters is understood → X → Y 

Courtesy of I. R. E.

HEATH COMPANY

A Subsidiary of Daystrom Inc.

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

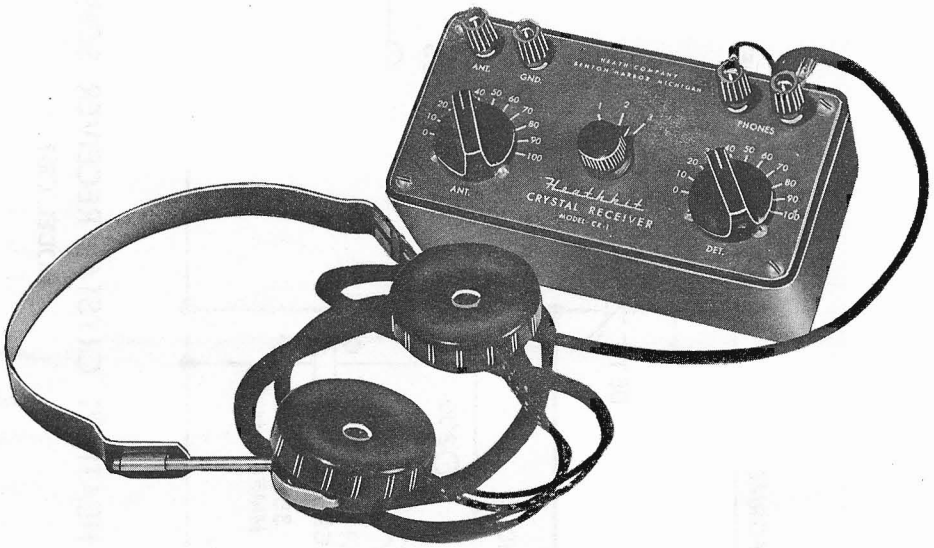
BENTON HARBOR, MICHIGAN

4/30/56

Litho in U. S. A.

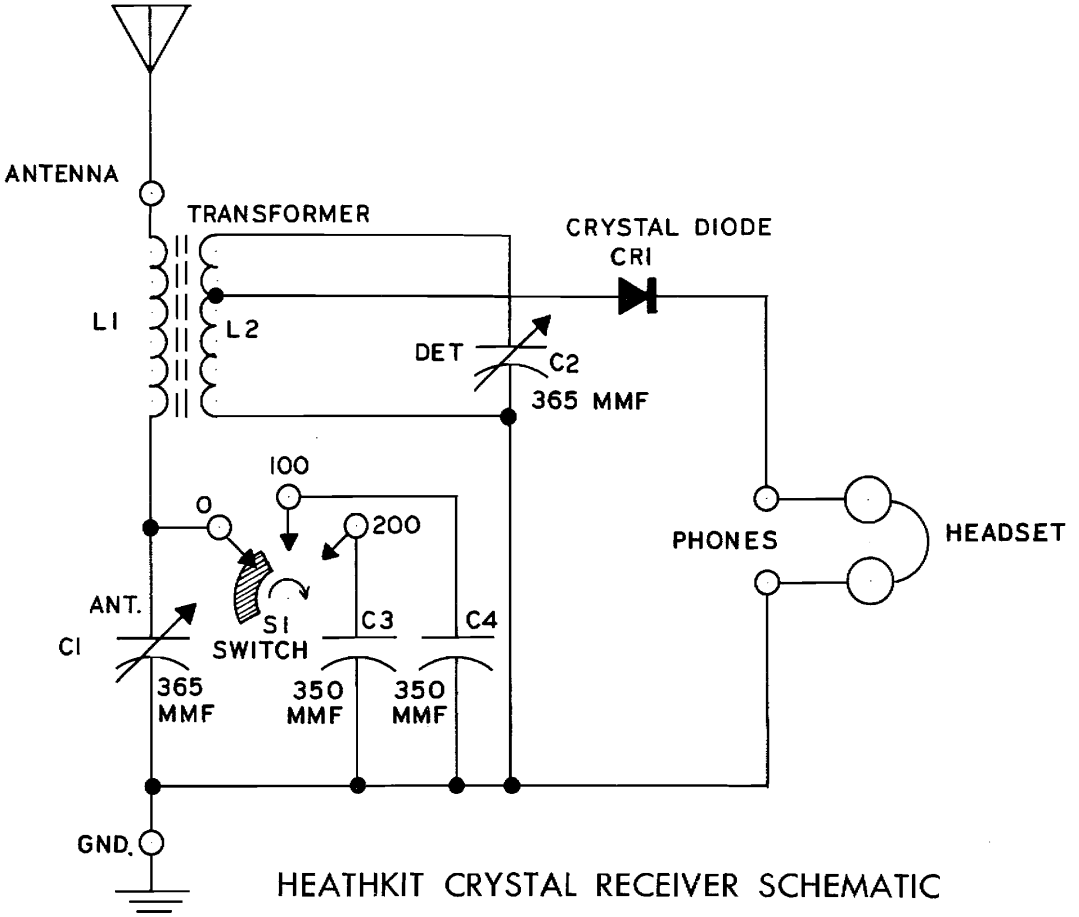
ASSEMBLY AND OPERATION OF THE HEATHKIT CRYSTAL RECEIVER

MODEL CR-1



SPECIFICATIONS

Tuning Range:	540-1600 kilocycles
Controls:	Primary Tuning - variable capacitor and switch selected fixed capacitors. Secondary Tuning - variable capacitor. Binding Posts for Antenna, Ground and Headset
Cabinet Size:	6" long x 3" wide x 2 1/8" deep
Headset:	Double, 4000 Ω DC resistance
Net Weight:	1 1/4 lbs.
Shipping Weight:	3 lbs.



HEATHKIT CRYSTAL RECEIVER SCHEMATIC

MODEL CR-1

INSTRUMENT DESCRIPTION

The Heathkit Crystal Receiver model CR-1 is an improved version of a type of radio that enjoyed popularity around the early 1920's. Such a receiver contains circuits capable of tuning or selecting the desired radio signal and a crystal detector to extract the electrical sound energy from the radio signal. Headphones are used to reproduce the program material. An outdoor antenna and a ground are required except in locations near the radio transmitter.

Modern components have made it possible to design a more efficient and compact receiver than was possible when radio was in its infancy. The temperamental "cats-whisker" and galena crystal have been replaced by a germanium diode that requires no adjustment and is much more sensitive. Powdered iron cores in the coils permit a great reduction in size and increase their efficiency.

Crystal receivers possess advantages not found in other receivers. No power is required in their operation, making them independent of power lines or batteries. They are small, light and have no parts to wear out. The crystal receiver is capable of better audio quality and signal-to-noise ratio than most broadcast receivers available today, making it practical as a tuner for high fidelity sound installations. Its simplicity and low cost make it ideal for the beginner in radio or as an emergency receiver such as recommended by Civil Defense authorities.

The Heathkit Crystal Receiver is housed in an attractive black bakelite cabinet and has matching black knobs. The panel is charcoal gray and all controls are identified by white lettering. All components were selected for optimum performance of the finished receiver. Construction is easily accomplished with simple hand tools. You can enjoy reception within an hour after opening your kit. Even in these days of short wave and television, there is a certain thrill to be had in logging stations from 500 to 1000 miles or more on a receiver built by yourself and powered only by the signal from the antenna.

CIRCUIT DESCRIPTION

The design of a crystal radio receiver involves the conflicting factors of selectivity and sensitivity. Selectivity is the ability of the radio to separate one radio station from another when they operate near the same frequency. Sensitivity is the ability of the radio to produce usable volume from a weak signal. The circuit of your Heathkit Crystal Receiver was designed to provide the best possible combination of selectivity and sensitivity. A brief theory of operation of the various components follows for those interested in learning more about the way in which this has been accomplished.

In order to talk about any science or field of learning, it is necessary to use the language of that science. In the description that follows, any words that may be new to you will be explained. If some of them are still not too clear, an ordinary dictionary will be helpful. Besides learning words that may be new to you, you should also learn the meaning and use of the symbols used in drawing a "schematic diagram" of a radio circuit, such as appears on Page 2. These symbols are sort of an electronic shorthand used to represent the various components that go into the making of a radio or any other electronic circuit. By using the proper symbols and connecting lines, any circuit, simple or complicated, can be written so that anyone familiar with the system will have no difficulty in understanding it. The inside cover of this manual gives examples of most of the commonly used radio symbols. Several of them are used in the schematic diagram of your CR-1 Crystal Receiver on Page 2. In the description that follows, a reference number is assigned to each of the components as it is described. This number corresponds with a number placed next to the symbol for that component on the diagram. By referring to the diagram as you read the text, you should become familiar with the use of the system and gain a better understanding of the relationship of the various components of your receiver.

You will probably find many statements that are not explained in much detail. This is because there is not enough room in a book this size to go into great detail. Many volumes have been written to cover each and all of the various parts of the circuit. It is hoped that this discussion will throw a little light on an interesting subject and that those interested in learning more will avail themselves of the many books that may be found in the public library.

Radio signals travel from the transmitting antenna to your receiving antenna in the form of electromagnetic waves. These waves are a form of energy similar to light, although we cannot see them. When these waves pass the receiving antenna, they cause an electrical current to flow in it. Because of the nature of the radio waves, the current that flows is an alternating current (AC) or one that continuously reverses its direction of flow in the wire. You might compare it to the baseball in a game of "catch," where the ball travels first in one direction and then the other. Two complete changes of direction form what is called one "cycle." In our ball game, one cycle would consist of your throwing the ball and then catching it one time. In radio or electricity, the number of cycles that occur in one second is called the frequency. Ordinary house lighting current flows back and forth sixty times every second, therefore it is called 60 cycle AC. The frequency of the radio signals used in the standard broadcast band may vary between 540 kilocycles and 1600 kilocycles. Kilo is a Greek word meaning one thousand, therefore the frequencies range from 540,000 cycles to 1,600,000 cycles; much higher than standard house lighting current.

Because signals from many different radio stations are present at the antenna at the same time, it becomes necessary to select or tune in the desired signal and reject the others. In radio this may be accomplished by using a "resonant" circuit. Two such circuits are used in the CR-1 Crystal Receiver. The first one consists of the ANT. tuning capacitor C1 and coil L1 connected to it. In order to keep the tuning capacitor at a reasonable physical size, a switch S1 is provided to connect additional fixed mica capacitors C3 and C4, in parallel with it to extend the capacity if required. These additional capacitors may or may not be required, depending on the antenna in use.

The second resonant circuit consists of the DET. tuning capacitor C2 and coil L2 connected to it. More will be said about the coils later. A combination of a coil and a capacitor has the ability to accept an alternating current of a certain frequency in preference to all other frequencies. By adjusting the electrical size of either the coil or the capacitor, the resonant frequency may be adjusted or tuned to any desired value. Since the size of the coils in the CR-1 Crystal Receiver cannot be changed, tuning is done by changing the electrical size of both the ANT. and DET. capacitors. As you turn the knob, notice that the metal plates of the capacitor move into or out of "mesh." When the plates are fully meshed, the capacity is greatest and when the plates are out of mesh, the capacity is smallest. In this way, you can adjust the capacity to the correct value to tune in the desired station. Because the principles of resonant circuits are too involved for this book, let us compare them to resonance in a mechanical form. Imagine a weight hung on a spring as shown in Figure 1A. If you pull down on the weight and release it, it will continue to bounce up and down for a while at a certain rate called the resonant frequency. If you were to change either the weight or the spring, the resonant frequency would also change.

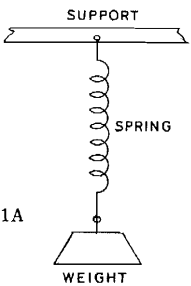


Figure 1A

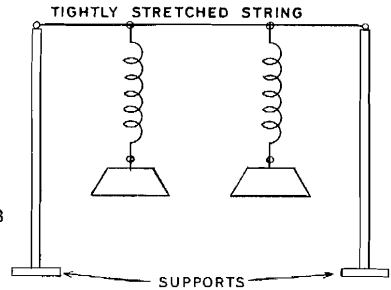


Figure 1B

Now if you were to hang two identical springs and weights from a support as shown in Figure 1B, you would have "coupled" resonant circuits. When one of the weights is set into motion, you will notice that the other one will also bounce up and down at the same rate or frequency. We can say that they are in resonance with each other. If one of the springs or weights were changed, very little or no motion would be transferred from one to the other.

This simple experiment can be tried by using rubber bands for the springs and fishing sinkers for the weights. By experimenting with the size of the rubber bands and weights, you will find many combinations that will resonate with each other.

At this time we can return to the discussion about the coils and see what they do in the radio. First of all, it becomes necessary to learn a little more about an electric current. One very important fact is that when a current flows in a wire or conductor, a magnetic field will exist around that wire or conductor. The strength of the magnetic field depends upon the amount of current that is flowing. This principle is used in making the huge electro-magnets used in steel yards for lifting large pieces of iron and steel. Such a magnet is made of many turns of wire with a great amount of current flowing in them. If we use an alternating current, the magnetic field will build up and fall back as the current changes direction in the wire. This fact is very important as you will soon learn.

Another very important fact is this; when a wire is made to move through a magnetic field, a current will flow in the wire. The same thing will happen if the magnetic field is made to move past the wire. Electric generators work because many turns of wire are made to move in a magnetic field. Water, steam or gasoline power is usually used to turn the generator. A transformer is a device designed to work on the principle of a moving magnetic field. It usually consists of two or more coils of wire placed near each other or wound on a common iron core. An alternating current flowing in one of the coils will cause a current to flow in the other coil or coils. A common example of a transformer is a doorbell transformer. It consists of two coils of wire wound on an iron core. Sixty cycle house-lighting current flowing in one of the coils creates a moving magnetic field that passes the wires in the other coil. A current is made to flow in the second coil. The transformer is made so that this current is proper for operating the doorbell. The coils in your Heathkit Crystal Receiver also form a transformer. The difference between it and a doorbell transformer is the type of construction necessary to make it operate at the higher frequencies used for radio broadcasting. The coils are wound with Litz wire, which consists of many strands of extremely fine wire, insulated from each other and given an overall insulation of nylon. This type of wire has lower losses than solid wire at the broadcast frequencies. Cores of finely powdered iron are placed within the coils. Iron such as used in the doorbell transformer would not work at the broadcast frequencies.

By now, you have probably started to see the purpose of the transformer in your radio. The electric current from the antenna flows through one of the coils. The ANT. tuning capacitor tunes or resonates the circuit to the desired station. Since this is an alternating current, the moving magnetic field passes through the other coil, causing current to flow in it. This coil is tuned or resonated by the DET. tuning capacitor. By providing two tuned or resonant circuits, the selectivity of the radio has been improved greatly. It would be possible to add more tuned circuits to further improve selectivity, however, there is some loss involved each time the signal passes through a transformer, making further circuits undesirable.

Before continuing with the description of your crystal receiver, it will be helpful to learn a little more about electricity. Up to this point, we have talked only about an electric current. Another very important thing to understand is the term "voltage" or simply "volts." Current is the term we have been using to mean the flow or movement of electricity in a wire. Voltage is a term used to describe a difference in electrical pressure at various points in an electrical circuit or device. A battery is a simple device that produces a difference in electrical pressure at its terminals by chemical action of the material used in making it. When a wire or bulb or buzzer is connected to its terminals, a current will flow through it because of the difference in electrical pressure or the voltage that exists between its terminals. This action will continue until the chemicals are exhausted. We might compare the battery to a pump forcing water through pipes. The water will flow as long as there is a difference in pressure between different points in the system, flowing from the point of high pressure to the point of lower pressure.

Let us return to the battery and connect three bulbs in "series" across its terminals. Figure 2 shows what is meant by a series connection. The current flows through each bulb in succession, therefore, the same amount of current must flow in each. Let us assume that the three bulbs are identical and that the battery voltage is three volts. If you were to place the leads of a voltmeter across each of the bulbs, you would find that there is one volt of pressure across each. The total voltage across the three bulbs would be the same as the battery voltage. Since the bulb itself is not capable of producing electrical pressure or voltage such as the battery, there must be another reason for this observation. The voltage appearing across the bulb is caused by the current flowing through the bulb. The voltage caused by current flowing in the coil of the transformer is used to operate the headphones of your crystal receiver.

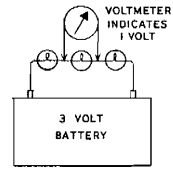


Figure 2

At this time it becomes necessary to examine the nature of the voltage and the necessity for the crystal detector. Figure 3A is a graph that represents the voltage appearing across the coil. It is assumed that the radio is tuned to a station at 1000 kilocycles and at the moment there is no speech, music or any program material. This signal is what is called the "carrier." Even if it were possible to convert this voltage into sound in the headphones, it would be impossible to hear anything because our ear cannot hear sounds above fifteen to twenty thousand vibrations per second. You can see that it is necessary to do something to the carrier signal before it will be possible to hear any sounds. This "something" is called modulation.

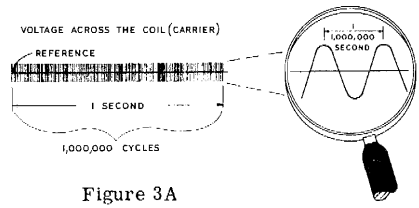


Figure 3A

Figure 3B is a graph that represents the carrier voltage with modulation added. It is assumed that a musical note of 1000 cycles is modulating the carrier. 1000 cycles is approximately the frequency of the note two octaves above middle C on the piano. Notice that the height or amplitude of the carrier voltage is changing 1000 times each second. The voltage now has a complicated form with fast variations of 1,000,000 cycles per second and slow variations of 1000 cycles per second. If the variations of 1000 cycles are converted to sound in the headphones, we will hear the musical note. As yet it is not possible to use this voltage to operate the headphones, for this reason; notice that the changes of voltage are equal above and below the reference line. Because of this, the average value of the voltage represented by the graph is 0. In order to extract the electrical sound energy or modulation from the carrier, the crystal is used. Because of its function in the radio, it is called a detector or demodulator.

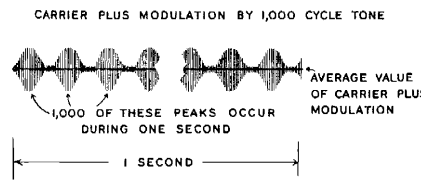


Figure 3B

The crystal detector CR1 consists of a small block of refined germanium with a very fine wire resting on its surface. This wire is welded in position so that it cannot be disturbed. In the early days of radio, the crystal was made of a mineral called galena. The wire, called a "cats-whisker" had to be carefully placed on the surface of the crystal and very often it would be jarred out of position. The modern germanium crystal is much more sensitive and is completely protected by its molded case.

The crystal allows current to flow through it in one direction only, like traffic on a one way street. A vacuum tube also has this same property. The process of passing current in one direction only is called "rectification."

When the voltage appearing across the coil is applied to the crystal, only the voltage or pressure operating in the direction that the crystal passes current will get through. Figure 3C is a graph that represents the signal voltage after it passes through the crystal detector. It consists of many separate spurts, changing in value from a minimum to a maximum 1000 times a second.

Figure 3C

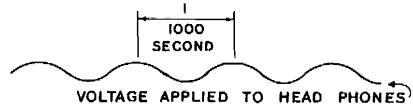


Figure 3D

Notice now that the average voltage changes or alternates 1000 times a second. The graph in Figure 3D represents this voltage. By the process of detection, we have extracted the audio voltage from the carrier. Audio is the word used to refer to the range of frequencies that can be heard by the ear, approximately 20 cycles to 20,000 cycles. Remember, the ear cannot hear a voltage, only vibrations in the air that we call sound.

The headphones are constructed to convert this voltage into sound. Each unit contains a small permanent magnet wound with many turns of fine wire. A thin disc or diaphragm of iron is placed close to the end of the magnet so that it is pulled toward it very slightly. Figure 4 is a cross-section view of a typical headphone. The dotted line shows the position of the diaphragm if there were no magnet. The coil of wire wound around the magnet forms an electro-magnet such as we have already learned about. When the voltage from the crystal detector is applied to the headphones, the strength of the electro-magnet will change with the changes in the voltage. These changes in the strength of the magnet will alternately aid or oppose the permanent magnet and cause the diaphragm to move or vibrate at a rate equal to the frequency of the musical note, or 1000 cycles. The vibrations of the diaphragm produce the sound which we hear. Although modulation by a single tone was used to illustrate the principles involved, the same effect occurs when modulation consists of speech, music or even picture information in a television broadcast.

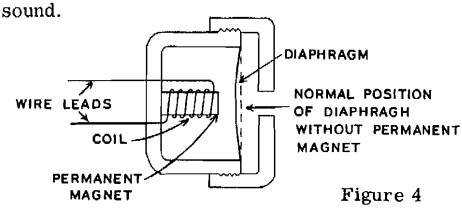


Figure 4

PRELIMINARY NOTES

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with the parts. If a shortage is found, attach the inspection slip to your claim and notify us promptly. Screws, nuts and washers are counted mechanically and if a few are missing, please secure them locally if at all possible. Use the charts on the inside covers of the manual to identify the parts.

Read the manual completely through before starting actual construction. In this way, you will become familiar with the general procedure used. Study the pictorials and diagrams to get acquainted with the circuit layout and location of parts. When actually assembling and wiring, read each step all the way through before you do it so that no suggestions will be missed.

In constructing your kit, you will need a soldering iron, 60-100 watt, 1/4" tip or the equivalent in a soldering gun; rosin core radio solder; two screwdrivers, 1/8" and 1/4" blades; pliers, preferably long nosed; diagonal wire cutters or a suitable substitute. A small adjustable wrench is convenient but not necessary.

PROPER SOLDERING PROCEDURE

Only a small percentage of Heathkit purchasers find it necessary to return an instrument for factory service. Of these, by far the largest proportion function improperly due to poor or improper soldering.

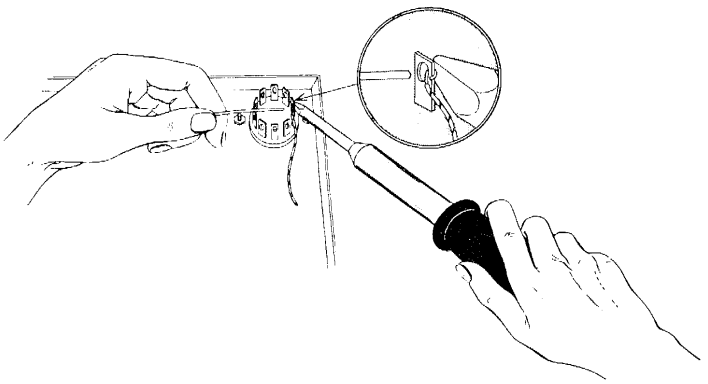
Correct soldering technique is extremely important. Good solder joints are essential if the performance engineered into the kit is to be fully realized. If you are a beginner with no experience in soldering, a half-hour's practice with odd lengths of wire and a tube socket will be a worthwhile investment.

High quality solder of the proper grade is most important. There are several different brands of solder on the market, each clearly marked "Rosin Core Radio Solder." Such solders consist of an alloy of tin and lead, usually in the proportion of 50:50. Minor variations exist in the mixture such as 40:60, 45:55, etc. with the first figure indicating the tin content. Radio solders are formed with one or more tubular holes through the center. These holes are filled with a rosin compound which acts as a flux or cleaning agent during the soldering operation.

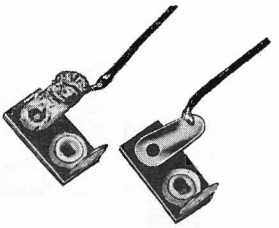
NO SEPARATE FLUX OR PASTE OF ANY KIND SHOULD BE USED. We specifically caution against the use of so-called "non-corrosive" pastes. Such compounds, although not corrosive at room temperatures, will form residues when heated. The residue is deposited on surrounding surfaces and attracts moisture. The resulting compound is not only corrosive but actually destroys the insulation value of non-conductors. Dust and dirt will tend to accumulate on these "bridges" and eventually will create erratic or degraded performance of the instrument.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

If terminals are bright and clean and wires free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Crimp or otherwise secure the wire (or wires) to the terminal, so a good joint is made without relying on solder for physical strength. To make a good solder joint, the clean tip of the soldering iron should be placed against the joint to be soldered so that the terminal is heated sufficiently to melt solder. The solder is then placed against both the terminal and the tip of the iron and will immediately flow out over the joint. Refer to the sketch below. Use only enough solder to cover wires at the junction; it is not necessary to fill the entire hole in the terminal with solder. Excess solder may flow into tube socket contacts, ruining the socket, or it may creep into switch contacts and destroy their spring action. Position the work so that gravity tends to keep the solder where you want it.



A poor solder joint will usually be indicated by its appearance. The solder will stand up in a blob on top of the connection, with no evidence of flowing out caused by actual "wetting" of the contact. A crystalline or grainy texture on the solder surface, caused by movement of the joint before it solidified is another evidence of a "cold" connection. In either event, reheat the joint until the solder flows smoothly over the entire junction, cooling to a smooth, bright appearance. Photographs in the adjoining picture clearly indicate these two characteristics.



A good, clean, well-tinned soldering iron is also important to obtain consistently perfect connections. For most wiring, a 60 or 100 watt iron, or the equivalent in a soldering gun, is very satisfactory. Smaller irons generally will not heat the connections enough to flow the solder smoothly over the joint and are recommended only for light work, such as on etched circuit boards, etc. Keep the iron tip clean and bright. A pad of steel wool may be used to wipe the tip occasionally during use.

Take these precautions and use reasonable care during assembly of the kit. This will insure the wonderful satisfaction of having the instrument operate perfectly the first time it is turned on.

STEP-BY-STEP ASSEMBLY INSTRUCTIONS

Check off each step in the space provided as it is completed (✓).

(✓) Observe Pictorial 1 at the top of Page 10. Mount the ANT. binding post using a fiber shoulder washer, fiber flat washer, solder lug and 6-32 nut. Make sure that the shoulder washer is centered in the hole and tighten securely. See Figure 5.

(✓) In a like manner, mount a PHONE binding post in the hole nearest the corner of the panel.

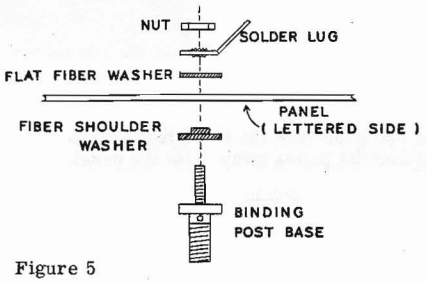


Figure 5

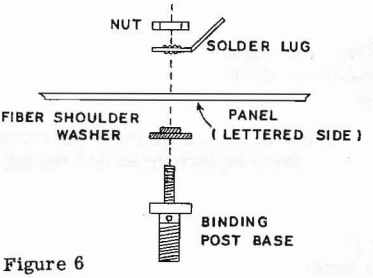


Figure 6

(✓) Mount the GND. and remaining PHONE binding post, using a fiber shoulder washer, solder lug and 6-32 nut. Tighten securely. See Figure 6.

(✓) Thread a 3/8" nut about half way on the ANT. switch and then mount it, using a 3/8" lockwasher, flat washer and nut. See Figure 7.

(✓) Mount the two tuning capacitors, using 6-32 x 3/16" screws. Be careful not to bend the plates of the capacitors.

( ) Solder a short length of wire between ANT. capacitor terminal 1 and ANT. switch terminal 1.

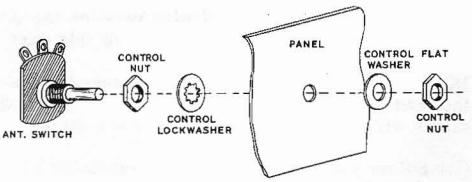
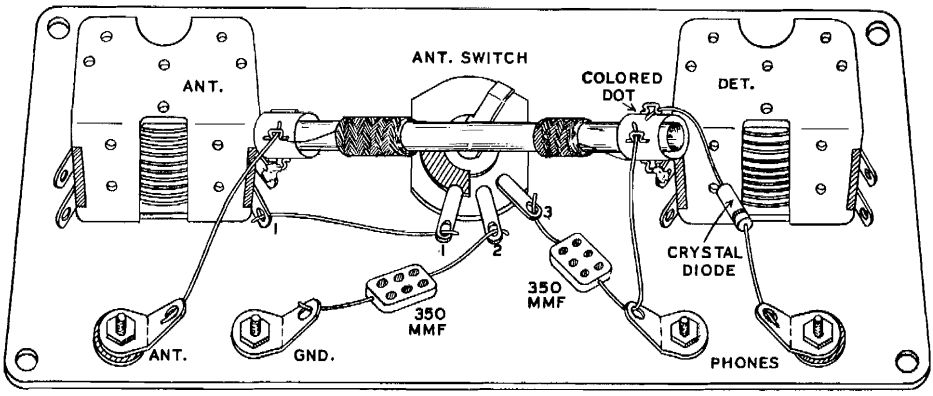


Figure 7



PICTORIAL 1

( ) Solder a molded 350 $\mu\mu$f mica capacitor between the GND. binding post solder lug and ANT. switch terminal 2. Place the capacitor flat against the panel. Cut off the excess leads.

( ) Solder the other mica capacitor between ANT. switch terminal 3 and the nearest solder lug. Do not cut off the lead protruding through the solder lug.

NOTE: The coils (transformer) are held in position by soldering to the lugs on the two tuning capacitors. Solder as quickly as possible to avoid charring the fiber coil form. Handle carefully to avoid damage to the fine wire.

( ) One end of the transformer has three lugs. This end must face the DET. tuning capacitor. Turn the transformer so that the lug with the colored dot points away from the panel.

( ) If necessary, bend the lugs on the tuning capacitor so that the lugs on the transformer can be soldered to them.

( ) Refer to Pictorial 1 and solder the transformer to the lugs on the tuning capacitor.

( ) Cut the lead of the mica capacitor to the proper length and solder it to the nearest lug on the transformer.

( ) Solder a short length of wire between the ANT. binding post solder lug and the nearest lug on the transformer. Do not allow this wire to touch anything else.

NOTE: The crystal diode can be damaged by too much heat while soldering. To avoid this, grip the lead of the diode with pliers between the body of the diode and the point of soldering. The pliers will absorb the heat and prevent damage.

( ) Solder the diode between the remaining PHONE binding post solder lug and the colored lug on the transformer. The end of the diode with the dot, band, or bands nearest it should go to the PHONE terminal.

( ) Check all connections to make sure they are properly soldered. Remove any loose pieces of wire or solder that may have dropped into the assembly.

( ) Mount the assembly in the case, using 6-32 x 2" screws through the corner holes.

( ) Rotate the ANT. tuning capacitor shaft to the right and place a tuning knob on it so that the line points to 0. Tighten the set screw.

( ) Rotate the DET. tuning capacitor shaft to the left and place a tuning knob on it so that the line points to 100. Tighten the set screw.

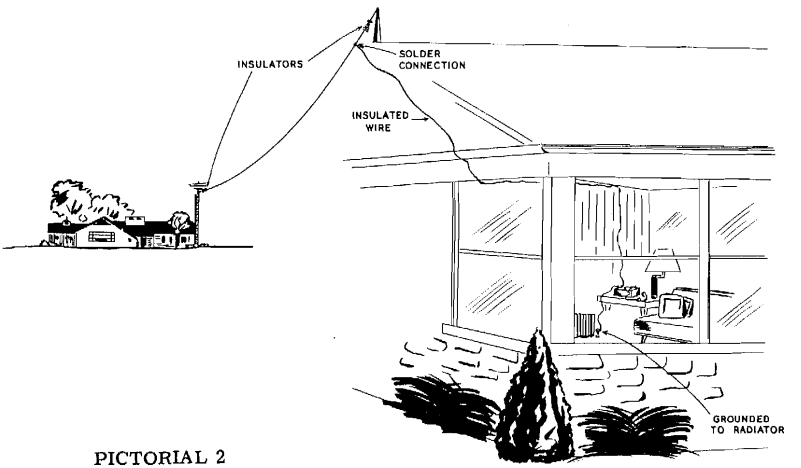
( ) Rotate the shaft of the ANT. switch to the left. Use pliers if necessary. Place the small pointer knob on the shaft so that it points to 0. Tighten the set screw.

( ) Screw the binding post caps on the four binding posts.

( ) Attach the tips of the headphones to the PHONES binding posts. The tip with a colored thread should go to the post nearest the corner.

( ) Attach an antenna and ground as described in the following section.

USING YOUR HEATHKIT CRYSTAL RECEIVER



PICTORIAL 2

Most locations require a good antenna and ground installation for best results. A suitable antenna can be made of 50 feet or more of wire supported as high and away from surrounding objects as possible. An insulator should be used at each end of the antenna where it is attached to the support. An insulated lead-in wire of sufficient length should be scraped clean at one end and soldered to the antenna. The other end should be scraped clean and attached to the ANT. binding post on the crystal receiver. A ground may be obtained by using a cold water pipe, a radiator, or a metal stake 6 to 8 feet long driven into moist ground. Scrape or sandpaper the pipe so that it is shiny and attach an insulated wire to it, first scraping the wire clean. Wrap or twist the wire securely around the pipe or use a ground clamp available at hardware, radio or electrical stores. Scrape the other end of the ground wire clean and attach it to the GND. binding post on the receiver. Connect the tips of the headset wires to the two binding posts marked PHONES. Pictorial 2 illustrates a typical installation suitable for your receiver.

A little practice will be required to enable you to tune your crystal receiver for best results. Since there are two tuned circuits, both must be properly adjusted in order to receive radio broadcasts. The DET. tuning capacitor will tune from approximately 1600 kilocycles at 0 to 540 kilocycles at 100. Because the antenna that is used with your CR-1 Crystal Receiver will have an effect on the tuning of the ANT. tuning capacitor, the calibration that applies to the DET. tuning will not always apply to the ANT. tuning. As mentioned in the theory of operation, a switch has been included to connect additional capacitors into the ANT. tuning circuit if necessary. Notice that the switch positions have been marked 0, 100 and 200. The reading of the antenna tuning knob should be added to the number of the switch position in use for the correct calibration figure.

Generally, if a long antenna is used, all ANT. tuning can be accomplished with the switch in the 0 position. In this case, the setting of the ANT. tuning knob would correspond closely to that of the DET. tuning knob. When shorter antennas are used, it will be necessary to advance the switch to the 100 position and possibly also to the 200 position, while tuning from 1600 kilocycles toward 540 kilocycles. Note that the tuning of the ANT. circuit will be approximately the same with the switch at 0 and the knob at 100 as with the switch at 100 and the knob at 0, since the two figures must be added to obtain the proper calibration figure. The same rule applies when the switch is in the 200 position. It can be seen that the tuning of the ANT. circuit can vary from approximately 0 at 1,600 kilocycles to a maximum of 300 at 540 kilocycles. A few minutes practice will soon familiarize you with the proper technique for your particular antenna. A "log" is included on Page 15 to enable you to record the dial settings, frequency and call letters of the various stations that you receive.

Reception of distant (DX) stations will be best at night time. It is not uncommon to receive stations from 1,000 miles or more when a good antenna is used.

Keep in mind that the only power available to operate your CR-1 Crystal Receiver comes from the signal received by the antenna. For this reason, the headphone volume depends directly on the strength of the received signal. Only in locations very close to the broadcast station can makeshift antennas such as window screens or bedsprings be used. A good ground connection will probably be required even in such locations. For emergency use, a wire can be thrown over a tree branch for an antenna and a short metal stake pushed into the ground for a ground connection. Television lead-in wires or wire fences may also be used for antennas providing they are not "grounded" through metal masts or fence posts.

Since there are no parts to wear out or any power requirements needed, your CR-1 Crystal Receiver is ready to operate at any time. Simply put down the headphones when you are through listening. With proper care in construction and use, your CR-1 Crystal Receiver will last almost indefinitely. Give it reasonable care and it will provide you with enjoyment for years to come.

IN CASE OF DIFFICULTY

1. Recheck the wiring. Most cases of difficulty result from poor or improper connections. Having a friend check the wiring will often reveal a mistake consistently overlooked.

2. Be sure that a sufficiently strong station is operating at the time of test.

3. Be sure that the antenna and ground system is properly installed and that the antenna is not grounded at any point.

4. If possible, secure the help of a friendly "ham" or radio service man.

REPLACEMENTS

Material supplied with Heathkits has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty tube or component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information:

A. Thoroughly identify the part in question by using the part number and description found in the manual parts list.
B. Identify the type and model number of kit in which it is used.
C. Mention the order number and date of purchase.
D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. If tubes are to be returned, pack them carefully to prevent breakage in shipment as broken tubes are not eligible for replacement. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SERVICE

In event continued operational difficulties of the completed instrument are experienced, the facilities of the Heath Company Service Department are at your disposal. Your instrument may be returned for inspection and repair for a service charge of $3.00 plus the cost of any additional material that may be required. THIS SERVICE POLICY APPLIES ONLY TO COMPLETED INSTRUMENTS CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned not repaired.

The Heath Company is willing to offer its full cooperation to assist you in obtaining the specified performance level in your instrument. Factory repair service is available for a period of one year from the date of purchase or you may contact the Engineering Consultation Department by mail. For information regarding possible modification of existing kits, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at any electronic outlet store. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for specific purposes. Therefore, such modifications must be made at the discretion of the kit builder according to information which will be much more readily available from some local source.

SHIPPING INSTRUCTIONS

Before returning a unit for service, be sure that all parts are securely mounted. Attach a tag to the instrument giving name, address and trouble experienced. Pack in a rugged container, preferably wood, using at least three inches of shredded newspaper or excelsior on all sides. DO NOT SHIP IN THE ORIGINAL KIT CARTON AS THIS CARTON IS NOT CONSIDERED ADEQUATE FOR SAFE SHIPMENT OF THE COMPLETED INSTRUMENT. Ship by prepaid express if possible. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damage in transit if packing, in HIS OPINION, is insufficient.

SPECIFICATIONS

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specification at any time without incurring any obligation to incorporate new features in instruments previously sold.

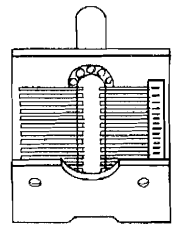
WARRANTY

The Heath Company limits its warranty of parts supplied with any kit to a period of three (3) months from the date of purchase. Replacement will be made only when said part is returned postpaid, with prior permission and in the judgment of the Heath Company was defective at the time of sale. This warranty does not extend to any Heathkits which have been subjected to misuse, neglect, accident and improper installation or applications. Material supplied with a kit shall not be considered as defective, even though not in exact accordance with specifications, if it substantially fulfills performance requirements. This warranty is not transferable and applies only to the original purchaser. This warranty is in lieu of all other warranties and the Heath Company neither assumes nor authorizes any other person to assume for them any other liability in connection with the sale of Heathkits.

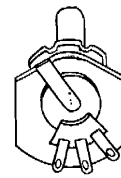
The assembler is urged to follow the instructions exactly as provided. The Heath Company assumes no responsibility or liability for any damages or injuries sustained in the assembly of the device or in the operation of the completed instrument.

HEATH COMPANY
Benton Harbor, Michigan

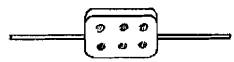
PART No.	PARTS Per Kit	DESCRIPTION
20-34	2	350 $\mu\mu$f mica capacitor
26-30	2	365 $\mu\mu$f variable capacitor
40-78	1	Coil, ANT. DET.
56-3	1	Crystal diode
63-77	1	Switch, ANT.
100-M16B	4	Binding post cap
203-M86F121	1	Panel
250-7	4	6-32 x 3/16" screw
250-27	4	6-32 x 2" screw
252-3	4	6-32 nut
252-7	2	3/8-32 control nut
253-1	2	#6 fiber washer
253-2	4	#6 fiber shoulder washer
253-10	1	3/8 control flat washer
254-4	1	3/8 control lockwasher
259-1	4	#6 solder lug
340-2	1	length Bare wire
401-14	1	Headset, dual 4000 Ω
408-M3	1	Case
427-2	4	Binding post base
462-17	1	Pointer knob
462-24	2	Knob, w/indicator
595-122	1	Instruction manual



VARIABLE CAPACITOR



ANTENNA SWITCH

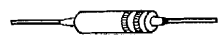


MICA CAPACITOR

6-32 SOLDER LUG

6-32 x 2"

6-32 x 3/16



CRYSTAL DIODE

CONTROL LOCKWASHER

SCREWS

NUTS

6-32

CONTROL

3/8" CONTROL FLAT

WASHERS

#6 FIBER

#6 FIBER SHOULDER

DIAL SETTING ANT.	DET.	FREQUENCY KILOCYCLES	CALL LETTERS	LOCATION - NOTES