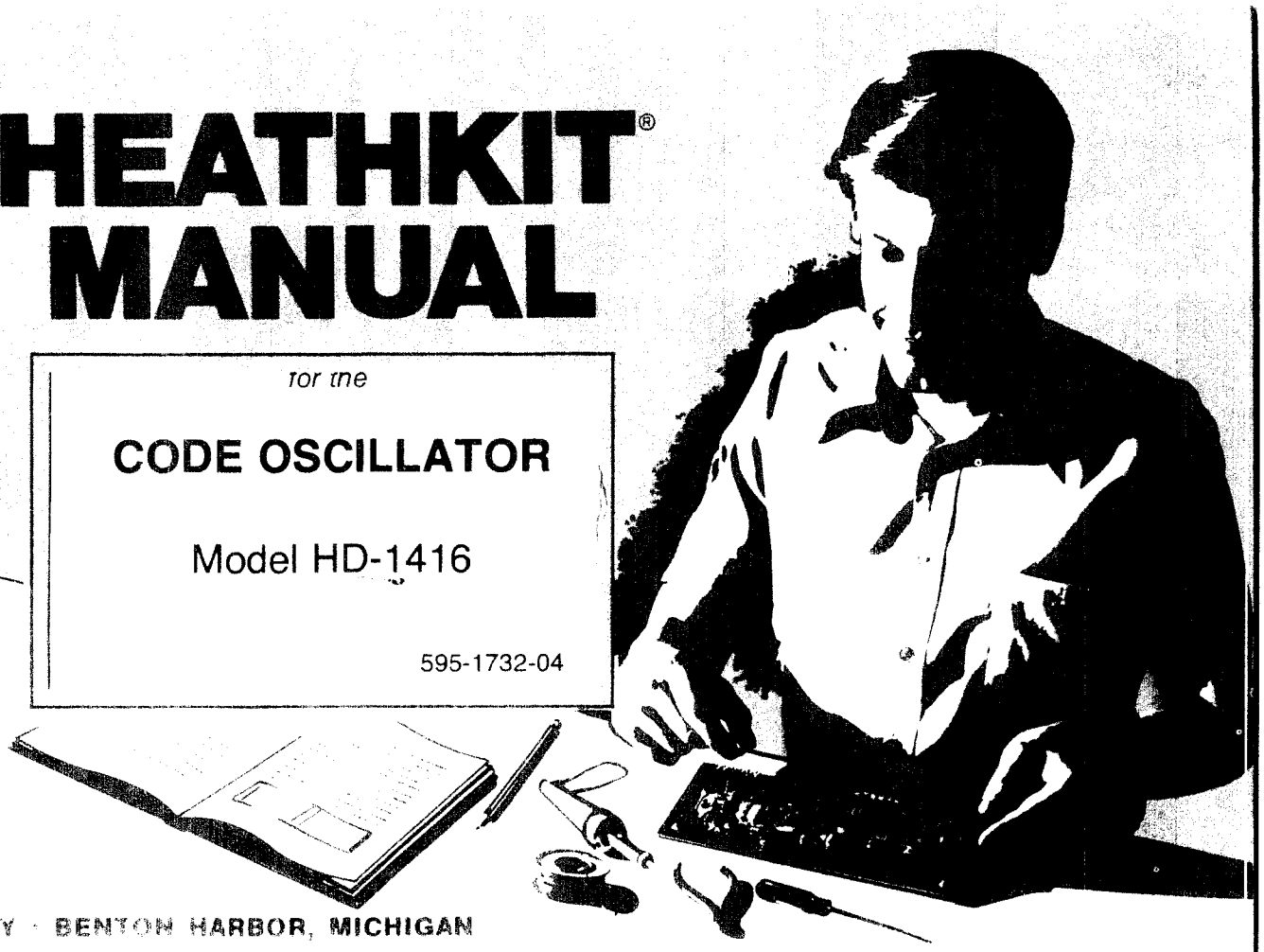
HEATHKIT® MANUAL

for the

CODE OSCILLATOR

Model HD-1416

595-1732-04



HEATH COMPANY · BENTON HARBOR, MICHIGAN

Pages 3-19 (assembly) omitted

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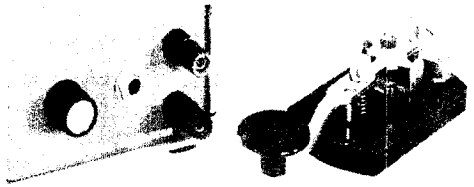

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HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

INTRODUCTION

The Heathkit Model HD-1416 Code Oscillator provides you with a simple and inexpensive means of learning the Morse code. The key furnished with the Kit is the only external item you require to form audible code characters. Power is supplied by an inexpensive and easy-to-get 9-volt battery.

An audible signal is provided by an astable multivibrator. You can adjust the volume and tone of the signal for the level and pitch you desire.

A phone jack is provided so you can use headphones for private listening.

This Code Oscillator provides you with the means to develop the ability to receive and transmit code. You must have both of these abilities to obtain an amateur radio license from the Federal Communications Commission. We recommend that two persons learn the code together by sending to each other. Additional comments on this subject are in the "Learning the Code" section of this Manual.

The styling of the Code Oscillator is compatible with the SB series of Heath amateur radio equipment. This versatile, portable, safe, and reliable Code Oscillator will have a strong appeal to those individuals or groups who have a sincere desire to learn the Morse code.

Refer to the "Kit Builders Guide" for information on tools, wiring, soldering, resistors, and capacitors.

PARTS LIST

Check each part against the following list. Make a check (✓) in the space provided as you identify each part. Any part that is packed in an individual envelope with the part number on it should be placed back in the envelope after it is identified until it is called for in a step. Do not throw away any packing materials until all parts are accounted for.

To order a replacement part, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of the Manual. For pricing information, refer to the separate "Heath Parts Price List."

Each circuit part in this kit has its own component number (R2, C4, etc.). Use these numbers when you want to positively identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

- In the Parts List.
- At the beginning of each step where a component is installed.
- In some illustrations.
- In the Schematic.
- In the sections at the rear of the Manual.

QTY.	DESCRIPT
RESISTORS	
( ) 1	2200 Ω (re
( ) 1	5600 Ω (gr
( ) 1	8200 Ω (gr
( ) 1	10 kΩ (bro orange)
( ) 1	33 kΩ (ora orange)
( ) 1	68 kΩ (blu
( ) 1	220 kΩ (re
CONTROLS	
( ) 1	25 kΩ
( ) 1	500 kΩ
CAPACITORS, Disc	
( ) 1	.005 µF
( ) 1	.01 µF, 10
( ) 1	.01 µF
( ) 1	.1 µF
( ) 1	.2 µF

INITIAL TEST

NOTE: If the unit does not perform properly in the following test, refer to the "In Case of Difficulty" section of the Manual.

Refer to Pictorial 10 for the following steps.

( ) Turn the TONE and VOLUME controls to their centers of rotation.

( ) Close (depress) the key with one hand. You should hear a tone. Use the other hand to adjust the TONE and VOLUME controls. The highest-pitched tone will be heard with the TONE control set fully clockwise (see inset). The loudness will increase as you rotate the VOLUME control clockwise.

This completes the "Initial Test."

FINAL ASSEMBLY

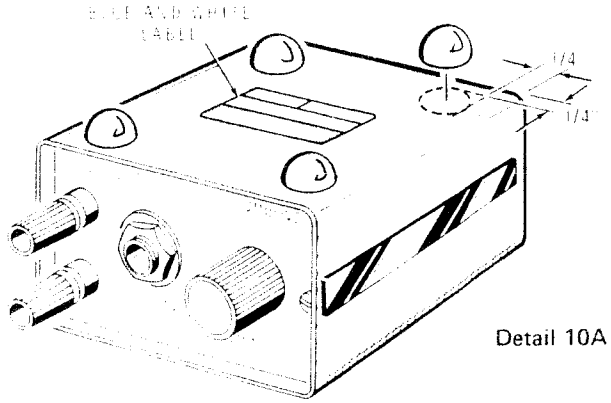
( ) Refer to Pictorial 10 and install the circuit board and front panel assembly in the cabinet. Install two #4 × 3/8" self-tapping screws through the remaining two holes in the front panel and into the inside of the cabinet. Press the battery connector wires down to clear the cabinet.

( ) Mount the back panel to the back of the cabinet with two #4 x 3/8" self-tapping screws. Be sure to mount the panel with the part number toward the inside.

( ) Peel the backing from two trim strips. Then press one trim strip against the smooth area in the center of each cabinet side.

( ) Refer to Detail 10A and install a plastic foot near each corner on the bottom of the cabinet. Remove the paper backing; then press the foot onto the cabinet in the position shown.

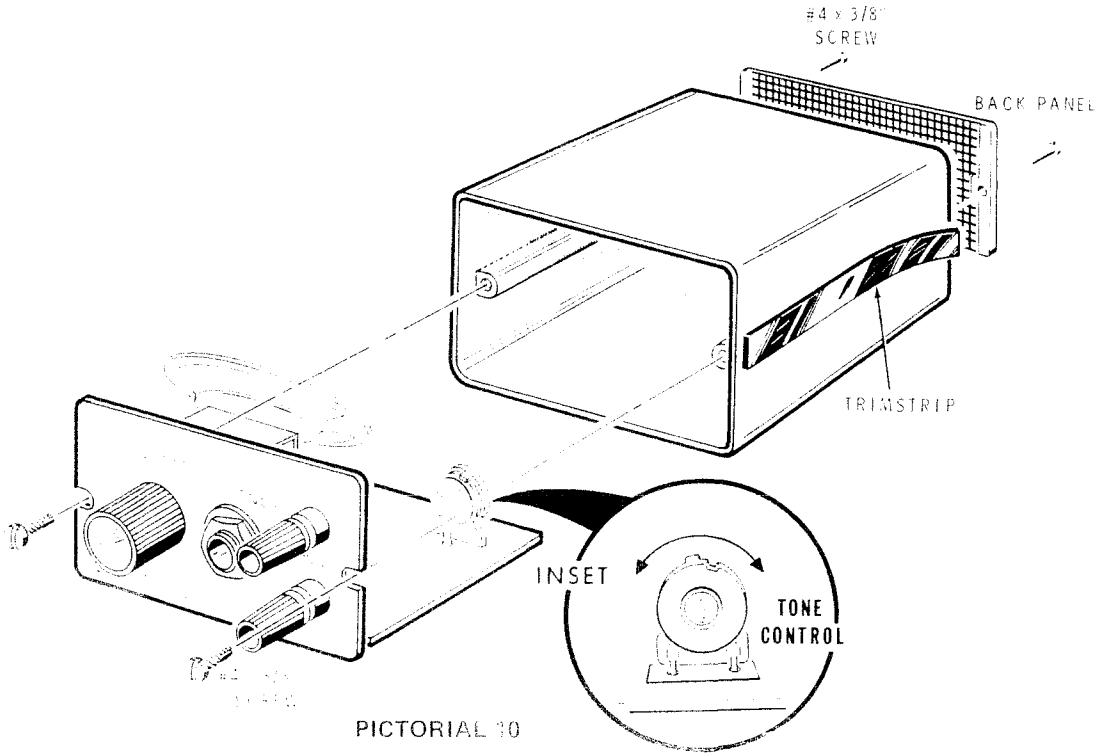
( ) Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the bottom of the cabinet.



Detail 10A

Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.

This completes the assembly of your Code Oscillator.



PICTORIAL 10

ADJUSTMENT

Refer to Figure 2 for the following step.

( ) Loosen the locknuts and adjusting screws of the key at Y and Z by turning counterclockwise. NOTE: The locknuts may be very tight.

( ) Tighten the adjusting screw at Y until 3 thicknesses of ordinary typing paper, or a common business card, may be withdrawn from between the key contacts at AA without friction. Tighten the locknut at Y. This key contact spacing is approximate and may be adjusted to conform to your keying preference.

( ) Adjust the screw at Z to provide the key "stiffness" desired. Retain the adjustment by tightening the locknut.

NOTE: For best results, secure the key by attaching it to a block of wood (not supplied) as shown in Figure 2. Ream out the two holes visible from the bottom of the key. Then attach the key with two screws.

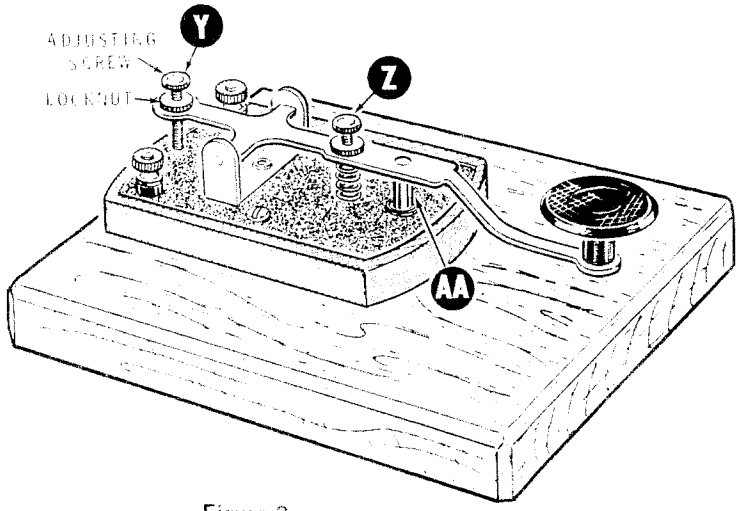


Figure 2

HEATHKIT

ADJUSTS T
FROM SPE
MAXIMUM
IN THE E
POSITION

OPERATION AND APPLICATIONS

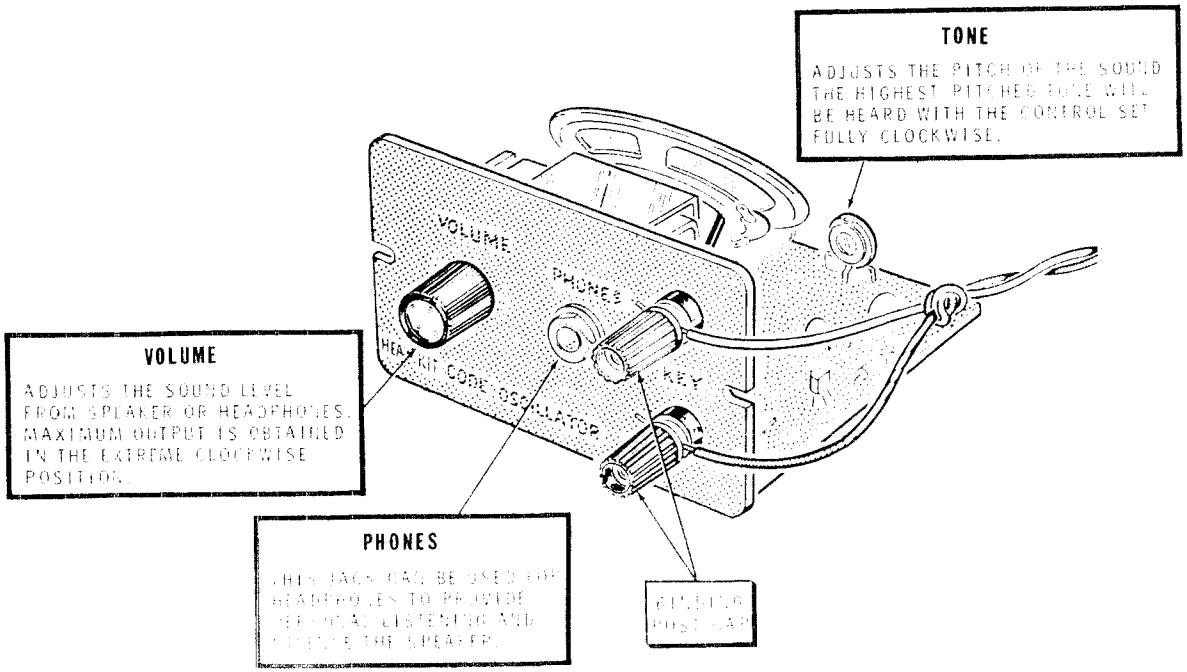


Figure 3

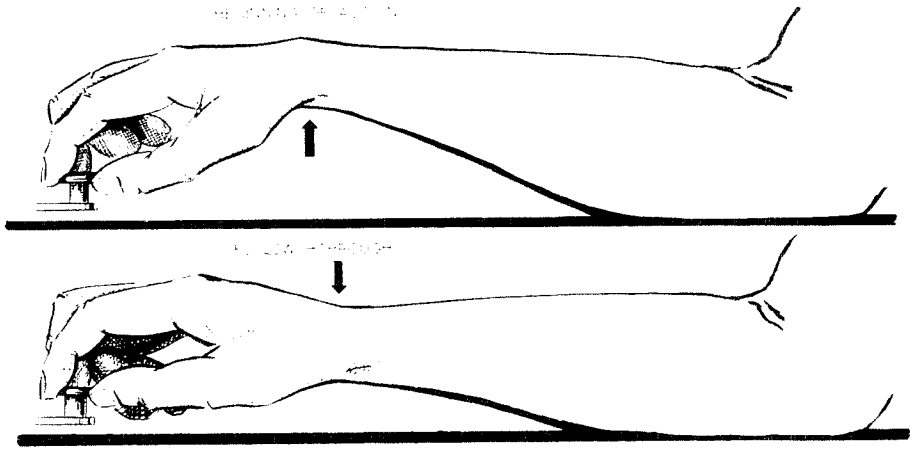
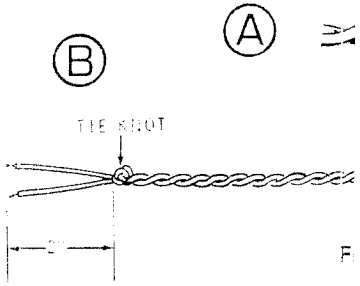


Figure 4

Figure 4 shows the suggested position for the hand on the key knob. Work the key with simultaneous hand and wrist movements. The use of hand movements alone tends to create muscle tension and will soon become tiring. Try and keep your hand and arm muscles as relaxed as possible.



SIDETONE OSCILLATOR

If you wish, you may use this Code O
transmitter using grid-block keying, o
(bias) voltage is shorted to ground to ke

To use the Code Oscillator as a sidetone

Locate and prepare the following e
supplied).

2' black
2' red

) Remove 1/4" of insulation fro
strands of wire at the end of e
solder to the ends of each wire fo

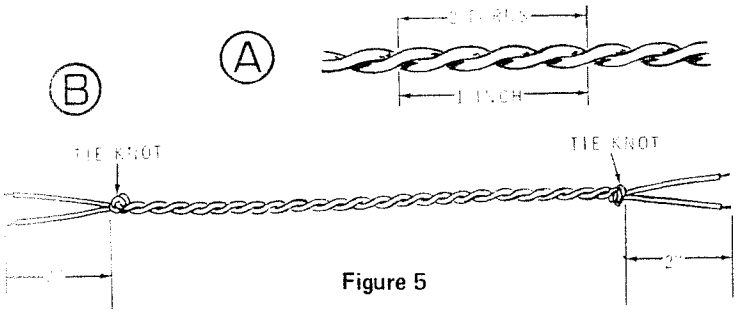


Figure 5

SIDETONE OSCILLATOR

If you wish, you may use this Code Oscillator as a sidetone oscillator with any transmitter using grid-block keying, or other types of keying where a negative (bias) voltage is shorted to ground to key the transmitter.

To use the Code Oscillator as a sidetone oscillator, proceed as follows:

( ) Locate and prepare the following lengths of insulated stranded wire (not supplied).

2" black
2" red

( ) Remove 1/4" of insulation from each wire end. Twist together the small strands of wire at the end of each wire. Then apply a small amount of solder to the ends of each wire to hold the separate strands together.

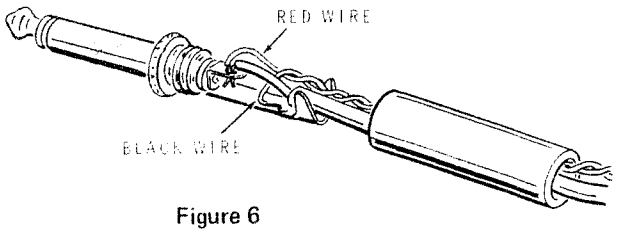


Figure 6

( ) Refer to Figure 5 and gather the black and the red wires and twist them together approximately two turns per inch.

( ) Tie a knot two inches from each end of the twisted pair of wires.

( ) Insert the black wire in circuit board hole GND (S-1).

( ) Insert the red wire in circuit board hole ST (S-1).

( ) As shown in Figure 6, connect the remaining ends of the twisted pair of wires to the key plug you normally need with your transmitter.

( ) Insert the key plug into the key jack of your transmitter. When you close the key you can now monitor the transmitted signal.

INTERNATIONAL MORSE CODE

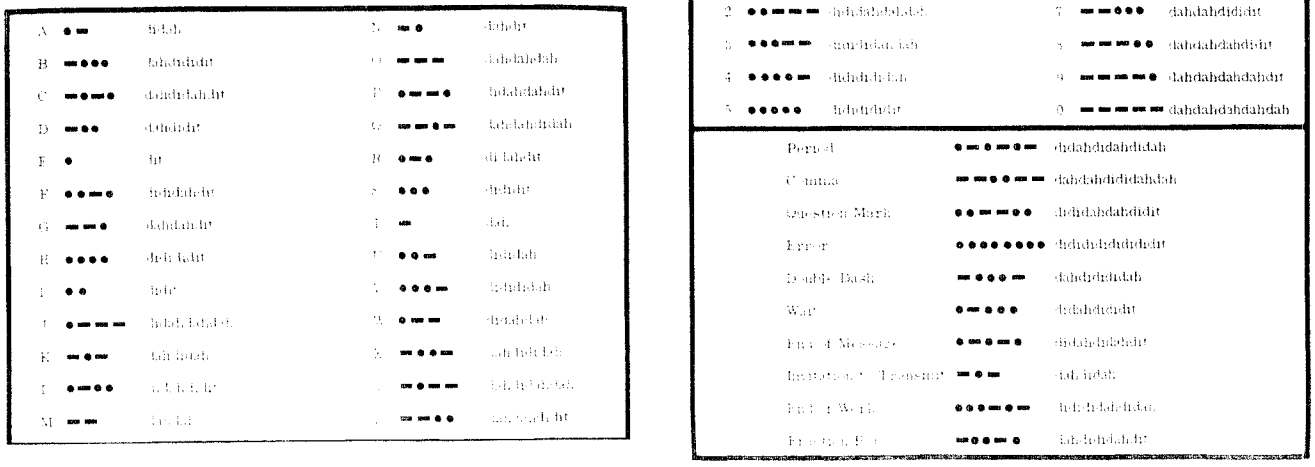


Figure 7

HEATHKIT

The Continental (International) Morse can be recorded on paper, it is most o all possible the code should be learnec in code, for example, should implant th receiving operator. If the code were l would first have to convert the sound shown on a printed page; and then he v letter "A" in his mind. This would co difficult to acquire code speed.

You can best learn the Morse code cassette tapes. These are available from member of the family, or a friend, se Code Oscillator. A letter should be c These small groups of letters can be se learn them. In similar fashion, additio During this learning process, the sele should be such that simple words ca learning.

The person sending the code should First, the sender should concentrate c smoothness of keying. Speed in send become more familiar.

The code symbols are designated in instead of "dot" and "dash." Thus, t dropped in such combinations. The " "5" (• • • • •) in spoken code lan "dididididit." Each "dah" should b or longer than another.

LEARNING THE CODE

The Continental (International) Morse code is a language of sound. Although it may be recorded on paper, it is most often sent and received as sound. Thus if at all possible the code should be learned as sound. The "sound" of the letter "A" in code, for example, should implant the letter "A" directly into the mind of the receiving operator. If the code were learned from a printed page, the operator would first have to convert the sound of "A" in code to a "dot-dash" symbol, as shown on a printed page; and then he would have to convert the symbol into the letter "A" in his mind. This would consume more time and make it much more difficult to acquire code speed.

You can best learn the Morse code by listening to code-teaching records or cassette tapes. These are available from the Heath Company. You can also have a member of the family, or a friend, send a few letters at a time to you with the Code Oscillator. A letter should be called out (pronounced) and then keyed. These small groups of letters can be sent, with pauses after each letter, until you learn them. In similar fashion, additional groups of letters can then be learned. During this learning process, the selection of the letters for these first groups should be such that simple words can be formed. This will tend to speed up learning.

The person sending the code should use the Code Chart, Figure 7, as his text. First, the sender should concentrate on proper formation of the characters and smoothness of keying. Speed in sending will come later when the characters become more familiar.

The code symbols are designated in speech by operators as "dit" and "dah" instead of "dot" and "dash." Thus, the letter A (• ▬) is "didah," the "t" being omitted in such combinations. The "di" sound should be staccato. The number 5 (• • • • •) in spoken code language should sound like a machine-gun burst: "didididit." Each "dah" should be stressed equally, with one being no shorter or longer than another.

Many operators recommend that as you go about your daily work, or as the opportunity presents itself, you spell out the names of common objects around you in "didah" language, either silently to yourself or aloud. Any characters that seem to be especially difficult should be given special attention and repetition until they no longer remain a problem.

If you have a radio receiver capable of receiving amateur radio station W1AW (the headquarter's station of the American Radio Relay League, 225 Main Street, Newington, Connecticut, 06111) you will find that it transmits code practice twice nightly. The station's schedule as to the time and frequencies can be secured from the American Radio Relay League magazine "QST," from a local ham, or by sending a postcard of inquiry direct to the address given above. You might also wish to inquire about the League publication "Learning the Radio Telegraph Code," which contains practice material for both home study and classroom use.

Determination is required to learn the code, just as in learning to type by touch. Only practice and more practice will produce results. Your immediate objective may well be an amateur radio license. For this, the Federal Communications Commission requires that you demonstrate your ability to both send and receive code in an acceptable manner at prescribed speeds. You will find this Code Oscillator an invaluable aid.

When you master the Morse code, you will have completed a very important step towards obtaining your amateur radio license. After you have completed the theory requirements, you will soon be able to enjoy a very fascinating hobby, Ham Radio.

IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead and wire in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the builder.

2. About 90% of the kits that are returned for repair are defective due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as illustrated in the Soldering section of the Kit Builders Guide.

3. Check the values of the component parts. Be sure that the proper parts have been wired into each circuit, as shown in the Pictorials and as called out in the wiring instructions.

4. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring or components, causing a short circuit.

5. Tone variation, or a warbling note during keying, is usually caused by poor contact in the keying circuit or at the key contacts themselves. The key contacts may be cleaned by drawing a strip of emery paper between the contacts with very slight pressure on the key knob. Turn the strip of emery paper over and draw it through a second time to clean the other key contact.

6. Little or no tone output indicates that the 9-volt battery may be weak.

7. The complete absence of tone indicates that the key contacts are dirty or not closing.

8. A continuous tone may indicate closed KEY contacts or a short circuit in the key cable or other parts of the keying circuit.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE
DC voltages low or absent.	1. Weak or defective battery. 2. Wires from battery connector to circuit board interchanged.
No sound.	1. Phone jack incorrectly wired. 2. Check voltages on transistors Q1, Q2, and Q3. 3. Diode D1 backwards. 4. Telegraph key not wired. 5. Speaker terminals shorted together or to battery bracket. 6. Phone jack shorted to speaker bracket.
Tone control has no effect.	1. Control R3 shorted (solder bridge).
Tone varies when Volume control is rotated (only when headphones are used).	1. The front panel is shorted to circuit board ground.
Sound from speaker when key is not closed and unit is used as sidetone oscillator.	1. Diode D1 wired backwards. 2. There is a positive voltage present at ST on the circuit board. Code Oscillator should only be used with transmitter using negative voltage grid block keying. 3. Wires in plug interchanged.

SPECIFICATIONS

Mode of Operation	Audible tone from speaker or headphones (600 ohms or greater).
Tone Frequency	Typically 200-850 Hz (adjustable).
Controls	Volume control. Tone control (internally).
Front Panel Connections	Key jack (key furnished). Phone jack.
Speaker	45 ohms, permanent magnet type.
Transistors	2 – MPSA20. 1 – 2N5249A.
Battery Required (not supplied).	1 – 9-volt transistor battery (NEDA #1604). See the note on Page 8.
Sidetone Oscillator	Grid-block keying type transmitters. Maximum -400V DC.

HEATHKIT

Color . . . . . .

Dimensions . . . . .

Net weight (including k

Color	Dark green and gray wrinkle finish.
Dimensions	4-1/8" wide x 2-5/8" high x 4-3/8" deep.
Weight (including key and battery)	12 oz.

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligations to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

The key is connected in series with the 9-volt battery. When the key is closed, the astable multivibrator; consisting of Q1, Q2, and associated components; produces a series of voltage pulses. These pulses are fed through audio filtering circuit C4, R8, and C5 to the base of the amplifier, Q3.

The 500 kΩ TONE control, R3, adjusts the rate of pulses per second from the astable multivibrator. The 25 kΩ VOLUME control, R8, adjusts the level of the voltage pulses fed to amplifier Q3.

When headphones are used, amplifier Q3 is disconnected from the circuit. (The contact between lugs 2 and 3 of the phone jack is broken.)

Diode D1 prevents any negative voltage from being fed back into the circuitry when the Code Oscillator is used as a side tone oscillator. The diode acts as an open circuit when a negative voltage is applied to the anode; the diode is reverse biased. When the key is closed, the diode will conduct and thus complete the electrical circuit. The diode is forward biased.

NOTE: To find the PART NUM
ordering a replacement part:

A. Find the circuit comp
View" or "Chassis Phot

B. Locate this same nur
column of the "Parts L

C. Adjacent to the circuit
NUMBER and DESCF
order a replacement pa

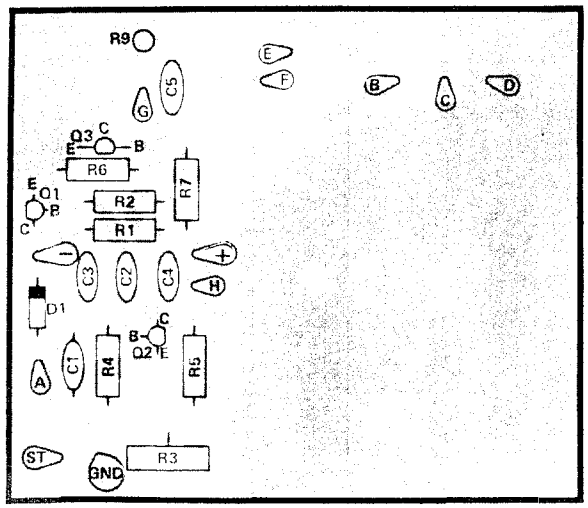
CIRCUIT BOARD X-RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

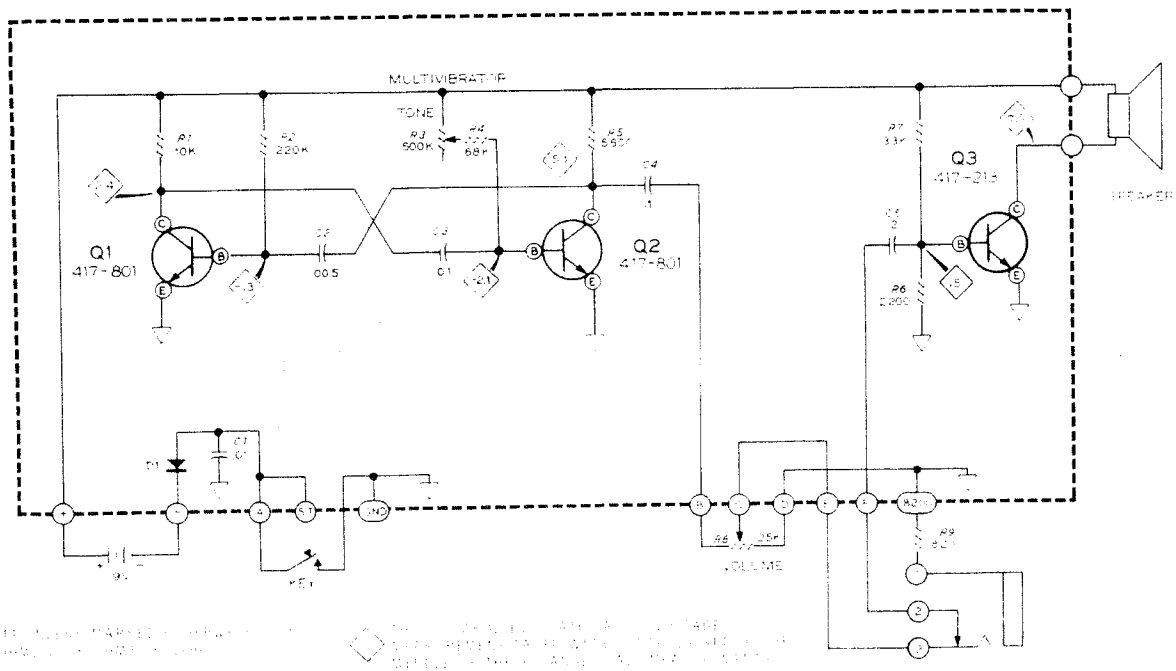
A. Find the circuit component number (R5, C3, etc.) on the "X-Ray View" or "Chassis Photograph."

B. Locate this same number in the "Circuit Component Number" column of the "Parts List."

C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



CIRCUIT BOARD X-RAY VIEW
(Viewed from lettered side)



SCHEMATIC OF THE HEATHKIT

CODE OSCILLATOR
MODEL HD-1416

NOTES:

Q1 = Q2 = MPSA20

Q3 = 2N5294