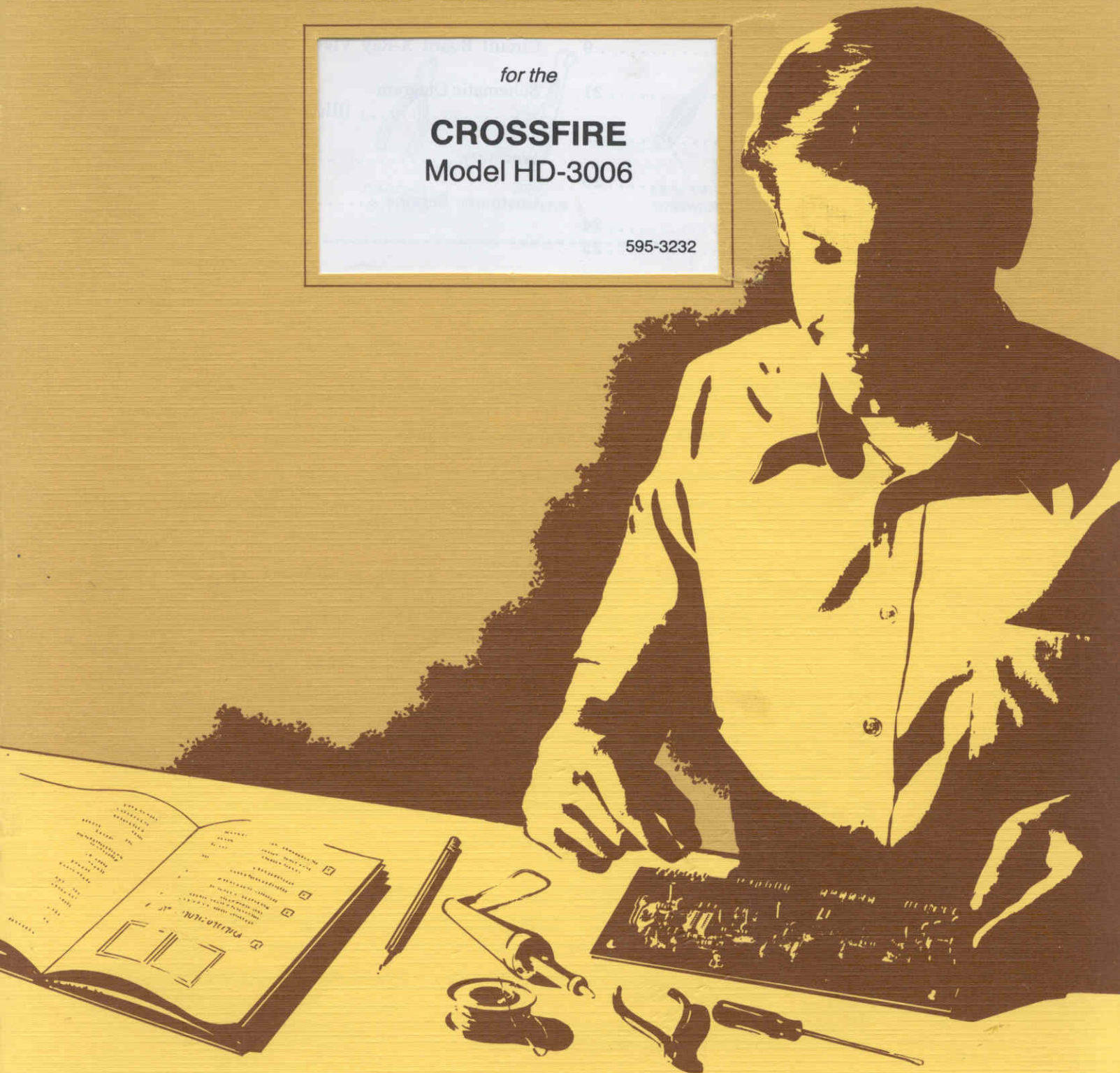


HEATHKIT[®] MANUAL

for the

CROSSFIRE
Model HD-3006

595-3232



HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information (616) 982-3411
Credit (616) 982-3561
Replacement Parts (616) 982-3571

Technical Assistance Phone Numbers

8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only
R/C, Audio, and Electronic Organs (616) 982-3310
Amateur Radio (616) 982-3296
Test Equipment, Weather Instruments and
Home Clocks (616) 982-3315
Television (616) 982-3307
Aircraft, Marine, Security, Scanners, Automotive,
Appliances and General Products (616) 982-3496
Computers — Hardware (616) 982-3309
Computers — Software:
Operating Systems, Languages, Utilities (616) 982-3860
Application Programs (616) 982-3884
Heath Craft Wood Works (616) 982-3423



YOUR HEATHKIT 90-DAY LIMITED WARRANTY

Consumer Protection Plan for Heathkit Consumer Products

Welcome to the Heath family. We believe you will enjoy assembling your kit and will be pleased with its performance. Please read this Consumer Protection Plan carefully. It is a "LIMITED WARRANTY" as defined in the U.S. Consumer Product Warranty and Federal Trade Commission Improvement Act. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Heath's Responsibility

PARTS — Replacements for factory defective parts will be supplied free for 90 days from date of purchase. Replacement parts are warranted for the remaining portion of the original warranty period. You can obtain warranty parts direct from Heath Company by writing or telephoning us at (616) 982-3571. And we will pay shipping charges to get those parts to you . . . anywhere in the world.

SERVICE LABOR — For a period of 90 days from the date of purchase, any malfunction caused by defective parts or error in design will be corrected at no charge to you. You must deliver the unit at your expense to the Heath factory, any Heathkit Electronic Center (units of Veritechnology Electronics Corporation), or any of our authorized overseas distributors.

TECHNICAL CONSULTATION — You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

NOT COVERED — The correction of assembly errors, adjustments, calibration, and damage due to misuse, abuse, or negligence are not covered by the warranty. Use of corrosive solder and/or the unauthorized modification of the product or of any furnished component, will void this warranty in its entirety. This warranty does not include reimbursement for inconvenience, loss of use, customer assembly, set-up time, or unauthorized service.

This warranty covers only Heath products and is not extended to other equipment or components that a customer uses in conjunction with our products.

SUCH REPAIR AND REPLACEMENT SHALL BE THE SOLE REMEDY OF THE CUSTOMER AND THERE SHALL BE NO LIABILITY ON THE PART OF HEATH FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO ANY LOSS OF BUSINESS OR PROFITS, WHETHER OR NOT FORSEEABLE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Owner's Responsibility

EFFECTIVE WARRANTY DATE — Warranty begins on the date of first consumer purchase. You must supply a copy of your proof of purchase when you request warranty service or parts.

ASSEMBLY — Before seeking warranty service, you should complete the assembly by carefully following the manual instructions. Heathkit service agencies cannot complete assembly and adjustments that are customer's responsibility.

ACCESSORY EQUIPMENT — Performance malfunctions involving other non-Heath accessory equipment, (antennas, audio components, computer peripherals and software, etc.) are not covered by this warranty and are the owner's responsibility.

SHIPPING UNITS — Follow the packing instructions published in the assembly manuals. Damage due to inadequate packing cannot be repaired under warranty.

If you are not satisfied with our service (warranty or otherwise) or our products, write directly to our Director of Customer Service, Heath Company, Benton Harbor MI 49022. He will make certain your problems receive immediate, personal attention.

Heathkit® Manual

for the

CROSSFIRE Model HD-3006

595-3232

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

Copyright © 1984
Heath Company
All Rights Reserved
Printed in the United States of America

TABLE OF CONTENTS

Introduction	2	Specifications	26
Assembly Notes	3	Circuit Description	26
Parts List	7	Semiconductor Identification Charts	27
Step-By-Step Assembly	9	Circuit Board X-Ray View	28
Initial Tests	21	Schematic Diagram (Illustration Booklet, Page 4)	
Calibration	22	Warranty	inside front cover
Operation	23	Customer Service	inside rear cover
In Case Of Difficulty	24		
Troubleshooting Chart	25		

INTRODUCTION

The Heathkit Model HD-3006 Crossfire is a visual tuning indicator for radioteletype (RTTY) communication. There are sixteen LED's that make up the tuning display. The eight vertical LED's are for the mark signal and the eight horizontal LED's are for the space signal. When tuning in a signal, you tune for a maximum number of vertical and horizontal LED's.

The HD-3006 Crossfire has a wide input voltage range and is compatible with almost any interface / terminal unit that has oscilloscope outputs for tuning. The Crossfire is a versatile tuning indicator that eliminates the need for an oscilloscope for this type of communication.

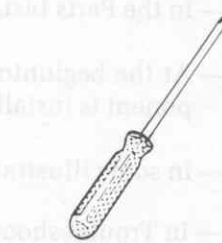
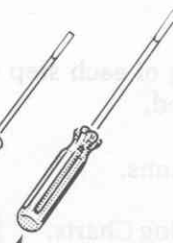
ASSEMBLY NOTES

TOOLS

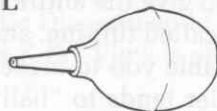
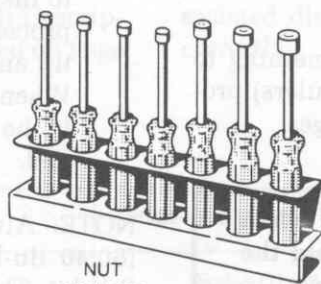
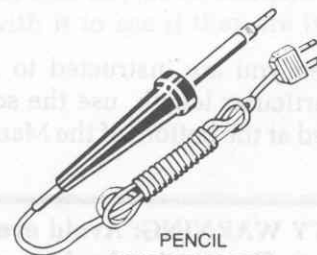
You will need these tools to assemble your kit.



PLIERS

LONG-NOSE
PLIERSDIAGONAL
CUTTERSWIRE
STRIPPERS1/8" & 1/4"-BLADE
SCREWDRIVERSPHILLIPS
SCREWDRIVER

OTHER HELPFUL TOOLS

NUT STARTER
(May Be Supplied
With Kit)DESOLDERING
BULB*DESOLDERING
BRAID*NUT
DRIVERSPENCIL
SOLDERING IRON
(22 to 25 WATTS)

*To Remove Solder From Circuit Connections.

ASSEMBLY

1. Follow the instructions carefully. Read the entire step before you perform each operation.
2. The illustrations in the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.
3. Most kits use a separate "Illustration Booklet" that contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.
4. Position all parts as shown in the Pictorials.
5. Solder a part or a group of parts only when you are instructed to do so.

6. Each circuit part in an electronic kit has its own component number (R2, C4, etc.). Use these numbers when you want to 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 Troubleshooting Charts,
 - In the Schematic,
 - In the sections at the rear of the Manual.
7. When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

SAFETY WARNING: Avoid eye injury when you cut off excessive lead lengths. Hold the leads so they cannot fly toward your eyes.

SOLDERING

Soldering is one of the most important operations you will perform while assembling your kit. A good solder connection will form an electrical connection between two parts, such as a component lead and a circuit board foil. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

It is easy to make a good solder connection if you follow a few simple rules:

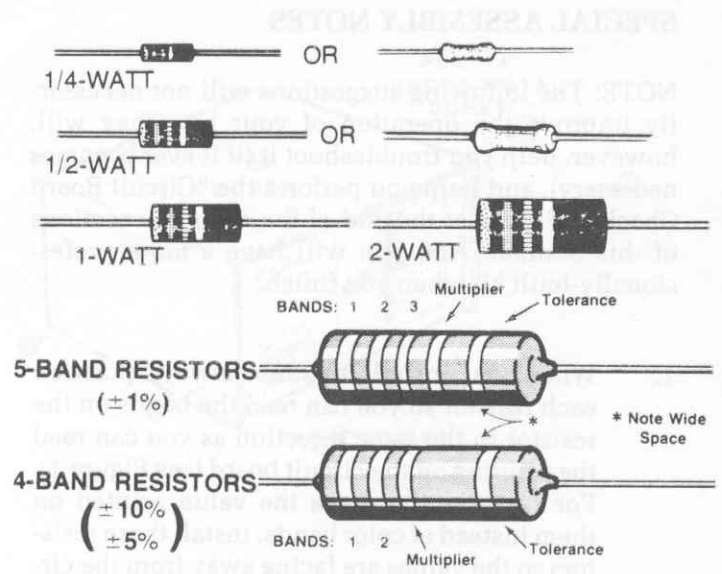
1. Use the right type of soldering iron. A 22 to 25-watt pencil soldering iron with a 1/8" or 3/16" chisel or pyramid tip works best.
2. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and retinned.

NOTE: Always use rosin core, radio-type solder (60:40 tin-lead content) for all of the soldering in this kit. This is the type we have supplied with the parts. The Warranty will be void and we will not service any kit in which acid core solder or paste has been used.

Heathkit®

PARTS

Resistors are identified in Parts Lists and steps by their resistance value in Ω (ohms), $k\Omega$ (kilohms), or $M\Omega$ (megohms). They are usually identified by a color code and four or five color bands, where each color represents a number. These colors (except for the last band, which indicates a resistor's "tolerance") will be given in the steps in their proper order. Therefore, the following color code is given for information only. NOTE: Occasionally, a "precision" or "power" resistor may have the value stamped on it.



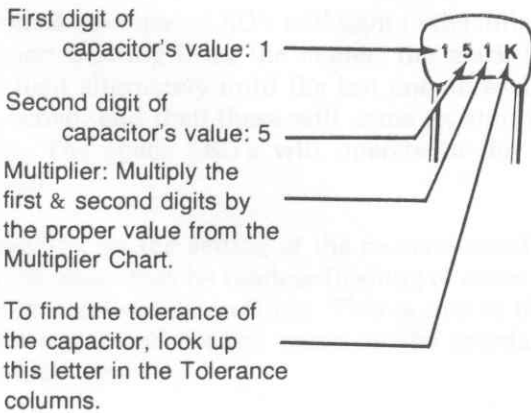
Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	± 10%
Brown	1	Brown	1	Brown	1	Brown	10	Gold	± 5%
Red	2	Red	2	Red	2	Red	100	Red	± 2%
Orange	3	Orange	3	Orange	3	Orange	1,000	Brown	± 1%
Yellow	4	Yellow	4	Yellow	4	Yellow	10,000	Green	± .5%
Green	5	Green	5	Green	5	Green	100,000	Blue	± .25%
Blue	6	Blue	6	Blue	6	Blue	1,000,000	Violet	± .1%
Violet	7	Violet	7	Violet	7	Silver	0.01	Gray	± .05%
Gray	8	Gray	8	Gray	8	Gold	0.1		
White	9	White	9	White	9				

Capacitors will be called out by their capacitance value in μF (microfarads) or pF (picofarads) and type: ceramic, Mylar*, electrolytic, etc. Some capacitors may have their value printed in the following manner:

EXAMPLES:

151K = $15 \times 10 = 150 pF$
 759 = $75 \times 0.1 = 7.5 pF$

NOTE: The letter "R" may be used at times to signify a decimal point: as in: 2R2 = 2.2 (pF or μF).



MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10 pF OR LESS	LETTER	OVER 10 pF
0	1	±0.1 pF	B	
1	10	±0.25 pF	C	
2	100	±0.5 pF	D	
3	1000	±1.0 pF	F	±1%
4	10,000	±2.0 pF	G	±2%
5	100,000		H	±3%
			J	±5%
8	0.01		K	±10%
9	0.1		M	±20%

*DuPont Registered Trademark.

SPECIAL ASSEMBLY NOTES

NOTE: The following suggestions will not necessarily improve the operation of your kit. They will, however, help you troubleshoot it (if it ever becomes necessary), and help you perform the "Circuit Board Checkout" steps at the end of the assembly sections of this Manual. And you will have a more professionally-built kit when you finish.

- When you install resistors, always position each resistor so you can read the bands on the resistor in the same direction as you can read the printing on the circuit board (see Figure 1). For resistors that have the value printed on them instead of color bands, install these resistors so the values are facing away from the circuit board and read in the same direction as the printing on the circuit board.

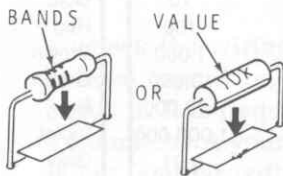


Figure 1

- When you install ceramic, Mylar, or mica capacitors, always position each capacitor so you can read the value on the capacitor in the same direction as you can read the printing on the circuit board (see Figure 2).

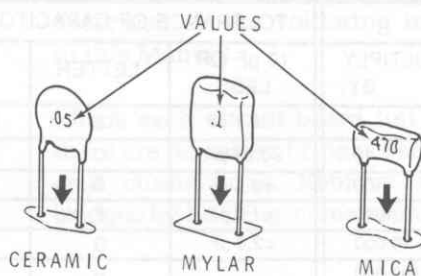


Figure 2

- When you install electrolytic or other tubular capacitors, always position each capacitor so the value is facing away from the circuit board (see Figure 3). Be sure to observe the correct polarity when you install electrolytic capacitors (as you will be directed in the steps). Other, non-polarized, capacitors should be installed so you can read the values in the same direction as the printing on the circuit board.

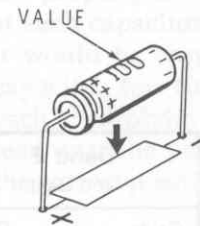


Figure 3

- Install diodes so the type numbers or part numbers are facing away from the circuit board. Be sure to match the band on one end of each diode with the band mark on the circuit board.

PARTS LIST

Unpack the kit and check each part against the following list. The key numbers correspond to the numbers on the "Parts Pictorial" (Illustration Booklet, Page 1). Return any part that is packed in an individual envelope, with the part number on it, back to the envelope after you identify it until that part is called for in a step. Do not discard any packing material until after you locate all of the parts.

KEY HEATH No. Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------------------------	------	-------------	----------------------

ELECTRONIC COMPONENTS

NOTE: The following resistors are rated at 1/4-watt and have a tolerance of 5%.

A1	6-222-12	2	2200 Ω (red-red-red) resistor	R1, R6
A1	6-184-12	2	180 k Ω (brn-gry-yel) resistor	R2, R5
A2	10-946	2	500 k Ω control	R3, R4
A3	21-140	2	.001 μ F (1000 pF) ceramic capacitor	C1, C2
A4	25-837	2	1.5 μ F tantalum capacitor	C4, C5
A5	25-891	1	470 μ F electrolytic capacitor	C3
A6	56-56	2	1N4149 diode	D21, D22
A6	57-65	4	1N4002 diode	D1, D2, D3, D4
A7	61-48	1	Rocker switch	SW1
A8	150-94	1	Power cube	
A9	412-634	16	LED (light-emitting diode)	D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Customer Service" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

KEY HEATH No. Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------------------------	------	-------------	----------------------

Electronic Components (Cont'd.)

NOTES:

- Integrated circuits (ICs) may be marked for identification in any of the following four ways:
 - Part number.
 - Type number. (This refers only to the numbers and letters shown in **bold** print in the Parts List. Disregard any other numbers and letters on the IC.)
 - Part number and type number.
 - Part number with a type number other than the one listed.
- Some ICs are packed in conductive foam. Do not remove these ICs from the foam until a step directs you to install them.

A10	442-54	1	UA7805 IC	U1
A11	442-718	2	LM3915 IC	U2, U3

HARDWARE

B1	250-1307	4	#6 \times 1/4" sheet metal screw
B2	250-1325	4	6-32 \times 1/4" screw
B3	252-3	7	6-32 nut
B4	254-1	8	#6 lockwasher
B5	255-49	4	Round spacer

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------	----------------	------	-------------	-------------------

CONNECTORS — SOCKETS

C1	432-72	2	Male terminal pin	
C2	432-73	2	Female terminal pin	
C3	432-196	1	2-pin plug shell	
C4	432-907	1	2-pin socket shell	
C5	434-42	2	Phono socket	
C6	434-310	2	18-pin IC socket	
C7	438-4	2	Phono plug	

PRINTED MATERIAL

D1	390-2638	1	Front panel label*	
D2		1	Blue and white label*	
	597-260	1	Parts Order Form*	
		1	Assembly Manual (See Page 1 for the part number.)	

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------	----------------	------	-------------	-------------------

MISCELLANEOUS

	85-2955-1	1	Circuit board	
E1	90-1325-1	1	Top cover	
E2	90-1326-1	1	Chassis	
E3	261-29	4	Foot	
	344-52	24"	Red wire	
	344-55	18"	Green wire	
E4	490-5	1	Nut starter	
		1	Package of solder	

HARDWARE

*These items may be packed inside the Manual.



STEP-BY-STEP ASSEMBLY

CIRCUIT BOARD ASSEMBLY

Refer to Pictorial 1-1 (Illustration Booklet, Page 2) as you read the following notes and steps.

NOTES:

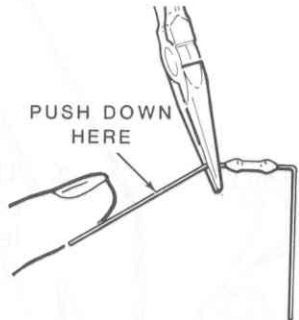
- 1. This circuit board drawing is divided into two sections. These sections show you which area of the circuit board you are working in for a specific series of steps.
- 2. Each series of steps has you installing parts in a top-to-bottom, left-to-right sequence. Occasionally, you may be directed to install a particular component in an area out of sequence. These components are each identified in the step and on the Pictorial with a special callout.
- 3. Check off each step as you perform it. You may also wish to place a check mark near each component on the Pictorial as you install it.
- 4. In general, solder instructions are given only at the end of a series of similar steps. You may solder more often, if you desire.

In the following steps, you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on a circuit board.

- () Note that the circuit board has foil on both sides, but only one side has the component outlines shown on it. This side of the circuit board is referred to as the "component side."

Position the circuit board as shown in the Pictorial with the component side up. Always install components on the component side of the circuit board, and solder the leads to the foil on the other side unless a step specifically directs you otherwise.

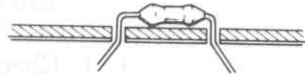
- () R6: Hold a 2200 Ω (red-red-red) resistor as shown and bend the leads straight down with long-nose pliers to fit the hole spacing on the circuit board.



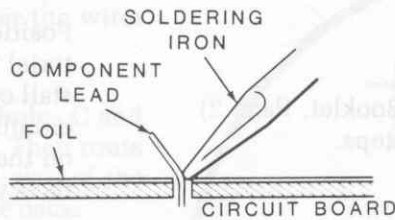
- () Start the leads into the holes at the resistor's location at the top of Section 1 of the circuit board. The end with color bands may be positioned either way. NOTE: Resistors are identified by the following outline:



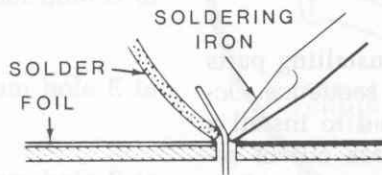
- () Press the resistor against the circuit board. Then bend the leads outward slightly to hold it in place.



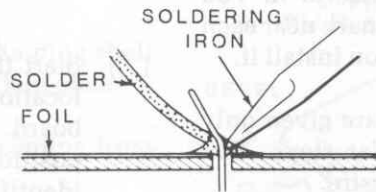
- () Solder the resistor leads to the circuit board as follows:



1. Push the soldering iron tip against both the lead and the circuit board foil. Heat **both** for two or three seconds.



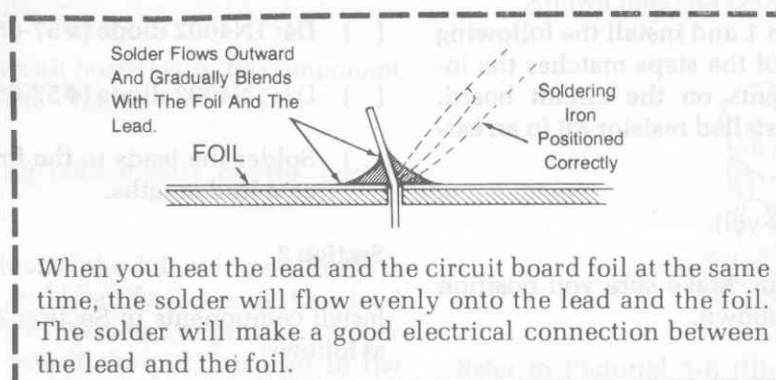
2. Then apply solder to the other side of the connection. **IMPORTANT:** Let the heated lead and the circuit board foil melt the solder.



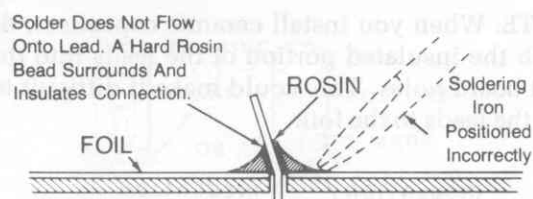
3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.

- () Cut off the excess lead lengths close to the connection. **WARNING:** Clip the leads so the ends will not fly toward your eyes.
- () Check each connection. Compare it to the illustrations on Page 11. After you have checked the solder connections, proceed with the assembly on Page 12. Use the same soldering procedure for each connection.

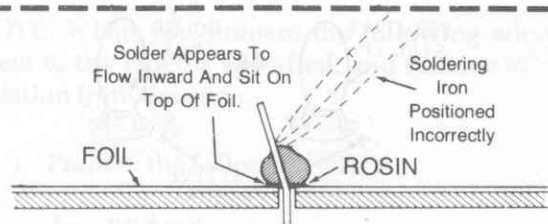
A GOOD SOLDER CONNECTION



POOR SOLDER CONNECTIONS



When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

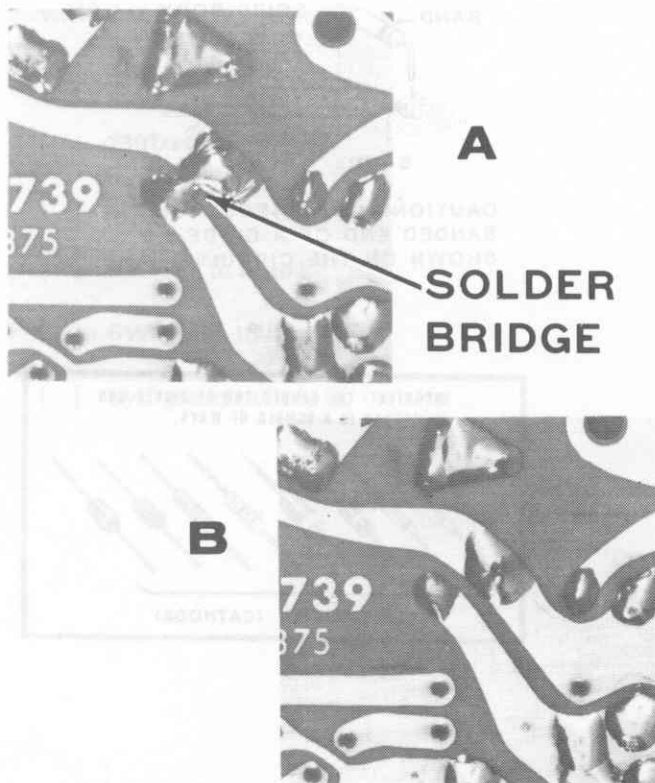


When the foil is not heated sufficiently the solder will blob on the circuit board as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

SOLDER BRIDGES

A solder bridge between two adjacent foils is shown in photograph A. Photograph B shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. A good rule to follow is: always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when the foils are small and close together. NOTE: It is alright for solder to bridge two connections on the same foil.

Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, turn the circuit board foil-side-down and heat the solder between connections. The excess solder will run onto the tip of the soldering iron, and this will remove the solder bridge. NOTE: The foil side of most circuit boards has a coating on it called "solder resist." This is a protective insulation to help prevent solder bridges.

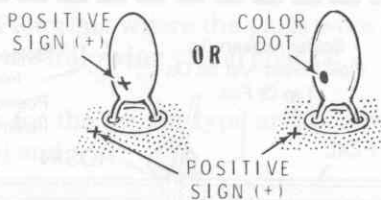


Section 1

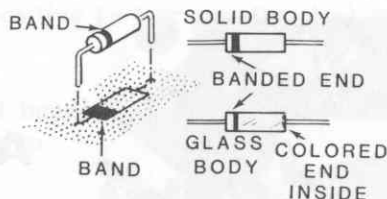
Start at the top of Section 1 and install the following resistors. The sequence of the steps matches the locations of the components on the circuit board.
NOTE: Make sure you installed resistor R6 in an earlier step.

- () R5: 180 k Ω (brn-gry-yel).
- () C5: 1.5 μ F tantalum. Make sure you position the marked end as shown.

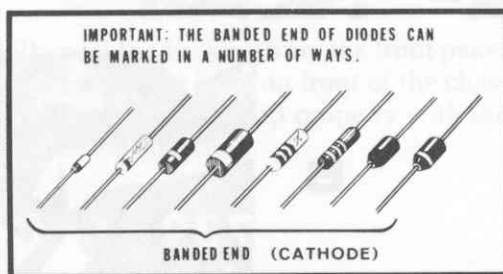
MAY BE MARKED WITH POSITIVE SIGN (+) OR COLOR DOT



NOTE: In some of the following steps, you will install diodes. Whenever you install a diode, always match the banded end of the diode with the band mark on the circuit board. A diode will not work properly if it is installed backwards.



CAUTION: ALWAYS POSITION THE BANDED END OF A DIODE AS SHOWN ON THE CIRCUIT BOARD.



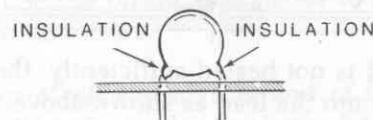
- () D2: 1N4002 diode (#57-65).
- () D4: 1N4002 diode (#57-65).
- () D3: 1N4002 diode (#57-65).
- () Solder the leads to the foil and cut off the excess lead lengths.

Section 2

Install components in Section 2 of the circuit board as follows:

- () D22: 1N4149 diode (#56-56).

NOTE: When you install ceramic capacitors, do not push the insulated portion of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.

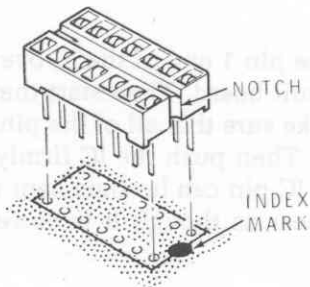


- () C2: .001 μ F (1000 pF) ceramic.
- () C1: .001 μ F (1000 pF) ceramic.
- () D1: 1N4002 diode (#57-65).
- () R1: 2200 Ω (red-red-red).
- () D21: 1N4149 diode (#56-56).
- () R2: 180 k Ω (brn-gry-yel).
- () C4: 1.5 μ F tantalum. Be sure to match the marked end with the positive (+) mark on the board.
- () Solder the leads to the foil and cut off the excess lead lengths.

Refer to Pictorial 1-2 (Illustration Booklet, Page 2) for the following steps.

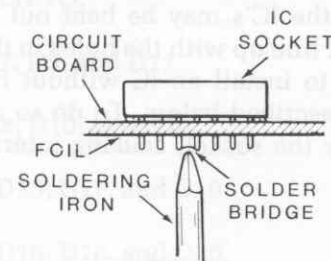
NOTES:

1. In the following steps, you will install IC sockets. To install an IC socket, make sure the pins are straight. Then start the pins into the circuit board holes. The index mark on the circuit board must still be visible after you install the socket. Solder the pins to the foil as you install each socket.



2. It is very easy to form a solder bridge between foils when you install an IC socket. After you install each socket, carefully inspect the foil for solder bridges and remove any that you find as described in the next column. If you suspect that you have a solder bridge, but are not positive, you can check your foil pattern against the one shown on Page 28.

To remove a solder bridge, hold the circuit board component-side-up as shown and hold your soldering iron tip between the two points that are bridged. The solder will flow down the soldering iron tip.



Install the IC sockets on the circuit board as follows:

- () Two IC sockets at U2 and U3.

Use the procedure shown in Detail 1-2A when you are directed to install the ICs.

() U3, U2: LM3915 (#442-718).

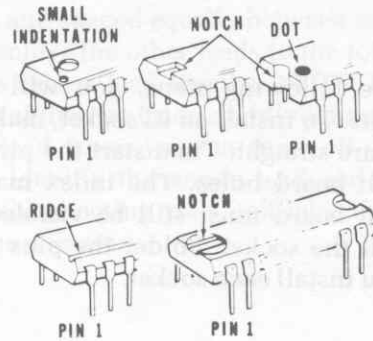
The pins on the IC's may be bent out at an angle, so they do not line up with the holes in the IC socket. DO NOT try to install an IC without first bending the pins as described below. To do so may damage the IC pins or the socket, causing intermittent contact.



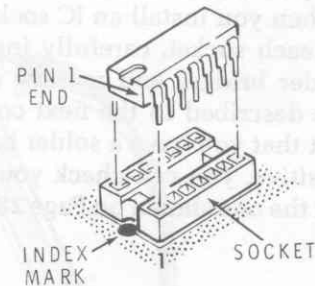
Before you install an IC, lay it down on its side as shown below and very carefully roll it toward the pins to bend the lower pins into line. Then turn the IC over and bend the pins on the other side in the same manner.



Compare the IC to the drawing shown below. Then determine which end of the IC is the pin 1 end.



Position the pin 1 end of the IC over the index mark on the circuit board. Then start the IC pins into the socket. Make sure that all of the pins are started into the socket. Then push the IC firmly into the socket. NOTE: An IC pin can become bent under the IC and it will appear as though it is correctly installed in the socket.



Detail 1-2A

Heathkit®

- () Place the chassis as shown in Pictorial 1-4 (Page 16) and slide four round spacers over the threaded studs. Then return to this page and complete the steps.

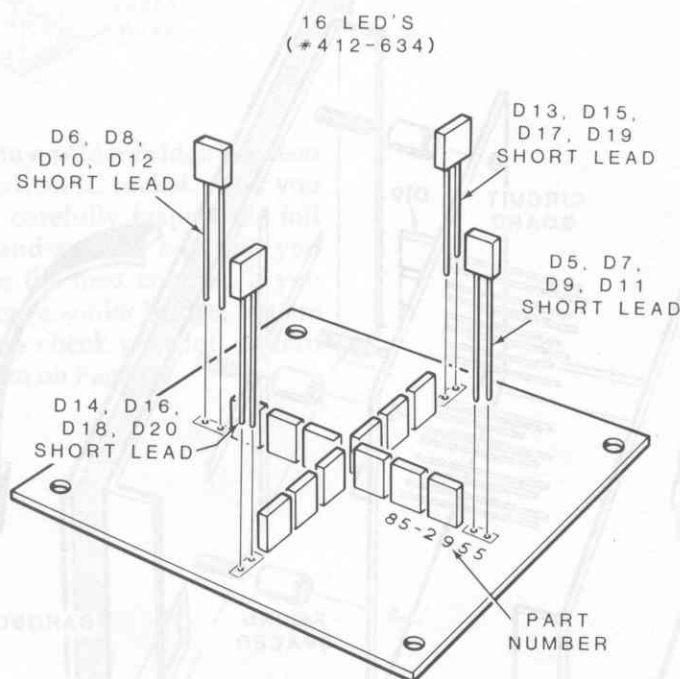
Refer to Pictorial 1-3 for the following steps.

- () Turn the circuit board over so the foil side is up and position it so the part number 85-2955 is readable as shown.

NOTE: Before you install the following LED's, make sure the leads are straight.

Insert the LEDs (#412-634) into the circuit board holes at the following locations. When you install the LED's, make sure the shorter lead is positioned as called out in the Pictorial. DO NOT SOLDER ANY OF THE LEADS TO THE FOIL UNTIL YOU ARE INSTRUCTED TO.

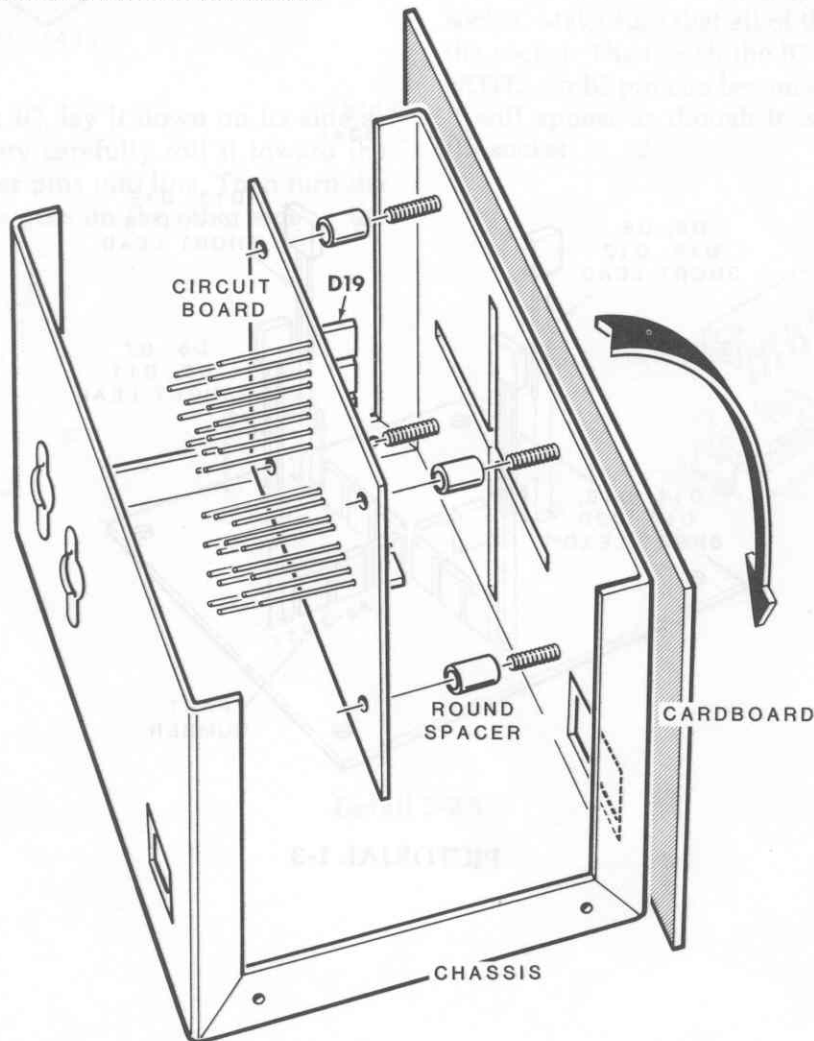
- () D5, D7, D9, and D11.
 () D6, D8, D10, and D12.
 () D13, D15, D17, and D19.
 () D14, D16, D18, and D20.



PICTORIAL 1-3

Refer to Pictorial 1-4 for the following steps.

- () Now position the circuit board in a vertical position so the component side is toward you and LED D19 is toward the top. Then place the board only part way onto the threaded studs.
- () Place a piece of cardboard against the front of the chassis and hold it tightly in place as you turn the chassis over onto its front.
- () Move each LED around by its leads until they are all seated into the chassis slots. Make sure the circuit board is against the spacers.
- () Solder only one lead of each LED to the foil.
- () Now remove the circuit board from the chassis. Also remove the spacers and set the chassis aside. Make sure all of the LEDs are straight across and spaced equally between each other. Then solder the other leads to the foil and cut off the excess lead lengths. NOTE: Leave the longer of the two leads slightly longer than the other lead when you cut them off. This will easily identify the anode lead and aide you in troubleshooting your unit later if it should become necessary.



PICTORIAL 1-4

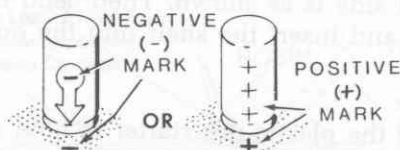
Heathkit®

Refer to Pictorial 1-5 (Illustration Booklet, Page 2) for the following steps.

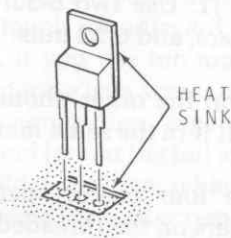
- () Position the circuit board with the component side up as shown.

Install the remaining components on the circuit board as follows:

NOTE: Before you install the following electrolytic capacitor, look at it and identify the leads. One lead will have a positive (+) mark or a negative (-) mark near it. Be sure to install the positive lead in the positive-marked hole, or the negative lead in the negative-marked hole.



- () C3: 470 μ F electrolytic. Solder the leads to the foil and cut off the excess lead lengths.
- () U1: UA7805 IC (#442-54). Match the heat sink of the IC with the double outline on the board and insert the leads. Position the IC $\frac{1}{4}$ " above the board, solder the leads to the foil, and cut off the excess lead lengths.



- () R4, R3: 500 k Ω control (#10-946). Insert the control lugs and solder them to the foil.



Refer to Pictorial 1-6 (Illustration Booklet, Page 2) for the following steps.

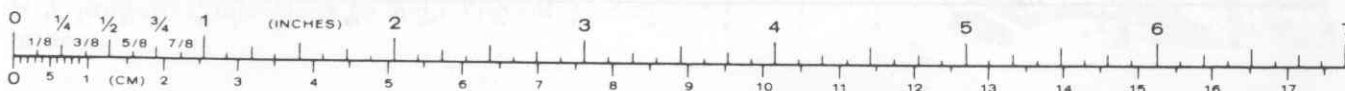
NOTE: When you prepare the following wires, cut them to the lengths specified, and remove $\frac{1}{4}$ " of insulation from the ends.

- () Prepare the following wires:

Two $3\frac{3}{4}$ " red
 One 7" red
 One $9\frac{1}{2}$ " red
 Two $6\frac{1}{2}$ " green

Connect and solder one end of these wires to the circuit board as follows. Cut off the excess lead lengths from the foil side. The other end of the wires will be connected later.

- () $3\frac{3}{4}$ " red to hole C.
 () $3\frac{3}{4}$ " red to hole D.
 () 7" red to hole E.
 () $9\frac{1}{2}$ " red to hole F.
 () $6\frac{1}{2}$ " green to hole A.
 () $6\frac{1}{2}$ " green to hole B.



CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following most-commonly-made errors.

- Unsoldered connections.
- Poor solder connections.
- Solder bridges between foil patterns.
- Protruding leads which could touch together or touch the chassis when the circuit board is installed later.

Refer to the Pictorials where the parts were installed as you make the following visual checks:

- Diodes for the proper type and position of the banded end.
- Tantalum capacitors for the correct position of the marked lead.
- ICs for the proper installation.
- LEDs for the proper installation.
- Electrolytic capacitor for the correct position of the positive (+) or negative (-) marked lead.

Set the circuit board aside temporarily until it is called for in a step.

CHASSIS ASSEMBLY

Refer to Pictorial 1-7 for the following steps.

- Position the chassis as shown.
- Carefully peel the backing from the front panel label and install the label on front of the chassis. Make sure it is lined up properly with the openings in the chassis.

- Peel the backing from the four feet and install them on the bottom of the chassis about $\frac{1}{4}$ " in from each corner.
- Peel the backing from the blue and white label. Install the label on the bottom of the chassis as shown in the Pictorial. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.
- SW1: Position the rocker switch as shown and install it at SW1. Push the switch into the opening until it snaps into place.
- S1: Position the 2-pin socket shell so the beveled side is as shown. Then bend both tabs back and insert the shell into the opening at S1.

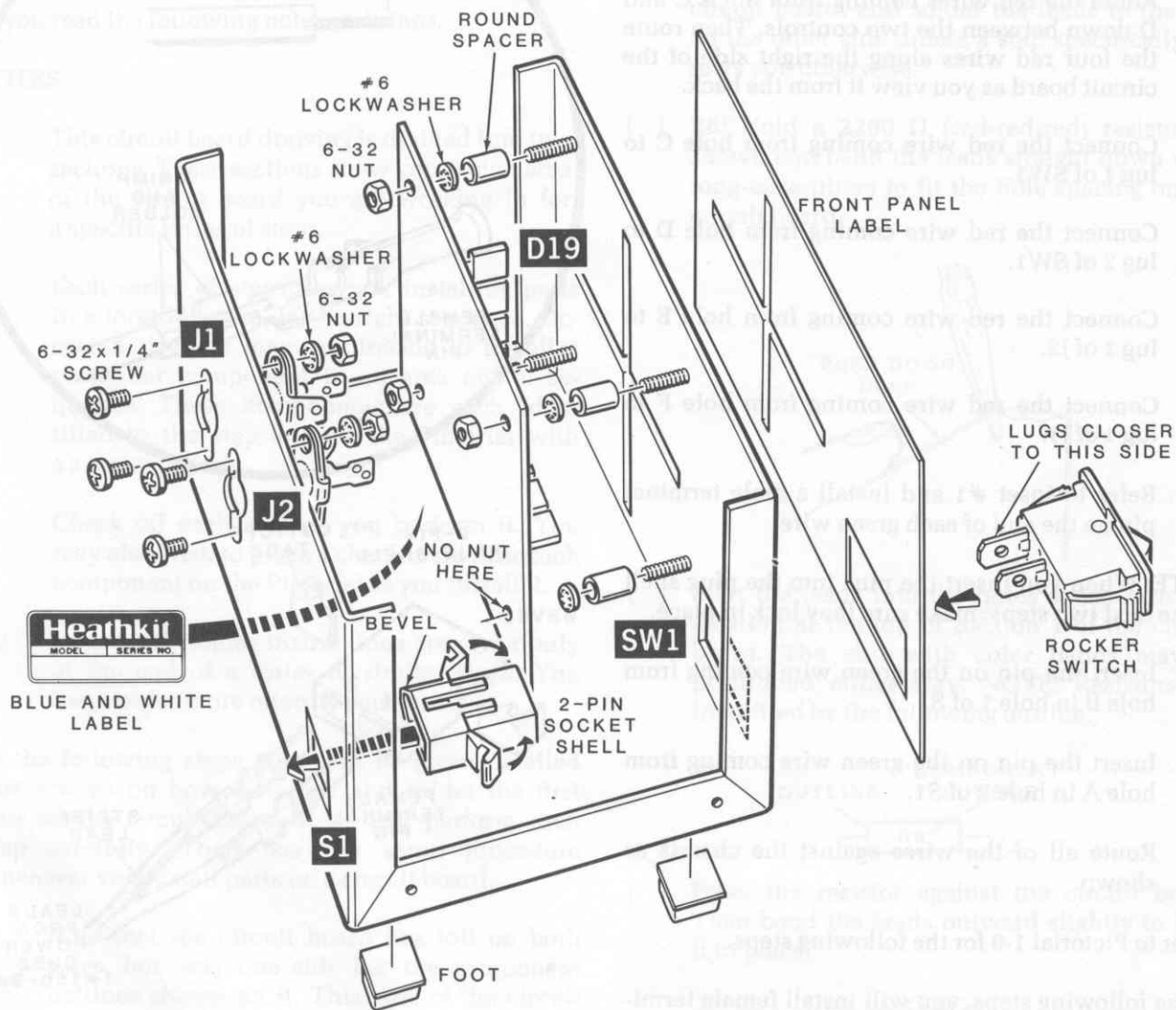
NOTE: Use the plastic nut starter to hold and start 6-32 nuts on screws.

- Cut 1" off the narrow end of the nut starter so it can be used easier in the following steps.

NOTE: If there is any paint on the inside of the chassis at locations J1 and J2, be sure to scrape it off before you install the phono sockets in the following steps.

- J1: Position a phono socket as shown and install it at J1. Use two 6-32 \times $\frac{1}{4}$ " screws, #6 lockwashers, and 6-32 nuts.
- J2: Position the other phono socket as shown and install it in the same manner at J2.
- Place the four round spacers and four #6 lockwashers on the threaded studs. Inspect the LED's on the foil side of the circuit board to make sure they are still lined up properly. Then position the board so that LED D19 is as shown and install the board on the spacers with three 6-32 nuts. NOTE: No nut will be used on the indicated stud.





PICTORIAL 1-7

Refer to Pictorial 1-8 (Illustration Booklet, Page 3) for the following steps.

Connect the wires coming from the circuit board to the chassis in the following steps. Solder the wires as you connect them.

- () Route the red wires coming from holes C and D down between the two controls. Then route the four red wires along the right side of the circuit board as you view it from the back.
- () Connect the red wire coming from hole C to lug 1 of SW1.
- () Connect the red wire coming from hole D to lug 2 of SW1.
- () Connect the red wire coming from hole E to lug 1 of J2.
- () Connect the red wire coming from hole F to lug 1 of J1.
- () Refer to inset #1 and install a male terminal pin on the end of each green wire.

NOTE: When you insert the pins into the plug shell in the next two steps, make sure they lock in place.

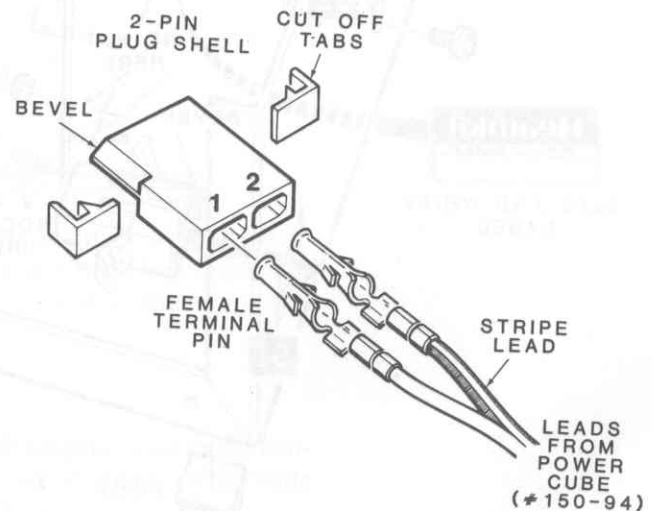
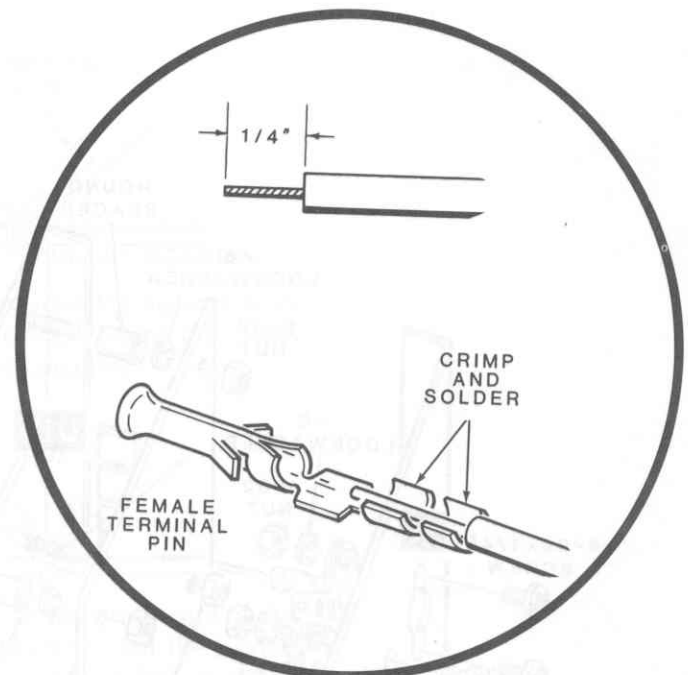
- () Insert the pin on the green wire coming from hole B in hole 1 of S1.
- () Insert the pin on the green wire coming from hole A in hole 2 of S1.
- () Route all of the wires against the chassis as shown.

Refer to Pictorial 1-9 for the following steps.

In the following steps, you will install female terminal pins and a 2-pin plug shell on the ends of the power cube leads.

- () Prepare the ends of both leads and install the female terminal pins as shown.
- () Cut off both tabs from the 2-pin plug shell.
- () Position the shell with the bevel as shown and insert the lead with the stripe in hole 2. Insert the plain lead in hole 1.

This completes the assembly, except the top cover, which you will install later. Check the inside of the chassis for any bits of solder or cut leads. Then proceed to the "Initial Tests".



PICTORIAL 1-9

INITIAL TESTS

If a volt-ohmmeter is available, perform the following tests. If a meter is not available, proceed to the "Calibration."

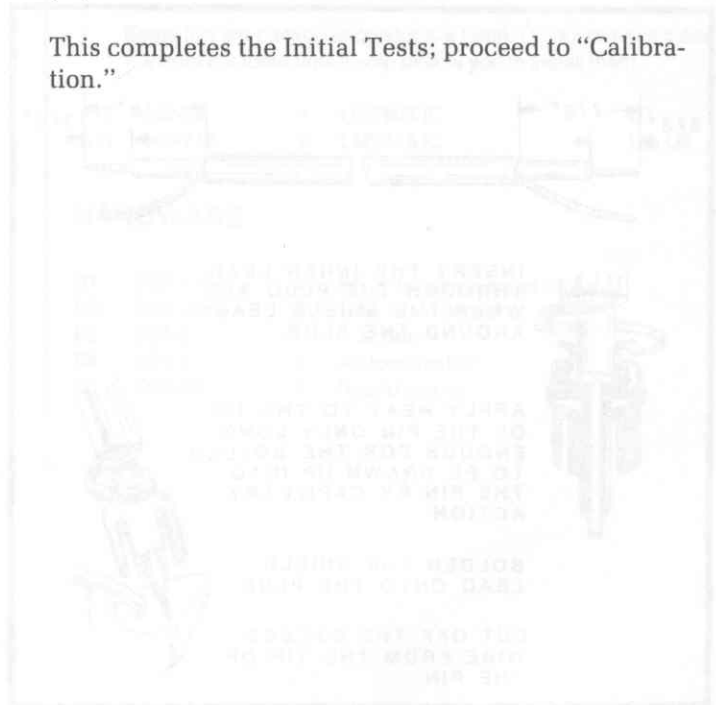
Refer to Pictorial 2-1 (Illustration Booklet, Page 3) for the following steps.

If you do not get the proper reading in a step, reverse the meter leads and take another reading. If you still do not get the proper results, refer to the "In Case Of Difficulty" section of the Manual and the Schematic Diagram. Also, review the Circuit Description.

NOTE: Do not plug in the power cube at this time.

- Place the OFF-ON switch (SW1) to ON.
- Set your ohmmeter to the $R \times 100$ range.
- Connect one of the ohmmeter leads to chassis ground.
- Take a reading from either lug of switch SW1 to ground. The reading should be greater than 1000Ω .
- Set your ohmmeter to the $R \times 1000$ range.
- Take a reading from the indicated common foil of the 16 LEDs to ground. The reading should be greater than 2500Ω .
- Take a reading from pin 1 and pin 2 of socket S1 to ground. Each reading should be greater than $20 k\Omega$.
- Plug the power cube into an AC outlet. Then insert the plug into socket S1 on the chassis.
- Set your volt-ohmmeter to DC volts and to the 15-volt range.
- Connect the common lead of the meter to chassis ground.
- Take a reading at either lug of switch SW1. The reading should be $13.4 \text{ volts} \pm 10\%$.
- Take a reading at the indicated common foil of the 16 LEDs. The reading should be $5.0 \text{ volts} \pm 10\%$.
- Disconnect the meter leads.

This completes the Initial Tests; proceed to "Calibration."



CALIBRATION

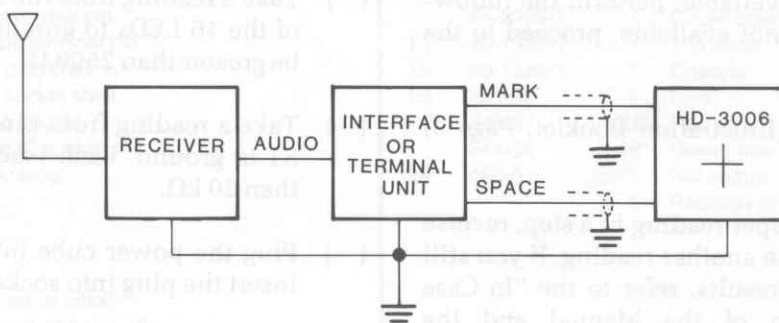


FIGURE 1

NOTE: You will need two shielded cables to connect your HD-3006 to your interface/terminal unit. Two phono plugs are supplied that you will install on one end of these cables. The other end of these cables are connected to your interface/terminal unit with the correct style of connector.

() Install the phono plugs on one end of the cables as shown below.

() Figure 1 shows a typical hookup between the HD-3006 Crossfire, a terminal unit, and a receiver. Connect these units together as shown.

Refer to Pictorial 2-1 (Illustration Booklet, Page 3) for the locations of the controls, LEDs, and switch in the following steps.

() Make sure the power cube is plugged into an AC outlet and into socket S1 of the Crossfire.

() Turn the ON-OFF switch (SW1) ON.

() Tune your receiver to an RTTY signal.

() Adjust the AF gain on your receiver for normal operating level.

() Tune your receiver off station so that all you hear is background noise. NOTE: If you can not obtain the following results, disregard steps 1 and 2 and perform Steps 3, 4, and 5 instead.

1. () Adjust control R3 to the point before LED D5 just starts to light.

2. () Adjust control R4 to the point before LED D13 just starts to light.

3. () Tune your receiver to a strong RTTY signal.

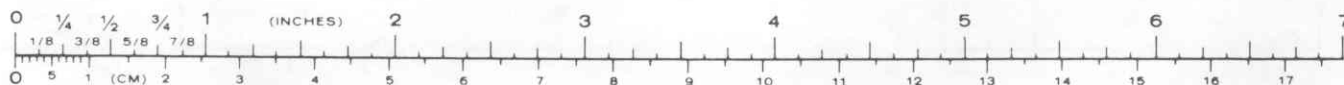
3/8" 7/8" 7/8" 3/8"

INSERT THE INNER LEAD THROUGH THE PLUG AND WRAP THE SHIELD LEAD AROUND THE PLUG.

APPLY HEAT TO THE TIP OF THE PIN ONLY LONG ENOUGH FOR THE SOLDER TO BE DRAWN UP INTO THE PIN BY CAPILLARY ACTION.

SOLDER THE SHIELD LEAD ONTO THE PLUG.

CUT OFF THE EXCESS WIRE FROM THE TIP OF THE PIN.



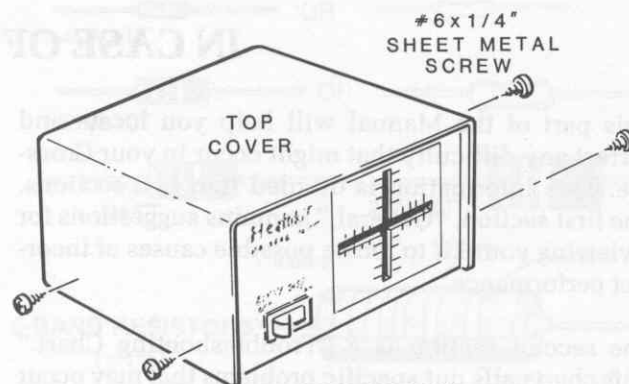
Heathkit®

4. () Adjust control R3 to the point where LED's D11 and D12 just light.
5. () Adjust control R4 to the point where LED's D19 and D20 just light.

This completes the Calibration.

Refer to Pictorial 3-1 and install the top cover on the chassis with four #6 × 1/4" sheet metal screws.

This completes the assembly, proceed to the "Operation."



PICTORIAL 3-1

OPERATION

The following information describes the function of your HD-3006 Crossfire.

RTTY DISPLAY – The vertical LEDs are for the mark channel and the horizontal LEDs are for the space channel. When you tune your receiver, try for the maximum number of "lit" mark and space LEDs on the display. Normally, there will be more mark LEDs indicating than space LEDs. This is due to shifting of the mark-to-space condition; the space signal being in the "on" state for a shorter period of time than the mark signal. With exceptionally strong signals, the mark and space indications may be equal.

The mark and space LED's will light in the following manner: Starting from the center, the mark LED's will light alternately until the last one on each end is reached, and then these will come on simultaneously. The space LED's will operate in the same manner.

Depending on the setting of the receiver sensitivity control, there may be random flashing of some LEDs during a no-signal condition. This is due to the receiver noise and limiter action in the interface or terminal unit.

Assuming that the sensitivity is adjusted to the same level for each channel and the receiver is tuned correctly, some of the space LEDs may indicate when only a mark signal is present. This is due to the coupling between the filters in the interface or terminal unit.

OFF-ON Switch – Turns the unit On or Off.

8-16V AC/DC 150 mA Power Socket – The power cube or any power source that is capable of these requirements may be plugged into this socket. If you use a DC power supply, the polarity does not matter.

SPACE Socket – The space cable from the interface or terminal unit plugs into this socket.

MARK Socket – The mark cable from the interface or terminal unit plugs into this socket.

IN CASE OF DIFFICULTY

This part of the Manual will help you locate and correct any difficulty that might occur in your Crossfire. This information is divided into two sections. The first section, "General," contains suggestions for reviewing your kit to locate possible causes of incorrect performance.

The second section is a "Troubleshooting Chart." This chart calls out specific problems that may occur and lists one or more conditions or components that could cause each difficulty.

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

GENERAL

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you consistently overlook.
2. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.
3. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, you can often eliminate many troubles by reheating all connections to make sure they are soldered properly, as described in the soldering instructions in this Manual.
4. Check each circuit board foil to be sure there are no solder bridges between adjacent connections. Remove any solder bridges by holding a clean soldering iron tip between the two points that are bridged until the excess solder flows **down** onto the tip of the soldering iron.
5. Check integrated circuits for proper positioning and for good contact at each pin connection.
6. Check capacitor values carefully. Be sure the proper part is wired into the circuit at each capacitor location. For example, it would be easy to mistake a .001 μF capacitor for 100 pF capacitor. Check each electrolytic capacitor to be sure the lead near the positive (+) marking is at the correct position.
7. Check each resistor value carefully. It would be easy, for example, to install a 2200 Ω (red-red-red) resistor where a 220 Ω (red-red-brown) resistor is called for. A resistor that is discolored, or cracked, or shows any sign of bulging indicates that it is faulty and should be replaced.
8. Be sure the correct diode is installed at each diode location, and that the banded end is positioned correctly.
9. Check all component leads connected to the circuit board. Make sure the leads do not extend through the circuit board and come in contact with other connections or parts, such as the chassis.
10. If you still cannot locate the trouble and a voltmeter is available, check the voltage readings against those shown on the Schematic Diagram. A review of the "Circuit Description" may also help you locate the trouble.

Heathkit®

NOTE: To remove faulty multi-lead components from a circuit board, clip all the leads, and then unsolder and remove them one at a time.

NOTE: Refer to the "Circuit Board X-Ray View" on Page 28 of this Manual for the physical location of parts.

Troubleshooting Chart

This Troubleshooting Chart lists specific problems that could occur and some possible causes. The numbers for the components are the same numbers used in the Schematic Diagram and Circuit Description. A Circuit Board X-ray View is provided on Page

28 to help you locate any circuit board component. If a component is indicated (such as U1 for example), check that part and any other components associated directly with it to see if they are installed correctly.

PROBLEM	POSSIBLE CAUSE
No 13.4 volt supply.	<ol style="list-style-type: none"> 1. Diodes D1-D4. 2. Capacitor C3. 3. Switch SW1. 4. ICs U2, U3. 5. Power cube.
No 5-volts, but 13.4 volts is present.	<ol style="list-style-type: none"> 1. IC U1.
Have supply voltage, but not all LEDs light.	<ol style="list-style-type: none"> 1. LED installed incorrectly. 2. Diodes D21, D22. 3. IC's U2, U3. 4. Controls R3, R4 misadjusted. 5. Signal not strong enough.

SPECIFICATIONS

Display	Two 8-LED bars. Each bar requires approximately 14 dB no-signal-to-signal voltage ratio (5:1) for full use of the bar.
Input Level	
Threshold	AC, 0.3 volts RMS. DC, 0.5 volts.
Maximum	AC, 15 volts RMS. DC, 15 volts.
Power Supply	8-16 volts AC/DC power cube at 150 mA typical.
General	
Dimensions	3 ³ / ₁₆ " high × 5" wide × 4" deep (8.1 × 12.7 × 10.0 cm).
Net Weight	2.3 lbs (1.0 kg).

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

Refer to the Schematic Diagram (Illustration Booklet, Page 4) as you read this description.

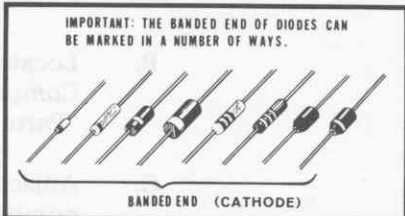
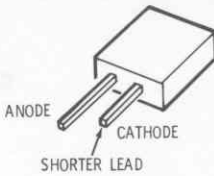
The space and mark signals are routed through sensitivity controls R3 and R4 and diodes D21 and D22 to the input of driver ICs U2 and U3. U2 and U3 are log LED drivers that drive LED's D5 through D20 for mark and space indications. D21 and D22 rectify the AC mark and space signals, while resistors R2 and R5 and capacitors C4 and C5 form filter timing networks. The timing networks reduce the effect of

noise bursts. Once the input level exceeds the threshold set by the sensitivity controls, R3 and R4, ICs U2 and U3 will start turning on LED's D5 through D20. As the input level increases, more LEDs are turned on. Resistors R1 and R6 provide a reference voltage for ICs U2 and U3.

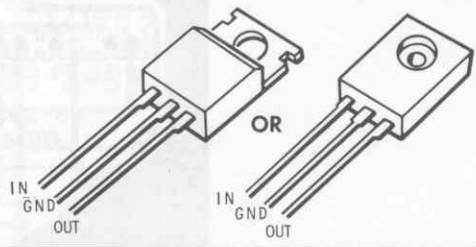
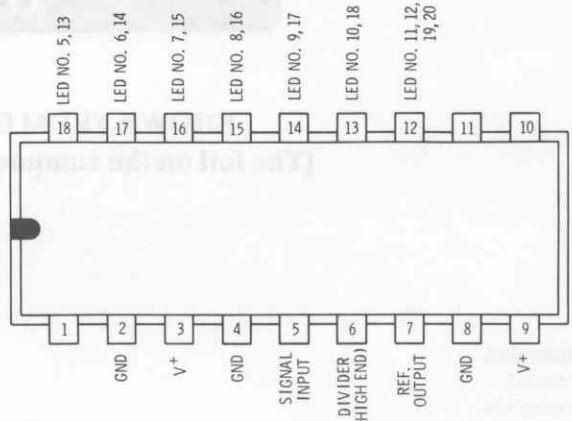
Diodes D1 through D4 and capacitor C3 form a bridge rectifier-filter circuit. Capacitors C1 and C2 are line bypass filters. IC U1 is a 5-volt regulator for LEDs D5 through D20.

SEMICONDUCTOR IDENTIFICATION CHARTS

DIODES

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
D21, D22	56-56	1N4149	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="font-size: small; margin: 0;">IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.</p>  <p style="text-align: center; font-size: x-small; margin: 0;">BANDED END (CATHODE)</p> </div> 
D1, D2, D3, D4	57-65	1N4002	
D5, D6, D7, D8 D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20	412-634	Light-emitting diode (LED)	

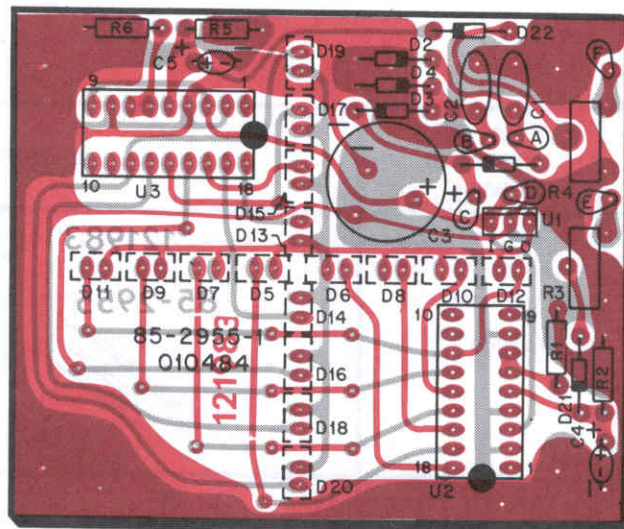
INTEGRATED CIRCUITS

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
U1	442-54	UA7805	
U2, U3	442-718	LM3915	

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



SHOWN FROM COMPONENT SIDE
 (The foil on the component side is shown in red)

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least **THREE INCHES** of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022



HEATH COMPANY • BENTON HARBOR, MICHIGAN
THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

LITHO IN U.S.A.