HEATHKIT® MANUAL

for the

EXTENDED CONFIGURATION BOARD
Model HA8-8

595-2509-01

Prices and specifications subject to change without notice.

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EXTENDED CONFIGURATION BOARD
Model HA8-8

595-2509-01

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

Heathkit

TABLE OF CONTENTS

INTRODUCTION

The Heathkit Model HA8-8 Extended Configuration Board is designed to operate with the Model H8 Computer to provide a general purpose status port, ROM disable (ORG $\emptyset$), and side select for double-sided disk drives.

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ASSEMBLY NOTES

TOOLS

You will need these tools to assemble your kit.

LONG-NOSE
PLIERS

DIAGONAL
CUTTERS

WIRE
STRIPPERS

1/8" & 1/4" - BLADE
SCREWDRIVERS
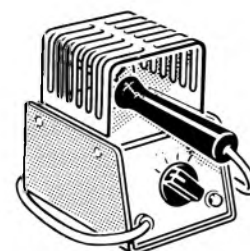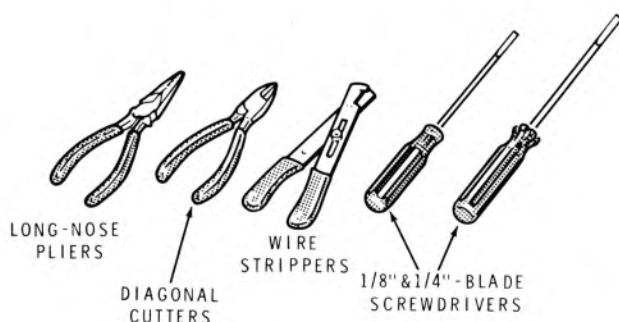
HEATHKIT
SOLDERING
IRON

OR
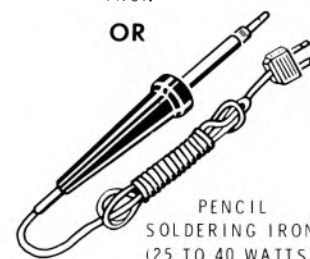
PENCIL
SOLDERING IRON
(25 TO 40 WATTS)

OTHER HELPFUL
TOOLS

DESOLDERING
BULB*

NUT STARTER
(MAY BE SUPPLIED
WITH KIT)

DESOLDERING
BRAID*
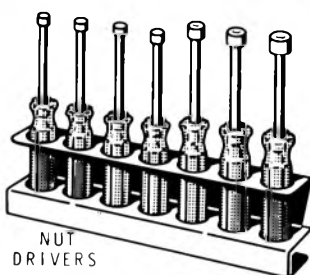
NUT
DRIVERS

*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 the Schematic,

— In the section 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 25 to 40-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 or 50:50 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.

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PARTS

Resistors are identified in Parts Lists and steps by their resistance value in Ω (ohms), kΩ (kilohms), or MΩ (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.

1/4-WATT OR

1/2-WATT OR

1-WATT   2-WATT

BANDS: 1 2 3   Multiplier   Tolerance

5-BAND RESISTORS (±1%)

* Note Wide Space

4-BAND RESISTORS (±10% ±5%)

BANDS: 1 2   Multiplier   Tolerance
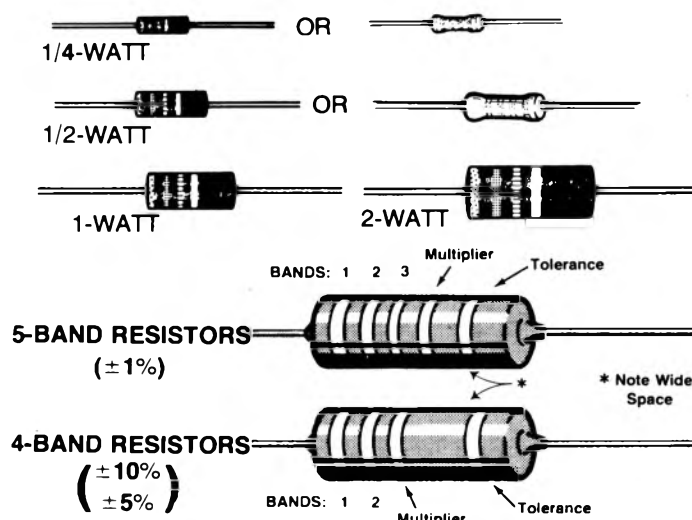
Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	±10%
Brown	1	Brown	1	Brown	1	Brown	10	Gold	± 5%
Red	2	Red	2	Red	2	Red	100	Brown	± 1%
Orange	3	Orange	3	Orange	3	Orange	1,000		
Yellow	4	Yellow	4	Yellow	4	Yellow	10,000		
Green	5	Green	5	Green	5	Green	100,000		
Blue	6	Blue	6	Blue	6	Blue	1,000,000		
Violet	7	Violet	7	Violet	7	Silver	0.01		
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:

First digit of capacitor's value: 1 ─────

Second digit of capacitor's value: 5 ─────

Multiplier: Multiply the first & second digits by the proper value from the Multiplier Chart.

To find the tolerance of the capacitor, look up this letter in the Tolerance columns.

1 5 1 K

EXAMPLES:

151K = 15 × 10 = 150 pF
759 = 75 × 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).
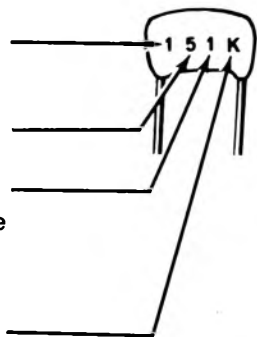
MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10 pF OR LESS	LETTER	OVER 10 pF
0	1	±0.1 pF	B	
1	10	±0.25 pF	C	
2	100	±0.5 pF	D	
3	1000	±1.0 pF	F	±1%
4	10,000	±2.0 pF	G	±2%
5	100,000		H	±3%
			J	±5%
8	0.01		K	±10%
9	0.1		M	±20%

*DuPont Registered Trademark

PARTS LIST

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

To order a replacement part, always include the Part Number and use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, use one of the "Expedited Parts Order Forms" at the rear of this Manual, or refer to "Replacement Parts" inside the rear cover. Your Warranty is located inside the front cover. For prices, refer to the separate "Heath Parts Price List."

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

RESISTORS—CAPACITORS

NOTE: The following resistors are rated at 1/4-watt and have a tolerance of 5%. 5% is indicated by a gold fourth color band.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
A1	6-221-12	2	220 Ω (red-red-brn) resistor	R1, R2,
A1	6-102-12	11	1000 Ω (brn-blk-red) resistor	R3, R4, R5, R6, R7, R8, R9, R11, R12, R13, R14
B1	21-761	3	.01 μF ceramic capacitor	C1, C2, C5
B2	25-221	2	2.2 μF tantalum capacitor	C3, C4

INTEGRATED CIRCUITS

NOTE: Integrated circuits are marked for identification in one of the following four ways:

1. Part number.
2. Type number. (This refers only to the numbers; the letters may be different or missing.)
3. Part number and type number.
4. Part number and a type number other than the one listed.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
C1	443-755	1	74LS04	U4
C1	443-732	1	74LS30	U5
C1	443-77	1	7438	U6
C1	443-730	1	74LS74	U3
C1	443-754	1	74LS240	U2
C2	442-54	1	7805	U1

CAUTION: The following IC can be damaged by static electricity. Do not remove this IC from the conductive foam until you are instructed to do so in a step.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
C1	444-70*	1	ROM	IC204

*NOTE: Your integrated circuit may be marked 444-74. Either integrated circuit will work properly.

CONNECTORS—SOCKETS

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
D1	432-865	1	3-connector shell	
D2	432-866	4	Spring connector (3 extra)	
D3	432-946	1	25-pin plug	
D4	432-986	1	3-pin plug	
D5	432-1125	2	26-pin socket**	
D6	434-298	4	14-pin IC socket	
D7	434-311	1	20-pin IC socket	

MISCELLANEOUS

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
E1	60-621	1	8-section slide switch	SW1
	85-2521-1	1	Circuit board	
E2	261-29	2	Square foot	
	340-8	12"	Bare wire	
	344-55	6"	Green wire	
	344-92	12"	Red wire	
E3	438-55	2	Polarizing plug	
E4			Blue and white label	
E5	490-185	1	Desoldering braid	
		1	Manual (See Page 1 for part number.)	
		1	ROM (listing)	
			Solder	
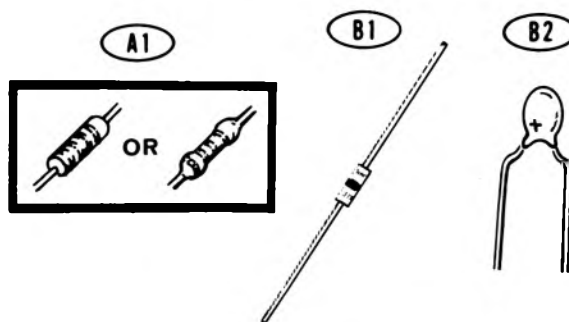
**NOTE: You may have been supplied two 6-pin and two 20-pin sockets instead of two 26-pin sockets.

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PARTS PICTORIAL

C1

ALWAYS IDENTIFY AN I.C. BY THE PART NUMBER OR TYPE NUMBER **NOTE:** THE STYLE MAY BE SLIGHTLY DIFFERENT THAN SHOWN.

C2

OR
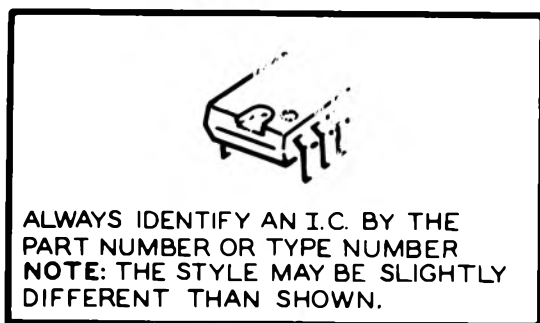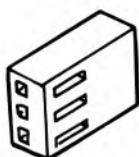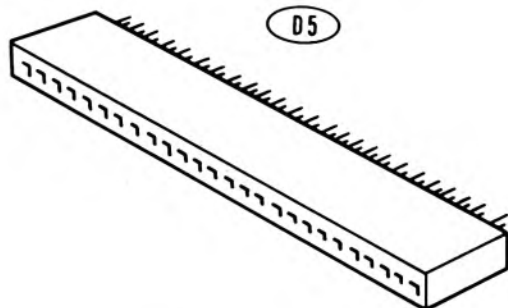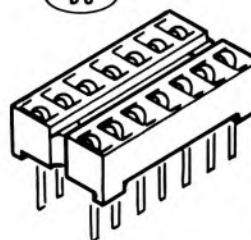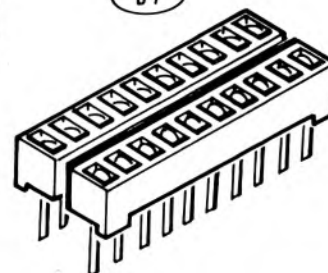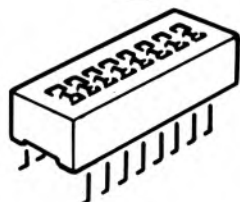
D1
D2
D3
D4
D5
D6
D7
E1
E2
E3
E4
Heathkit
MODEL | SERIES NO.
E5

STEP-BY-STEP ASSEMBLY

CIRCUIT BOARD ASSEMBLY

START ▼

( ) 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.

( ) Position the circuit board as shown with the printed side (not the foil side) up.

( ) R5: Hold a 1000 Ω (brn-blk-red) resistor with long-nose pliers as shown and bend the leads straight down to fit the hole spacing on the circuit board.

PUSH DOWN HERE
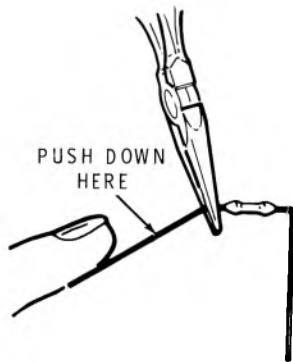
( ) Push the leads through the holes at the indicated location on the circuit board. The end with color bands may be positioned either way.
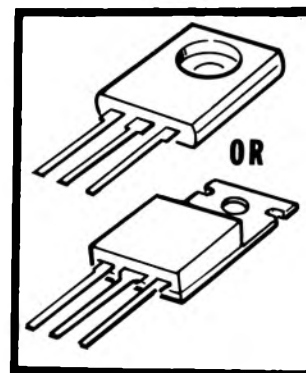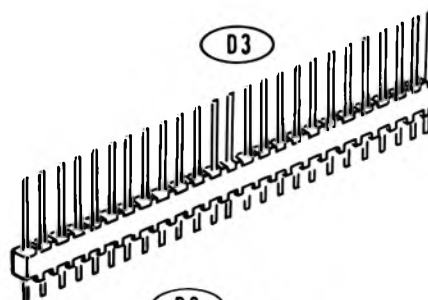
( ) Press the resistor against the circuit board. Then bend the leads outward slightly to hold the resistor in place.
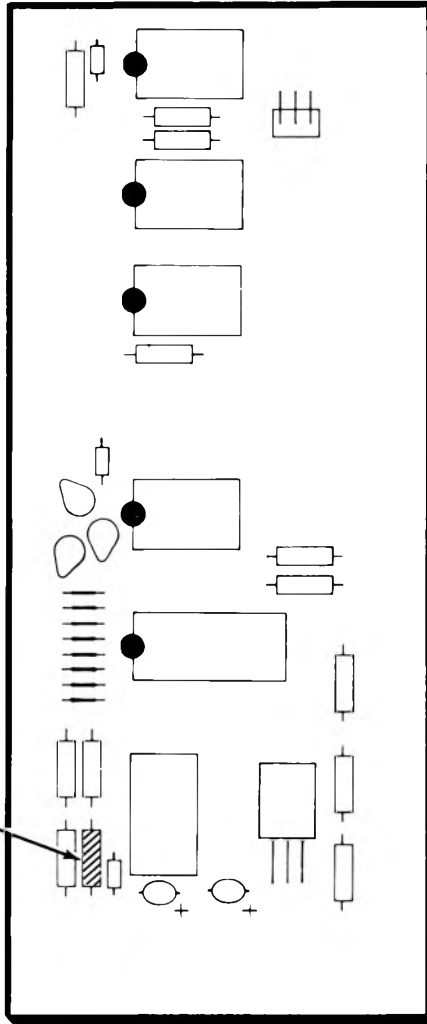
PICTORIAL 1-1

CONTINUE ▽

( ) 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.

SOLDERING IRON
COMPONENT LEAD
FOIL
CIRCUIT BOARD
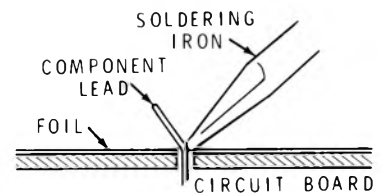
2. Then apply solder to the other side of the connection. IMPORTANT: Let the heated lead and the circuit board foil melt the solder.

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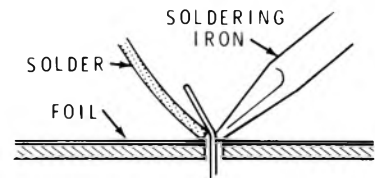
3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.

SOLDERING IRON
SOLDER
FOIL
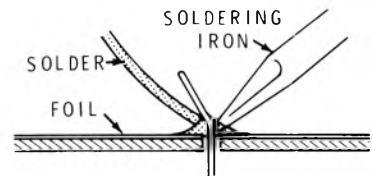
( ) Cut off the excess lead lengths close to the connection. WARNING: Clip the leads so the ends will not fly toward your eyes.

( ) Check each connection. Compare it to the illustrations on Page 9. After you have checked the solder connections, proceed with the assembly on Page 10. Use the same soldering procedure for each connection.

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A GOOD SOLDER CONNECTION

SOLDER FLOWS OUTWARD AND GRADUALLY BLENDS WITH THE FOIL AND THE LEAD.

SOLDERING IRON POSITIONED CORRECTLY

FOIL

When you heat the lead and the circuit board foil at the same time, the solder will flow evenly onto the lead and the foil. The solder will make a good electrical connection between the lead and the foil.

POOR SOLDER CONNECTIONS

SOLDER DOES NOT FLOW ONTO LEAD. A DARK ROSIN BEAD SURROUNDS AND INSULATES THE LEAD FROM THE CONNECTION.

ROSIN

SOLDERING IRON POSITIONED INCORRECTLY

FOIL

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.

SOLDER APPEARS TO FLOW INWARD AND SET ON TOP OF THE FOIL.

SOLDERING IRON POSITIONED INCORRECTLY

FOIL

ROSIN

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.

A

SOLDER BRIDGE

B

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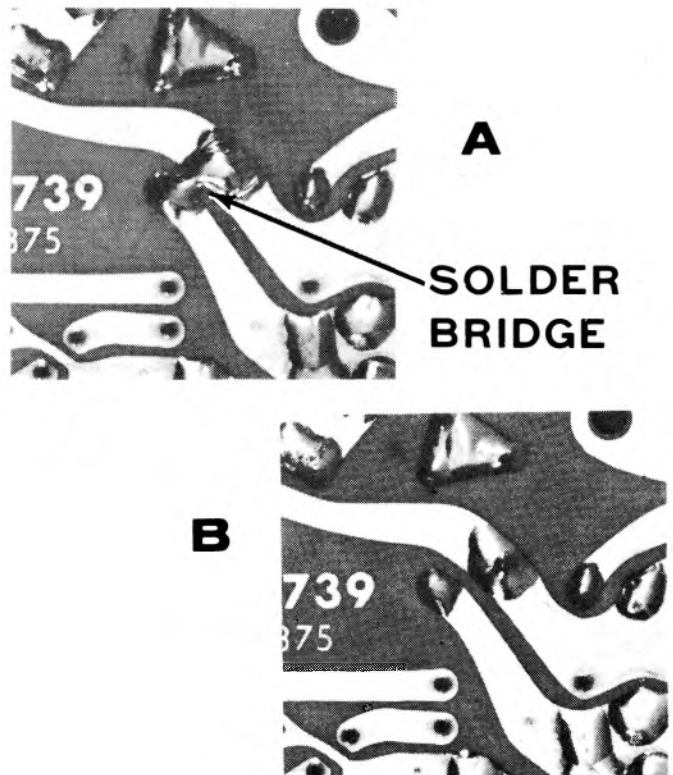
START ⬇

( ) Make sure you installed resistor R5 in Pictorial 1-1.

( ) R12: 1000 Ω (brn-blk-red).

NOTE: Ceramic capacitors may be installed either way in the circuit board.

( ) C2: .01 μF (103) ceramic capacitor.

Install three 1000 Ω (brn-blk-red) resistors at the following locations:

( ) R3. . . . .

( ) R8. . . . .

( ) R4. . . . .

( ) C5: .01 μF (103) ceramic capacitor.

( ) Solder the leads to the foil and cut off the excess lead lengths.
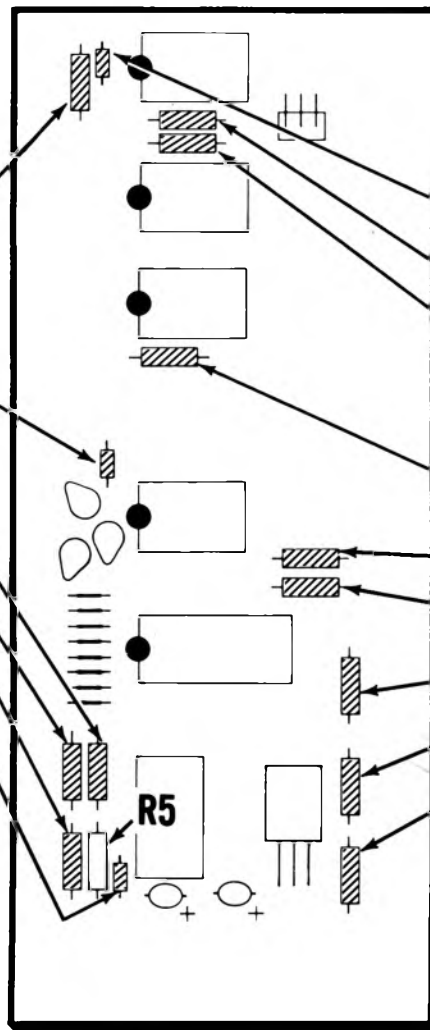
CONTINUE ⬇

( ) C1: .01 μF (103) ceramic capacitor.

( ) R2: 220 Ω (red- red-brn).

( ) R1: 220 Ω (red-red-brn).

Install six 1000 Ω (brn-blk-red) resistors at the following locations:

( ) R14.

( ) R13.

( ) R9.

( ) R7.

( ) R11.

( ) R6.

( ) Solder the leads to the foil and cut off the excess lead lengths.

R5

PICTORIAL 1-2

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You will install IC sockets in the following steps. Be sure the socket pins are straight and then install the socket on the circuit board so the index mark on the board can still be seen. Turn the circuit board over, be sure there is a pin in each of the holes, and then solder the pins to the foil.

NOTCH

INDEX MARK
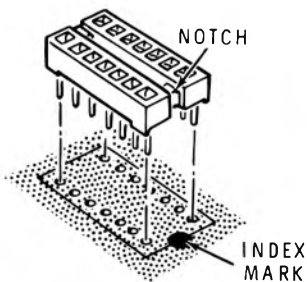
( ) 14-pin IC socket.

( ) 14-pin IC socket.

( ) 14-pin IC socket.

( ) 14-pin IC socket.

( ) 20-pin IC socket.

( ) Carefully check each socket for solder bridges between pins. If a solder bridge has occurred, hold the circuit board foil-side-down as shown, and hold the soldering iron tip between the two points that are bridged. The solder will flow down the soldering iron tip.

CIRCUIT BOARD
IC SOCKET
FOIL
SOLDERING IRON
SOLDER BRIDGE
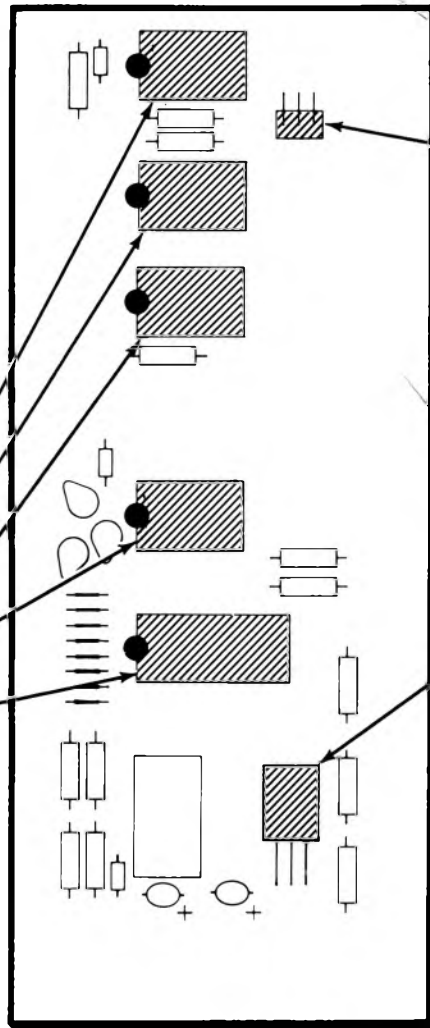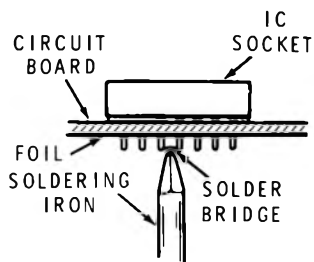
PICTORIAL 1-3

( ) P1: 3-pin plug. Start the shorter plug pins into the circuit board holes as shown and push the plug down tight against the circuit board. Then solder the pins to the foil and cut off any excess pin lengths.
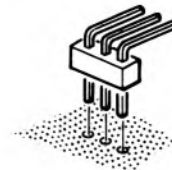
( ) U1: 7805 integrated circuit (#442-54). First bend the leads straight down as shown. Then insert the leads into the circuit board holes. Be sure the IC is tight against the circuit board. Then solder the leads to the foil and cut off any excess lead lengths.

1/4"
BEND LEADS STRAIGHT DOWN
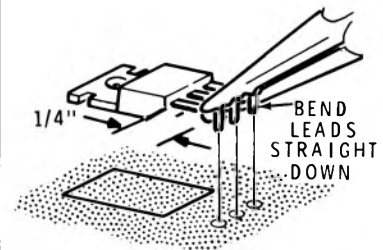
START ▼

( ) Cut eight 1″ lengths of bare wire. Use these 1″ bare wires in the following steps.

NOTE: When you install each bare jumper wire in the next step, first form the wire into a loop as shown. Then install the wire at the indicated location. Position the top of the loop 1/4″ above the circuit board. Then solder the lead to the foil and cut off any excess lead lengths.

1/4″
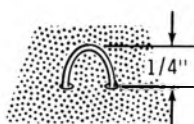
( ) Install bare jumper wires at the eight locations indicated.
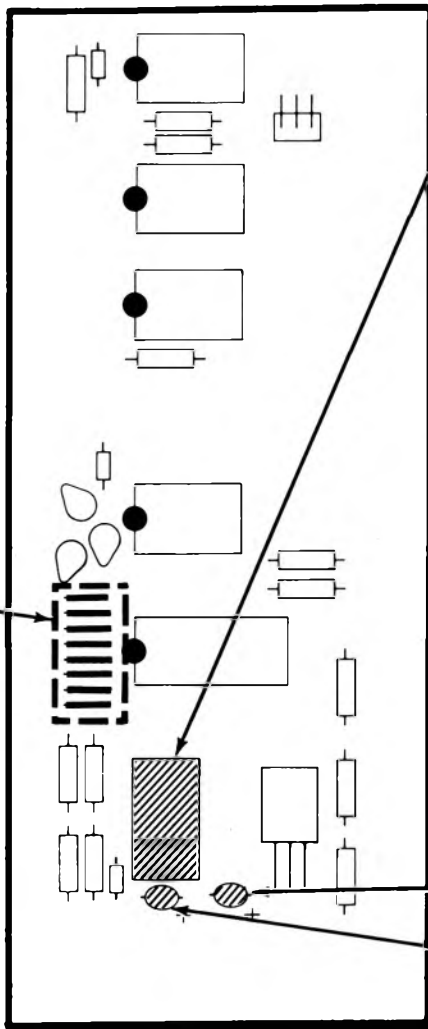
CONTINUE ▽

( ) SW1: 8-section slide switch. Mount the switch so the numbers 0 through 7 are away from integrated circuit U1 as shown. Then solder the lugs to the foil and cut off any excess lug lengths.

NUMBERS

INTEGRATED CIRCUIT U1
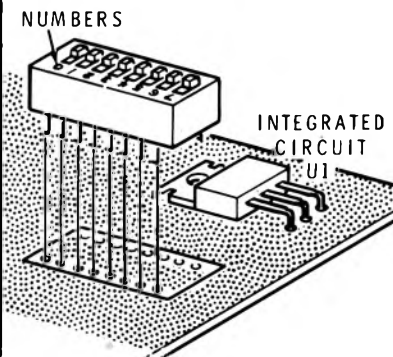
NOTE: When you install a tantalum capacitor, match the positive (+) mark, or color dot on the capacitor with the positive (+) mark on the board.

POSITIVE MARK (+)

COLOR DOT

POSITIVE MARK (+)
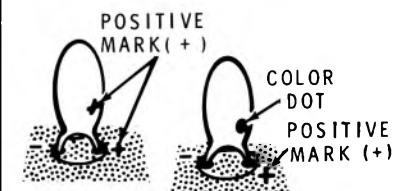
( ) C3: 2.2 μF tantalum.

( ) C4: 2.2 μF tantalum.

( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 1-4

0 ¼ ½ ¾ 1 (INCHES) 2 3 4 5 6 7

1/8 3/8 5/8 7/8

0 5 1 (CM) 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

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START ▼

NOTE: The pin 1 end of inline integrated circuits may be marked in a number of ways; with a notch, triangle, dot, the numeral 1, etc.
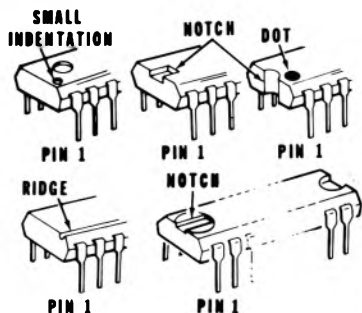
Be sure you install each of the following IC's so its pin 1 end is toward the index mark on the circuit board.

Before you apply downward pressure to the IC, make sure each pin is centered in its proper socket hole. Handle IC's with care as their pins are very easily bent.
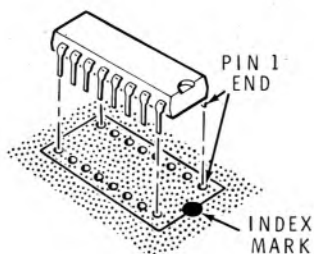
Should it ever become necessary to remove an IC, use a screwdriver and insert it beneath the IC; then gently rock it up and down to lift the IC.
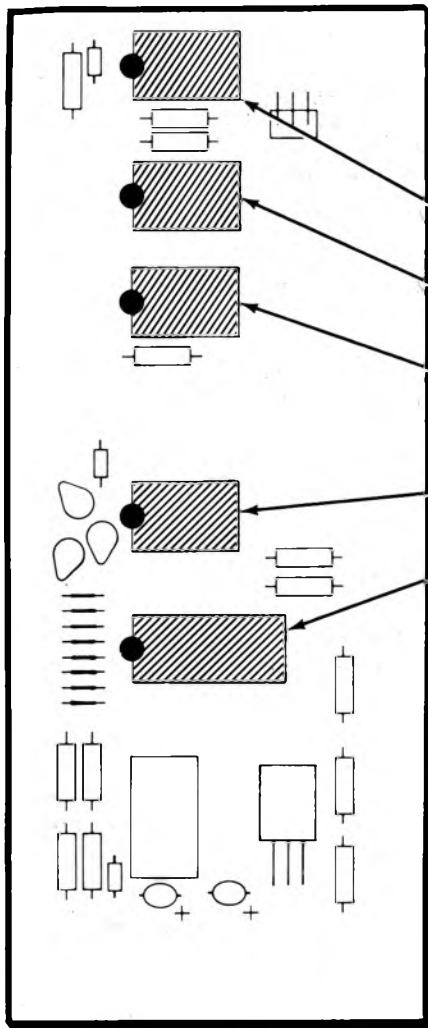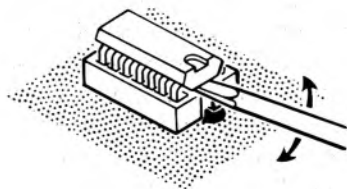
CONTINUE ▽

( ) U6: 7438 integrated circuit (#443-77).

( ) U5: 74LS30 integrated circuit (#443-732).

( ) U4: 74LS04 integrated circuit (#443-755).

( ) U3: 74LS74 integrated circuit (#443-730).

( ) U2: 74LS240 integrated circuit (#443-754).

PICTORIAL 1-5
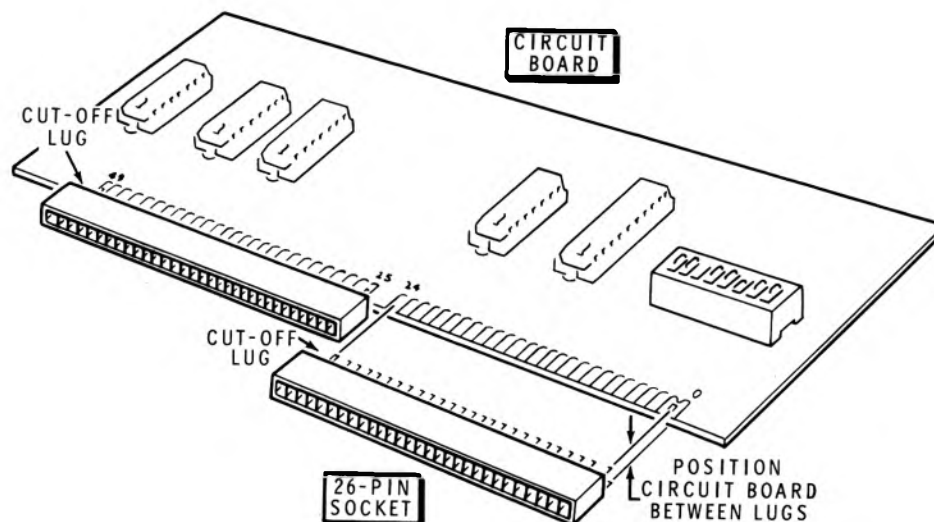
PICTORIAL 1-6

NOTE: You may have been supplied two 6-pin and two 20-pin sockets or two 26-pin sockets. Use the steps that match your sockets.

26-PIN SOCKETS

Refer to Pictorial 1-6 for the following steps.

( ) Locate the two 26-pin sockets. Then refer to Detail 1-6A and cut off the indicated lugs at one end of each socket.
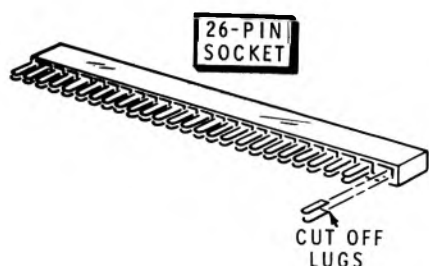
Detail 1-6A

NOTE: Perform the following carefully. The sockets are very difficult to remove once they are installed wrong.

( ) Use the following procedure to install one of the 26-pin sockets on the circuit board:

1. Push the socket onto the edge of the circuit board next to the data jumpers.

2. Make sure the circuit board is between the two lugs at each socket connector. Also make sure each lug lines up with a foil on the circuit board. NOTE: The socket hole where you cut off the lugs must be between foil contacts 24 and 25 as shown.

3. Solder only lugs 0 and 24 to the foil on the component side of the circuit board. The other lugs will be soldered later.

( ) Similarly, install the remaining 26-pin socket on the edge of the circuit board next to the other socket. Make sure the circuit board is between the two lugs at each socket connector. Also, make sure each lug lines up with a foil on the circuit board. NOTE: The socket hole where you cut off the lugs must be between foil contact 49 and the nearby corner of the circuit board. Solder only lugs 25 and 49 to the foil on the component side of the circuit board.

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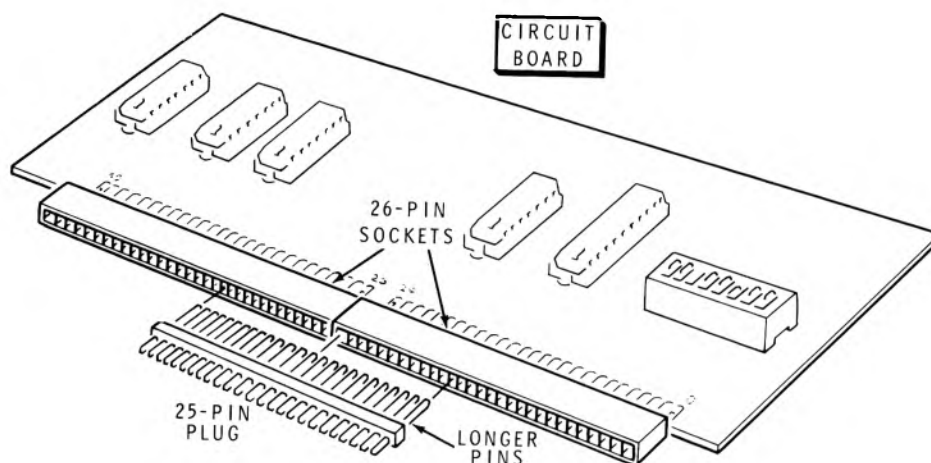
Detail 1-6B

( ) Locate the 25-pin plug. Then refer to Detail 1-6B and push the longer pins of the plug into the two 26-pin sockets so that about half of the plug pins are in each socket.

( ) Check the two sockets to make sure the edges of each socket are parallel to the surfaces of the circuit board.

( ) Adjust the sockets as necessary so they are parallel to the circuit board. Then solder all the socket lugs to the circuit board (both sides).

( ) Remove and discard the 25-pin plug.

PICTORIAL 1-7

6-PIN AND 20-PIN SOCKETS

Refer to Pictorial 1-7 for the following steps.

NOTE: Perform the following steps carefully. The sockets are very difficult to remove once they are installed wrong.

( ) Use the following procedure to install one of the 20-pin sockets on the circuit board:

1. Push the socket onto the edge of the circuit board next to the data jumpers.

2. Make sure the circuit board is between the two lugs at each socket connector. Also make sure each lug lines up with a foil on the circuit board. NOTE: The lugs at one end of the socket must line up with foil contact "0" on the circuit board as shown.

3. Solder only lugs 0 and 19 to the foil on the component side of the circuit board. The other pins will be soldered later.

( ) Locate a 6-pin socket. Then refer to Detail 1-7A and cut off the indicated lugs at one end of the socket.

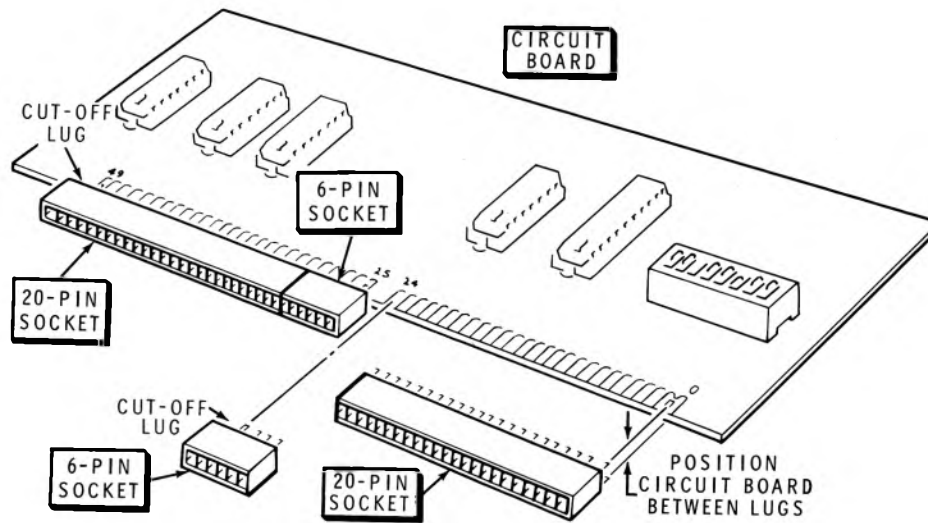( ) Push the prepared 6-pin socket onto the edge of the circuit board next to the 20-pin socket. Make sure the circuit board is between the two lugs at each socket connector. Also make sure each lug lines up with a foil on the circuit board. NOTE: The socket hole where you cut off the lugs must be between foil contacts 24 and 25 as shown. Do not solder any of the lugs yet.

( ) Push the remaining 6-pin socket onto the edge of the circuit board next to the other 6-pin socket. Make sure the circuit board is between the two lugs at each socket connector. Also make sure each lug lines up with a foil on the circuit board (foil contacts 25 through 30).

Detail 1-7A

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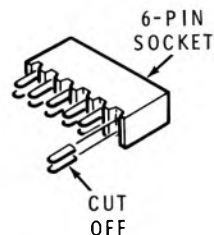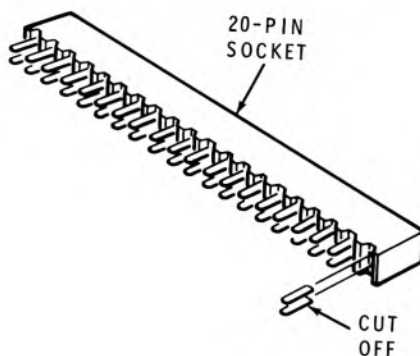
Detail 1-7B

( ) Refer to Detail 1-7B and cut off the indicated lugs at one end of the remaining 20-pin socket.

( ) Push the prepared 20-pin socket onto the edge of the circuit board next to the 6-pin sockets. Make sure the circuit board is between the two lugs at each socket connector. Also make sure each lug lines up with a foil on the circuit board. NOTE: The socket hole where you cut off the lugs must be between foil contact 49 and the nearby corner of the circuit board. Solder only lugs 31 and 49 to the foil on the component side of the circuit board.

( ) Locate the 25-pin plug. Then refer to Detail 1-7C and push the longer pins of the plug into the four sockets as shown.

( ) Check the four sockets to make sure the edges of each socket are parallel to the surfaces of the circuit board.

( ) Adjust the sockets as necessary so they are parallel to the circuit board. Then solder all the socket lugs to the circuit board (both sides).

( ) Remove and discard the 25-pin plug.
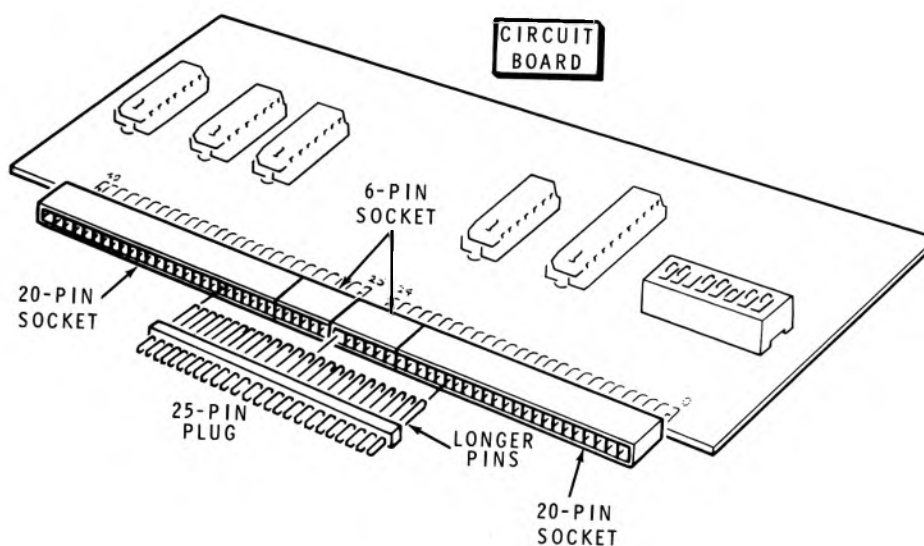
Detail 1-7C
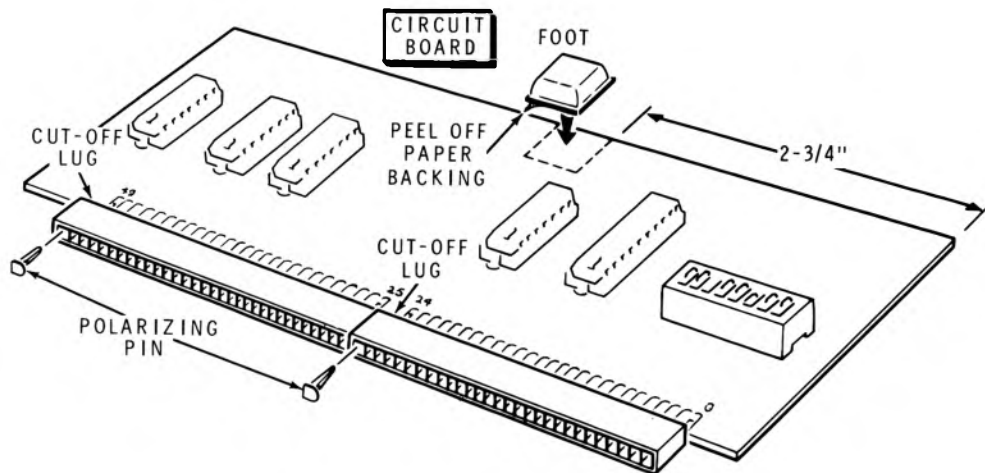
PICTORIAL 1-8

Refer to Pictorial 1-8 for the following steps.

( ) Locate the two polarizing plugs. Then push the plugs into the holes of the 26-pin sockets where you cut off the lugs.

( ) Carefully peel the backing paper from a square foot. Then press the foot onto the component side of the circuit board in the location shown.

( ) Position the circuit board as shown in Pictorial 1-9 with the component side away from you.

( ) Carefully peel the backing paper from the remaining square foot. Then press the foot onto the foil side of the circuit board in the location shown in Pictorial 1-9.
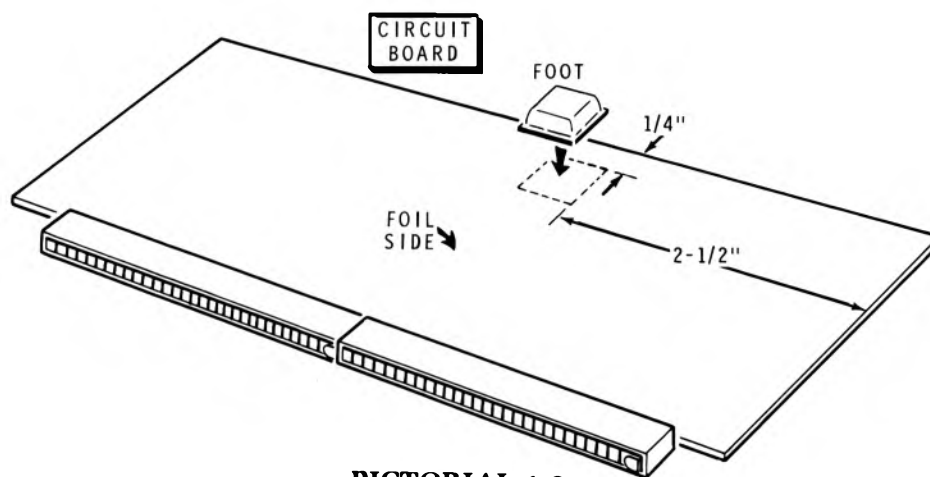
PICTORIAL 1-9

Heathkit®
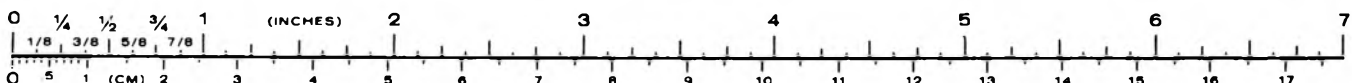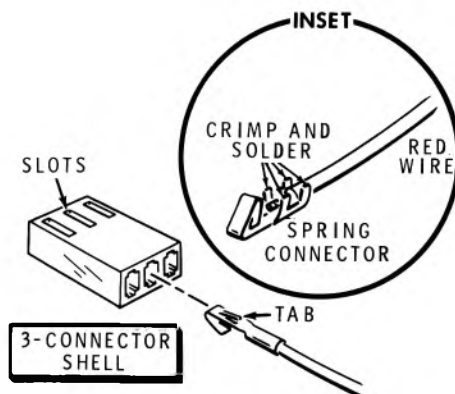
PICTORIAL 1-10

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions:

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

( ) Integrated circuits for the proper type and installation.

( ) Tantalum capacitors for the correct installation.

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

JUMPER WIRE ASSEMBLY

Refer to Pictorial 1-10 for the following steps.

( ) Remove 1/4" of insulation from one end and 1/8" of insulation from the other end of a 12" red wire. Twist the strands at each end of the wire tightly together. Then melt a very small amount of solder on these ends to hold the fine strands together.

( ) Solder a spring connector onto the 1/8" bare end of the prepared red wire as shown.

( ) Insert the spring connector on the red wire into the center hole of a 3-connector shell. Be sure to position the socket with the slotted side up and the spring connector with the small tab up as shown. The connector will lock into place when you have it properly inserted in the shell.

Set the jumper wire assembly aside until it is called for.
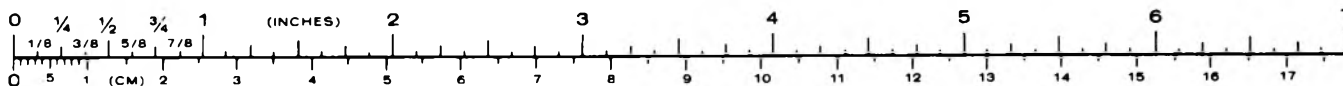
INSTALLATION AND OPERATION
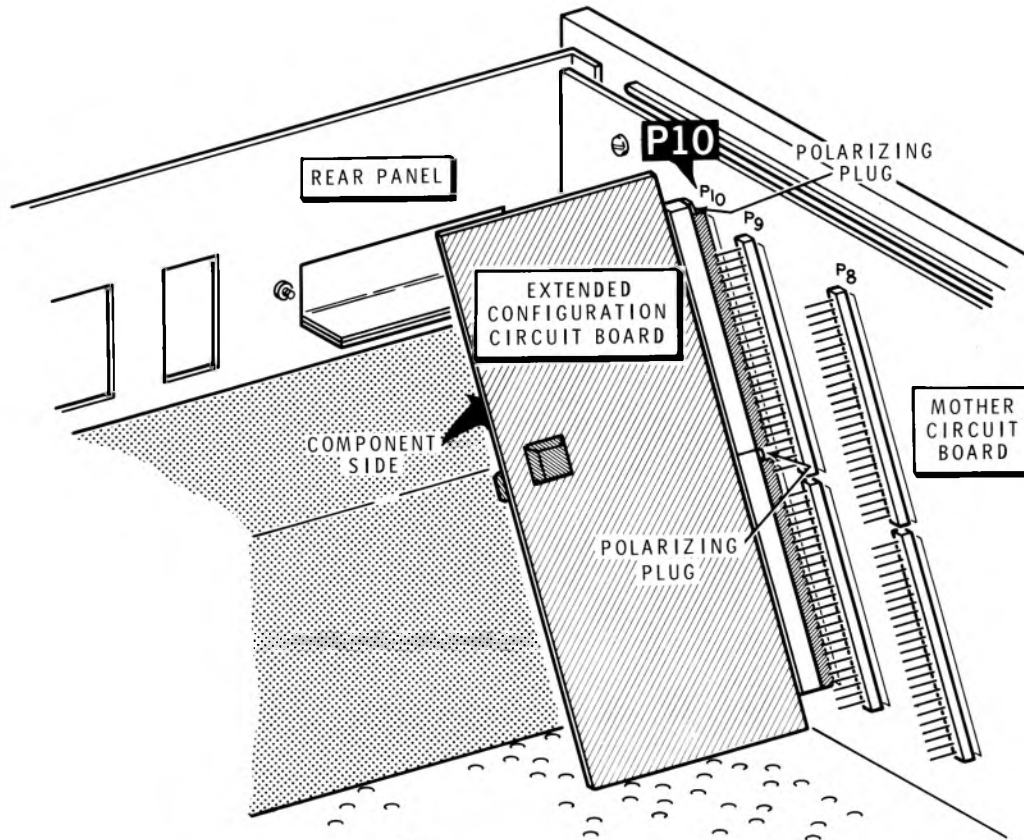
PICTORIAL 2-1

Refer to Pictorial 2-1 for the following steps.

( )   Make sure the POWER switch (on the rear panel of your Computer) is in the OFF position.

( )   Unplug the Computer's line cord.

( )   If this has not already been done, remove the two screws that hold the top cover on the Computer. Then remove the cover.

NOTE: You may wish to set the switches on the Extended Configuration Board before you install it in your Computer. Refer to the information in the "Status Port" section, which follows.

( )   Position the Extended Configuration Board inside the chassis as shown. (NOTE: You must install this circuit board with the components toward the rear panel.) Then carefully push the connectors on this circuit board onto the plugs at P10 on the mother circuit board.

NOTE: The blue and white label shows the Model Number and Production Series Number of your kit. Be sure to refer to these numbers in any communications you have with the Heath Company about your kit. This assures you that you will receive the most complete and up-to-date information in return.

( )   Carefully peel the backing paper from the blue and white label. Then press the label onto the rear panel of the Computer in a clear area.

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INITIAL TESTS

The following tests will check the construction of your Extended Configuration Board for errors. It will also check the mother circuit board in your Computer for solder bridges on some of the bus lines which were not used until now. We strongly recommend that you perform these tests before you continue.

NOTE: To perform the following tests, you should have only the following plug-in circuit boards in your Computer:

CPU circuit board

Extended Configuration Board

One 16 k Memory Board set to 040 (or two 8 k Memory Boards, one set to 8 k and the other set to 16 k).

TEST #1

( ) Turn the Computer on. You should hear a short beep, the display should light, and the front panel pushbuttons should operate normally.

If you obtained the proper results, proceed to "Test #2."

If you did not obtain the proper results, remove the Extended Configuration Board and repeat this test. If you now obtain the proper results, check the Extended Configuration Board for solder bridges or other construction errors.

TEST #2

( ) Check the upper right corner of your CPU circuit board for the presence of a jumper wire between holes X1 and X2. If there is a jumper wire at this location, remove it.

( ) Make sure the Extended Configuration Board is installed. Then turn the Computer on and check the voltage at X1 on the CPU. It should measure 5 volts DC.

If you obtained the proper voltage, proceed to "Test #3."

If you did not obtain the proper results, check the mother circuit board for a solder bridge between bus lines 45 and 46. Also check the installation of integrated circuit U6 on the Extended Configuration Board.

TEST #3

( ) Turn the Computer on. Then enter MEM, 040, 362, and OUT. The voltage at X1 on the CPU should go low (less than .5 volts DC). This voltage should go high upon reset.

If you obtained the proper results, proceed to "Test #4."

If you did not obtain the proper results, check the installation of integrated circuit U6 on the Extended Configuration Board.

TEST #4

( ) Set the eight sections of switch SW1 on the Extended Configuration Board to "0".

( ) Turn the Computer on and enter MEM, 111, 362, and IN. The display should read 000,362.

If you obtained the proper results, proceed to "Test #5."

If you did not obtain the proper results, check the installation of integrated circuit U2 and switch SW1 on the Extended Configuration Board.

TEST #5

( )   Set the eight sections of switch SW1 on the Extended Configuration Board to "1."

( )   Turn the Computer on and enter MEM, 111, 362, and IN. The display should read 377, 362.

If you obtained the proper results, proceed to "Status Port."

If you did not obtain the proper results, check the installation of integrated circuits U2, U4, U5, and U6 and switch SW1 on the Extended Configuration Board.

NOTE: The following sections describe the three functions available with the Extended Configuration Board and some modifications that you must make to other circuit boards in your H8. Read all of the information before you actually perform any of the modifications. Decide which functions you wish to use. Then make the necessary modifications for those functions.

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STATUS PORT

The status port is interrogated by version 2.0 (or later) HDOS as well as by Heath CP/M. This can be used to determine the system configuration upon bootup without requiring any user interaction. Some user programs may also interrogate the status port.

Refer to Pictorial 2-2 for the following steps.

NOTE: The sections of switch SW1 are grouped as shown by the letters on the Pictorial. These groups are defined as follows:
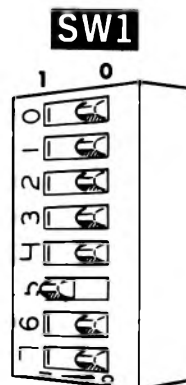
PICTORIAL 2-2

SWITCH	SETTING	DESCRIPTION
1,0	00*	Port 174(7CH)/177Q(7FH) has an H17 type disk (normal)
	01	Port 174/177Q has an H47 type disk
	10	Undefined
	11	Undefined
3,2	00**	Port 170(78H)/173Q(7BH) is not in use (normal without H47)
	01	Port 170/173Q has an H47 (normal with H47)
	10	Undefined
	11	Undefined
4	0	Boots from device at port 174/177Q (H17, normal)
	1	Boots from device at port 170/173Q (H47)
5	0	Performs memory test upon boot up (not currently supported)
	1	Does not perform memory test (normal)
6	0	Sets Console to 9600 baud (normal)
	1	Sets Console to 19,200 baud (not currently supported)
7	0	Normal boot (normal)
	1	Auto boot on power up or reset (not recommended)

NOTE: Press either the GO key or the 1 key on the Computer's front panel to boot from the drive indicated by the setting of switch section 4 (the primary boot device). Press the 2 key to boot from the device that is not selected by switch section 4 (the secondary boot device).

*Right column is switch 0.

**Right column is switch 2.

ROM DISABLE (ORG 0)

The ROM disable function is normally used with the CP/M operating system. Since the system RAM must be a continuous block originating at zero instead of 8k, your first RAM circuit board will be addressed at 000 instead of 040.

You can also use this function with Microsoft Basic under HDOS, since the unused memory area between PAM-8 and the H17 ROM/RAM is an excellent location for user functions. You must take care in this application, however, not to overwrite the PAM-8 or H17 ROM/RAM areas. This is due to the fact that these areas now exist in read/write RAM, rather than ROM and write-protected RAM. You can also use up to 64 k of memory with this configuration.

NOTE: If you have less than 64 k of memory, you can use HDOS Version 1.6. For 64 k of memory, you must use HDOS Version 2.0.

This function pulls the ROM disable line on the bus (pin 46) low when a write is performed at I/O address 362Q (0F2H) and it sets data bit D5 to a logic 1. This, in turn, disables the ROM on the CPU circuit board and allows you to address the RAM between 0 and 8 k in the memory space.

To use the ROM disable function, make the following modifications to the circuit boards in your H8 computer.

( ) Remove the tie bracket from your Computer.

( ) Carefully unplug the H17 controller circuit board from your Computer.

( ) Check the controller circuit board to see if there is an IC U28 (in the upper left corner of the board). If there is, disregard the following information and proceed to Page 25: If there is no IC at this location, perform the following three steps.

1. ( ) Refer to Pictorial 2-3 below and carefully remove IC U22 from the circuit board.

2. ( ) Refer to Detail 2-3A, position the IC as shown, then bend pins 2 and 13 up so they will not make contact when the IC is reinstalled.

3. ( ) Reinstall the IC at U22. Make sure you position the pin 1 end toward the index mark on the circuit board.

PICTORIAL 2-3

Detail 2-3A

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PICTORIAL 2-4

Refer to Pictorial 2-4 for the following steps.

NOTE: Be careful not to damage any circuit board foils when you perform the following steps. Follow the directions on the package of desoldering braid supplied with this kit to unsolder leads or wires.

( ) Refer to the inset drawing and carefully unsolder or cut the leads of capacitor C15 (47 pF mica). This capacitor will no longer be used.

( ) Refer again to the inset drawing and carefully unsolder or cut the leads of resistor R6 (68 Ω, blu-gry-blk). This resistor will no longer be used.

( ) Cut a 3/4" length of bare wire. Then solder this bare wire to the foils where the capacitor you removed was connected.

( ) Carefully reinstall the controller circuit board in your Computer.

( ) Carefully unplug the CPU circuit board from your Computer.
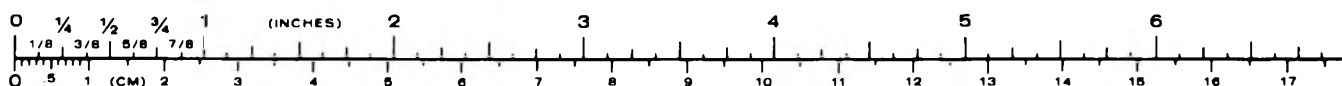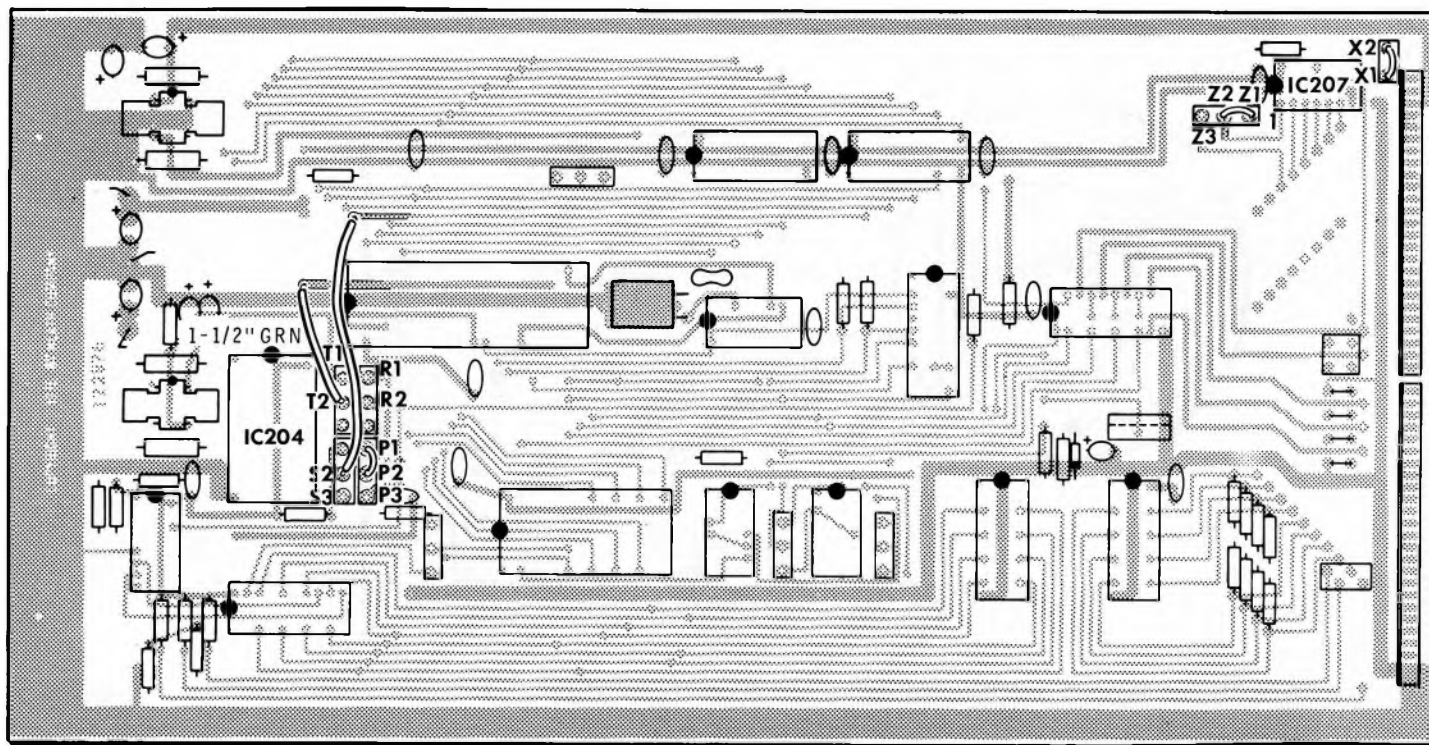
PICTORIAL 2-5

Refer to Pictorial 2-5 for the following steps.

Carefully unsolder or cut the following jumper wires:

( )   Wire between holes T1 and T2.

( )   Wire between holes R1 and R2.

( )   Wire between holes S2 and S3.

( )   Wire between holes P2 and P3.

( )   Wire between holes Z2 and Z3.

( )   Cut three 3/4" bare wires. Use these wires in the next three steps.

( )   Solder a 3/4" bare wire from hole P1 to hole P2.

( )   Solder a 3/4" bare wire from hole Z1 to hole Z2.

( )   Solder a 3/4" bare wire from hole X1 to hole X2.

( )   Cut the following lengths of green wire. Then remove 1/4" of insulation from the ends of each wire.

   1-1/2"
   2-3/4"

( )   Connect and solder one end of the 1-1/2" green wire to hole T2. Connect and solder the other end of the wire to the indicated circuit board foil. NOTE: Be sure to scrape the solder resist away from this hole on the foil side of the circuit board to insure a good solder connection.

( )   Connect and solder one end of the 2-3/4" green wire to hole S2. Connect and solder the other end of the wire to the indicated circuit board foil. NOTE: Be sure to scrape the solder resist away from this hole on the foil side of the circuit board to insure a good solder connection.
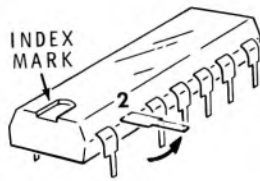
Detail 2-5A

( ) Carefully unplug integrated circuit IC207 from its socket. Then modify this integrated circuit as follows:

   1. Refer to Detail 2-5A and note how the pins are numbered.

   2. Carefully bend lug 2 of the integrated circuit out as shown so it cannot make contact with the socket when you reinstall it in the next step.

( ) Refer to Detail 2-5B and reinstall integrated circuit IC207 in its socket. Be sure to position the integrated circuit so pin 1 is at the correct location.

( ) Carefully unplug IC204 from your CPU circuit board.
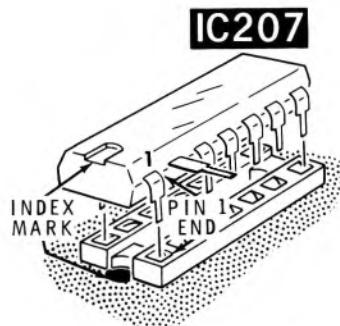
Detail 2-5B

NOTE: The integrated circuit that you will install in the next step is a rugged and reliable component. However, normal static electricity discharged from your body through an integrated circuit pin to an object can damage the integrated circuit. Read the entire instruction first. Then carefully do each step without interruption.

( ) IC204: Install a ROM IC (444-70) at IC204 in your CPU circuit board as follows:

   1. Remove the IC from the conductive foam.

   2. Hold the IC in one hand and straighten any bent pins with the other hand.

   3. Continue holding the IC, being careful not to touch it to anything while you touch the circuit board with your other hand.

   4. Install the IC in its socket. Be sure to install this IC so its pin 1 end is toward the index mark on the circuit board. See Detail 2-5C.
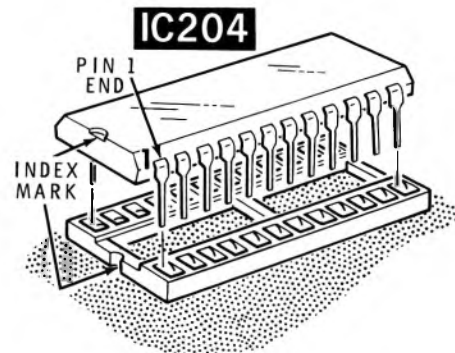
Detail 2-5C

( ) Carefully reinstall the CPU circuit board in your Computer. Be sure to reconnect the 5-pin socket coming from the front circuit board in your Computer.

NOTE: Make sure to reconfigure your memory circuit boards so the memory starts at 0 k instead of 8 k. (To set the Model WH8-16 16 k Memory Board to start at 0 k, push the four ORG ADDR switches to OFF and the ENABLE switch to ON.)

( ) Reinstall the tie bracket and top cover on your Computer.

SIDE SELECT

The side select function allows you to use double-sided disk drives with your Computer. NOTE: Heath systems software does not support double-sided drives at this time. This feature is only provided for advanced users who wish to implement non-standard configurations on their own.

This function pulls pin 32 of your H-17 controller circuit board low (logic 0) whenever a write is performed at I/O address 362Q (0F2H) and data bit D6 is set to a logic 1. This, in turn, selects side 1 of your disk instead of side 0.

CAUTION: Since the side select function and the ROM disable use the same port, be careful to preserve memory status whenever you perform a side select.

You can configure your Computer to use the side select function in two ways. "Method #1" (preferred) allows you to use an unused bus line, while "Method #2" requires a connection to the H-17 controller circuit board. Perform the steps under only one of the following headings.

Method #1

( ) Position the Extended Configuration Board as shown in Pictorial 2-6. Then solder a 1" bare wire between holes AC in the circuit board and cut off any excess lead lengths.

1" BARE WIRE
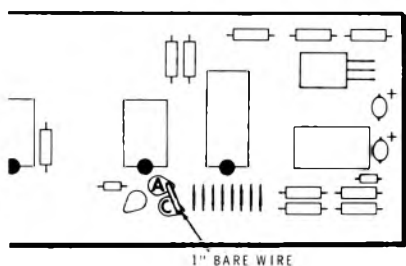
PICTORIAL 2-6

( ) Remove the tie bracket from your Computer.

( ) Carefully unplug the CPU circuit board from your Computer.

( ) Refer to Pictorial 2-7 and carefully unsolder or cut the indicated jumper wire from the CPU circuit board.

CPU CIRCUIT BOARD

UNSOLDER OR CUT JUMPER WIRE
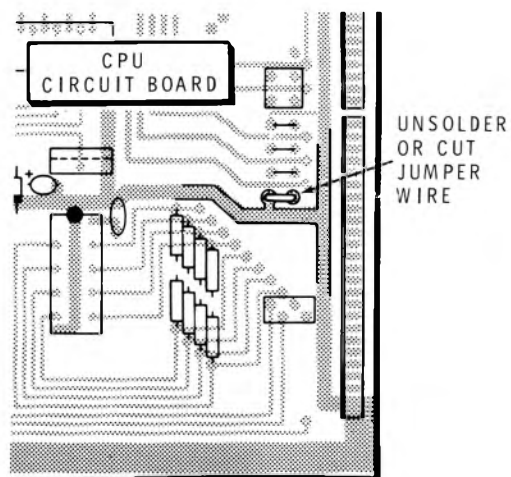
PICTORIAL 2-7

( ) Carefully reinstall the CPU circuit board in your Computer. Be sure to reconnect the 5-pin socket from the front circuit board in your Computer.

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FOIL
SIDE

PIN 32

S103

3-1/2"
GREEN WIRE

PIN 18

CONTROLLER
CIRCUIT BOARD
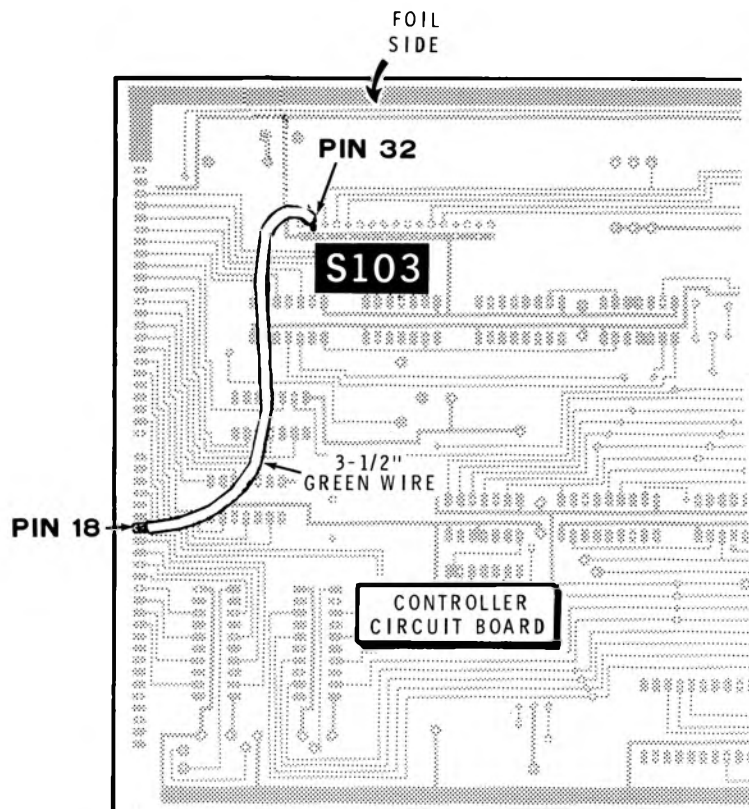
PICTORIAL 2-8

NOTE: If you are using any non-Heath circuit boards in your Computer, be sure to check these boards to make sure bus line 18 is not connected to anything.

( ) Carefully unplug the H17 controller circuit board from your Computer.

( ) Cut a 3-1/2" green wire. Then remove 1/4" of insulation from each end.

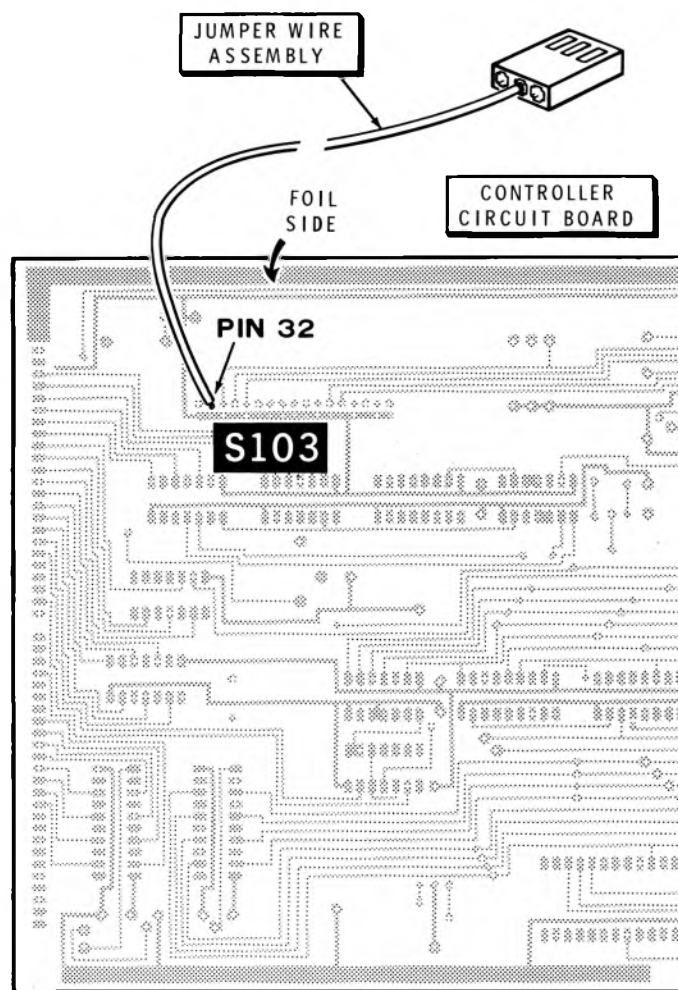( ) Position the controller circuit board as shown in Pictorial 2-8. Then solder one end of the 3-1/2" green wire to the foil at pin 32 of socket S103 on your controller circuit board. Connect the other end of the wire to the foil at pin 18 of socket S102 on your controller circuit board.

( ) Reinstall the tie bracket and top cover on your Computer.

Method #2

( ) Remove the tie bracket from your Computer.

( ) Carefully unplug the H17 controller circuit board from your Computer.

PICTORIAL 2-9

Refer to Pictorial 2-9 for the following steps.

( ) Position the controller circuit board as shown in the Pictorial.

( ) Locate the jumper wire assembly you assembled earlier. Then solder the free end of this jumper wire to the foil at pin 32 of socket S103 on your controller circuit board.

( ) Carefully reinstall the controller circuit board in your Computer.

( ) Push the connector on the free end of the jumper wire assembly onto plug P1 on your Extended Configuration Board. NOTE: This connector may be installed either way on the plug (only the center pin is used).

( ) Reinstall the tie bracket and top cover on your Computer.

MODIFICATION TESTS

The following test will check the modifications that you made on your CPU circuit board. To make these tests, you should have only the following plug-in circuit boards in your Computer:

The modified CPU circuit board.

One 16 k Memory Card set to 040 (or one 8 k Memory board, one set to 8 k).

( ) Turn the Computer on. You should hear a short beep and the display should read 137 377 SP with a 16 k Memory Card installed, or 077 377 SP with an 8 k Memory Card installed.

( ) Press the "2" key. The display should momentarily display "boot Err."

If you did not obtain the proper results, check the modifications you made to your CPU circuit board.

CIRCUIT DESCRIPTION

Refer to the Schematic (fold-in) while you read the following "Circuit Description." The following paragraphs are grouped according to the various circuits on the circuit board.

ADDRESS DECODER

Integrated circuits U4 and U5 form the address decoder which decodes I/O address 362Q from the address bus. Whenever octal address 362Q appears on the bus, the output of inverting buffer U4D (pin 8) goes to a logic 1. NAND gates U6A and U6B AND this 362Q address signal with the IOR (read) and IOW (write) signals to generate the read and write signals that are exclusive to I/O address 362Q.

STATUS PORT

An octal tri-state buffer and an 8-section slide switch form the status port. The data bus reads the switch information from port 362Q when buffer U2 is enabled. Address decoder U6A enables this buffer via pins 1 and 19.

ROM DISABLE

Latch U3A and buffer U6D generate the ROM DISABLE signal. If data bit D5 is low and a write is performed at I/O address 362Q, the write signal (362IOW) from U6B clocks the data bit into U3A and causes its $\overline{Q}$ output to go high (logic 1). This causes the output of U6D to go low and asserts the ROM DISABLE signal on the bus.

SIDE SELECT

Latch U3B and buffer U6C generate the SIDE SELECT signal. If data bit D6 is low and a write is performed at I/O address 362Q, the write signal (362IOW) from U6B clocks the data bit into U3B and causes its $\overline{Q}$ output to go high (logic 1). This causes the output of U6C to go low and asserts the SIDE SELECT signal at plug P1 pin 2 and at circuit board hole A.

VOLTAGE REGULATOR

Integrated circuit U1 is a conventional 3-terminal voltage regulator which converts the unregulated 8-volts DC available on the Computer's bus to a regulated 5-volts DC. This regulated voltage operates all of the integrated circuits on the Extended Configuration Board.

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 board number (R5, C3, etc.) on the X-Ray View.

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.
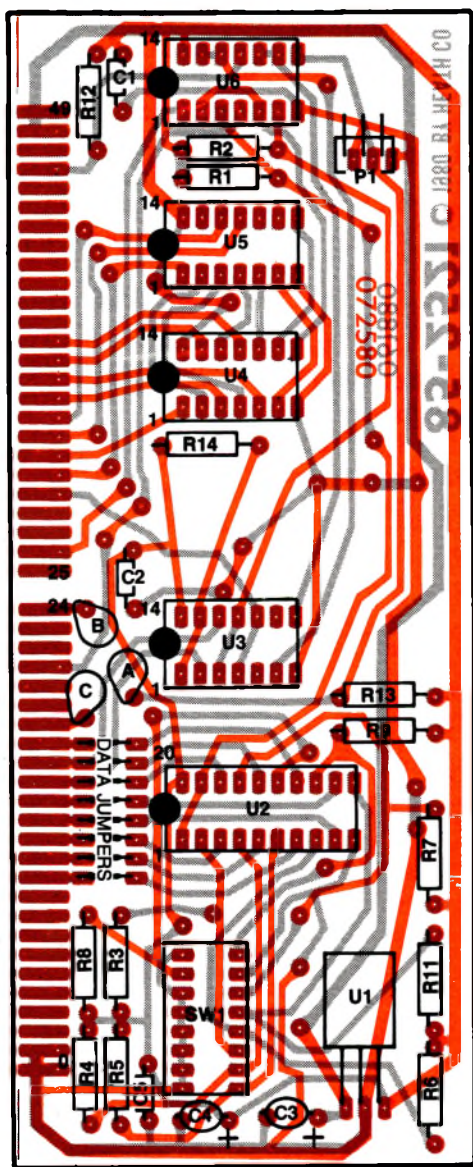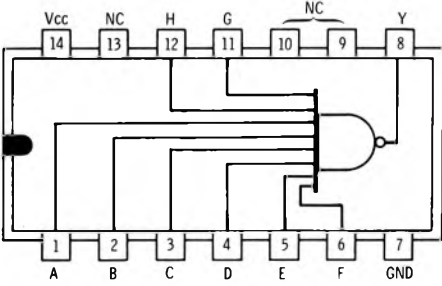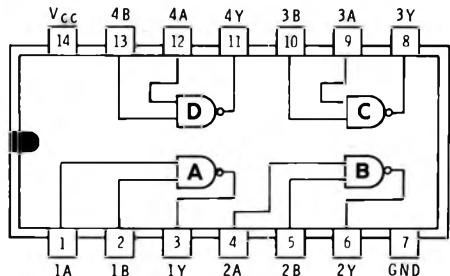
(Shown from the component side. The foil on the component side is shown in red.)

Heathkit®

INTEGRATED CIRCUIT IDENTIFICATION

CIRCUIT COMPONENT NUMBER	HEATH PART	MAYBE REPLACED (TOP VIEW)	DESCRIPTION	LEAD CONFIGURATION
U1	442-54	7805	5-volt regulator	
U2	443-754	74LS240	Tri-state inverting buffer	
U3	443-730	74LS74	Dual flip-flop	
U4	443-755	74LS04	Hex inverter	

Integrated Circuits (cont'd.)

CIRCUIT COMPONENT NUMBER	HEATH PART	MAY BE REPLACED (TOP VIEW)	DESCRIPTION	LEAD CONFIGURATION
U5	443-732	74LS30	8-input NAND gate	
U6	443-77	7438	Quad 2-input NAND gate	

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

Schlumberger