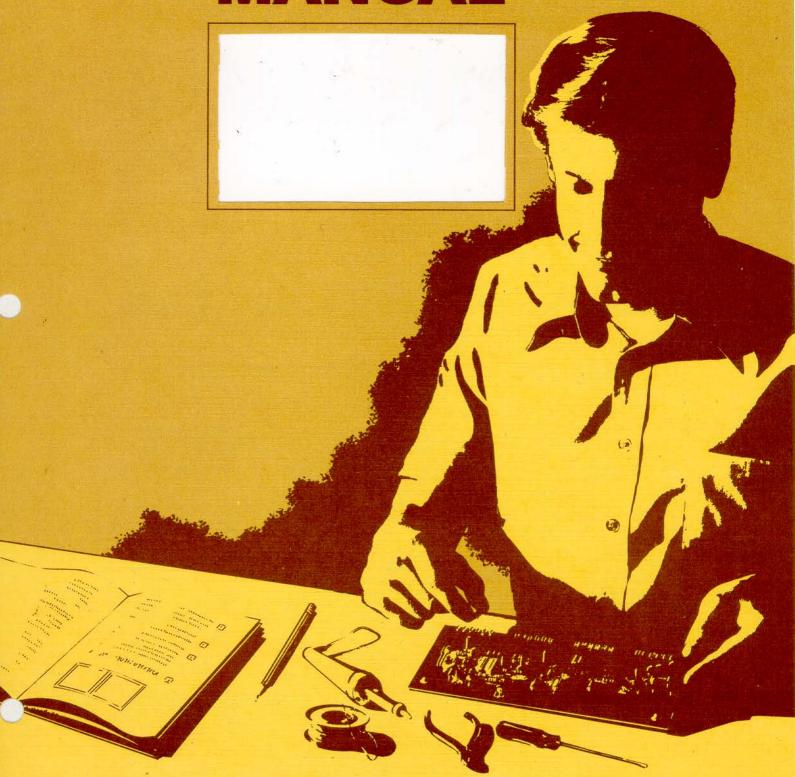
HEATHKIT' MANUAL



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) 9	82-3411
Credit(616) 9	
Replacement Parts	82-3571
Technical Assistance Phone Numbers	
8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekday	s Only
R/C, Audio, and Electronic Organs(616) 9	82-3310
Amateur Radio(616) 9	82-3296
Test Equipment, Weather Instruments and	
Home Clocks	82-3315
Television	82-3307
Aircraft, Marine, Security, Scanners, Automotive,	
Appliances and General Products	82-3496
Computers	82-3309



YOUR HEATHKIT 90-DAY FULL WARRANTY

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

Our attorney, who happens to be quite a kitbuilder himself, insists that we describe our warranty using all the necessary legal phrases in order to comply with the new warranty regulations. Fine. Here they are:

For a period of ninety (90) days after purchase, Heath Company will replace or repair free of charge any parts that are defective either in materials or workmanship. You can obtain parts directly from Heath Company by writing us at the address below or by telephoning us at (616) 982-3571. And we'll pay shipping charges to get those parts to you — anywhere in the world.

We warrant that during the first ninety (90) days after purchase, our products, when correctly assembled, calibrated, adjusted and used in accordance with our printed instructions, will meet published specifications.

If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center (units of Schlumberger Products Corporation), or any of our authorized overseas distributors.

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.

Our warranty does not cover and we are not responsible for damage caused by the use of corrosive solder, defective tools, incorrect assembly, misuse, fire, or by unauthorized modifications to or uses of our products for purposes other than as advertised. Our warranty does not include reimbursement for customer assembly or set-up time.

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. We are not responsible for incidental or consequential damages. 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. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HEATH COMPANY BENTON HARBOR, MI. 49022

Heathkit® Manual

for the

MEMORY EXPANSION MODULE

Model H11-1

595-2009



TABLE OF CONTENTS

Introduction
Assembly Notes
Parts List
Step-by-Step Assembly
Configuring the Memory Expansion Module
Module Installation
Specifications
Circuit Description
Circuit Board X-Ray View
Integrated Circuit Identification Chart
Schematic Fold-in

INTRODUCTION

The H11-1 Memory Expansion Module uses the latest in static memories. These memories are organized as 1024 words by 4 bits wide. As such, a complete 4096 word by 16 bits wide memory bank is contained on a circuit board only 8-3/4" high by 5-1/4" wide. A single

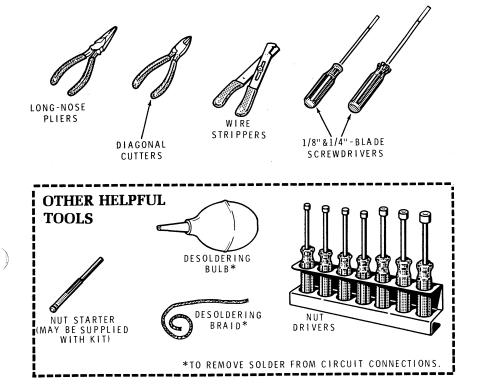
jumper wire locates the operation of the memory circuit board in any one of eight available 4096 word increments throughout the memory area. This Module is completely compatible with the H11 Digital Computer backplane as well as all LSI-11 backplanes.

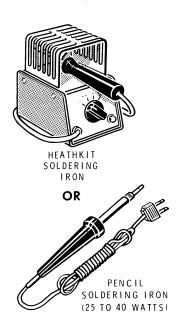


ASSEMBLY NOTES

TOOLS

You will need these tools to assemble your kit.





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 excess 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.

TOLERANCE

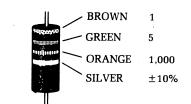
Gold 5% Silver 10%



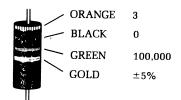
PARTS

Resistors will be called out by their resistance value in Ω (ohms), $k\Omega$ (kilohms), or $M\Omega$ (megohms). Certain types of resistors will have the value printed on the body, while others will be identified by a color code. The colors of the bands and the value will be given in the steps, therefore the following color code is given for information only.

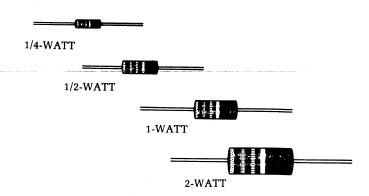
EXAMPLES:

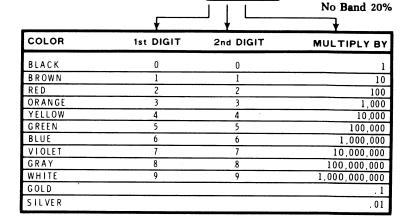


15 \times 1,000 = 15,000 Ω (15,000 OHMS), or "15 $k\Omega$ "



30 \times 100,000 = 3,000,000 Ω (or 3 M Ω) 3 M Ω = 3 MEGOHMS





Capacitors will be called out by their capacitance value in μ F (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

EXAMPLES:

RESISTOR COLOR CODE

$$151K = 15 \times 10 = 150 \text{ pF}$$

 $759 = 75 \times 0.1 = 7.5 \text{ pF}$

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

MULTIPLI	ER	TOLERANC	E OF CAPACI	TOR
FOR THE NUMBER:	MULTIPLY BY:	10pF OR LESS	LETTER	OVER 10pF
0	1	±0.1pF	В	
1	10	±0.25pF	С	
2	100	±0.5pF	D	
3	1000	±1.0pF	F	±1%
4	10,000	±2.0pF	G	± 2 %
5	100,000		Н	±3%
			J	± 5%
8	0.01		K	±10%
9	0.1		М	±20%

columns.

^{*}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.

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, see "Replacement Parts" inside the rear cover of your Digital Computer Assembly Manual. For prices, refer to the separate "Heath Parts Price List."

KEY	HEATH
No.	Part No.

QTY. DESCRIPTION

CIRCUIT Comp. No.

RESISTORS — CAPACITORS

NOTE: The following resistors are 1/4-watt and have a tolerance of 5% (gold fourth band).

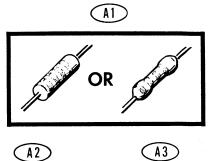
1-62-12	1	220 Ω (red-red-brown) resistor	R4
1-65-12	3	470 Ω (yellow-violet- brown) resistor	R1, R2, R3
21-150	8	820 pF ceramic capacitor	C8, C9, C11, C12, C13, C14, C15, C16
21-25	1	.0013 μ F (1300 pF) ceramic capacitor	C1
25-221	6	2.2 μF tantalum capacitor	C2, C3, C4, C5, C6, C7
	1-65-12 21-150 21-25	1-65-12 3 21-150 8 21-25 1	brown) resistor 1-65-12 3 470 Ω (yellow-violet-brown) resistor 21-150 8 820 pF ceramic capacitor 21-25 1 .0013 μ F (1300 pF) ceramic capacitor 25-221 6 2.2 μ F tantalum

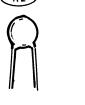
HARDWARE

B1	250-52	4	4-40 × 1/4" screw
B2	252-2	4	4-40 nut
B2	254-0	1	#4 lockwasher

SOCKETS

C1	434-298	3	14-pin IC socket
C2	434-299	2	16-pin IC socket
СЗ	434-310	16	18-pin IC socket
C4	434-311	7	20-pin IC socket

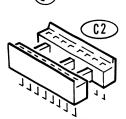


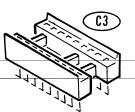


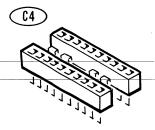














KEY HEATH No. Part No. QTY. DESCRIPTION

CIRCUIT Comp. No.

INTEGRATED CIRCUITS (IC's)

IMPORTANT

If any components are missing from the sealed IC package, return the unopened package for replacement. Claims for missing IC's will not be honored if the package has been opened.

If you locate damaged or defective IC's, order individual replacements. Be sure to follow the standard instruction on the "Parts Order Form" and on the inside rear cover of the Manual. Save defective or damaged components for return instructions.

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 vary.)
- 3. Part number and type number.
- 4. Part number with a type number other than the one listed.

D1	443-77	1	7438 IC	IC10
D2	443-852	1	74LS259 (or 9LS259) IC	IC9
D1	443-728	1	74LS00 IC	IC6
D1	443-780	1	74LS08 IC	IC11
D2	443-782	1	74LS155 IC	IC12
D3	443-754	3	74 <u>LS</u> 240 IC	IC1, IC3,
				IC5
D3	443-805	2	74LS273 IC	IC7, IC8
D3	443-753	2	74 <u>S</u> 240 IC	IC2, IC4

CAUTION: The #434-764 IC's can be damaged by static electricity. Do not remove these IC's from the conductive foam $% \left\{ 1,2,\ldots ,n\right\}$ until you are instructed to do so in a step.

D4 443-764

16 2114L IC

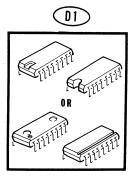
IC13-IC28

MISCELLANEOUS

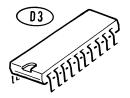
	85-2032-1	1	Memory circuit board
E1	266-949	2	Circuit board puller
E2	390-1399	1	Memory label
E3	391-34	1	Blue and white label
	490-185	1	Soder Wick*
			(desoldering braid)
E4	490-189	1	IC puller
	597-260	_1_	Parts Order Form
		1	Assembly Manual (See Pag

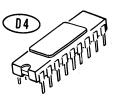
1 for part number.)

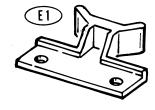
Solder



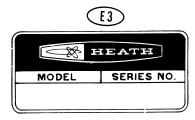


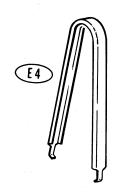












^{*}Registered Trademark, Solder Removal Company

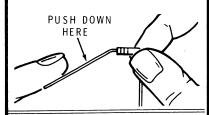


STEP-BY-STEP ASSEMBLY

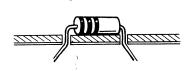
START -

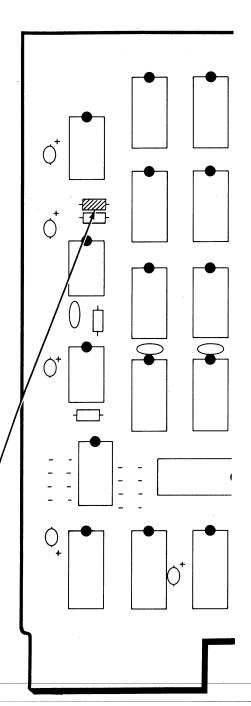
In the following steps, you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on a circuit board.

- () Position the circuit board as shown with the printed side up.
- () R2: Hold a 470 Ω (yellow-violetbrown) resistor by the body as shown and bend the leads straight down.



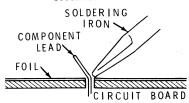
-) Push the leads through the holes at the indicated location on the circuit board. The end with color bands may be positioned either way.
- Press the resistor against the circuit board. Then bend the leads outward slightly to hold the resistor in place.



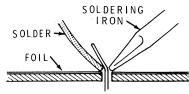


CONTINUE

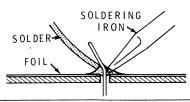
-) Solder the resistor leads to the circuit board as follows:
 - Push the soldering iron tip against both the lead and the circuit board foil. Heat both for two or three seconds.



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



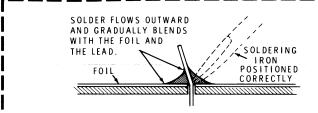
 As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.



- Cut off the excess lead lengths close to the connection. WARN-ING: 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.

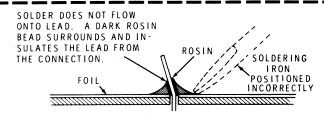


A GOOD SOLDER CONNECTION

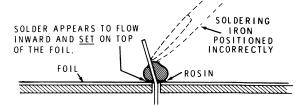


When you heat the lead and the circuit board foil at the same time, the solder will flow evenly onto the lead and the foil. The solder will make a good electrical connection between the lead and the foil.

POOR SOLDER CONNECTIONS



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.

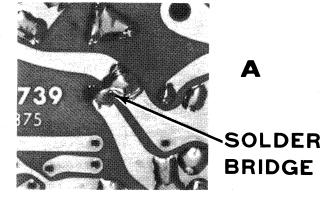


When the foil is not heated sufficiently the solder will blob on the circuit board as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

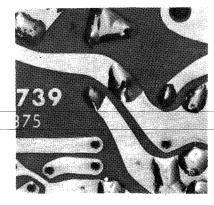
SOLDER BRIDGES

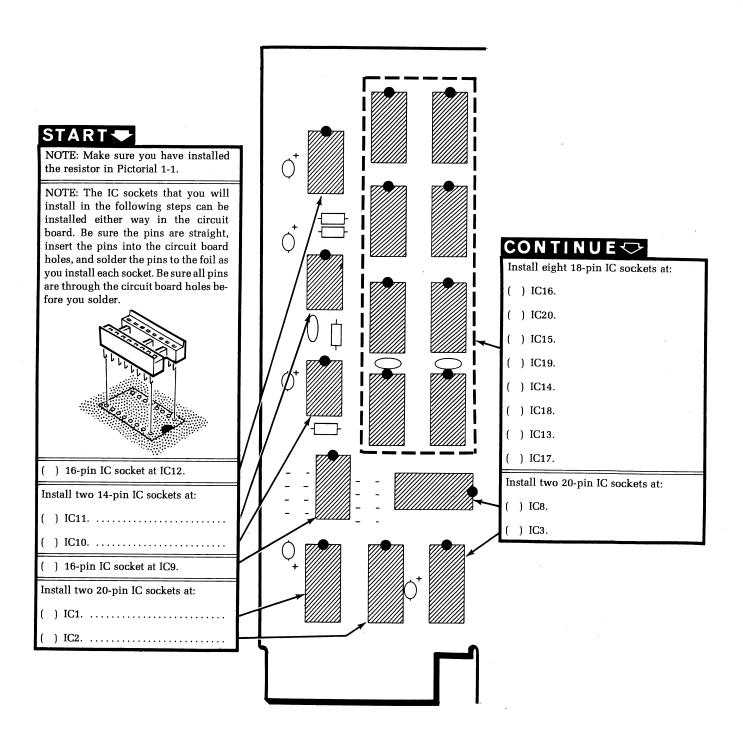
A solder bridge between two adjacent foils is shown in photograph A. Photograph B shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils 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.

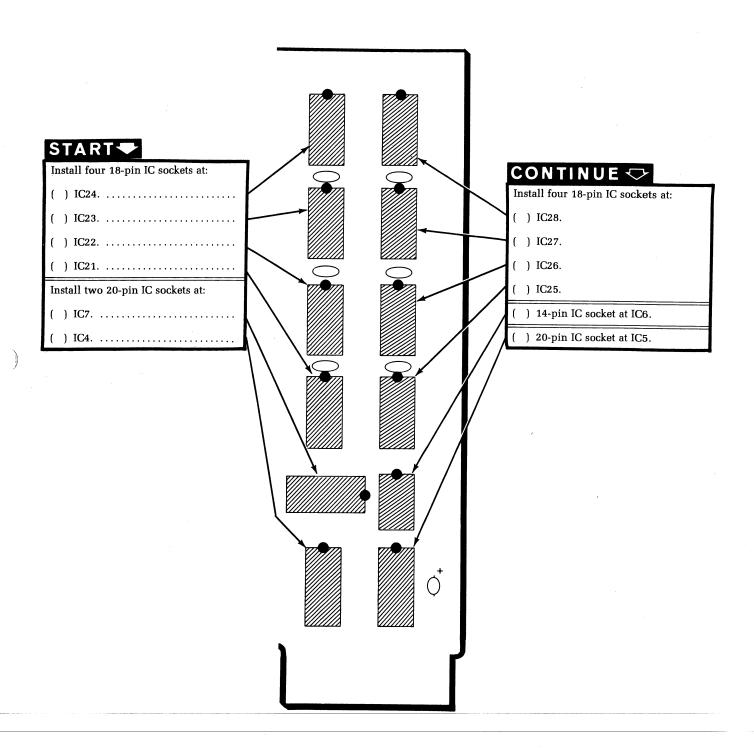
Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, turn the circuit board foil-side-down and heat the solder between connections. The excess solder will run onto the tip of the soldering iron, and this will 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.



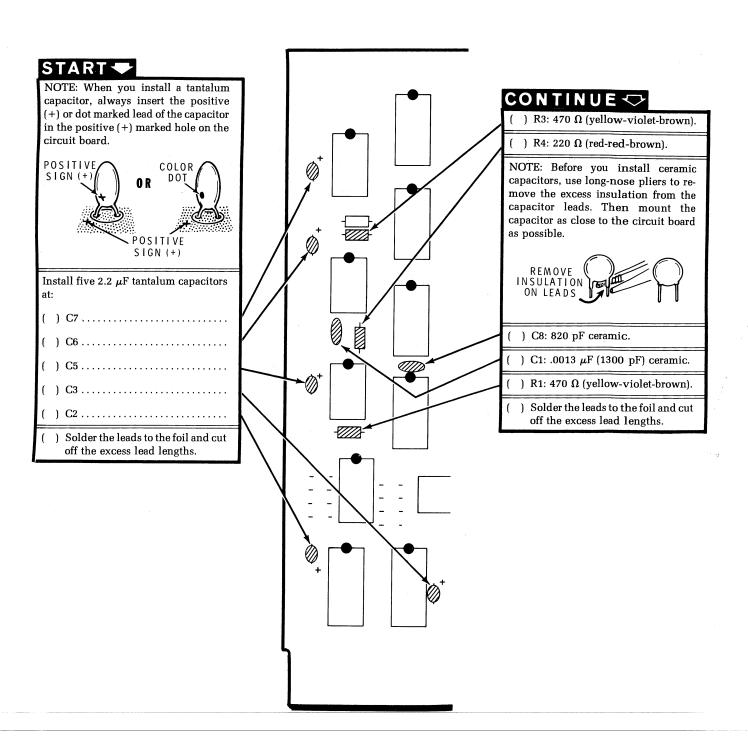
В

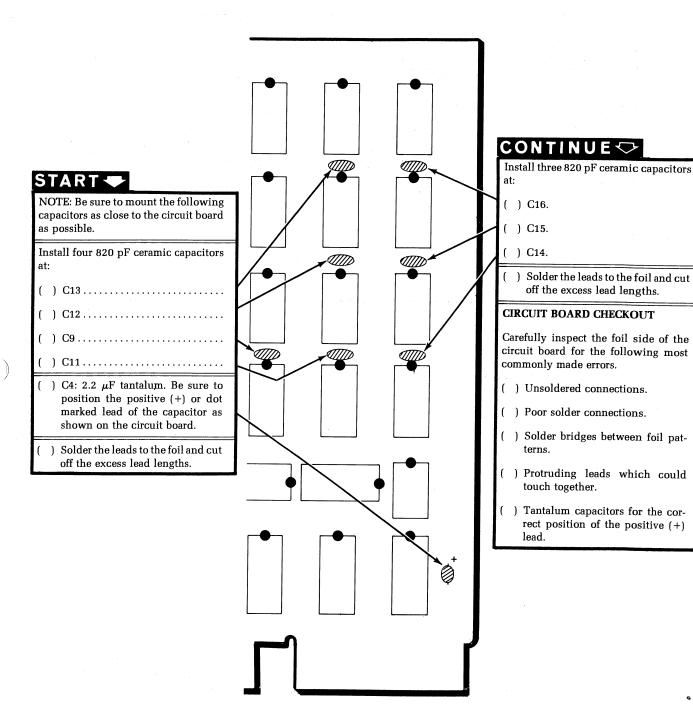


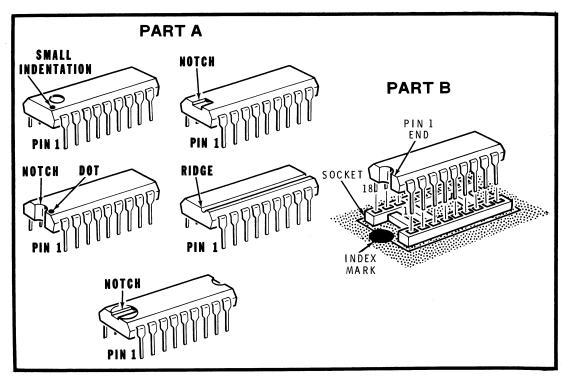




PICTORIAL 1-3







Detail 1-6A

Refer to Pictorial 1-6 (Illustration Booklet, Page 1).

NOTES:

- Refer to Detail 1-6A and, as you install each IC in the following steps, position the pin 1 end of each IC (as shown in Part A of the Detail) toward the index mark on the circuit board (see Part B). Then insert the leads into the socket and push the IC down into place.
- 2. If it ever becomes necessary to remove an IC from its socket, use the IC puller. Refer to inset drawing on the Pictorial and insert the hooks in the end of the puller beneath the IC; then gently rock the tool back and forth to lift the IC.

Install IC's as follows:

- () IC6: 74LS00 IC (#443-728).

 () IC5: 74LS240 IC (#443-754).

 () IC7: 74LS273 IC (#443-805).
- () IC3: 74LS240 IC (#443-754).
 () IC2: 74S240 IC (#443-753).
 () IC12: 74LS155 IC (#443-782).
 () IC11: 74LS08 IC (#443-780).
 () IC10: 7438 IC (#443-77).
 () IC9: 74LS259 (or 9LS259) IC (#443-852).
 () IC1: 74LS240 IC (#443-754).

IC8: 74LS273 IC (#443-805).

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 perform each step without interruption.



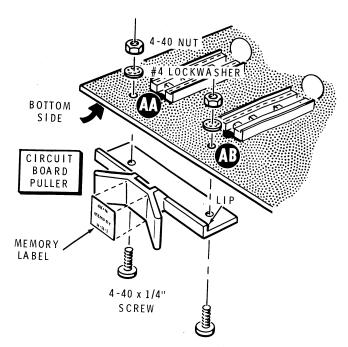
- () IC28: Install a 2114L IC (#443-764) at IC28 as follows:
 - 1. Remove the IC from the conductive foam.
 - Hold the IC in one hand and straighten any bent pins with the other hand.
 - 3. Continue holding the IC being careful not to touch it to anything while you touch the circuit board with your hand.
 - 4. Install the IC in its socket.

Use the same procedure to install the fifteen remaining 2114L IC's (#443-764) at the following locations:

()	IC27.
()	IC26.
()	IC25.
()	IC24.
()	IC23.
()	IC22.
()	IC21.
()	IC20.
()	IC19.
()	IC18.
()	IC17.
()	IC16.
()	IC15.
()	IC14.
()	IC13.
()	Check all of the IC's in the circuit board for the proper type and installation. Pay particular attention to IC1 through IC5. The 74S240 IC's

should be at IC2 and IC4. The 74LS240 IC's

should be at IC1, IC3, and IC5.



Detail 1-6B

- () Refer to Detail 1-6B and mount a circuit board puller on the bottom of the circuit board at AA and AB. Use a 4-40 × 1/4" screw, a #4 lockwasher, and a 4-40 nut at each mounting hole. Be sure to position the puller so the lip is around the edge of the circuit board as shown.
- () Carefully peel the backing paper from the memory label. Then press the label onto the center portion of the circuit board puller as shown in Detail 1-6B.
- () Similarly, mount a circuit board puller on the bottom of the circuit board at AC and AD. Use a 4-40 × 1/4" screw, a #4 lockwasher, and a 4-40 nut at each mounting hole.
- Carefully peel the backing paper from the blue and white label. Then press the label onto the lower right corner of the rear panel of your H11 Computer. Do not cover up any other labels that may already be present.

Proceed to "Configuring the Memory Expansion Module" in this Manual.



CONFIGURING THE MEMORY EXPANSION MODULE

Before you put the Memory Expansion Module into operation, you will have to install a jumper wire at one of the eight bank select locations (BS\$\psi\$ through BS7).

- () Refer to Table 1-1 and determine which memory bank you desire to have this Module operate in. NOTE: Normally, neither bank Ø nor bank 7 is used as a memory bank location. Bank Ø is supplied as part of the KD11-F processor and bank 7 is reserved for I/O ports.
- () Refer to Pictorial 1-7 and install a short bare jumper wire (use a cutoff component lead or similar wire) at your selected memory bank location. Position the wire about 1/4" above the circuit board as shown in the inset drawing. Then solder the wire to the foil and cut off any excess wire lengths. NOTE: If this is the first Memory Expansion Module in your system, install the jumper at BS1. If this is the second Memory Expansion Module in your system, install the jumper at BS2, etc. Do not install this jumper wire in the same position as any other Module. This could cause memory read/write errors.

BANK	ADDRESS RANGE	OCTAL ADDRESS
BSØ	0-4K	000000-017776
BS1	4-8K	020000-037776
BS2	8-12K	040000-057776
BS3	12-16K	060000-077776
BS4	16-20K	100000-117776
BS5	20-24K	120000-137776
BS6	24-28K	140000-157776
BS7	28-32K	160000-177776

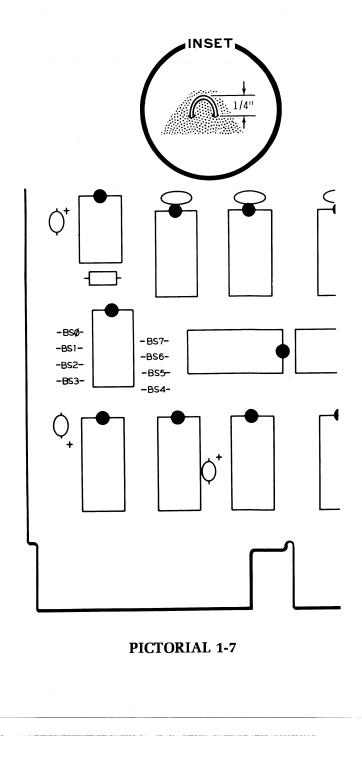


TABLE 1-1



MODULE INSTALLATION

NOTE: If you already have at least one Memory Expansion Module installed in your Computer, skip the following steps and proceed to "Installation" in Section 2 of your H11 Operation Manual. Refer to Pictorial 1-8 (Illustration Booklet, Page 2) when you perform the following steps.	 Install your Memory Expansion Module as follows: Carefully start the circuit board (component side down) into the card guides that correspond to the sockets at slot 4 in the backplane assembly.
() Remove the top cover from your Computer, if this has not already been done.	Push the circuit board firmly into the sockets in the backplane assembly.
() Remove the two 6-32 nuts, on the bottom of the Computer, that secure the front of the backplane assembly to the chassis.	() Lower the backplane assembly into the chassis and secure it on the bottom of the chassis with two 6-32 nuts.
	() Reinstall the top cover on the Computer.

SPECIFICATIONS

Memory Size	4096×16 .
Access Time	500 nsec. maximum.
Interface	Compatible with H11 and LSI-11 buses.
Power Requirements	4.75 to 5.25 volts DC at 2 amperes maximum. 1.5 amperes typical.
Ambient Temperature	10° C. to 55° C.
Circuit Board Size	$8-3/4''$ high \times $5-1/4''$ wide \times $1/2''$ thick. (22.6 \times 13.2 \times 1.3 cm).
Net Weight	3oz. (85 grams).

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



CIRCUIT DESCRIPTION

NOTE: Refer to your H11 Operation Manual for information concerning bus timing and signal flow.

Refer to the Block Diagram (Illustration Booklet, Page 2) and the Schematic (large fold-in) while you read this "Circuit Description." The following description is divided into four groups called "Addressing," "Write Cycle," "Read Cycle," and "General."

ADDRESSING

In this mode, BSYNC L is quiescent high which causes bus receivers IC1 and IC3 to become active via gate IC11B. At the same time, IC10A causes bus drivers IC2 and IC4 to be inactive (high impedance output). When the bus controlling device (processor or DMA device) places an address on the bus via the BDAL Ø through 15 L lines, BSYNC L is asserted low 150 nanoseconds (minimum) later. This edge, which is translated to SYNC H by IC5A, latches the address information in IC's 7, 8, and 9.

Address line AØ H, when asserted, selects the high byte of the word that is addressed by lines A1 H through A1Ø H. Address lines A11 H and A12 H are decoded by IC12 to determine which 1K segment of the 4K bank is to be addressed. IC9 latches and decodes lines BDAL 13 L, BDAL 14 L, and BDAL 15 L to determine the bank position within the total memory area for which each Memory Expansion Module will respond.

WRITE CYCLE

100 nanoseconds (minimum) after BSYNC L is asserted low, the bus controlling device places the data to be written into the memory on the BDAL β L through 15 L lines. After another 100 nanoseconds

(minimum), the BDOUT L line is asserted low. This information is converted to DOUT H by IC5A and is used in conjunction with the bank select signal (MS H) to generate the WE L signal. This WE L signal enables the bus receivers (IC1 and IC3) and forces the bus drivers (IC2 and IC4) to remain inactive. At this time, the data to be written into the memory is present at memory IC's IC13 through IC28. The WE L signal inhibits the output buffers of the memory IC's and, in conjunction with the chip select lines, enables the input buffers of the memory IC's.

In the write mode, the following operations can occur: write high byte, write low byte, and write word. Lines A\$\psi\$ H and WTBT H determine which of these operations occur by selecting only the required memory IC's. IC12 decodes this information and also determines which 1K segment of the 4K bank is enabled. Table 1-2 shows the full decoding information.

READ CYCLE

100 nanoseconds (minimum) after BSYNC L is asserted low, the bus controlling device removes the address information from the BDAL Ø through 15 L lines. At the same time, BDIN L is asserted low and is converted to DIN H by IC5A. Since both SYNC H and WE L are high, IC11B disables bus receivers IC1 and IC3. The RPLY H line enables the bus drivers, IC2 and IC4, via IC10A. This line will be further explained later.

In the read mode, only the read word operation can occur. IC6B NAND's DIN H and MS H to produce a low (RE L) at IC11A pin 2. This is the same as if WTBT H was low. Table 1-2 can therefore be used to determine the various memory IC's that are selected during a read operation.

GENERAL

As soon as either DOUT H or DIN H occurs, IC10D and IC10C enable IC12. BRPLY L and RPLY H, however, do not occur until after a delay of approximately 150 nanoseconds as determined by R4 and C1. This insures that the memory IC's have fully responded before the bus controlling device terminates either the read or write cycle.

If BDCOK H goes low (indicates a DC power failure), IC12 is immediately disabled via IC10C. Thus, none of the memory IC's can be selected, and therefore, no false data can be written into memory.

BINIT L occurs whenever a reset operation is performed and also during the power up sequence. IC5A and IC5B convert this signal to INIT L which, when asserted, clears IC7 and IC8.

TABLE 1-2

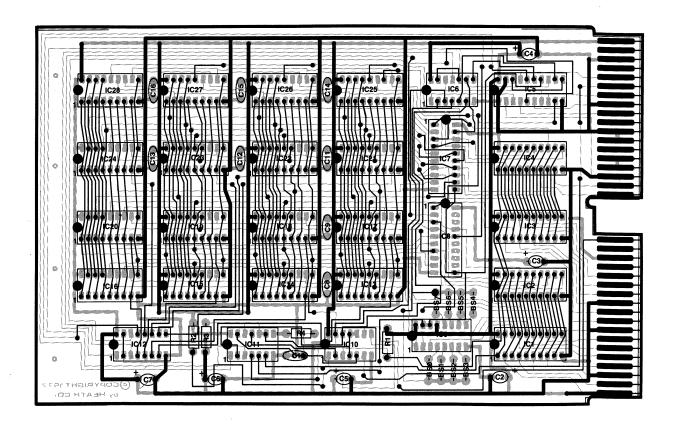
			T		
A11 H	A12 H	Aø H	WTBT H	OPERATION	SELECT LINES ENABLED
0	0	0	1		CSLB Ø L
1	0	0	1	Low byte	CSLB 1 L
s sagara wated t 0 garage a 0	1	0	1		CSLB 2 L
1	1	0	1		CSLB 3 L
0	0	1	1	High byte	CSHB Ø L
1 - 1 - 1 - 1	0	1	1		CSHB 1 L
0	1	1	1		CSHB 2 L
10 25 20 1 10 20 20 20 20 20 20 20 20 20 20 20 20 20	1	1	1		CSHB 3 L
0	0	# B	0		CSLB Ø L and CSHB Ø L
1	0	Don't	0	747	CSLB 1 L and CSHB 1 L
0	1		0	Word	CSLB 2 L and CSHB 2 L
1	1		0		CSLB 3 L and CSHB 3 L



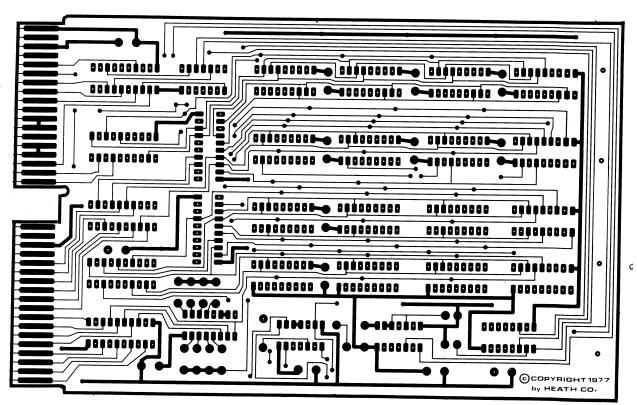
CIRCUIT BOARD X-RAY VIEW

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

- A. Find the circuit component number (R1, C5, 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 DESCRIP-TION which must be supplied when you order a replacement part.



MEMORY CIRCUIT BOARD (Shown from component side. Foil on component side is shown in red.)



(Shown from foil side.)

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, \$3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

Total enclosed \$___

 If you prefer COD shipment, check the COD box and mail this form.

NAME		
ADDRESS		
CITY		
STATE	ZIP	

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # Date Purchased	Invoice # Location Purchased		
LIST HEATH PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE

TOTAL FOR PARTS
HANDLING AND SHIPPING
MICHIGAN RESIDENTS ADD 4% TAX
TOTAL AMOUNT OF ORDER

SEND TO:

HEATH COMPANY

BENTON HARBOR MICHIGAN 49022

ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

ı

LINE

DOTTED

ALONG

CUT

Model # .

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, \$3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

Total enclosed \$_____

If you prefer COD shipment, check the COD box and mail this form.

NAME	
ADDRESS	
CITY	
OTATE '	710

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Invoice #

Purchased	Purchased		
LIST HEATH PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE
TOTAL FOR PARTS			
HANDLING AND SHIPPING			
MICHIGAN RESIDENTS ADD 4% TAX			
TOTAL AMOUNT OF ORDER			

SEND TO:

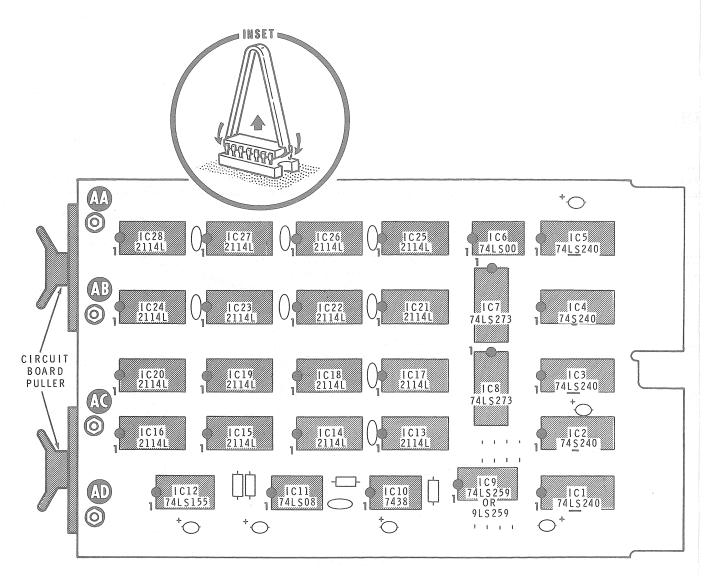
HEATH COMPANY

BENTON HARBOR MICHIGAN 49022

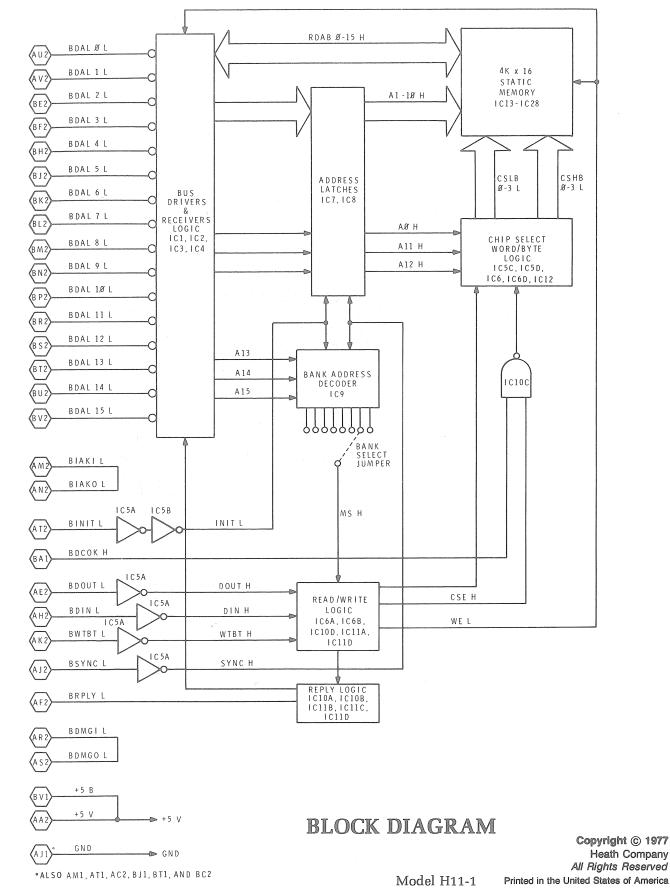
ATTN: PARTS REPLACEMENT

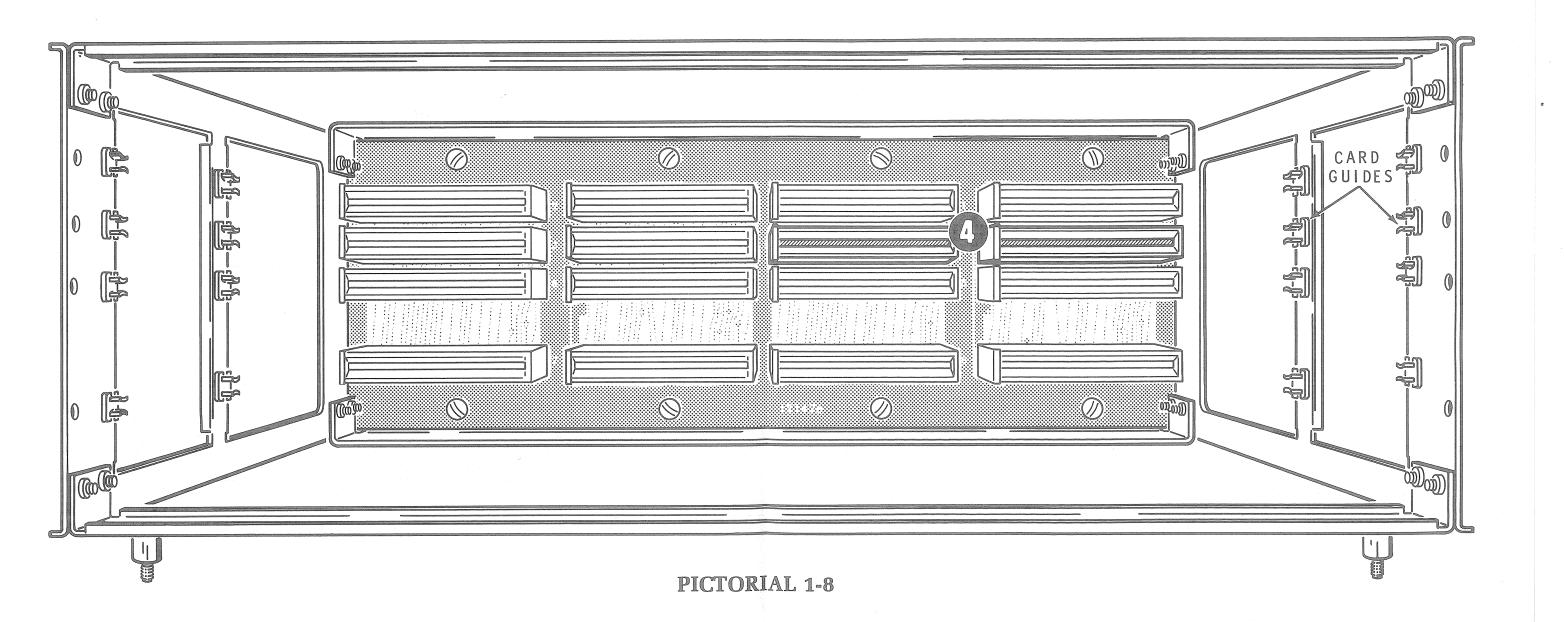
Phone (Replacement parts only): 616 982-3571

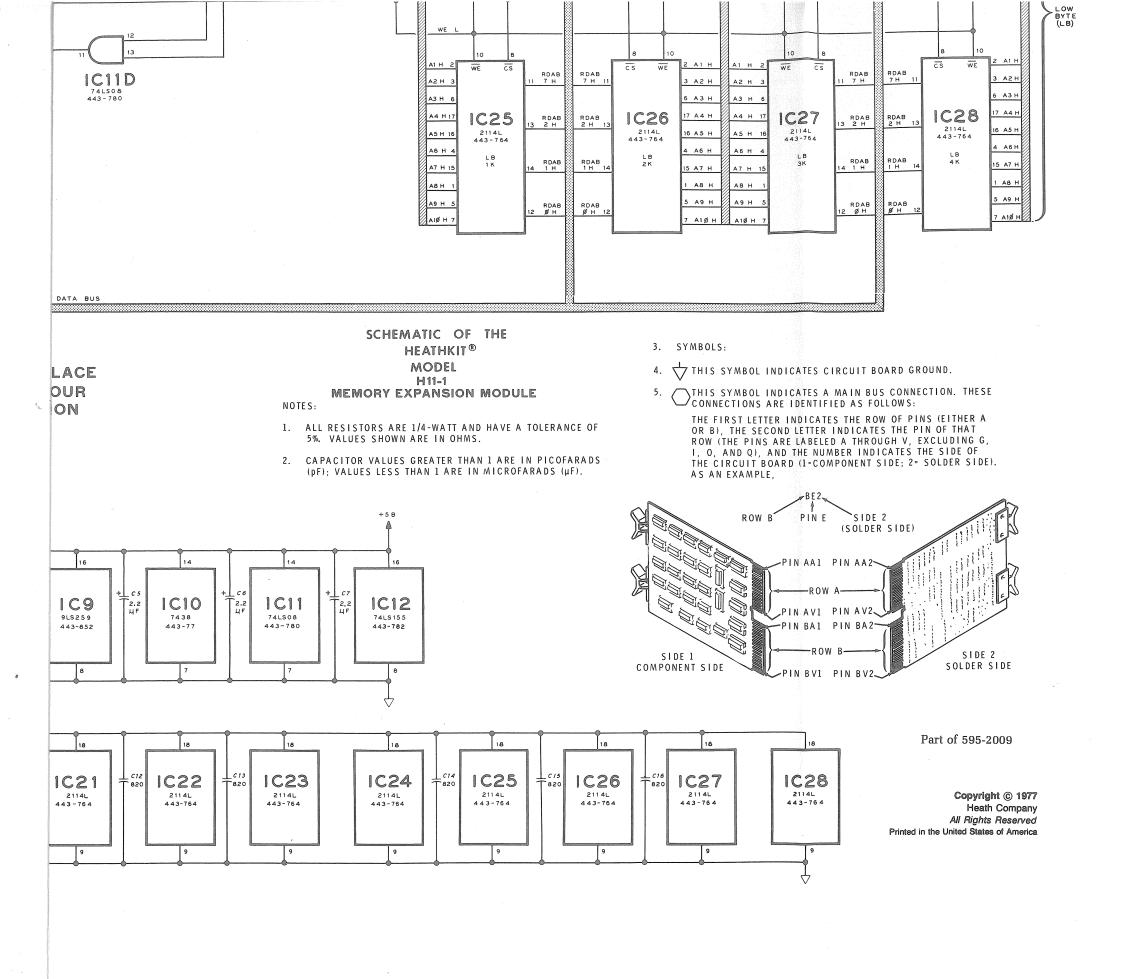
ILLUSTRATION BOOKLET

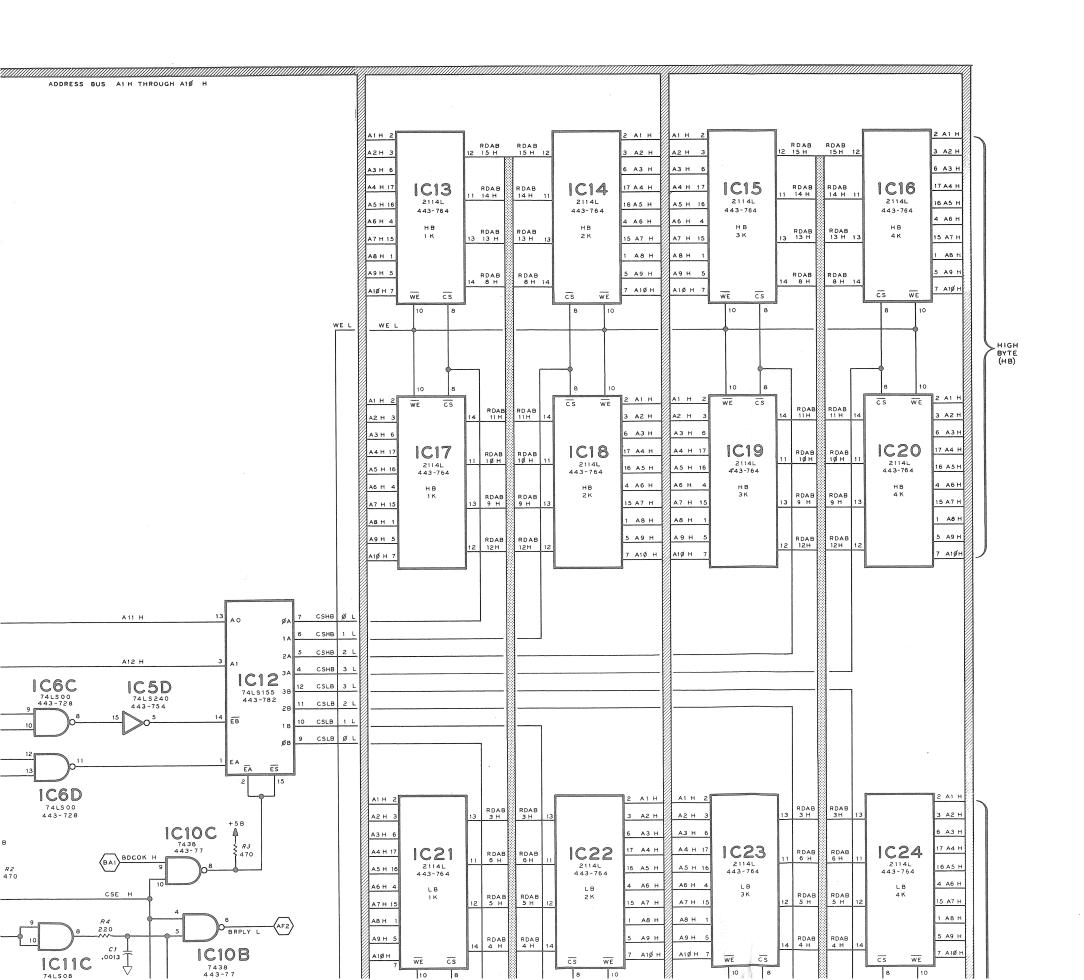


PICTORIAL 1-6

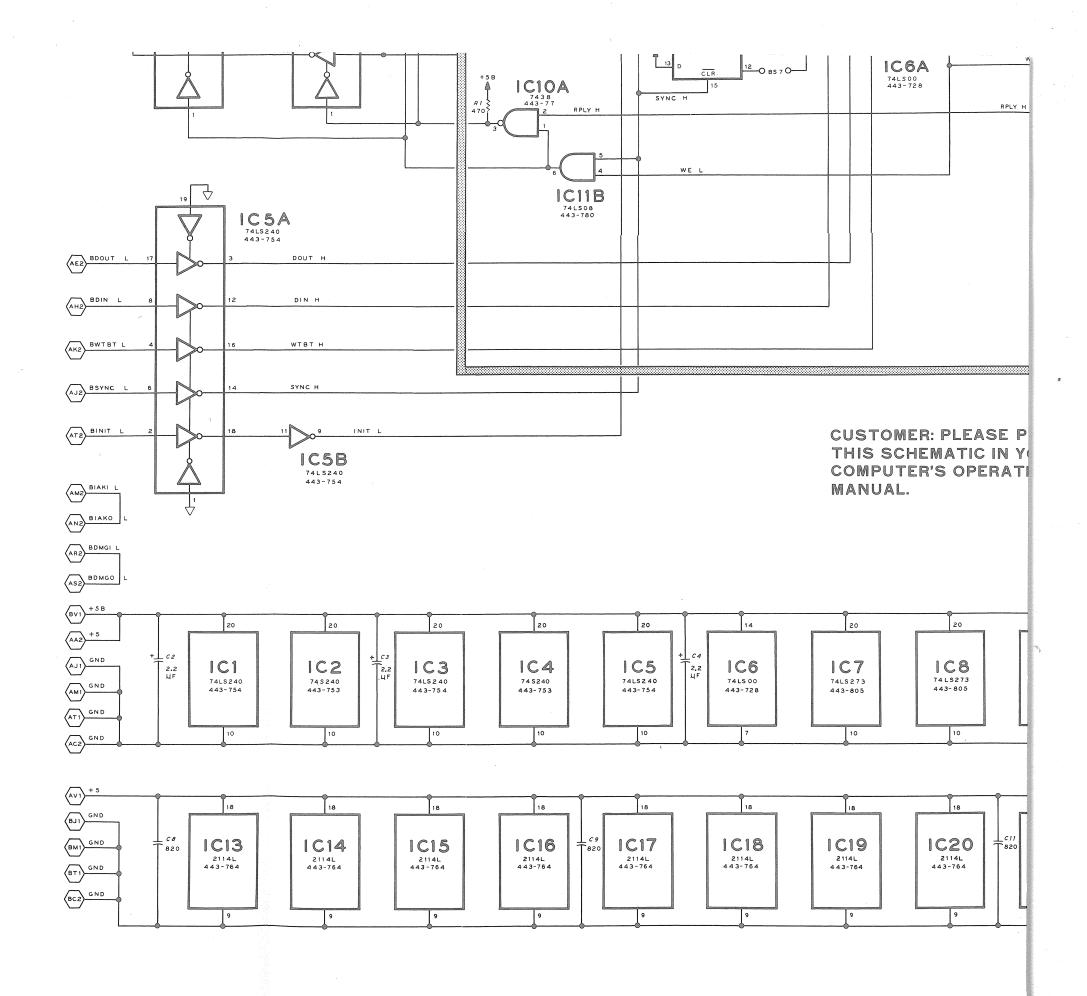




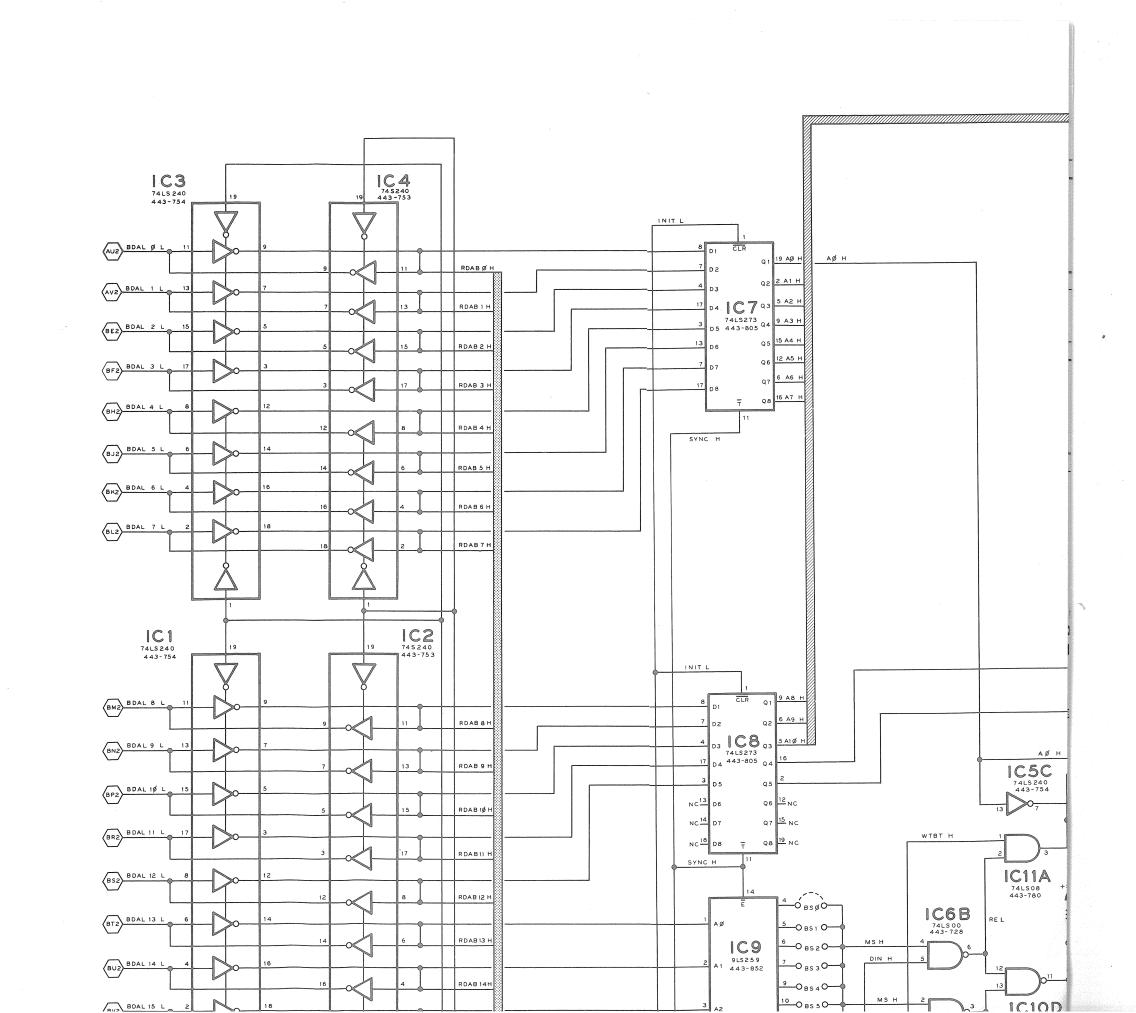




•



às.



-

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 Schlumberger Schlumberger

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM