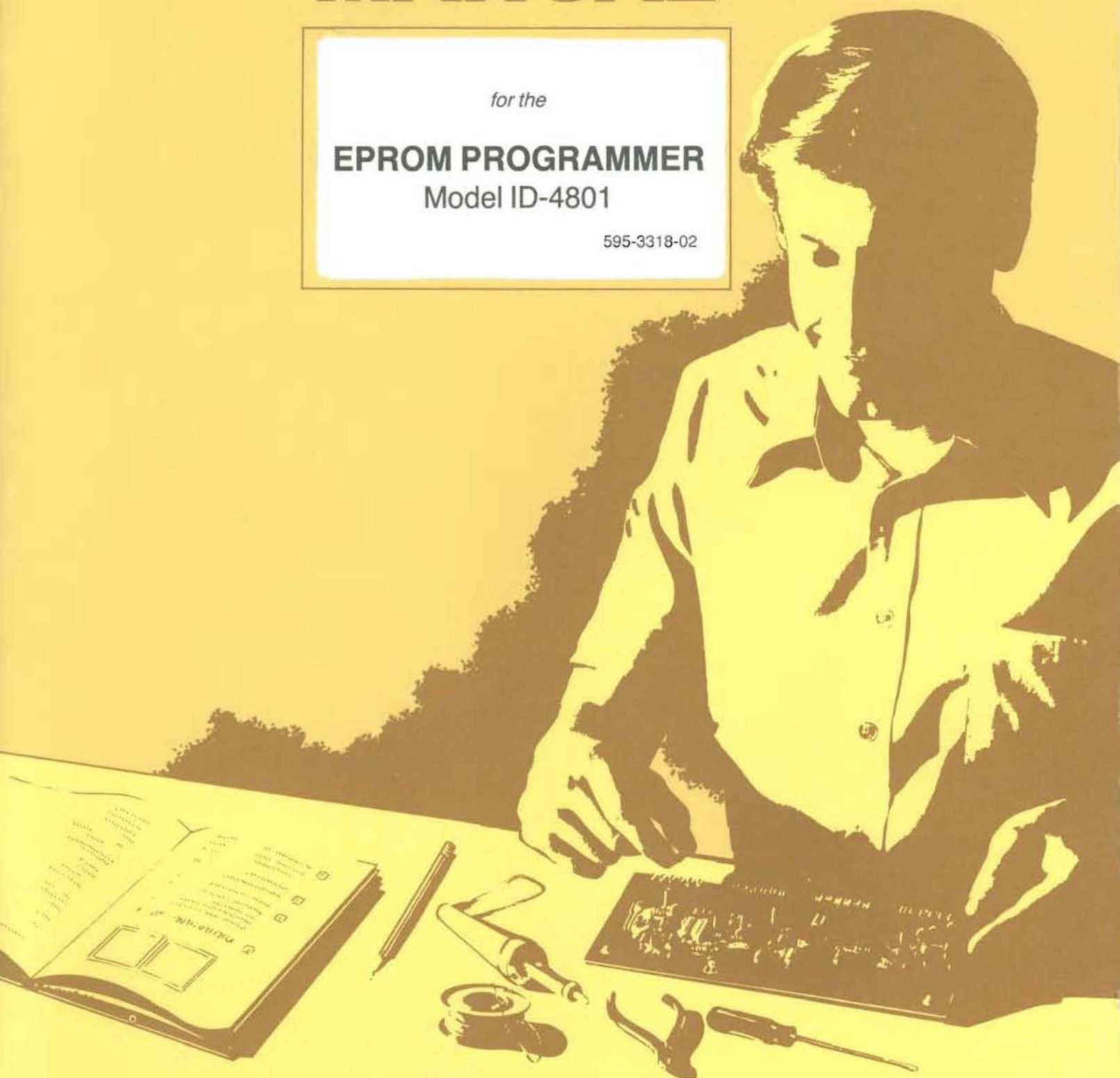


HEATHKIT[®] MANUAL

for the

EPROM PROGRAMMER
Model ID-4801

595-3318-02



HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

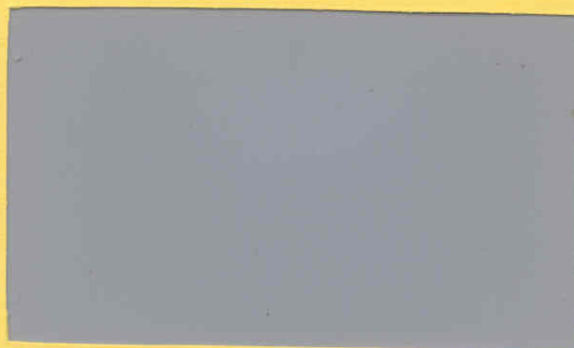
The following telephone numbers are direct lines to the departments listed:

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

Technical Assistance Phone Numbers

8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only

Audio (616) 982-3310
Amateur Radio (616) 982-3296
Test Equipment, Weather Instruments and
Home Clocks (616) 982-3315
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Computers — Software:
Operating Systems, Languages, Utilities (616) 982-3860
Application Programs (616) 982-3884



YOUR HEATHKIT 90-DAY LIMITED WARRANTY

Consumer Protection Plan for Heathkit Consumer Products

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

Heath's Responsibility

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

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

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

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

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

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

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

Owner's Responsibility

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

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

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

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

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

Condensed Heathkit® Manual

for the

EPROM PROGRAMMER Model ID-4801

595-3318-02

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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WARNING

Federal Communications Commission requirements prescribe certification of personal computers and any interconnected peripherals in Part 15 Subpart J of the Rules and Regulations. This computing device will meet these requirements when constructed in strict accordance with the instructions in this Manual, using only components and materials supplied with the kit or the exact equivalent thereof. You will be instructed to sign and date the enclosed FCC ID label and affix the label to the equipment certifying that you have constructed this equipment in accordance with the above mentioned instructions. In order to meet legal requirements, be certain to follow the instructions exactly as they are stated in this Manual.

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of the FCC Rules. Only computers certified to comply with the Class B limits may be attached to this equipment. Operation with non-certified computers is likely to result in interference to radio and TV reception.

This equipment uses radio frequency energy for its operation and if not installed and used properly, that is, in strict accordance with the instruction manual, may cause interference to radio and television reception. It has been type tested and found to comply with the RF emission limits for a Class B computing device which is intended to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio and television reception, which you can determine by turning the equipment off and on, try to correct the interference by one or more of the following measures:

- Move the computing device away from the receiver being interfered with.
- Relocate the computing device with respect to the receiver.
- Reorient the receiving antenna.
- Plug the computing device into a different AC outlet so that the computing device and receiver are on different branch circuits.
- Disconnect and remove any I/O cables that are not being used. (Unterminated I/O cables are a potential source of high RF emission levels.)
- Unplug and remove any serial I/O circuit board cards that are not being used. (Here again, unterminated cards can be a source of potential interference.)
- Be certain that the computing device is plugged into grounded outlet receptacles. (Avoid using AC cheater plugs. Lifting of the power cord ground may increase RF emission levels and may also present a lethal shock to the user.)

If you need additional help, consult your dealer or ask for assistance from the manufacturer. Customer service information is on the inside back cover of this Manual or on an insert sheet supplied with this equipment. You may also find the following booklet helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the US Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00345-4.

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IDA-4801-1 Personality Module		Schematic	Fold-in
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INTRODUCTION

The ID-4801 EPROM Programmer is an inexpensive device that is used to program, duplicate, verify, and simulate single power supply EPROMs. Features of the Programmer include Keypad Address and Data Entry, EPROM to RAM program transfers, RS-232 Transmit and Receive, Program EPROM, and Verify. Editing features include Insert RAM Data, Delete RAM Data, and one or two Byte Search operations. Your Programmer can be used with the popular 2500 series and 2700 series EPROMs and other compatible devices up to 16 K bytes.

Useful to computer enthusiasts and advanced electronic hobbyists, the Programmer can perform ten distinct functions, some of which require user-wired Personality Modules for different EPROM configurations. The Programmer allows you to program an EPROM with data stored in the Programmer's RAM and then verify the transfer. Data can also be loaded into the Programmer's RAM from an existing EPROM. With the connection of an appropriate cable, the Programmer can simulate ROM in an external device.

Data can be transmitted and received between the Programmer and a computer through an RS-232 Port. This port allows data transfers at 9600 baud in Intel Hex Format.

Data can also be entered through the Programmer's 4×4 hexadecimal keypad in conjunction with six control keys. You can select any legal memory address and enter, delete, and edit the data. Addresses can also be incremented, decremented, and searched to find one or two bytes and then display both the data and the address. A repeat function allows you to repeat data in a memory block without repetitive keystrokes.

Six LEDs indicate function selections, while six 7-segment LEDs display memory addresses, data, and operation prompts.

Your Programmer is equipped with a $4K \times 8$ system ROM and $2K \times 8$ system RAM. The RAM can be expanded to 16K with optional memory expansion accessories. Additional Personality Modules are also available as an option.

WARNING

Most programs contained in EPROMs, PROMs, ROMs, etc. are copyrighted. It is unlawful to copy or duplicate copyrighted material.

UNPACKING

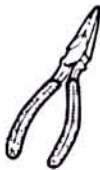
The shipping carton in which your kit was packed contained this Manual and other papers. Set these papers aside. Then refer to the "Pack Index Sheet" and remove Pack #1 from the shipping carton but do not open it. After you remove this pack, the remaining parts in the shipping carton are the "Final Pack", which consist principally of larger items and parts used in the chassis assembly.

IMPORTANT: To avoid intermixing parts, **DO NOT** remove anything from a parts pack until you are directed to do so at the beginning of a Parts List. After you identify any part that is packed in an individual envelope with a part number on it, place the part back in its envelope after you check it until that part is called for in a step.

ASSEMBLY NOTES

TOOLS

You will need these tools to assemble your kit.



LONG-NOSE
PLIERS



DIAGONAL
CUTTERS



WIRE
STRIPPERS

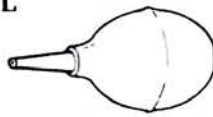


PHILLIPS
SCREWDRIVERS
(#0 & #1 or Larger)

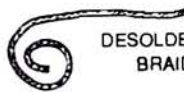
OTHER HELPFUL TOOLS



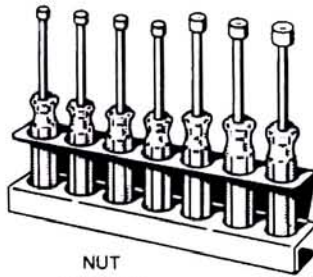
NUT STARTER
(May Be Supplied
With Kit)



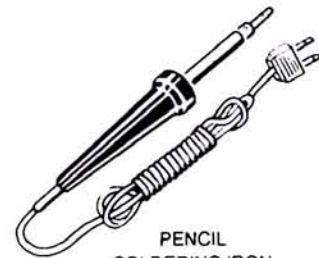
DESOLDERING
BULB*



DESOLDERING
BRAID*



NUT
DRIVERS



PENCIL
SOLDERING IRON
(22 to 25 WATTS)

*To Remove Solder From Circuit Connections.

ASSEMBLY

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

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

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

7. When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

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

SOLDERING

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

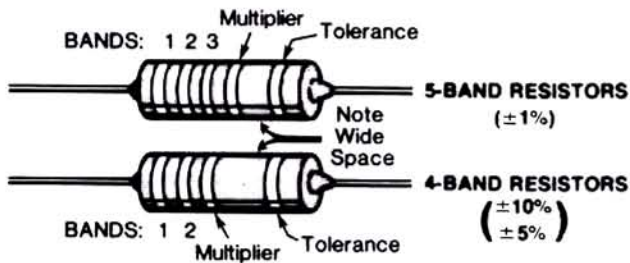
It is easy to make a good solder connection if you follow a few simple rules:

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

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

RESISTORS

Resistors are identified in Parts Lists and steps by their resistance value in Ω (ohms), $k\Omega$ (kilohms), or $M\Omega$ (megohms). They are usually identified by a color code of four or five color bands, where each color represents a number. See the "Resistor Color Code" chart. These colors are given in the steps in their proper order (except for the last band, which indicates a resistor's "tolerance"; see the "Resistor Tolerance Chart"). You do not need to memorize the color codes.



Occasionally, a "precision" or "power" resistor may have the value stamped on it. The letter R, K, or M may also be used at times to signify a decimal point, as in:

$$\begin{aligned} 2R2 &= 2.2 \Omega \\ 2K2 &= 2.2 k\Omega, \text{ or } 2200 \Omega \\ 2M2 &= 2.2 M\Omega \end{aligned}$$

Precision resistors may also be marked as shown in the following examples. The values of the multipliers are shown in the "Multiplier Chart," and the tolerance values are shown in the "Resistor Tolerance" chart.

Resistor Value Multiplier Tolerance

EXAMPLES: $1009C = 100 \times 0.1 = 10 \Omega, \pm 0.25\%$
 $1001D = 100 \times 10 = 1000 \Omega, \pm 0.5\%$

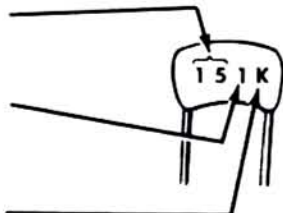
CAPACITORS

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 and second digits of capacitor's value: 15

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 capacitor Tolerance chart.



RESISTOR COLOR CODE CHART

	Band 1	Band 2	Band 3 (if used)	Multiplier
Color	1st Digit	2nd Digit	3rd Digit	
Black	0	0	0	1
Brown	1	1	1	10
Red	2	2	2	100
Orange	3	3	3	1,000
Yellow	4	4	4	10,000
Green	5	5	5	100,000
Blue	6	6	6	1,000,000
Violet	7	7	7	10,000,000
Gray	8	8	8	100,000,000
White	9	9	9	—
Silver	—	—	—	.01
Gold	—	—	—	.1

RESISTOR TOLERANCE CHART

	COLOR OR LETTER	
$\pm 10\%$	SILVER	
$\pm 5\%$	GOLD	J
$\pm 2\%$	RED	G
$\pm 1\%$	BROWN	F
$\pm 0.5\%$	GREEN	D
$\pm 0.25\%$	BLUE	C
$\pm 0.1\%$	VIOLET	B
$\pm 0.05\%$	GRAY	

MULTIPLIER CHART

FOR THE NUMBER:	MULTIPLY BY:	FOR THE NUMBER:	MULTIPLY BY:
0	1	4	10,000
1	10	5	100,000
2	100	8	0.01
3	1000	9	0.1

CAPACITOR TOLERANCE CHART

LETTER	10 pF OR LESS	OVER 10 pF
B	$\pm 0.1 pF$	
C	$\pm 0.25 pF$	
D	$\pm 0.5 pF$	
F	$\pm 1.0 pF$	$\pm 1\%$
G	$\pm 2.0 pF$	$\pm 2\%$
H		$\pm 3\%$
J		$\pm 5\%$
K		$\pm 10\%$
M		$\pm 20\%$

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

NOTE: The letter "R" may be used at times to signify a decimal point, as in: $2R2 = 2.2 (pF \text{ or } \mu F)$.

CIRCUIT BOARD

PARTS LIST

Open Parts Pack #1 and check each part against the following list. The key numbers correspond to the numbers on the Parts Pictorial (Illustration Booklet, Page 1). **Do not remove any parts that are supplied on the tape strips until they are called for in an assembly step.** If a part is packed in an individual envelope, with a part number on it, identify the part; then place it back into the envelope until a step calls for it. Do not throw away any packing materials until you have accounted for all the parts.

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

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

A1	25-864	2	10 μ F electrolytic	C103, C151
A1	25-866	1	22 μ F electrolytic	C153
A1	25-874	2	470 μ F, 50 V electrolytic	C149, C154
A1	25-875	1	1000 μ F electrolytic	C148
A1	25-903	1	6800 μ F electrolytic	C138
A1	25-953	2	470 μ F, 25 V electrolytic	C142, C145

DIODES – TRANSISTORS – INTEGRATED CIRCUITS (ICs)

NOTE: Transistors and integrated circuits may be marked for identification in any one of the following four ways:

1. Part number.
2. Type number. (For integrated circuits, this refers only to the numbers and letters shown in **BOLD** print in the Parts List. Disregard any other numbers or letters shown on the IC.)

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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3. Part number and type number.
4. Part number with a type number other than the one shown.

CAUTION: Some of the integrated circuits can be easily damaged by static electricity. **DO NOT** remove any ICs from their foam pads until you are instructed to do so in a step.

B1	57-42	2	3A1	D102, D103
B2	411-875	6	7-segment LED	V101, V102, V103, V104, V105, V106
B3	412-654	6	Small LED	V107, V108, V109, V111, V112, V113
B4	417-819	1	MJE171	Q103
B5	417-864	1	MPS-A05	Q101
B5	417-865	1	MPS-A55	Q102
B6	442-22	1	N5741	U136

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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NOTE: The following integrated circuits are in a bag marked "Parts 2 of 2 IC's". Return these ICs to the bag after you check them until they are called for during the "Final Assembly".

B7	442-30	1	UA309	U137
B8	442-63	1	UA7815	U139
B8	442-613	1	MC7915	U138
B6	443-730	1	74LS74	U105
B6	443-755	2	74LS04	U119, U121
B6	443-780	1	74LS08	U135
B6	443-794	1	MC1488/75188	U134
B6	443-795	1	MC1489/75189	U133
B6	443-804	6	74LS259	U126, U127, U128, U129, U131, U132
B6	443-807	1	74LS42	U125
B6	443-837	2	74LS373	U106, U107
B6	443-857	1	74LS367	U118
B6	443-863	2	74LS374	U114, U122
B6	443-875	3	74LS32	U103, U117
B6	443-1075	1	74F138	U123
B6	443-881	1	Z80	U124
B6	443-885	1	74LS245	U101
B6	443-1027	1	HM6116-P4	U104
B6	444-341-2*	1	Program ROM	U108
				U102

SOCKETS – CONNECTORS

C1	432-825	1	6-pin plug	P102
C2	432-1149	1	8-pin plug	P101
C3	434-189	1	3-pin IC socket	
C4	434-230	1	8-pin IC socket	
C4	434-253	1	40-pin IC socket	
C4	434-298	15	14-pin IC socket	
C4	434-299	9	16-pin IC socket	
C4	434-307	5	24-pin IC socket	
C4	434-311	5	20-pin IC socket	
C4	434-312	1	28-pin program socket head	
C6	434-349	1	24-pin socket with long leads	
C5	434-383	1	28-pin IC socket	
C7	434-384	1	28-pin program socket with hardware	

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

D1	3-26-5	1	390 Ω , 5-watt	R121
D2	9-140	12	Resistor pack	RP101, RP102, RP103, RP104, RP105, RP106, RP107, RP108, RP109, RP111, RP112, RP113
D3	64-946	22	Pushbutton switch	SW101, SW102, SW103, SW104, SW105, SW106, SW107, SW108, SW109, SW111, SW112, SW113, SW114, SW115, SW116, SW117, SW118, SW119, SW121, SW122, SW123, SW124
D4	73-92	1	Foam gasket	
D5	75-788	1	Insulator paper	
	85-3252-1	1	Circuit board	
D6	215-658	1	Heat sink	
D7	250-1425	2	6-32 x 1/2" phillips screw	
D8	253-3	2	#10 flat fiber washer	
			Solder	
D9	352-31	1	Thermal compound	
D10	390-1255	1	Fuse label**	
D11	390-1855-28	1	FCC label**	
D12	390-2728	1	Caution label**	
D13	390-2729	1	Model label**	
D14	390-2737	1	Personality module label set** Extra	
D15			Blue and white label**	
D16	404-536	1	4 MHz crystal	Y101
D17	406-681	1	Magnifier	
D18	462-1196	16	Gray button	
D18	462-1197	4	White button	
D18	462-1198	2	Red button	
		1	Assembly manual (See Page 1 for Part Number.)	
	597-260	1	Parts Order Form**	

*Copyright © 1985 Heath Company.

** These items may be packed inside the Manual. Set them aside for use later.

TAPED COMPONENTS

The remaining parts are supplied on taped strips. It is not necessary to check them against the following list.

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

All 5% and 10% resistors have four color bands (last band gold for 5% and silver for 10%). The last band (gold or silver) will not be called out.

All resistors are 1/4-watt unless specified otherwise.

6-101-12	2	100 Ω (brn-blk-brn)	R119, R126,
6-181-12	1	180 Ω (brn-gry-brn)	R102
6-331-12	1	330 Ω (org-org-brn)	R105
6-391-12	1	390 Ω (org-wht-brn)	R124
6-471-12	1	470 Ω (yel-viol-brn)	R102, R122
6-681-12	1	680 Ω (blu-gry-brn)	R104
6-102-12	1	1000 Ω (brn-blk-red)	R111
6-682-12	1	6800 Ω (blu-gry-red)	R103
6-822-12	2	8200 Ω (gry-red-red)	R101, R123
6-103-12	9	10 k Ω (brn-blk-org)	R106, R107, R108, R109, R112, R113, R114, R115, R116
6-153-12	2	15 k Ω (brn-grn-org)	R125, 1 extra
6-334-12	2	330 k Ω (org-org-yel)	R117, R118

PRECISION RESISTORS

All color banded 1% resistors have five color bands (last band brown). This brown band is set apart from the other bands. The last band (brown) will not be called out.

All resistors are 1/4-watt unless specified otherwise.

6-1372-12	1	13.7 k Ω (brn-org-viol-red)	R128
6-2152-12	1	21.5 k Ω (red-brn-grn-red)	R127
6-4422-12	1	44.2 k Ω (yel-yel-red-red)	R129

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

21-761	40	.01 μ F (103) glass ceramic	C101, C102, C104, C105, C106, C107, C108, C109, C111, C112, C113, C114, C115, C116, C117, C118, C119, C121, C122, C123, C124, C125, C126, C127, C128, C129, C131, C132, C133, C134, C135, C136, C137, C139, C141, C143, C144, C146, C147, C152
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DIODES

56-56	3	1N4149	Extra
56-620	1	1N4744A	D112
56-659	3	1N5998 (selected)	D111, 2 extra
57-65	7	1N4002	D101, D104, D105, D106, D107, D108, D109

NOTE: The extra parts are supplied to assemble the Personality Modules.

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 1-1 for the following steps.

NOTES:

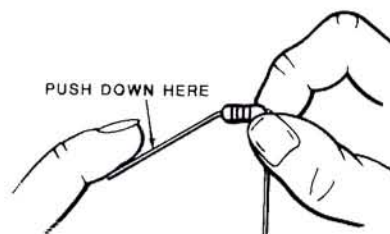
1. Many circuit board drawings such as the one shown in Pictorial 1-1 are divided into two or more sections. These sections show you which area of the circuit board you are working in for a specific series of steps.
2. Cut the "Taped Component Chart" from the last page in the Illustration Booklet. Make sure you read the instructions at the top of the chart before you use it. Note that it is divided into numbered sections which correspond to the numbered sections on the circuit board pictorial. The components are listed in the order of assembly.
3. In each series of steps, corresponding to a circuit board section, you will install parts in a top-to-bottom, left-to-right sequence. Occasionally, you may be directed to install a particular component in an area out of sequence. Each of these components is identified in the step and on the Pictorial with a special callout (R2, C4, or D1, for example).
4. As you perform each step, check it off in the box provided. You may also wish to place a check mark near each component on the Pictorial as you install the part.
5. In general, solder instructions are given only at the end of a series of similar steps; you may solder more often if you wish.

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

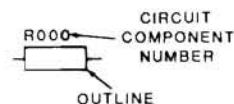
Note that one side of the circuit board has the component outlines shown on it. This is referred to as the "component side." Position the circuit board as shown in the Pictorial with the component side up.

Always install components on the component side of the circuit board, and solder the leads to the foil on the other side unless instructed otherwise.

- () R116: Hold a 10 k Ω (brn-blk-org) resistor by the body as shown and bend the leads straight down with your finger to fit the hole spacing on the circuit board.



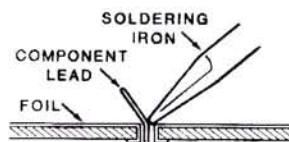
- () Start the leads into the holes at the resistor's circuit board location. The end with color bands may be positioned either way. NOTE: Resistors are identified by the following circuit board outline:



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

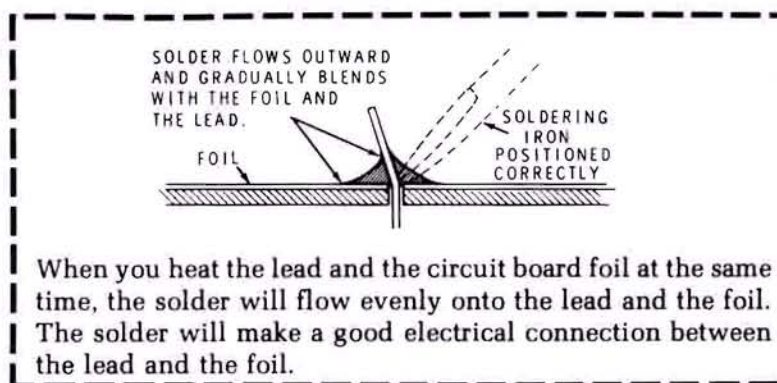


- () Solder the leads to the circuit board as follows:

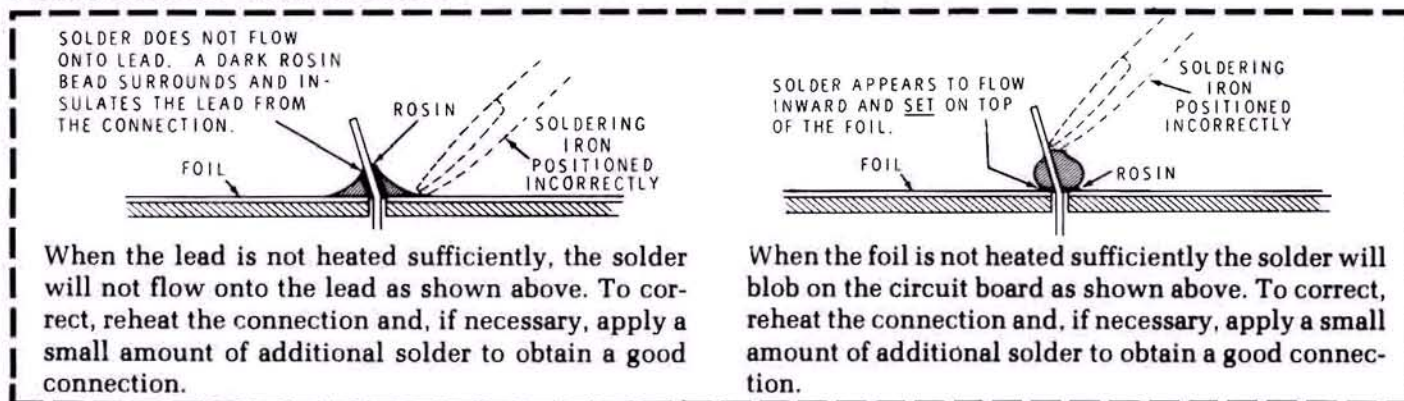


- () Cut off the excess lead lengths close to the connection. WARNING: Clip the leads so the ends will not fly toward your eyes.
- () Check each connection and compare it to the "Solder Illustrations" (Illustration Booklet, Page 13). After you have checked the solder connections, proceed with the assembly. Use the same soldering procedure for each connection.

A GOOD SOLDER CONNECTION



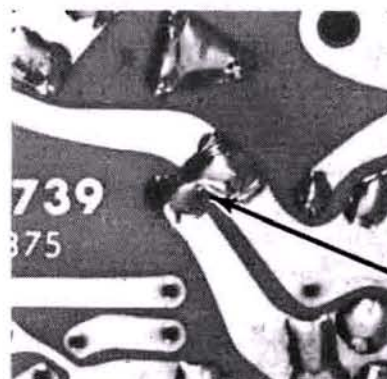
POOR SOLDER CONNECTIONS



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



Section 1

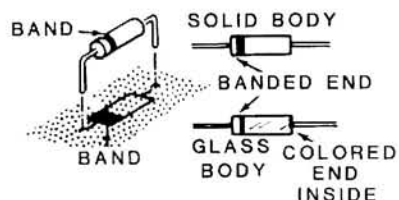
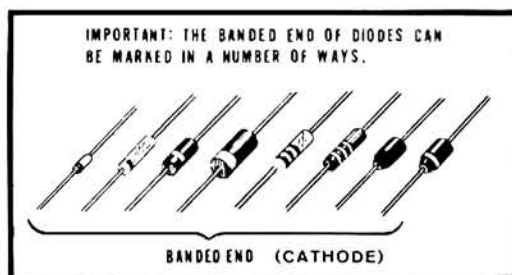
Start at the top of Section 1 of the Pictorial and install the following components on the circuit board. Make sure you installed resistor R116 on Page 12 in an earlier step.

NOTE: You can install the following capacitors in either direction on the circuit board.

Install five .01 μ F (103) glass ceramic capacitors at:

- ☐ C139.
- ☐ C141.
- ☐ C127.
- ☐ C146.
- ☐ C143.

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



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

NOTE: Position the part number on the diode body facing up on all diodes.

Install four 1N4002 diodes (#57-65) at:

- ☐ D107.
- ☐ D106.
- ☐ D105.
- ☐ D104.

Install six .01 μ F (103) glass ceramic capacitors at:

- ☐ C126.
- ☐ C147.
- ☐ C144.
- ☐ C122.
- ☐ C119.
- ☐ C152.
- ☐ D112: 1N4744A diode (#56-620).
- ☐ C116: .01 μ F (103) glass ceramic.
- ☐ R109: 10 k Ω (brn-blk-org).
- ☐ D109: 1N4002 diode (#57-65).
- ☐ D108: 1N4002 diode (#57-65).
- ☐ C117: .01 μ F (103) glass ceramic.
- ☐ R123: 8200 Ω (gry-red-red).
- ☐ R124: 390 Ω (org-wht-brn).
- ☐ R125: 15 k Ω (brn-grn-org).
- ☐ R126: 100 Ω (brn-blk-brn).

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- ☐ D111: 1N5998B (#56-659).
- ☐ R127: 21.5 k Ω , 1% (red-brn-grn-red).
- ☐ R129: 44.2 k Ω , 1% (yel-yel-red-red).
- ☐ R128: 13.7 k Ω , 1% (brn-org-viol-red).
- ☐ Solder the leads to the foil and cut off the excess lead lengths.
- ☐ C113.
- ☐ C114.
- ☐ C115.
- ☐ Solder the leads to the foil and cut off the excess lead lengths.

Section 2

Install four .01 μ F (103) glass ceramic capacitors at:

- ☐ C128.
- ☐ C129.
- ☐ C131.
- ☐ C132.
- ☐ D101: 1N4002 diode (#57-65).
- ☐ C118: .01 μ F (103) glass ceramic.

Install four 10 k Ω (brn-blk-org) resistors at:

- ☐ R112.
- ☐ R113.
- ☐ R114.
- ☐ R115.

Install five .01 μ F (103) glass ceramic capacitors at:

- ☐ C121.
- ☐ C112.

Section 3

Install four .01 μ F (103) glass ceramic capacitors at:

- ☐ C133.
- ☐ C136.
- ☐ C135.
- ☐ C134.
- ☐ R118: 330 k Ω (org-org-yel).
- ☐ R119: 100 Ω (brn-blk-brn).
- ☐ R117: 330 k Ω (org.org-yel).
- ☐ R122: 470 Ω (yel-viol-brn).
- ☐ C106: .01 μ F (103) glass ceramic.
- ☐ C124: .01 μ F (103) glass ceramic.
- ☐ R105: 330 Ω (org-org-brn).
- ☐ C105: .01 μ F (103) glass ceramic.
- ☐ C104: .01 μ F (103) glass ceramic.
- ☐ C108: .01 μ F (103) glass ceramic.

- () R102: 180 Ω (brn-gry-brn).
- () R101: 8200 Ω (gry-red-red).
- () R103: 6800 Ω (blu-gry-red).
- () R104: 680 Ω (blu-gry-brn).
- () C102: .01 μ F (103) glass ceramic.
- () C101: .01 μ F (103) glass ceramic.
- () R111: 1000 Ω (brn-blk-red).
- () C137: .01 μ F (103) glass ceramic.
- () R106: 10 k Ω (brn-blk-org).
- () R107: 10 k Ω (brn-blk-org).
- () R108: 10 k Ω (brn-blk-org).

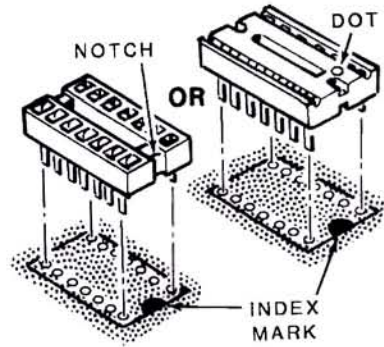
Install five .01 μ F (103) glass ceramic capacitors at:

- () C109.
- () C123.
- () C107.
- () C125.
- () C111.
- () Solder the leads to the foil and cut off the excess lead lengths.

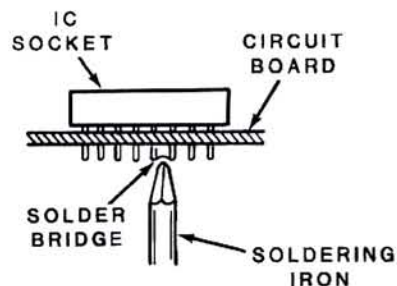
Refer to Pictorial 1-2 for the following steps.

NOTES:

1. To install an IC socket, make sure the pins are straight. If there is any kind of identification mark (notch, dot, arrowhead, etc.) at or near one end of the socket, place this marked end toward the index mark on the circuit board (this index mark should still be visible after you install the socket). Then insert the pins into the circuit board holes and solder them to the foil.



2. It is very easy to form a solder bridge between foils when you solder IC pins. After you install an IC socket, carefully inspect the foil for solder bridges and remove any that you find as described below. If you suspect that you have a solder bridge but are not positive, you can check your foil pattern against the one shown in the Illustration Booklet, Page 32.
3. To remove a solder bridge, hold the circuit board component-side-up as shown and hold your soldering iron tip between the two points that are bridged. The solder will flow down the soldering iron tip.



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Section 1

- ☐ 16-pin IC socket at U126.
- ☐ 16-pin IC socket at U125.
- ☐ 14-pin IC socket at U121.
- ☐ 16-pin IC socket at U118.
- ☐ 8-pin IC socket at U136.
- ☐ 20-pin IC socket at U107.
- ☐ 28-pin IC socket at U113.

Section 2

Install four 16-pin IC sockets at:

- ☐ U127.
- ☐ U128.
- ☐ U129.
- ☐ U131.

Install eight 14-pin IC sockets at:

- ☐ V101.
- ☐ V102.
- ☐ V103.
- ☐ V104.
- ☐ V105.
- ☐ V106.
- ☐ U105.
- ☐ U117.

Install four 24-pin IC sockets at:

- ☐ U108.
- ☐ U109.
- ☐ U111.
- ☐ U112.

Section 3

- ☐ 16-pin IC socket at U132.

Install four 14-pin IC sockets at:

- ☐ U134.
- ☐ U133.
- ☐ U103.
- ☐ U123.

NOTE: Do not install an IC socket at U116 at this time.

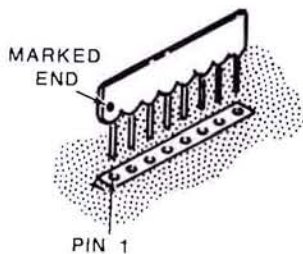
- ☐ 24-pin IC socket at U102.
- ☐ 40-pin IC socket at U101.
- ☐ 14-pin IC socket at U119.
- ☐ 16-pin IC socket at U124.
- ☐ 20-pin IC socket at U106.
- ☐ 20-pin IC socket at U122.
- ☐ 20-pin IC socket at U104.
- ☐ 14-pin IC socket at U135.
- ☐ 20-pin IC socket at U114.

Refer to Pictorial 1-3 for the following steps.

Section 1

- () D102: 3A1 diode (#57-42).
- () D103: 3A1 diode (#57-42).
- () Solder the leads to the foil and cut off the excess lead lengths.

NOTE: In some of the following steps, you will install resistor packs. To install a resistor pack, start its leads into the circuit board holes so the line- or dot-marked end is toward the number 1 on the outline on the circuit board. Then push the resistor pack down against the circuit board and solder the leads to the foil. Cut off any excess lead lengths.



- () RP101: Resistor pack (#9-140).
 - () U139: Refer to Detail 1-3A and use the following procedure to install a UA7815 integrated circuit (#442-63) to the circuit board.
1. Use long-nose pliers to bend the leads 90° at a point 1/8" away from the IC body as shown in the Detail.
 2. Start the IC leads into the corresponding circuit board holes (the outline of this part is shown on the component side of the circuit board). Then push the IC down flat against the circuit board.
 3. Solder the IC leads to the foil and cut off any excess lead lengths.

- () U138: In a similar manner, install an MC7915 integrated circuit (#442-613) to the circuit board. Position the IC so that it does not touch the foil near the top of the IC body.

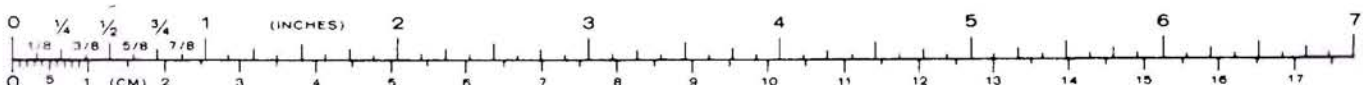
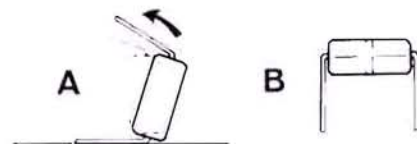
NOTE: Some of the ICs used in this kit are MOS (metal-oxide semiconductor) devices. These are rugged and reliable components when they are installed, but they can be damaged by static electricity during installation. The other ICs are of a type that is not susceptible to static electricity. However, you should treat these ICs as if they were MOS types, since it will avoid all possible confusion between ICs and provide protection in all cases.

Once you remove a protected IC from its protective foam packing, DO NOT lay the IC down or let go of it until it is installed in its socket. When you bend the leads of a protected IC, hold it in one hand and place your other hand on your work surface before you touch the IC to your work surface. This will equalize the static electricity between the work surface and the IC.

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

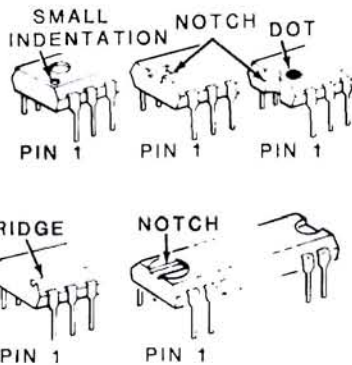


Before you install an IC, lay it down on its side as shown below and very carefully roll it toward the pins to bend the lower pins into line. Then turn the IC over and bend the pins on the other side in the same manner.

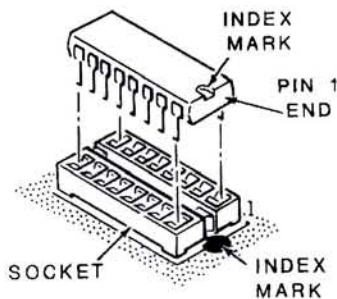


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Compare the IC to the drawing below. Then determine which end of the IC is the pin 1 end.



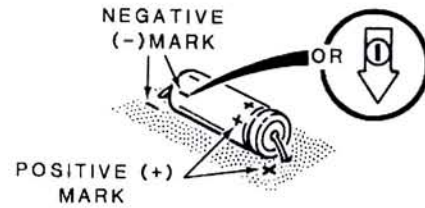
Position the pin 1 end of the IC over the index mark on the circuit board (refer to the Pictorial if you cannot find the index mark on your circuit board). Then start the IC pins into the socket. Make sure that all of the pins are started; then push the IC firmly into the socket. NOTE: An IC pin can become bent under the IC and it will appear as though it is correctly installed in the socket.



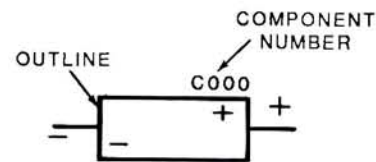
() U136: N5741 integrated circuit (#442-22).

() Q103: MJE171 transistor (#417-819). Use the same procedure you used to install U138 and U139 to install this transistor. Be sure to position the metal side of the transistor against the circuit board.

NOTE: Before you install an electrolytic capacitor, look at it and identify the leads. One lead will have either a negative (-) mark or a positive (+) mark near it on the side of the capacitor. (The marking for a negative lead may look like an oblong bar, sometimes with a circle around it, inside an arrow.) ... Be sure to install the negative lead in the negative-marked hole, and the positive lead in the positive-marked hole.



() C151: 10 μ F electrolytic capacitor. NOTE: Electrolytic capacitors are identified on the circuit board by the following outline:



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

Section 2

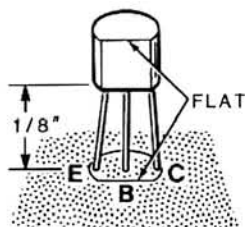
Install ten resistor packs (#9-140) at:

- () RP102.
- () RP103.
- () RP104.
- () RP105.
- () RP106.
- () RP107.
- () RP108.
- () RP109.
- () RP111.
- () RP112.

Section 3

() RP113: Resistor pack (#9-140).

NOTE: When you install each of the following transistors, position it so the flat side of the case is over the outline of the flat on the circuit board. Then insert the E, B, and C leads into their holes and position the bottom of the case 1/8" above the circuit board. Solder the leads to the foil after you install each transistor and cut off the excess lead lengths.



() Q101: MPS-A05 transistor (#417-864).

() Q102: MPS-A55 transistor (#417-865).

() R121: 390 Ω , 5-watt.

() Y101: Refer to Detail 1-3B and use the following procedure to install a 4 MHz crystal (#404-536) to the circuit board:

1. Cut a piece of foam gasket 3/8" \times 1/2".
2. Remove the paper backing from one side of the foam gasket and press the gasket to the crystal as shown.
3. Start the crystal leads into the corresponding circuit board holes. Then remove the paper backing from the remaining side of the foam gasket and press the crystal to the circuit board.
4. Solder the crystal leads to the foil and cut off any excess lead lengths.

() C103: 10 μ F electrolytic capacitor.

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

Refer to Pictorial 1-4 for the following steps.

NOTE: In the following steps, you will install pushbutton switches. To install a pushbutton switch, refer to Detail 1-4A and insert the leads of the switch into the corresponding circuit board holes. Then push the switch down against the circuit board and solder one lead to the foil. Check to make sure that the switch is seated against the circuit board. Then solder the remaining leads to the foil. If a switch is not installed properly, you will have problems when you install the front panel in a later step.

Section 1

Install five pushbutton switches (#64-946) at:

() SW124.

() SW118.

() SW113.

() SW107.

() SW101.

Section 2

Install twelve pushbutton switches (#64-946) at:

() SW119.

() SW114.

() SW108.

() SW103.

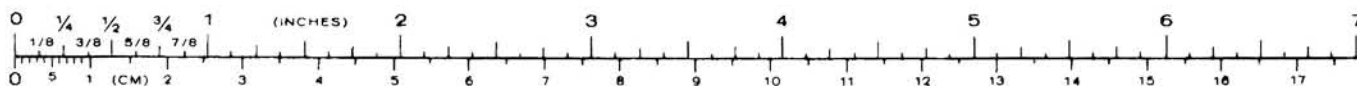
() SW121.

() SW115.

() SW109.

() SW104.

() SW122.



() SW116.

() SW111.

() SW105.

Section 3

Install five pushbutton switches (#64-946) at:

() SW123.

() SW117.

() SW112.

() SW106.

() SW102.

NOTE: In the following steps, you will install buttons on the pushbutton switches. To install a knob, refer to Detail 1-4B and position the button over the pushbutton switch as shown. Then push the button down onto the switch until it snaps into place.

Section 1

() Four white buttons at SW124, SW118, SW113, and SW107.

() One red button at SW101.

Section 2

() Twelve gray buttons at SW119, SW114, SW108, SW103, SW121, SW115, SW109, SW104, SW122, SW116, SW111, and SW105.

Section 3

() Four gray buttons at SW123, SW117, SW112, and SW106.

() One red button at SW102.

Refer to Pictorial 1-5 for the following steps.

() Locate the piece of insulator paper and cut it in half lengthwise to make two $4\frac{3}{4}'' \times 5/16''$ pieces.

NOTE: In some of the following steps, you will install small LEDs. To install an LED, refer to Detail 1-5A and position the LED as shown. Use a $4\frac{3}{4}'' \times 5/16''$ piece of insulator paper to space the LEDs above the circuit board as shown. Solder the leads to the foil and cut off the excess lead lengths. Remove the piece of insulator paper and set it aside until it is called for later.

Section 1

Install six small LEDs (#412-654) at:

() V113.

() V109.

() V112.

() V108.

() V111.

() V107.

Section 3

() Refer to Detail 1-5B and install the 24-pin socket with long leads at U116. Make sure the socket pins are straight. Then start the pins into the circuit board holes as shown in the Detail. Use two pieces of $4\frac{3}{4}'' \times 5/16''$ insulator paper to space the socket above the circuit board. Then solder the pins to the foil and cut off the excess lead lengths.

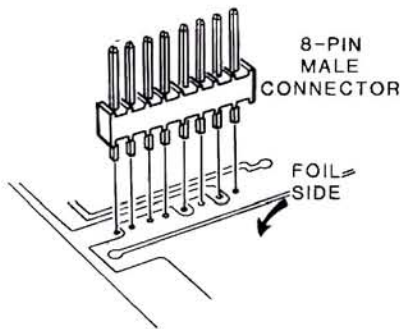
() Plug the program socket head into the program socket as shown. Attach the head to the socket with the screws provided.

() Refer to Detail 1-5C and install the 28-pin program socket at U115. Make sure this socket is seated firmly against the circuit board and positioned with the lever toward the pin 1 end as shown. Solder the leads to the foil and cut off the excess lead lengths.

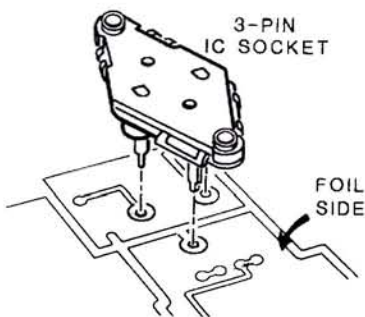
Refer to Pictorial 1-6 for the following steps.

NOTE: In the following steps, you will install components on the **foil side** of the circuit board. Solder the leads to the **component side** of the circuit board as you install each part and cut off any excess lead lengths.

- () Turn the circuit board over so that the foil side of the circuit board is facing up and it is positioned as shown in the Pictorial.



- () **P101:** 8-pin male connector.
- () **P102:** 6-pin male connector. Be sure to position this connector as shown in the Pictorial.



- () 3-pin IC socket at U137.
- () Cut the following lengths of foam gasket:
1-3/8"
1-1/8"
2"

Refer to Detail 1-6A for the following steps.

NOTE: When you install a foam gasket in each of the following three steps, center the gasket between the capacitor mounting holes.

- () Remove the paper backing from either side of the 1-3/8" length of foam gasket. Then, press the gasket to the circuit board at C138 as shown in the Detail.
- () Remove the paper backing from either side of the 1-1/8" length of foam gasket. Then press the gasket to the circuit board at C142 and C145 as shown in the Detail.
- () Remove the paper backing from either side of the 2" length of foam gasket. Then press the gasket to the circuit board at C148 and C149 as shown in the Detail.

NOTE: In the following steps, you will install electrolytic capacitors to the foil side of the circuit board at the locations where you installed the lengths of foam gasket. To install these capacitors, use the following procedure:

1. Remove the paper backing from the remaining side of the foam gasket.
 2. Start the leads of the capacitor into the circuit board holes as shown in the Pictorial. Be sure to identify the positive (+) or negative (-) leads and install the capacitor properly.
 3. Press the capacitor down against the foam gasket and solder the leads to the **COMPONENT SIDE** of the circuit board.
 4. Cut off any excess lead lengths.
- () C138: 6800 μ F electrolytic capacitor.
 - () C142: 470 μ F, **25 V** electrolytic capacitor.
 - () C145: 470 μ F, **25 V** electrolytic capacitor.
 - () C149: 470 μ F, **50 V** electrolytic capacitor.
 - () C148: 1000 μ F electrolytic capacitor.
 - () C154: 470 μ F, 50V, electrolytic capacitor.
 - () C153: 22 μ F electrolytic capacitor.



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Refer to Detail 1-6B for the following steps.

NOTE: The thermal compound you will use in the following steps helps transfer heat from the integrated circuit to the heat sink. The compound is not caustic, but make sure you do not get it into your eyes, ears, nose, mouth, or clothing. Always wash your hands after you use the compound. Keep this and all chemicals out of the reach of children.

- () Refer to the inset drawing and open the container of thermal compound.
- () Apply a layer of compound on the lead side of the UA309 (#442-30) integrated circuit and set it aside temporarily.
- () Place two #10 fiber flat washers over the shoulders on the 3-pin IC socket.

- () Position the heat sink so the prong side is facing up and the end with the single hole is as shown.
- () Note the shorter space from the leads of the IC and the hole in the case. Place the IC on the heat sink so the shorter space is toward the single hole in the heat sink.
- () While holding the IC in place, position the heat sink and IC over the 3-pin IC socket as shown. Then insert the IC leads into the socket.
- () Fasten the assembly to the 3-pin IC socket with two 6-32 \times 1/2" phillips screws.

Set the circuit board assembly, integrated circuits, and 7-segment LEDs aside temporarily. Proceed to "Chassis".

CHASSIS

PARTS LIST

Remove the remaining parts from the shipping carton and check each part against the following list. The key numbers correspond to the numbers on the "Chassis Parts Pictorial" (Illustration Booklet, Page 12). Return any part that is in an individual envelope back into the envelope after you have identified it, until that part is called for in a step. Do not throw away any packing material until you account for all the parts.

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

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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SOCKETS – CONNECTORS

A1	432-137	2	Push-on connector	
A2	432-753	7	Large spring connector (1 extra)	
A3	432-821	1	6-pin socket	S102
A4	432-866	10	Small spring connector (1 extra)	
A5	432-1028	1	25-pin D connector	S1
A6	432-1030	1	2-pin socket	S2
A7	432-1031	8	Female connector pin	
A8	432-1150	1	8-pin socket	S101

HARDWARE

NOTE: Hardware packets are marked to show the size of the hardware they contain (HDW #4, or HDW #8, etc.). You may have to open more than one packet to locate all of the hardware of any one size (#6, for example).

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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#4 Hardware

B1	250-1373	8	4-40 × 3/4" hex screw	
B2	252-2	2	4-40 nut	
B3	252-731	8	4-40 brass insert	
B4	254-9	2	#4 lockwasher	
B5	255-757	2	4-40 hex spacer	

#6 Hardware

B6	250-1325	1	6-32 × 1/4" phillips screw	
B7	250-1280	6	6-32 × 3/8" phillips screw	
B8	250-1420	8	6-32 × 3/8" phillips flat head screw	
B9	250-1322	1	#6 × 5/8" self-tapping phillips screw	
B10	252-3	3	6-32 nut	
B11	252-725	12	6-32 brass insert	
B12	254-1	3	#6 lockwasher	
B13	255-776	1	6-32 hex spacer	
B14	259-1	2	#6 solder lug	

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

B15	250-1436	6	8-32 × 3/8" phillips screw	
B16	252-4	6	8-32 nut	
B17	254-2	5	#8 lockwasher	
B18	259-2	1	#8 solder lug	

WIRE – SLEEVING

344-32	6"	Large green wire	
344-33	18"	Large black wire	
344-220	36"	Small black wire	
344-222	12"	Red wire	
344-223	12"	Orange Wire	
344-224	36"	Yellow wire	24" extra
344-225	18"	Green wire	
346-20	2"	Heat-shrinkable sleeving	
346-60	1-1/2"	Large clear sleeving	

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

C1	54-1036	1	Power transformer	T1
C2	61-43	1	Rocker switch	SW1
C3	75-754	1	Line cord strain relief	
	89-54	1	Line cord	
C4	92-786	1	Cabinet top	
C5	92-787	1	Cabinet bottom	
C6	181-4325	1	AC filter board	
C7	203-2249	1	Front panel	
C8	204-2849-1	1	AC filter bracket	
C9	204-2850	1	Transformer mounting plate	
C10	206-1498	1	RF shield	
C11	260-700	1	LED grommet	
C12	260-701	1	LED grommet ring	
C13	261-28	4	Plastic foot	
C14	350-12	1	Cement	Extra
C15	354-5	1	Cable tie	
C16	412-640	1	Large LED	V1
C17	421-33	1	1/4 A 3AG slow-blow fuse	F1
C18	422-1	1	Fuseholder	
C19	432-1423	2	24-pin personality module plug	Extra
C20	432-1424	2	24-pin personality module plug cover	Extra
C21	490-111	1	IC puller	
C22	73-147	2	Foam spacer (3")	
	490-185	1	Solder wick*	

NOTE: The extra parts are supplied to assemble the Personality Modules.

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 2-1 for the following steps.

NOTE: The term "hardware" will be used to refer to the screws, nuts, and lockwashers where parts are being mounted in some of the following steps. The phrase "Use 6-32 \times 1/2" phillips hardware," for example, means to use a 6-32 \times 1/2" phillips screw, one or more #6 lockwashers, and a 6-32 nut. Refer to any Pictorial or Details that are used in the steps for the correct number of lockwashers and the correct way to install the hardware.

The Details that are used during the assembly show an exploded view of a particular part being installed and the method for mounting it. Refer to the Pictorial for the positioning of all parts.

NOTE: To prepare a wire, cut it to the proper length and remove 1/4" of insulation from each end. For stranded wires, tightly twist together the strands at each wire end and add a small amount of solder to hold the separate strands together.

- () Prepare a 13" large black wire.

Refer to Detail 2-1A for the next three steps.

- () 1. Install a push-on connector on either end of the 13" large black wire as shown in the Detail.
- () 2. Cut a 1" length of heat-shrinkable sleeving.
- () 3. Slide the 1" length of heat-shrinkable sleeving over the end of the push-on connector and 13" large black wire. Position the sleeving so that it is flush with the end of the connector. Then shrink the sleeving in place with a lighter or match.

NOTE: If any of the holes in the AC filter board have solder in them, refer to the instructions supplied with the solder wick to remove the solder from the holes.

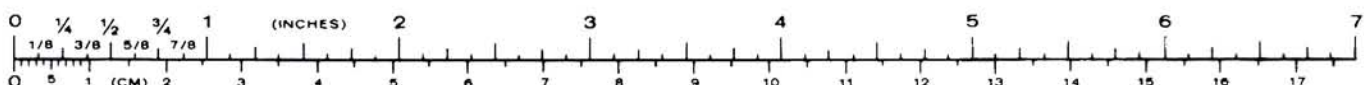
- () Position the AC filter circuit board assembly as shown in Pictorial 2-1.

- () Connect the free end of the 13" large black wire to the AC filter board at hole C. Solder the wire to the circuit board foil and cut off the excess lead length.
- () Prepare a 2" large black wire.
- () Connect either end of the 2" large black wire to the AC filter board at hole A. Solder the wire to the circuit board foil and cut off the excess lead length.
- () Mount a 6-32 hex spacer to the AC filter board assembly with 6-32 hardware as shown.
- () Temporarily set aside the AC filter board.

Refer to Pictorial 2-2 for the following steps.

NOTE: When you prepare the following wires, remove only 1/8" of insulation from the wire ends.

- () Prepare the following wires:
 - 12" small black
 - 12" orange
 - 12" red
 - 12" small black
 - 12" yellow
 - 12" small black
 - 12" green
- () Position the 8-pin socket with the slots as shown.
- () Install a small spring connector on either end of a 12" small black wire. Then push this connector into 8-pin socket S101 hole 1 until it locks into place.
- () Install a small spring connector on either end of a 12" orange wire. Then push this connector into 8-pin socket S101 hole 2 until it locks into place.
- () Install a small spring connector on either end of a 12" red wire. Then push this connector into 8-pin socket S101 hole 3 until it locks into place.



- () Install a small spring connector on either end of another 12" small black wire. Then push this connector into 8-pin socket S101 hole 5 until it locks into place.
 - () Install a small spring connector on either end of a 12" yellow wire. Then push this connector into 8-pin socket S101 hole 6 until it locks into place.
 - () Install a small spring connector on either end of the remaining 12" small black wire. Then push this connector into 8-pin socket S101 hole 7 until it locks into place.
 - () Install a small spring connector on either end of a 12" green wire. Then push this connector into 8-pin socket S101 hole 8 until it locks into place.
 - () Position the 2-pin socket with the slots as shown.
 - () Install a small spring connector on the free end of the 12" small black wire coming from S101 pin 7. Then push this connector into 2-pin socket S2 hole 1 until it locks into place.
 - () Install a small spring connector on the free end of the 12" green wire coming from S101 pin 8. Then push this connector into 2-pin socket S2 hole 2 until it locks into place.
 - () Position the 25-pin D connector as shown in the Pictorial.
 - () Install a female connector pin on the free end of the 12" red wire coming from S101 pin 3. Then push this connector into 25-pin D connector S1 hole 3 until it locks into place.
 - () Install a female connector pin on the free end of the 12" orange wire coming from S101 pin 2. Then push this connector into 25-pin D connector S1 hole 6 until it locks into place.
 - () Install a female connector pin on the free end of the 12" small black wire coming from S101 pin 1. Then push this connector into 25-pin D connector S1 hole 1 until it locks into place.
 - () Install a cable tie around the seven wires coming from socket S101 5" from the plug. Cut off the excess tie length.
- Refer to Pictorial 2-3 for the following steps.
- () Position the AC filter bracket as shown in the Pictorial.
 - () Mount a #6 solder lug to the hole nearest the back of the AC filter bracket as shown. Use 6-32 × 3/8" hardware.
 - () Mount the fuseholder to the AC filter bracket as shown. Use 6-32 × 3/8" hardware.
 - () Mount 25-pin D connector S1 to the AC filter bracket as shown. Use two 4-40 hex spacers and 4-40 hardware. Do not overtighten this hardware.
 - () Position the AC filter board near the AC filter bracket as shown.

NOTE: In the following steps, you will insert female connector pins into the D connector. Once these pins are inserted into the connector, they cannot be removed without damaging the pins and/or connector. Therefore, be careful when you assemble the D connector in the following steps.

- () Refer to the inset drawing and install a female connector pin on the free end of the 12" yellow wire coming from S101 pin 6. Then push this connector into 25-pin D connector S1 hole 2 until it locks into place.
- () Install a female connector pin on the free end of the 12" small black wire from S101 pin 5. Then push this connector into 25-pin D connector S1 hole 7 until it locks into place.
- () Connect the 2" black wire from the AC filter board, hole A to the fuseholder lug as shown. Be sure to make a mechanically secure connection and solder the wire.
- () Temporarily set the AC filter bracket assembly aside.

NOTE: Refer to the inset drawing on Pictorial 2-3 when you are directed to make a mechanically secure connection.

Refer to Pictorial 2-4 for the following steps.

- () Locate the power transformer and scrape the varnish from its mounting tabs.
- () Cut the bare ends of the transformer leads to 1/8" from the insulation.
- () Install a large spring connector on the free end of the green/yellow transformer lead. Then push this connector into 6-pin socket S102 hole 1 until it locks into place.
- () Install a large spring connector on the free end of either green transformer lead. Then push this connector into 6-pin socket S102 hole 2 until it locks into place.
- () Install a large spring connector on the free end of the remaining green transformer lead. Then push this connector into 6-pin socket S102 hole 3 until it locks into place.
- () Install a large spring connector on the free end of the red/yellow transformer lead. Then push this connector into 6-pin socket S102 hole 4 until it locks into place.
- () Install a large spring connector on the free end of either red transformer lead. Then push this connector into 6-pin socket S102 hole 5 until it locks into place.
- () Install a large spring connector on the free end of the remaining red transformer lead. Then push this connector into 6-pin socket S102 hole 6 until it locks into place.
- () Holding the transformer in one hand and S102 in your other hand, twist the transformer leads together to form a tight group.
- () Cut a 1" length of heat-shrinkable sleeving. Then slide this sleeving over either of the black transformer leads.
- () Install a push-on connector on the free end of the black transformer lead that contains the sleeving.

- () After the connector cools, position the sleeving over the push-on connector on the black transformer lead so that it is flush with the end of the connector and shrink the sleeving in place with a lighter or match.
- () Mount the transformer to the transformer mounting plate as shown. Use 8-32 hardware.
- () Temporarily set aside the transformer assembly.

Refer to Pictorial 2-5 for the following steps.

NOTE: There may be a film on the cabinet. If there is, wipe it thoroughly with a clean cloth.

- () Turn the cabinet bottom over. Then peel the backing from the four plastic feet and install them at the recesses at each corner.
- () Remove the backing from the Caution label and press it to the back of the cabinet bottom as shown.
- () Remove the backing from the Blue and White label and press it to the cabinet bottom as shown. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.

Refer to Pictorial 2-6 for the following steps.

- () Position the cabinet bottom as shown in the Pictorial.

NOTE: Before you install brass inserts, make sure your soldering iron is clear of solder, or solder may flow down into an insert. Then refer to Detail 2-6A and use your soldering iron to install the inserts in the following step.

- () Install four 6-32 brass inserts in the cabinet bottom as shown.
- () T1: Refer to Detail 2-6B and mount the transformer assembly to the cabinet bottom as shown. Use 8-32 hardware. Then bend the solder lug upward at approximately a 45° angle.
- () Position the AC filter bracket assembly in the cabinet bottom as shown in the Pictorial.



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- () Route the transformer leads as shown in the Pictorial.
- () Connect the black transformer lead without the push-on connector to AC filter board hole D. Solder the lead to the foil and cut off any excess lead length.
- () Prepare the ends of the 6" large green wire.
- () Connect and solder a #6 solder lug to either end of the 6" large green wire. Make a mechanically secure connection.
- () Connect and solder the free end of the 6" large green wire to the solder lug at transformer T1. Be sure to make a mechanically secure connection.
- () Route the 6" large green wire as shown in the Pictorial.
- () Refer to Detail 2-6C and mount the AC filter board to the AC filter bracket as shown. Use a 6-32 \times 1/4" phillips screw. Be sure to position the #6 solder lug with the 6" green wire between the AC filter bracket and the hex spacer on the AC filter board.
- () Refer to Detail 2-7B Part 1 and install the line cord in the strain relief as follows:
 1. Insert the prepared end of the line cord through the rear AC filter bracket as shown.
 2. Insert the end of the line cord through the strain relief hole with the shoulder and weave the line cord through the indicated hole for a distance of 4".
 3. Route the line cord through the remaining strain relief hole and pull it tight at both ends of the strain relief. Upon completion, you should have approximately 2-1/2" of line cord coming from the strain relief as shown in Part 2 of the Detail.
- () Refer to Detail 2-7B Part 2 and push the shoulder of the strain relief into the indicated hole of the AC filter bracket and secure it with a #6 \times 5/8" self tapping phillips screw.

Refer to Pictorial 2-7 for the following steps.

Refer to Detail 2-7A for the next four steps.

- () 1. Remove outer insulation from the end of the line cord for a total of 2" as shown. Be careful not to cut into the inner lead insulation when you remove the outer insulation.
 - () 2. Cut 1/2" from the end of the white lead. Remove 3/8" of insulation from the white lead and apply a small amount of solder to the lead end to hold the strands together.
 - () 3. Cut 1" from the end of the black lead. Remove 3/8" of insulation from the black lead and apply a small amount of solder to the lead end to hold the strands together.
 - () 4. Remove 3/8" of insulation (if this has not already been done) from the green lead and apply a small amount of solder to the lead end to hold the strands together.
- NOTE: In the following steps, (NS) means not to solder the connection because you will add other wires later. "S-" with a number, such as (S-2), means to solder the connection. The number following the "S-" tells you how many wires should be at the connection. This helps you check your work for errors as you go.
- Connect the line cord leads as follows. Make mechanically secure connections.
- () Green lead to the #6 solder lug (S-1).
 - () White lead to AC filter board lug BB (S-1).
 - () Black lead to the indicated fuseholder lug (S-1).
 - () Refer to Detail 2-7C and prepare the ends of the 1-1/2" length of clear sleeving as shown.
 - () F1: Position the sleeving over the 1/4 A 3AG slow-blow fuse. Then push the fuse into the fuseholder as shown.

Refer to Pictorial 2-8 for the following steps.

- () Turn the AC filter bracket assembly over and mount it to the cabinet bottom as shown in the Pictorial. Use 6-32 hardware. Be sure to route the wires coming from the AC filter bracket assembly as shown.
- () Twist the two black wires with the push-on connectors together to form a tight wire group.
- () Write the fuse value (1/4A, 3AG, slow-blow) on the fuse label. Then remove the backing from the label and press it to the AC filter bracket top as shown.
- () Temporarily set aside the cabinet bottom.

Refer to Pictorial 2-9 for the following steps.

- () Position the cabinet top as shown in the Pictorial. NOTE: There may be a film on the cabinet top. If there is, wipe it thoroughly with a clean cloth.

NOTE: Before you install brass inserts, make sure your soldering iron is clear of solder or solder may flow down into the insert. Use your soldering iron to install the inserts in the following steps. The white arrows on the Pictorial indicate where to install the smaller 4-40 inserts, and the dark arrows indicate where to install the larger 6-32 inserts.

- () Install eight 4-40 brass inserts at the white arrow locations in the cabinet top.
- () Install eight 6-32 brass inserts at the dark arrow locations in the cabinet top.

Refer to Pictorial 2-10 for the following steps.

- () Refer to Detail 2-10A and position the Power switch so the lugs are as shown. Then push the switch into the cabinet top from the top side of the cabinet at SW1. Use a screwdriver and pry the four tabs out slightly until they lock into place.
- () Position the cabinet top so that the top side is facing upward. Then peel the POWER, OFF, ON portion from the model label and press it to the recessed area at the right side of the cabinet top.
- () Peel the MODEL NUMBER portion from the model label and press it to the recessed area at the left side of the cabinet top.
- () V1: Install the large LED in the cabinet top as follows:
 1. Push the LED grommet into the hole from the outside of the cabinet top as far as it will go.
 2. Push the LED all the way into the grommet.
 3. Place the retainer ring over the LED and press the ring over the grommet as far as it will go. You will have to hold the grommet from the other side as you do this.

Proceed to the "Initial Tests" section on Page 31.

INITIAL TESTS

In this section of the Manual, you will perform certain tests to verify that your EPROM Programmer operates properly. If you do not obtain the correct results in any of the following steps, refer to the "Possible Cause of Trouble" column, or the "In Case of Difficulty" section on Page 55, and correct the problem before you continue.

The charts in this section list the correct Meter Readings for each test and several "Possible Causes of Trouble". If a particular part is mentioned as the possible cause, check that part to see if it was correctly installed. Also check the parts connected to it for poor connections. It is also possible, on rare occasions, for a part to be faulty and require replacement.

PRIMARY WIRING

A wiring error in the primary wiring circuit (line cord, ON-OFF switch, etc.) of your kit could cause you to receive a severe electrical shock. These "Primary Wiring Tests" will assure you that no such wiring errors exist.

Refer to Pictorial 3-1 for the following steps.

- () Be sure the line cord is not plugged in.
- () Place the POWER switch to the OFF position.
- () Position the cabinet top and cabinet bottom near each other as shown in the Pictorial.
- () Plug either of the two twisted black leads onto SW1 lug 1.
- () Plug the remaining twisted black lead onto SW1 lug 2.
- () If you do not have an ohmmeter, carefully check the line cord, fuse, ON-OFF switch, and transformer wiring with that shown in Pictorial 2-1. Make sure there are no fine strands of wire or solder blobs touching adjacent terminals or the AC filter bracket. Then proceed to "Final Assembly".

If you have an ohmmeter, perform the following resistance measurements. NOTE: When you are instructed to connect one of the ohmmeter leads to ground, connect it to the transformer mounting plate.

- () Place the ohmmeter range switch in its lowest resistance range position.

METER CONNECTIONS		METER READING	POSSIBLE CAUSE OF TROUBLE
RED LEAD	BLACK LEAD		
1. Either flat prong of the line cord plug.	Ground.	INFINITE with the POWER switch ON or OFF.	A. Line cord. B. Fuse F1. C. Transformer T1. D. AC filter circuit board.
2. Other flat prong of the line cord plug.	Ground.	INFINITE with the POWER switch ON or OFF.	
3. Round prong of the line cord plug.	Ground.	0 Ω with the POWER switch ON or OFF.	
4. Either flat prong.	Other flat prong.	1M or higher with the POWER switch OFF.	
() Place the POWER switch to ON.			
5. Either flat prong.	Other flat prong.	15 to 50 Ω	See A, B, C, and D above.
() Place the POWER switch to OFF.			

This completes the "Primary Wiring Tests". If all tests were satisfactory, proceed to the "Circuit Board Tests". If any of the tests were not correct, you must make the corrections necessary to obtain the correct readings before you continue.

CIRCUIT BOARD RESISTANCE

Refer to Pictorial 3-2 for the following steps.

NOTE: When you are instructed to connect the black meter lead to ground, connect it to the negative (–) lead of C138.

() Set your meter to the $R \times 1000$ range.

METER CONNECTIONS		METER READING	POSSIBLE CAUSE OF TROUBLE
RED LEAD	BLACK LEAD		
1. U137, pin O.	Ground.	Greater than 2 k Ω .	A. D102, D103, C138, U137.
2. U138, pin O.	Ground.	Greater than 2 k Ω .	A. D104, D105, D106, D107, C142, U136, U138.
3. U139, pin O.	Ground.	Greater than 2 k Ω .	A. D104, D105, D106, D107, C145, U136, U139.
4. Positive (+) lead of C149.	Ground.	Greater than 20 k Ω .	A. C148, D108, D109, C149, D112, C151, D111, Q103.

CIRCUIT BOARD VOLTAGE

Refer to Pictorial 3-3 for the following steps.

NOTE: When you are instructed to connect the black meter lead to ground, connect it to the negative (–) lead of C138.

- () Position the circuit board near the cabinet bottom as shown in the Pictorial.
- () Plug S102 onto P102 as shown. Be sure to plug in the connector with the grn/yel lead as shown.
- () Set your voltmeter to the DC Volts position and the range switch to measure positive (+) 20V DC range.
- () Plug in the line cord.
- () Place the POWER switch to ON.

METER CONNECTIONS		METER READING	POSSIBLE CAUSE OF TROUBLE
RED LEAD	BLACK LEAD		
1. U137, pin O.	Ground.	+ 5 VDC \pm 10%.	A. D102, D103, C138, U137.
() Set your voltmeter to measure negative (–) 20 VDC.			
2. U138, pin O.	Ground.	– 15 VDC \pm 10%.	A. D104, D105, D106, D107, C142, U138.
() Set your voltmeter to measure positive (+) 20 VDC.			
3. U139, pin O	Ground.	+ 15 VDC. \pm 10%.	A. D104, D105, D106, D107, C145, U139.
() Set your voltmeter to measure positive (+) 25 VDC.			
4. Indicated lead of R127.	Ground.	+ 21 VDC \pm 5%.	A. C148, D108, D109, C149, D112, C151, D111, Q103, U136.

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- () Place the POWER switch to OFF.
- () Prepare the ends of the remaining length of green wire.
- () Plug either end of the green wire into U116 pin 5.
- () Plug the other end of the green wire into U116 pin 10.
- () Place the POWER switch to ON.

METER CONNECTIONS		METER READING	POSSIBLE CAUSE OF TROUBLE
RED LEAD	BLACK LEAD		
1. Indicated lead of R127.	Ground	+ 25 VDC \pm 5%.	A. D108, D109, D111, C148, C149, C151, U116, U136, Q102, Q103, R127, R128, R129.

- () Place the POWER switch to OFF.
- () Unplug the line cord.
- () Remove the green wire from U116.
- () Unplug the two black leads from SW1.
- () Unplug S102 from P102.

This completes the "Initial Tests." If all tests were satisfactory, proceed to the "Final Assembly." If any of the tests were not correct, you must make the corrections necessary to obtain the correct readings before you continue.

FINAL ASSEMBLY

Refer to Pictorial 4-1 for the following steps.

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

Section 1

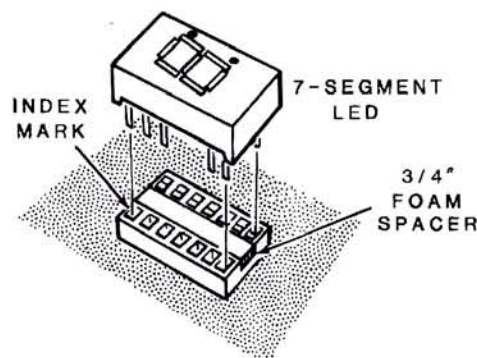
NOTE: Install each of the following ICs in the same manner that you installed IC U136 earlier in this Manual (Page 19).

- () U126: **74LS259** integrated circuit (#443-804).
- () U125: **74LS42** integrated circuit (#443-807).
- () U121: **74LS04** integrated circuit (#443-755).
- () U118: **74LS367** integrated circuit (#443-857).
- () U107: **74LS373** integrated circuit (#443-837).

Section 2

- () U127: **74LS259** integrated circuit (#443-804).
- () U128: **74LS259** integrated circuit (#443-804).
- () U129: **74LS259** integrated circuit (#443-804).
- () U131: **74LS259** integrated circuit (#443-804).
- () Locate the two 3" foam spacer strips. Then cut the strips into six 3/4" pieces.

- () Remove the paper backing from one side only of each of the 3/4" foam spacers. Press the adhesive side of the spacers against the center of sockets V101 through V106 as shown.



Position the 7-segment LED over the socket as shown in the Detail. Then start the LED pins into the socket. Push the LED firmly into the socket so it compresses the foam spacer. NOTE: An LED pin can become bent under the LED and it will appear as though it is correctly installed in the socket.

- () V101: 7-segment LED (#411-831).
- () V102: 7-segment LED (#411-831).
- () V103: 7-segment LED (#411-831).
- () V104: 7-segment LED (#411-831).
- () V105: 7-segment LED (#411-831).
- () V106: 7-segment LED (#411-831).

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- () U105: **74LS74** integrated circuit (#443-730).
- () U117: **74LS32** integrated circuit (#443-875).
- () U108: **HM6116-P4** integrated circuit (#443-1027).

Section 3

- () U132: **74LS259** integrated circuit (#443-804).
- () U134: **MC1488/75188** integrated circuit (#443-794).
- () U133: **MC1489/75189** integrated circuit (#443-795).
- () U103: **74LS32** integrated circuit (#443-875).
- () U123: **74LS32** integrated circuit (#443-875).
- () U102: **2732A** ROM integrated circuit (#444-341-2).
- () U101: **Z-80** integrated circuit (#443-881).
- () U119: **74LS04** integrated circuit (#443-755).
- () U124: **74F138** integrated circuit (#443-1075).
- () U106: **74LS373** integrated circuit (#443-837).
- () U122: **74LS374** integrated circuit (#443-863).
- () U104: **74LS245** integrated circuit (#443-885).
- () U135: **74LS08** integrated circuit (#443-780).
- () U114: **74LS374** integrated circuit (#443-863).

NOTE: Integrated circuits U109, U111, U112, and U113 are supplied with the IDA-4801-2 and IDA-4801-3 RAM Expansion Accessories. If you have purchased these accessories, refer to the "IC Installation" section (Page 41) and install your accessories. Then return to this section of the Manual and proceed with the following steps. If you have not purchased

either of these accessories, U109, U111, U112, and U113 will not be installed at this time. Proceed with the following steps.

Refer to Pictorial 4-2 for the following steps.

- () Position the lever on the program socket straight up as shown.
- () Position the front panel over the circuit board as shown.
- () Mount the circuit board / front panel assembly and the RF shield to the cabinet top as shown. Use eight 4-40 × 3/4" hex screws.

Refer to Pictorial 4-3 for the following steps.

- () Position the cabinet top near the cabinet bottom as shown.
- () Plug either of the black twisted wires onto SW1 lug 1.
- () Plug the remaining black twisted wire onto SW1 lug 2.
- () Plug S102 (the large wire harness from the AC shield) into P102 as shown.
- () Plug P2 (the small wire harness from the AC filter bracket) onto LED V1 as shown. Be sure to position the plug as shown with the long LED lead plugged into P2 hole 2 (green wire). Then bend the leads of the LED over to hold the plug in place.
- () Plug P101 (the transformer wire harness) into S101 as shown.
- () Install the cabinet top onto the cabinet bottom as shown. Use eight 6-32 × 3/8" phillips flat head screws.
- () Carefully read the FCC label. Then sign and date the label.
- () Peel the backing from the FCC label and press it to the cabinet bottom as shown.

NOTE: You will have the following parts left over. These parts are used to build Personality Modules. Refer to the "Personality Module Requirements" section (Page 45) of this Manual for Personality Module diagrams.

QTY.	HEATH Part No.	DESCRIPTION
1	6-153-12	15k Ω (brn-grn-org) resistor
3	56-56	1N4149 diode
2	56-659	1N5998B diode
24"	344-224	Yellow wire
1	350-12	Cement
2	432-1423	Personality module plug
2	432-1424	Personality module plug cover
1	390-2737	Personality module label set

This completes the assembly of your ID-4801 EPROM Programmer.

OPERATIONAL TESTS

This section of the Manual describes how your kit will operate after you first turn it on. If you do not obtain the indicated results, turn off the POWER switch and proceed to the "In Case of Difficulty" section on Page 55. Some of the displays you will observe in the following steps will be displayed for only .5 second. Therefore, read the steps thoroughly before you actually perform them. Refer to Figure 1(Illustration Booklet, Page 25) for the location of the front panel displays and indicators.

() Plug in the line cord to a 120 VAC outlet.

NOTE: In the following step, the Programmer will test its internal RAM. The results of this test will be displayed as indicated in step 4. Should an error occur, the Programmer will display the highest usable RAM address available. The Programmer will use this RAM address as its maximum address until you correct the error. For example, an ADDRESS display of 0223 and a DATA display of E indicates an error has occurred and the highest usable RAM address is 0223. After approximately .5 second, the display will reset to 0000 00.

() Place the POWER switch to ON and observe the following displays:

1. The POWER LED should be ON.

2. All of the Function Indicators should be ON.
3. The Data Display should be OFF.
4. The Address Display should display one of the following indications:
07FF
0FFF
1FFF
3FFF
5. If you installed U109 and U111, the Programmer will test for 6K of RAM and display the following indication:
17FF

NOTE: 6K of RAM is not a standard configuration.

After approximately 3 seconds, you should observe the following displays:

1. KEYPAD Function Indicator – ON.
2. EPROM to RAM Function Indicator – OFF.
3. RS-232 Function Indicator – OFF.
4. INSERT Function Indicator – OFF.
5. DELETE Function Indicator – OFF.
6. SEARCH Function Indicator – OFF.
7. Hex Address Display – 0000.
8. Data Display – 00.

Proceed to the "Operation" section on Page 43.

ACCESSORY INSTALLATION

IDA-4801-1 PERSONALITY MODULE ACCESSORY

Your IDA-4801-1 Personality Module Accessory contains five personality module plugs and covers. The components used to assemble these modules were supplied with your IDA-4801 EPROM Programmer.

Parts List

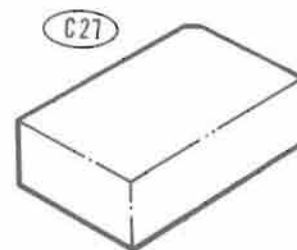
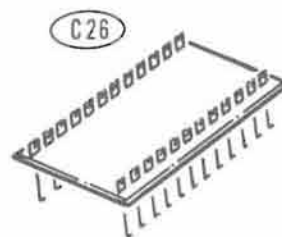
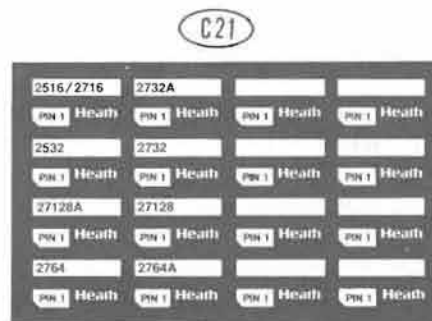
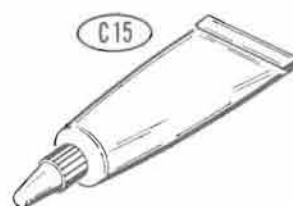
Refer to the Parts Pictorial to identify the following parts.

KEY	HEATH	QTY.	DESCRIPTION
No.	Part No.		

C15	350-12	1	Cement
C21	390-2737	1	Personality module label set
C26	432-1423	5	Personality module plug
C27	432-1424	5	Personality module plug cover
	597-260	1	Parts Order Form
		1	Instruction Sheet

Refer to the "Operation" section under "Personality Module Requirements" (Page 45) to assemble your personality modules. Figure 5 (Illustration Booklet, Page 28) contains wiring diagrams for eight common modules. Refer to the "Personality Module Requirements" section and Figure 5 and assemble the modules of your choice.

CAUTION: The personality module plugs may be damaged by excessive heat.



IDA-4801-2 8K RAM EXPANSION ACCESSORY

Your IDA-4801-2 RAM Expansion Accessory contains RAM to expand your EPROM Programmer's memory to a total of 8K bytes.

Parts List

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
A1	443-1027	3	HM6116-P4
	597-260	1	Parts Order Form
		1	Instruction Sheet

A1



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

Cabinet Removal

Refer to Figure 2 for the following steps.

- () Unplug the line cord.
- () Remove the eight 6-32 \times 3/8" phillips flat head screws as shown.
- () Straighten the leads of LED V1 and unplug socket S1.
- () Unplug socket S101.
- () Unplug socket S102.
- () Unplug the black, twisted wire pair at SW1 lugs 1 and 2.

Refer to Figure 3 for the following steps.

- () Remove the eight 4-40 \times 3/4" hex screws as shown and temporarily set aside the RF shield.
- () Remove the front panel and circuit board from the cabinet top and temporarily set aside the front panel.

IC Installation

Refer to Figure 4 for the following steps.

NOTE: Install each of the following ICs in the same manner that you installed ICs earlier in the Manual.

Install the ICs in the circuit board as follows:

- (✓) U109: HM6116-P4 integrated circuit (#443-1027).
- (✓) U111: HM6116-P4 integrated circuit (#443-1027).
- (✓) U112: HM6116-P4 integrated circuit (#443-1027).

This completes the installation of your 8K RAM Expansion Accessory. If you purchased the 16K RAM Expansion Accessory, refer to the following "IDA-4801-3 16K RAM Expansion Accessory" section.

If you did not purchase the 16K RAM Expansion Accessory, refer to Figures 2 and 3 and reassemble your Programmer. Then proceed to Page 39 and perform the "Operational Tests".

IDA-4801-3 16K RAM EXPANSION ACCESSORY

Your IDA-4801-3 16K RAM Expansion Accessory contains RAM to expand your EPROM Programmer's memory to a total of 16K bytes. NOTE: You must have purchased and installed the 8K RAM Expansion Accessory before you can install the 16K RAM Expansion Accessory.

Parts List

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
B6	443-1138	1	HM6264-P15
	597-260	1	Parts Order Form
		1	Instruction Sheet

B6



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

Installation

(1) If you have not already done so, refer to the "8K RAM Expansion Accessory" in this section of the manual and disassemble your Programmer.

Refer to Figure 4 for the following step.

NOTE: If it has been a long time since you installed the other ICs in this kit, reread the IC installation notes (Page 19) before you complete the next step.

(2) U113: HM6264-P15 integrated circuit (#443-1138).

This completes the installation of your IDA-4801-3 16K RAM Expansion Accessory. Refer to Figures 2 and 3 and reassemble your Programmer. Then proceed to the "Operational Tests" section.

OPERATION

This section of the Manual is divided into four sections: Error Conditions, Power Up Indications, Personality Module Requirements, and Modes of Operation. The "Personality Module Requirements" section contains wiring diagrams for eight commonly used Personality Modules. The IDA-4801-1 Personality Module Accessory contains parts to assemble five modules.

ERROR CONDITIONS

NOTE: To avoid damaging the PROM, remove any PROM from the program socket before turning the unit off. Be sure the Programmer is in the Keypad Mode before removing or inserting a PROM into the program socket.

Your Programmer will display three types of error messages: power up errors, address errors, and data transfer errors. Power up and address errors will automatically reset after approximately one second. However, to reset from a data transfer error, you must select another function.

POWER UP ERRORS

Upon power up, your Programmer will test its internal RAM. If no errors occur, the display will indicate the hexadecimal equivalent of the maximum available RAM as outlined in the "Initial Tests" section. If an error occurs during power up, the Address display will indicate the memory address where the error occurred and the Data display will indicate "E". After approximately 1 second, the display will reset and the Programmer will default to the Keypad Mode. Until you correct the error, the address displayed will be the maximum usable memory. This allows you to use your Programmer even though the full compliment of RAM is not available.

ADDRESS ERRORS

Every time your Programmer prompts you for an address, your address entry is compared to the maximum usable memory address. If your input is larger than the maximum memory available, the Address display will indicate "E". After approximately one second, the display will reset and the Programmer will default to the Keypad Mode.

DATA TRANSFER ERRORS

A Data Transfer Error can occur in the EPROM to RAM, RS-232, Program EPROM, and Verify Modes. This type of error will halt the current operation and display the memory address where the error occurred. The RAM data at that location will also be displayed. To further indicate that the current operation has been interrupted, all I/O Select and Edit LEDs, except the RS-232 LED, will turn ON.

To exit a Data Transfer Error, you must select any other function. This type of error display is extremely useful if an error occurs while the Programmer is unattended.

POWER UP INDICATIONS

This section of the manual describes how your unit will operate after you first turn it on. The initial displays you will observe will be displayed for only .5 second. Therefore, read this section thoroughly before you turn your Programmer on. Refer to Figure 1 for the location of the front panel displays and indicators.

Upon power up, you should observe the following displays:

1. The POWER LED will be ON.
2. All of the Function Indicators will be ON.
3. The Data Display will be OFF.
4. The Address Display will display the hex (hexadecimal) address of the highest RAM (random access memory) location. Depending on the amount of RAM you have installed in your Programmer, you will observe one of the following displays:

<u>RAM INSTALLED</u>	<u>ADDRESS DISPLAY</u>
2K	07FF
4K	0FFF
6K	17FF
8K	1FFF
16K	3FFF

The above indications will be displayed for approximately three seconds. After that time, you will observe the following displays:

1. The POWER LED will remain ON.
2. The KEYPAD Indicator will remain ON.
3. All other Function Indicators will go OFF.
4. The ADDRESS Display will display 0000.
5. The DATA Display will display 00.

Your Programmer is now in the Keypad mode, as indicated by the Keypad Indicator being ON. At this point, you can enter information from the hex keypad. Although the maximum memory address is no longer displayed, it is stored in memory for future reference. If you attempt to address a memory location above the maximum memory installed, the Address Display will display the maximum memory address and the Data Display will display E.

Should an address or data error occur when you turn on your Programmer, the Address Display will indicate the address where the error occurred and the Data Display will display E. The Programmer will then use this "error address" as the maximum RAM address. You can still use your Programmer if an error should occur. However, you will not be able to address any memory locations above the error address.

PERSONALITY MODULE REQUIREMENTS

Your Programmer performs ten distinct functions. Some of these functions require specific Personality Modules. Refer to the following chart to determine the functions that require a module.

<u>FUNCTION</u>	<u>MODULE REQUIRED</u>
EPROM to RAM	YES
SIMULATE	YES
PROGRAM EPROM	YES
VERIFY	YES
KEYPAD	NO
RS-232 TRANSMIT	NO
RS-232 RECEIVE	NO
INSERT	NO
DELETE	NO
SEARCH	NO

Eight commonly used Personality Module wiring diagrams are shown in Figure 5. Parts are supplied to assemble two modules. Refer to these wiring diagrams and assemble a module of your choice as follows. Use the components you set aside earlier.

Refer to Figure 6 for the following steps.

- () Assemble the Personality Module of your choice from the wiring diagrams shown in Figure 5.

- () Apply a small bead of glue completely around the Personality Module socket as shown in the Figure.
- () Install a Personality Module cover over the socket as shown.
- () Peel the corresponding label from the Personality Module label set and press it to the cover. Be sure to position the pin 1 end of the label as shown.
- () Allow the glue to dry for at least eight hours before you use the Personality Module.

NOTE: To program EPROMs or EEPROMs not listed on the Personality Module label set, refer to the device manufacturer's specifications to determine the programming sequence and voltage levels required for that EPROM or EEPROM. Once you determine the specifications, refer to the Timing Diagram (Figure 12) to determine how the signals may be used. Use the Schematic Diagram to determine the circuitry required for the Personality Module.

MODES OF OPERATION

OVERVIEW

The following description outlines a brief functional overview of your EPROM Programmer. For a detailed description of the various functions, refer to the following "Modes of Operation."

Refer to Figure 7, the Programmer's Functional Block Diagram, while you read this "Overview."

As Figure 7 shows, all data (programs) is loaded into your Programmer's RAM (random access memory). This RAM is accessed by one of three inputs: the Keypad, EPROM, or RS-232 Port. Once the data is loaded into RAM, it can be manipulated by a variety of editing features. It can then be output to program an EPROM or through the RS-232 Port into a computer.

The Keypad allows you to directly access specific memory locations (one location at a time) and enter and/or edit the data at the memory location addressed. You can then output this data (program) to create an EPROM or upload the program into a computer through the RS-232 Port.

You can also load a program from an existing EPROM into the Programmer's RAM. Once the program is loaded into RAM, you can use the editing features to modify the program or output the program unchanged to create a copy of your EPROM. The program can also be output through the RS-232 Port into a computer.

A program created on a computer can be downloaded through the RS-232 Port into the Programmer's RAM. The program can then be edited to create a new EPROM or output through the RS-232 Port back into the computer in its edited format.

Your Programmer's RAM can also be used to simulate an EPROM in a computer or other external device. During Simulate, the Programmer's RAM is substituted for the EPROM in the external device.

This section of the Manual describes the functions of your Programmer. Samples are also provided to help you better understand these functions. To enter sample information, press the key or keys listed in the "Press" columns. Your Programmer will respond with the displays listed in the "Address" and "Data" columns. A Data Display of XX means that the display is lighted with two unspecified hex digits. To exit any function, press the FUNCTION SELECT key followed by the 0 key.

KEYPAD

The Keypad Mode allows you to address a memory location, enter or examine data, increment by one the current memory address displayed, decrement by one the current memory address displayed, and repeat data being entered. Information is then entered from the keypad in hexadecimal beginning with the most significant digit and ending with the least significant digit. To enter the Keypad Mode, press the FUNCTION SELECT key and then press the 0 key (the keys corresponding to the functions are outlined on the front panel). You can do this at any time to exit other commands or correct entry mistakes.

CAUTION: Do not push two hexadecimal keys simultaneously. If you do, it may result in an illegal condition that can be corrected only by placing the Power Switch to OFF and back to ON again.

ADDRESS

You can address (select) any legal RAM address and then examine, change, or enter data at that address. A legal RAM address is any address between 0000 and the amount of RAM you have installed in your Programmer. After you have addressed a specific memory location and entered data at that address, the Address Display will automatically increment by one after .2 second. Start by pressing the ADDRESS key as shown at the top of the following chart. The - - - Address Display indicates that you are in the ADDRESS Mode and an address input is needed.

<u>PRESS</u>	<u>ADDRESS</u>	<u>DATA</u>
ADDRESS key	----	Blank
0100	0100	XX
A9	0100	A9
	After .2 second:	
	0101	XX
59	0101	59
	After .2 second:	
	0102	XX

As you can see, once you have addressed your first memory location and entered your desired data, the Programmer will continue to increment automatically through the available memory as you enter data. Upon reaching the upper memory limit, the Address Display will display FuLL and the Data Display will go OFF. After approximately one second, your Programmer will return to the Keypad Mode.

INCREMENT

The Increment function allows you to increase the current memory address displayed by one. This function works two ways. Pressing and releasing the INCREMENT button increases the current memory address by one. Pressing and holding the INCREMENT button increases the current memory

address at the rate of approximately two addresses per second. Upon reaching maximum memory, your Programmer will "wrap around" to memory address 0000 and start over.

<u>PRESS</u>	<u>ADDRESS</u>	<u>DATA</u>
ADDRESS key	----	Blank
0100	0100	XX
INCREMENT key	0101	XX
Press and hold	0102	XX
the INCREMENT	0103	XX
key	0104	XX
	0105	XX

DECREMENT

This function operates in the same manner as the Increment function. Pressing and releasing the DECREMENT key decreases the current memory address displayed by one. Pressing and holding the DECREMENT key decreases the current memory address at the rate of approximately two addresses per second. Upon reaching memory address 0000, your Programmer will "wrap around" to the highest memory address.

<u>PRESS</u>	<u>ADDRESS</u>	<u>DATA</u>
ADDRESS key	----	Blank
0105	0105	XX
DECREMENT key	0104	XX
Press and hold	0103	XX
the DECREMENT	0102	XX
key.	0101	XX
	0100	XX

REPEAT

This fully addressable feature allows you to fill any selected legal block of RAM with desired data when the Repeat key is pressed. You must be in the Keypad Mode to use this feature.

Your Programmer will prompt you for the first and last address of the block of RAM to be filled. The display will then return to the first RAM address and prompt you to enter the data to be inserted in the block of RAM you specified. Once the block of RAM is filled, the display will indicate the last address and the data in that address.

<u>PRESS</u>	<u>ADDRESS</u>	<u>DATA</u>
FUNCTION SELECT	XXXX	XX
0	XXXX	XX
REPEAT	----	F
	Enter first RAM address	
0092	0092	F
	After .5 second	
	----	L
	Enter last RAM address	
0261	0261	L
	After .5 second	
	0092	--
	Enter desired data	
F7	0261	F7

The Programmer will now load the data "F7" into all memory locations from address 0092 to address 0261. Once this block of memory is loaded, the display will indicate 0261 F7.

EPROM to RAM

NOTE: A Personality Module is required for this operation.

In this mode, you can load data from an existing EPROM into your Programmer's RAM. Each data byte is checked after it is transferred into RAM. Your Programmer will return to the Keypad Mode after all data is loaded into RAM.

To load an EPROM into RAM, use the following procedure:

1. Plug the correct Personality Module into the personality module socket. Be sure to match the pin 1 end of the Personality Module with the pin 1 end of the socket.

2. Make sure the Program Socket lever is in the OPEN (up) position.
3. Plug your EPROM into the Program Socket. Be sure to position the EPROM towards the bottom of the Program Socket as indicated on the front panel.
4. Move the Program Socket lever to the LOCK (down) position.
5. Press the FUNCTION SELECT key.
6. Press the 1 key. The EPROM to RAM Function Indicator will go ON, the Address Display will indicate LOAd, and the Data Display will go OFF.
7. Press the LOAD key. NOTE: Be sure that you have performed all of the steps above before you press the LOAD key.

CAUTION: If you press the LOAD key at an inappropriate time to the selected function, your Programmer will be forced into an inoperative condition that can be overcome only when you place the Power Switch to OFF and then back to ON again.

Your Programmer will return to the Keypad Mode after all of the data has been transferred into RAM. You will then observe the Keypad Indicator ON, the Address Displays will indicate 0000 and the Data Displays will indicate the data at address 0000.

NOTE: When you load an EPROM into RAM, your Programmer's entire available RAM will be loaded with the EPROM data. For example, if you load a 2K EPROM into your Programmer's full 16K of RAM, the EPROM will be repetitively loaded eight times into your Programmer's RAM.

RS-232 TRANSMIT/RECEIVE

Your Programmer uses Intel Hex Format for its RS-232 interface through the rear panel DCE Connector. All characters are transmitted and received in ASCII Code. A ":" is received and transmitted as 3A (hex) and a "3" is received and transmitted as 33 (hex). Refer to Table 1 for the ASCII codes used in your EPROM Programmer.

Table 1

Decimal	Hex	ASCII
0	00	NUL
10	0A	LINE FEED
13	0D	CARRIAGE RETURN
26	1A	SUB CONTROL Z END OF CP/MFILE
48	30	0
49	31	1
50	32	2
51	33	3
52	34	4
53	35	5
54	36	6
55	37	7
56	38	8
57	39	9
58	3A	:
65	41	A
66	42	B
67	43	C
68	44	D
69	45	E
70	46	F

ASCII codes used for RS-232 transfer

Intel Hex Format consists of two record types, data record format and end of file record.

Data Record Format

:BCAAAATTHH...CC/SPACE FOR CARRIAGE RETURN/LINEFEED/

Where:

- : = start character.
- BC = byte count for the record of data.
- AAAA = starting address for this record.
- TT = record type. TT = 00 data.
- HH = one byte in hexadecimal notation.
- CC = checksum. Negation (two's complement) of binary summation of preceding bytes in record (including byte count, address, and data bytes) in hexadecimal notation.

End of File Record

:BCAAAATTCC

Where:

- : = start character.
- BC = byte count for this record.
- AAAA = starting address for this record.
- TT = record type. TT = 01 end of file.
- CC = checksum

In the Receive Mode, BC (byte count) is determined by the transmitter. In the Transmit Mode, BC = 20 for a full data record or less than 20 for a partial record. In addition to record type TT = 01, the end of file is also identified during RS-232 receive if the byte count (BC) = 00. When this is used, record type (TT) is ignored.

RS-232 Transmit

The RS-232 Transmit Mode is used to transmit data from your Programmer's RAM to a computer. Data is transferred in Intel hex format at 9600 baud using lines 2 and 3, with line 7 as signal ground. The end-of-file character is control Z. The Programmer cannot exit the RS-232 Transmit Mode until the transmission is complete.

To receive the RS-232 signal from your Programmer, your computer must be configured to accept 8-bit serial bytes followed by one stop bit. You do not have to specify parity.

To use the RS-232 Transmit Mode, refer to the following procedure.

1. Press the FUNCTION SELECT key.
2. Press the 2 key. The RS-232 Function Indicator will go ON, the Address Display will indicate --- and the Data Display will indicate F. F is the prompt to enter the first RAM address.
3. Enter your first RAM address. The Address Display will indicate the address you entered and the Data Display will indicate F for .5 second. After approximately 1 second, the Address Display will indicate --- and the Data Display will indicate L. L is the prompt to enter the last RAM address.

4. Enter your last RAM address. The Address Display will indicate the address you entered and the Data Display will indicate L for approximately 1 second. After 1 second, the Address Display will indicate LOAd and the Data Display will go OFF.
5. Press the LOAD key. The Address Display will indicate LOAd and the Data Display will indicate --. NOTE: The right Data Display will appear brighter than the left Data Display.

After the last address is transmitted, your Programmer will return to the Keypad Mode. You will then observe the Keypad Indicator ON and the Address and Data Displays will indicate 0000 XX.

RS-232 Receive

This mode allows you to receive data from a computer into your Programmer's RAM. Data is received in Intel hex format at 9600 baud. To exit the RS-232 Receive Mode, press the FUNCTION SELECT key followed by the 0 key. There will be a slight delay before your Programmer returns to the Keypad Mode.

To use the RS-232 Receive Mode, use the following procedure.

1. Press the FUNCTION SELECT key.
2. Press the 3 key. The RS-232 Function Indicator will go ON, the Address Displays will indicate LOAd, and the Display Indicators will go OFF.
3. Press the LOAD key. The Address Display will go OFF, the left Data Display will go OFF, and the right Data Display will indicate --.

After all of the data is received, your Programmer will return to the Keypad Mode. You will then observe the Keypad Indicator ON, the Address Displays will indicate 0000 and the Data Displays will indicate the data at address 0000.

SIMULATE

Figure 8 shows the program socket-to-target and Personality Module cabling necessary for simulation of a 2716 EPROM. Figure 9 shows the Personality Module wiring diagram for this simulation.

All data is stored in your Programmer's RAM starting at address 0000. Note that the CE control is provided through an inverter in the Programmer to address line A14. Address lines A11, A12, and A13 of the Programmer's RAM are grounded in the Personality Module and/or the target circuitry. To simulate larger EPROMs, address lines A12 and/or A13 or neither are grounded. Additionally, some EPROMs may require controlling the OE (output enable) pin of the EPROM. This may require using the additional "OR" gate shown.

Several connections in the Personality Module are used specifically for programming and are not used for simulation circuits.

CAUTION: If you use the +5 VDC connection at program socket pin 28 to power simulation circuits, load current must be 150 mA or less. Overvoltage protection is not provided and short-circuit currents can exceed 2 amperes for this source. Use adequate bypass capacitors in the load circuit.

To use the Simulate Mode, make sure that your simulate cable and Personality Module are plugged in correctly. Then use the following procedure.

1. Press the FUNCTION SELECT key.
2. Press the 4 key. The Simulate Indicator will go ON and the Address and Data Displays will indicate ---- --.

The ---- -- display indicates that you are in the Simulate Mode. At this point, your Programmer's RAM is emulating your external device's ROM and system control is taken over by the external device. To resume Programmer control, you must exit the Simulate Mode. You can then use your Programmer to manipulate (verify, search, edit, etc.) the program loaded in your Programmer's RAM. To exit the Simulate Mode, press the FUNCTION SELECT key followed by the corresponding numeric key for the function you wish to perform.

INSERT RAM DATA

The Insert Mode allows you to insert new data at the currently displayed memory address. When the new data is inserted, all existing data is automatically incremented by one memory address.

From the Keypad Mode, enter the following data at the addresses indicated.

<u>ADDRESS</u>	<u>DATA</u>
0100	10
0101	11
0102	12
0103	13
0104	14
0105	15

Use the data you entered above and proceed with the Insert example listed below.

<u>PRESS</u>	<u>ADDRESS</u>	<u>DATA</u>
ADDRESS key	----	Blank
0100	0100	10
FUNCTION SELECT	0100	10
5	0100	10
The Insert Indicator will go ON.		
6A	0100	6A
	After .2 second	
	0101	10
ADDRESS key	----	Blank
0100	0100	6A
INCREMENT	0101	10
INCREMENT	0102	11
INCREMENT	0103	12
INCREMENT	0104	13
INCREMENT	0105	14
INCREMENT	0106	15

As shown in the above example, the Insert Mode allows you to insert data in an existing program without erasing any previously entered data. When you insert new data, all subsequent data is automatically incremented in memory. This feature is extremely useful when you are editing a program that has already been loaded into memory.

Be sure that you consider the results of using this function in EPROM codes that include "absolute" or "relative" jump instructions.

DELETE RAM DATA

This mode allows you to delete (erase) data from the currently displayed memory address. When data is deleted, all existing data above this address is automatically decremented in memory. From the Keypad Mode, enter the sample information listed below.

<u>ADDRESS</u>	<u>DATA</u>
0100	10
0101	11
0102	12
0103	13
0104	14
0105	15

Use the data you entered above and proceed with the Delete RAM Data example listed below.

<u>PRESS</u>	<u>ADDRESS</u>	<u>DATA</u>
ADDRESS key	----	Blank
0100	0100	10
FUNCTION SELECT	0100	10
6	0100	10
The Delete Indicator will go ON.		
6	0100	11
INCREMENT	0101	12
INCREMENT	0102	13
INCREMENT	0103	14
INCREMENT	0104	15

The above example demonstrates that you can delete (erase) data from the displayed memory address. When the data is deleted, all subsequent data is automatically decremented in memory. Similar to the Insert RAM Data Mode, the Delete RAM Data feature is extremely useful to edit an existing program.

Be sure that you consider the results of using this function in EPROM codes that include "absolute" to "relative" jump instructions.

Note that when data is deleted from RAM, the last memory address used will change.

BYTE SEARCH

The Byte Search Mode is used to locate data bytes in RAM and display both the data and the memory address. This mode can be used to locate one or two data bytes. Please note that when you perform a two-byte search, only the first memory address and data byte is displayed. Also, you must enter the data bytes to be searched for in ascending memory address order. For example, to locate bytes 6A and 10, you must enter the bytes in the order in which they were entered in memory. If 6A was entered first in your program, 6A must be the first byte entered when you perform a two-byte search.

The Byte Search Mode can be used to find bytes only. If editing data is required, return to the Keypad Mode.

From the Keypad Mode, enter the following data at the addresses indicated.

<u>ADDRESS</u>	<u>DISPLAY</u>
0100	6A
0101	10
0102	11
0103	6A
0104	13

Use the data you entered above and proceed with the one-byte search example listed below.

One-Byte Search

<u>PRESS</u>	<u>ADDRESS</u>	<u>DATA</u>
FUNCTION SELECT	0105	XX
7	—	Blank
The Search Indicator will go ON.		
1	1	--
6A	1	6A
	0100	6A
7	0103	6A

The 1 key that you pressed after you selected the Byte Search Mode indicates that you want to search for one data byte. 6A is the data byte that you want to search for. Your Programmer responded by indicating that data byte 6A is located at memory address 0100. If there were more than one data byte 6A, successive memory addresses that contain this data will be displayed each time you press the 7 key. Once all of the data bytes are located and displayed, the Address Display will indicate — and the Data Displays will go OFF, indicating that all of the data bytes have been located.

Two-Byte Search

Make sure the sample you entered for the One-Byte Search is still valid and proceed with the Two-Byte Search example listed below.

<u>PRESS</u>	<u>ADDRESS</u>	<u>DATA</u>
FUNCTION SELECT	XXXX	XX
7	—	Blank
2	2 --	--
6A	2 6A	--
10	2 6A	10
	0100	6A

The "2" key that you pressed after you selected the Byte Search Mode indicated that you want to search for two data bytes. 6A is the first data byte and 10 is the second data byte. Your Programmer responded by displaying 0100 6A, indicating that the two bytes you were searching for began at memory address 0100. The second data byte (10) and the second memory address (0101) will not be displayed. The next occurrence of the 6A 10 data bytes in your program, show the beginning memory address and beginning data byte will be displayed after you press the 7 key. Once all of the data bytes are located, the Address Displays will indicate — and the Data Displays will go blank. Please note that to use the Two-Byte Search Mode, the two bytes you are searching for must be originally entered in ascending consecutive order.

PROGRAM EPROM

NOTE: A Personality Module corresponding to the EPROM to be programmed is required for this operation.

Before an EPROM can be programmed, it must be erased. To erase an EPROM, it must be exposed to ultraviolet light for an extended period of time. The Heath Model ID-4803 EPROM Eraser is an ideal device for erasing EPROMs. An EPROM is completely erased when all of its data bits are set to logic 1. Most EPROMs can be erased and written to (programmed) 100 times or more before they can no longer be programmed.

Because of the wide variety of EPROMs available, there is no single programming method. However, all EPROMs do have some common characteristics. All EPROMs have a programming voltage (V_{pp}) that exceeds the EPROMs V_{cc} . This voltage is typically 12.5 VDC, 21 VDC, or 24 VDC and is applied by your Programmer for 50 ms.

All EPROMs also have some type of input and output control enables. The logic state of these signals determine whether the EPROM can be written to (programmed) or read only (ROM). If the output enable (OE) is logic 1, the EPROM can be programmed. If the output enable is logic 0, the EPROM can be read only (ROM).

In some cases, the chip select (\overline{CS}) is used to allow the EPROM to be programmed.

The Program EPROM Mode allows you to program a selected EPROM with the data that is currently stored in your Programmer's RAM.

To use this mode, refer to the following procedure.

1. Press the FUNCTION SELECT key.
2. Press the 8 key. The Address Display will be ---, the left Data Display will be blank, and the right Data Display will indicate F. F is the prompt to enter the first RAM address that contains data to be programmed into the EPROM.
3. Enter the first RAM address. The Address Display will indicate the address you entered, the left Data Display will be blank and the right Data Display will indicate F for .5 second.
4. After .5 second, the Address Display will be ---, the left Data Display will remain blank, and the right Data Display will indicate L. L is the prompt to enter the last RAM address that contains data to be programmed into the EPROM.
5. Enter the last RAM address. The Address Display will indicate the address you entered, the left Data Display will remain blank, and the right Data Display will indicate L for .5 second.
6. After .5 second, the Address Display will be --- and the Data Display will indicate FE. FE is the prompt to enter the first EPROM address to be programmed.
7. Enter the first EPROM address. The Address Display will indicate the address entered and the Data Display will indicate FE for .5 second.
8. After .5 second, the Address Display will indicate LOAD and the Data Display will go blank. NOTE: At this time, your Programmer tests the EPROM addresses to make sure they have been erased. If your EPROM to be programmed contains any data in the selected block of addresses, the Address Displays will indicate FuLL for .5 second and then return to the keypad Mode.
9. Press the LOAD key. The Address Display will indicate LOAD, the left Data Display will go blank and the right Data Display will indicate P. P is the prompt that indicates that the EPROM is being programmed.

During programming, every byte being programmed is verified. If an error is detected, the display will indicate the RAM address and data where the error occurred. Also, all I/O Select and Edit LEDs, except the RS-232 LED, will light.

Your Programmer will return to the Keypad Mode after the EPROM has been programmed. You will then observe the Keypad Indicator ON, the Address Displays will indicate 0000, and the Data Displays will indicate the data at address 0000.

VERIFY

This mode allows you to load a program into your Programmer's RAM and compare it to a programmed EPROM. The Programmer's RAM can be loaded from the Keypad, RS-232 Port, or an EPROM.

If the EPROM and RAM compare over the specified address range, the Address display will indicate the hexadecimal 16-bit checksum and the Data display will indicate "CS", for checksum.

If the EPROM and RAM do not compare, the display will indicate a data error message consisting of the RAM address and data where the error occurred. Also, all of the I/O Select and Edit LEDs, except the RS-232 LED, will go ON. This error message will be displayed until you select another function.

Do not confuse the checksum displayed with the checksum generated in the Intel Hex Format. This 16-bit checksum is simply the binary sum of all of the data compared. Since it is nearly impossible for different EPROMs to have the same checksum, you may want to use this checksum number as a signature for your EPROM.

Note that the checksum will vary dependent upon how much of the EPROM is verified. It is a good practice to verify the entire EPROM although you may not have used all of its available memory.

To use this function, refer to the following procedure.

1. Load your Programmer's RAM with the data to be verified.
2. Press the FUNCTION SELECT key.
3. Press the 9 key. The display will indicate --- L. L is the prompt to enter the last RAM address to be verified.
4. Enter the last RAM address of the data you wish to verify.
5. The Programmer will now compare its RAM to the EPROM from address 0000 to the last RAM address you entered.
6. If the RAM and EPROM are identical, the display will indicate the 16-bit checksum and "CS". If the RAM and EPROM are not identical, the display will indicate an error message as explained earlier.
7. If you wish to compare another EPROM to RAM, insert the next EPROM into the program socket. Then press the 9 key. The display will turn OFF for approximately 1 second and then display the checksum or error message.
8. To exit Verify, select any other function.

IN CASE OF DIFFICULTY

This part of the Manual will help you locate and correct difficulties that might occur in your EPROM Programmer. This information is divided into two sections. The first section, "General," contains suggestions in the following areas:

- A. Visual Checks.
- B. Precautions for Troubleshooting.
- C. Procedures for "Checking Transistors and Diodes."

The second section consists of a "Troubleshooting Chart." This chart calls out specific problems that may occur and lists one or more conditions or components that could cause each difficulty. A "Circuit Board X-Ray View" is also provided on Page 32 of the Illustration Booklet to help you locate parts on the circuit board.

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

GENERAL

VISUAL CHECKS

1. Recheck the wiring. Trace each lead with a colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something that you have consistently overlooked.
2. About 90% of the kits that are returned to the Heath Company for repair do not function properly due to poor connections and soldering. Therefore, you can eliminate many troubles by reheating all connections to make sure they are soldered as described in the "Soldering" section of the "Assembly Notes" on Page 7. Be sure there are no solder "bridges" between circuit board foils.
3. Check to be sure all transistors and diodes are in their proper locations. Make sure each lead is connected to the proper point. Make sure each diode band is positioned above the band printed on the circuit board.
4. Check electrolytic capacitors to be sure their positive (+) mark is at the correct position.
5. Check to be sure each IC is properly installed in its socket and pins are not bent out or under the IC. Also be sure the ICs are installed in their correct positions.

6. Check the values of the parts. Be sure in each step that you wired the correct part into the circuit, as shown in the Pictorial. It would be easy, for example, to install a 68 k Ω (blue-gray-orange) resistor where a 6800 Ω (blue-gray-red) resistor should be installed.
7. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.
8. A review of the "Circuit Description" may also help you determine where the trouble is.

If you still have not located the trouble after the "Visual Checks" are complete and a voltmeter is available, check voltage readings against those shown on the Schematic. Read the "Precautions for Troubleshooting" before you make any measurements.

PRECAUTIONS FOR TROUBLESHOOTING

1. Use caution when you test IC and transistor circuits. Although they have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than other circuit components.
2. Be sure you do not short any terminals to ground when you make voltage measurements. If the probe should slip, for example, and short across terminals or voltage sources, it is very likely to cause damage to one or more ICs, transistors, or diodes.

CHECKING TRANSISTORS AND DIODES

Transistors

To check a transistor accurately, you should use a transistor checker. However, if one is not available, you can use an ohmmeter to determine the general condition of any one of the transistors in this kit. The ohmmeter you use must exceed the threshold of the diode junctions in the transistor you are testing. Most vacuum tube voltmeters meet these requirements.

To check a transistor with an ohmmeter, proceed as follows:

1. Remove the transistor from the circuit.
2. Set the ohmmeter to the R \times 100 range.
3. Connect one of the ohmmeter leads to the base (B) of the transistor. Touch the other lead to the emitter (E) and then to the collector (C). Both readings should be the same, but may be either high or low. If one reading is high and the other is low, the transistor should be replaced. (Use the "Semiconductor Identification Charts" on Page 64 to identify the transistor leads).
4. Interchange the meter leads and repeat step 3.

NOTE: In the unusual case when the readings are all low, or all high, no matter which meter lead is connected to the base, the transistor should be replaced.

Diodes

To check a diode, unsolder one end from the circuit board, pull the lead up and out of the circuit board hole, and proceed as follows:

1. Set the ohmmeter to the R \times 1000 range.
2. Connect one of the meter leads to the lead of the cathode (banded) end of the diode. Connect the other lead to the other diode lead. Note the meter reading. Then interchange the meter leads and take another reading. One reading should be high and the other low (at least 10:1). If both readings are either high or low, the diode should be replaced.

TROUBLESHOOTING CHART

The following chart lists problems and possible causes of some troubles you might encounter. If a particular part is mentioned (Q103 for example) as a possible cause, check that part and other components connected to it to see that they are installed and/or wired correctly. Also check for solder bridges and poor connections in the surrounding area. It is also possible, on rare occasions, for a part to be faulty and require replacement.

CONDITION	POSSIBLE CAUSE
Power LED, V1, does not light.	<ol style="list-style-type: none"> 1. Fuse F1. 2. Plug P2 installed incorrectly. 3. IC U137. 4. Diodes D102 and/or D103. 5. LED V1.
+ 21 volt and/or + 25 volt power supply incorrect.	<ol style="list-style-type: none"> 1. Diodes D111 and/or D112. 2. Diodes D108 and/or D109. 3. Capacitors C148 and/or C149. 4. IC U136. 5. Transistor Q103.
+ 15 volt power supply incorrect.	<ol style="list-style-type: none"> 1. IC U139. 2. Diodes D105 and/or D107.
− 15 volt power supply incorrect.	<ol style="list-style-type: none"> 1. IC U138. 2. Diodes D104 and/or D106.
+ 5 volt power supply incorrect.	<ol style="list-style-type: none"> 1. IC U137. 2. Diodes D102 and/or D103.
Power up sequence error.	<ol style="list-style-type: none"> 1. ICs U108, U109, U111, U112, U113, and/or U115 RAM. 2. ICs U106 and/or U107 address controller. 3. IC U104 data bus transceiver. 4. IC U101 CPU. 5. ICs U119 and/or U105 system clock. 6. IC U122 system controller. 7. IC U124 memory address decoder.
Incorrect keypad entry and/or Data, Address, Increment, Decrement, or Repeat keys not functional.	<ol style="list-style-type: none"> 1. Keys rubbing against front panel. 2. Switches SW103, SW104, SW105, SW106, SW107, SW108, SW109, SW111, SW112, SW113, SW114, SW115, SW116, SW117, SW118, SW119, SW121, SW122, SW123, and/or SW124. 3. IC U118 keypad decoder. 4. ICs U117 and/or U119 keypad enable.

CONDITION	POSSIBLE CAUSE
Address, data, prompt, I/O select, and/or status LED's not functional.	<ol style="list-style-type: none"> 1. 7-segment LEDs V101, V102, V103, V104, V105, and/or V106. 2. Resistor packs RP101, RP102, RP103, RP104, RP105, RP106, RP107, RP108, RP109, RP111, RP112, and/or RP113. 3. ICs U126, U127, U128, U129, U131, and/or U132. 4. IC U125 display address decoder. 5. ICs U117 and/or U119 display enable. 6. Diode D101.
RS-232 port will not transmit or receive.	<ol style="list-style-type: none"> 1. IC U134 transmit level shifter. 2. IC U133 receive level shifter. 3. IC U131 transmit output. 4. IC U132 receiver logic driver. 5. Wiring error to 25-pin connector.
Will not load or program an EPROM.	<ol style="list-style-type: none"> 1. Personality module wired incorrectly. 2. Incorrect personality module. 3. EPROM installed in program socket incorrectly. 4. IC U122 controller. 5. Transistors Q101 and/or Q102 program voltage enable.
Load function does not operate properly.	<ol style="list-style-type: none"> 1. Switch SW101.
Function select does not operate properly.	<ol style="list-style-type: none"> 1. Switch SW102.

SPECIFICATIONS

Programmed Devices	2500 and 2700 series and compatible devices to 16K bytes that use a single supply voltage.
Personality Module	User-wired for flexibility. Two blanks provided.
Features	Keypad entry to RAM (stand-alone operation). EPROM to RAM download (address selectable). EPROM simulation using programmer RAM. Displays 16-bit check sum. EPROM test before programming start. Edit: Insert byte. Delete byte. Search for byte and display address. Verify (EPROM to RAM comparison).
I/O	RS-232C from 25-pin D connector provides read/ write channel to a computer.
I/O Formats	Intel Hex.
Data Transfer Rate	9600 baud.
Processor	Z-80 CPU.
Clock Speed	2 MHz.
Memory	4K × 8 system ROM and 2K × 8 system RAM ex- pandable to 16K × 8 system RAM.

Display	Six 7-segment LEDs for address, data, and prompt. Six LEDs for function indicators.
Keys	4 × 4 HEX keypad. Address, Increment, Decrement, Repeat, Function Select, and Load Function keys.
Programming Time	50 ms per byte.
Power Requirements	120 VAC, 60 Hz, 16 watts.
Dimensions	15-3/4" W × 10-3/4" D × 4-3/4" H (40.0 × 27.3 × 12.1 cm).
Weight	6 lbs. (2.7 kg).

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

THEORY OF OPERATION

Refer to Figure 10, the Programmer Block Diagram, while you read this "Theory of Operation." Figure 11 shows the Programming Pulse Timing Diagram and where to locate these timing pulses.

The ID-4801 EPROM Programmer consists of thirteen major circuits: the Z80 microprocessor, system clock, system ROM, keypad, RS-232 port, display, system controller, address controller, data controller, RAM, data save, power supply, and program and personality module sockets.

Z80 MICROPROCESSOR

U101, the Z80 microprocessor is the heart of the system. It controls the two major functions of the Programmer: code execution and servicing interrupts.

All code stored in system ROM U102 is executed by the Z80 microprocessor. Therefore, every feature of the Programmer is controlled by the Z80.

The second major function of the Z80 is to service interrupts input from the keypad to change programming functions. There are two types of interrupts serviced by the Z80, function select and load.

FUNCTION SELECT is the Z80 maskable interrupt. When you press the Function Select key, the Z80 goes to an interrupt service routine located at address 0038. This routine sets the SP register to the maximum RAM address. It then jumps to the key entry routine to determine the function you will select. Note that the SP register always contains the address of the maximum RAM available.

The LOAD function is the Z80 nonmaskable interrupt. When you press the Load key, the Z80 goes to an interrupt service routine located at address 0066. The SP register is then reset to the maximum RAM address and the correct load routine is selected. Note that the LOAD function should be activated only after the system prompt displays "LOAD".

SYSTEM CLOCK

4 MHz crystal Y101 is used by multivibrator U119 to provide the system clock. The output of this clock is divided by two by U105 to supply the Z80 with a 2 MHz master clock.

ROM

The system program is contained in ROM U102, a $4k \times 8$ ROM connected directly to the Z80's address and data busses. This ROM is located at address 0000-0FFF.

KEYPAD

The keypad is firmware-controlled by the Z80. Address decoder U118 determines if the keypad is active by decoding the Z80's I/O request and address bit 4.

When the keypad is active, a 4×5 switch matrix (keypad SW103 through SW124) is strobed to determine if any of the keys have been pressed. The strobe pulse is a logic 0 (0 volts) output on the address bus on bit 12, 13, 14, or 15. The strobe is sent to the data bus on bit 0, 1, 2, 3, or 4 and decoded by firmware in the system ROM (U102) when a key in the keypad is pressed.

RS-232 PORT

Receive

The RS-232 signal is received through RS-232 port connector S1 in Intel hex format at 9600 baud. This signal is shaped by level converter U133 and output to the data bus on bit 0 by gate U118. All timing and ASCII signals are decoded by firmware in system ROM U102. When the Programmer begins to receive data, the center segment of the least significant digit in the data display will turn on to indicate that data is being received.

Transmit

The RS-232 signal is also transmitted through RS-232 port connector S1 in Intel hex format at 9600 baud. This signal is firmware-controlled and output to the RS-232 port through level shifter U134 to comply with the RS-232 standard. When the Programmer begins to transmit, the G (center) segment of the most significant digit in the data display will go on to indicate that a transmission is in progress.

DISPLAY

Six 7-segment, common anode LEDs (V101 through V106) are used to indicate address, data, and prompt displays. The decimal points of the displays are tied to indicator LEDs V107 through V113 and are used for I/O select and edit indicators. All of these indicators and displays are generated by a firmware routine and look-up table in system ROM U102.

The Z80 treats the displays as an I/O port. Latch drivers U126 through U132 are addressed as an out-

put device. The correct data pattern is shifted into the latch drivers by firmware in system ROM U102.

SYSTEM CONTROLLER

System controller U122 is a firmware-controlled latch that determines the operation mode of the Programmer. It is also addressed as an I/O port and has eight outputs. Its outputs and their definitions are listed below.

$\overline{\text{ALE}}$	Address Latch Enable	Stores addresses for extended time periods during programming.
$\overline{\text{AOE}}$	Address Output Enable	Turns the address bus on and off.
$\overline{\text{SIM}}$	Simulate	Enters wait states during simulate mode operation.
$\overline{\text{SDO}}$	Store Data Out	Enables data output from data save register U114 during programming.
$\overline{\text{TOE}}$	Target Output Enable	Enables certain EPROMs during EPROM to RAM and programming functions.
$\overline{\text{TCE}}$	Target Chip Enable	Enables certain EPROMs during EPROM-to-RAM and programming functions.
$\text{V}_{\text{PP}}\text{E}$	Program Voltage Enable	Turns on the programming voltage.
$\overline{\text{DOE}}$	Data Output Enable	Turns the data bus on and off.

ADDRESS CONTROLLER

Address controllers U106 and U107 are latch drivers that operate in three modes: transparent, latch, and disabled.

In the transparent mode, the address controllers pass addresses directly to memory locations.

In the latch mode, the address controllers hold addresses for extended periods of time during programming.

In the disabled mode, the address controllers tri-state the address bus during the simulate function.

DATA CONTROLLER

Data controller U104 is also a latch driver that operates in three modes: read, write, and tri-state.

In the read mode, data is read from RAM.

In the write mode, data is written into RAM.

In the tri-state mode, the data bus is turned off.

RAM

RAM (random access memory) is the temporary storage area for all data input into the Programmer. Since this Programmer uses volatile type RAM, all data stored in it will be lost when the power is turned off. The Programmer is supplied with 2K of RAM. It is also expandable to a total of 16K of RAM. U108 is the supplied 2K × 8 static RAM. It is located

at address 4000-7FFF. During the simulate function, this RAM is also used as the ROM of the external device.

DATA SAVE

U114 is the data save latch. It retains data for extended periods of time during the programming function. This data is then used to program the EPROM. Normally, U114 is disabled. Data save is determined by the system controller.

PROGRAM AND PERSONALITY MODULE SOCKETS

The program socket is the interface for all EPROM operations. EPROMs to be programmed are plugged into the program socket. Data entered into RAM is then transferred to the EPROM through the program socket.

The personality module socket is used to make necessary hardware changes for various EPROMs and for simulate operation. The user-assembled personality module is plugged into this socket to match the Programmer's pin configuration with that of the EPROM. A personality module is also used to match the pin configuration in the simulate mode.

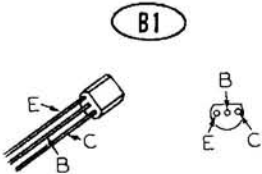
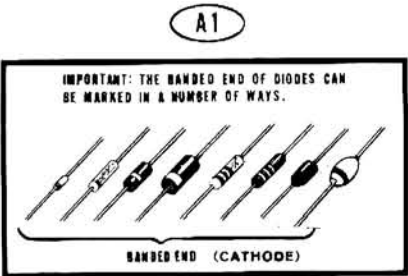
POWER SUPPLY

The power supply develops four regulated voltages: +5 VDC, +15 VDC, -15 VDC, and +25 VDC. Logic circuits are supplied by the +5 VDC supply. The +15 VDC and -15 VDC supplies furnish the RS-232 voltage. Programming voltage is supplied by the +25 VDC supply. This voltage can be modified from the personality module using diodes, zener diodes, and resistors.

SEMICONDUCTOR IDENTIFICATION CHARTS

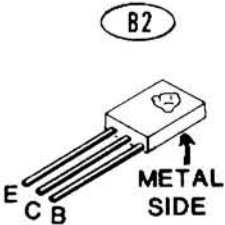
DIODES

COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	KEY NUMBER
D101	57-65	1N4002	A1
D102	57-42	3A1	A1
D103	57-42	3A1	A1
D104	57-65	1N4002	A1
D105	57-65	1N4002	A1
D106	57-65	1N4002	A1
D107	57-65	1N4002	A1
D108	57-65	1N4002	A1
D109	57-65	1N4002	A1
D111	56-659	1N5998B (selected 8.2 V zener)	A1
D112	56-620	1N4744A (15 V zener)	A1
D113	56-659	1N5998B (selected 8.2 V zener)	A1
D114	56-659	1N5998B (selected 8.2 V zener)	A1



TRANSISTORS

Q101	417-864	MPS-A05	B1
Q102	417-865	MPS-A55	B1
Q103	417-819	MJE171	B2



INTEGRATED CIRCUITS

COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH
U101	443-881	Z80
U102	444-341-1	N/A
U103	443-875	74LS32
U104	443-885	74LS245
U105	443-730	74LS74
U106	443-837	74LS373
U107	443-837	74LS373
U108	443-1027	HM6116-P4
U109*	443-1027	HM6116-P4
U111*	443-1027	HM6116-P4
U112*	443-1027	HM6116-P4
U113*	443-1138	HM6264-P15

*Optional

KEY
NUMBER

C1

C2

C3

C4

C5

C6

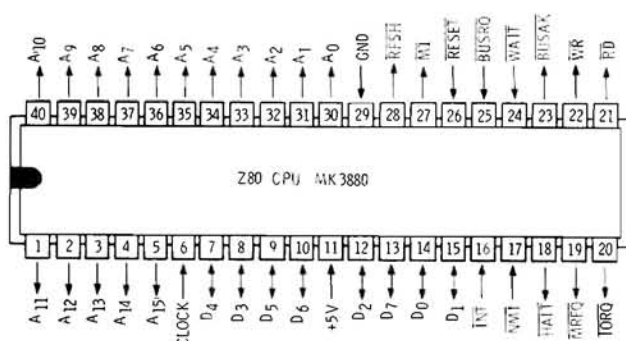
C7

C7

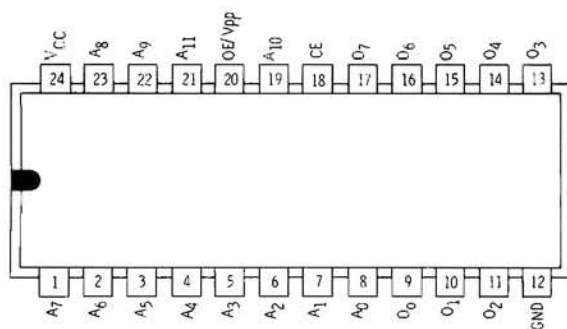
C7

C8

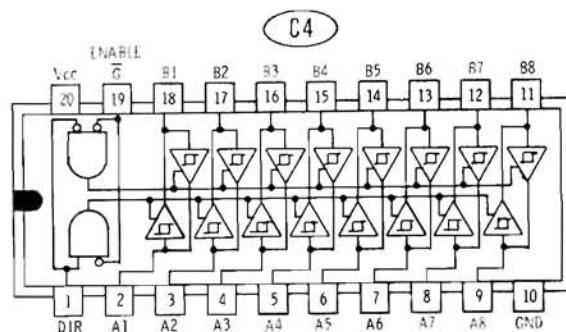
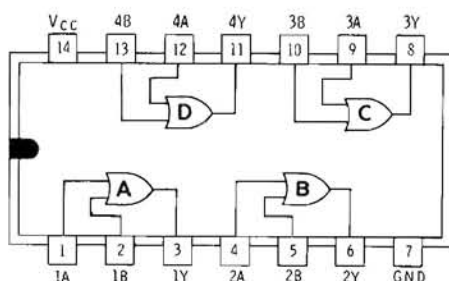
C1



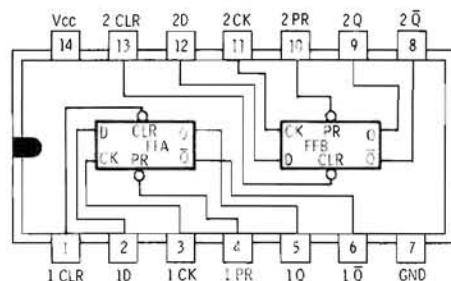
C2



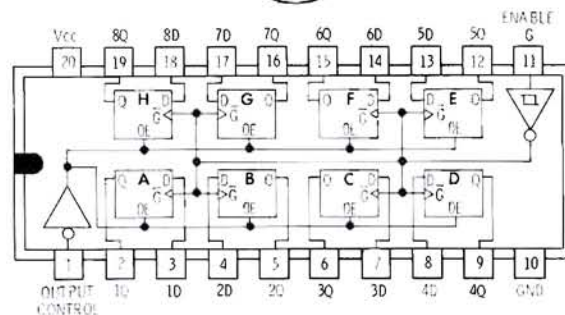
C3



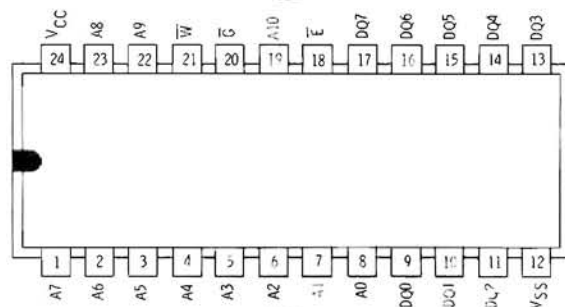
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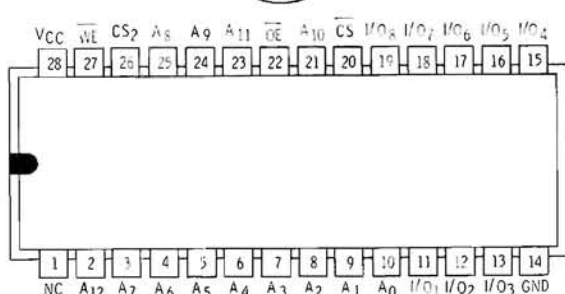
C6



C7

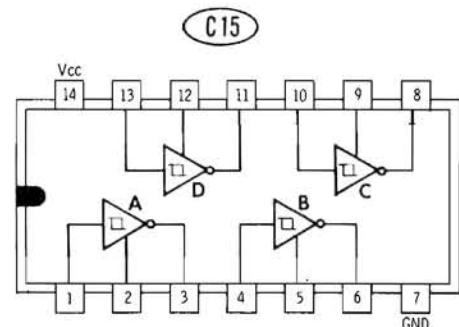
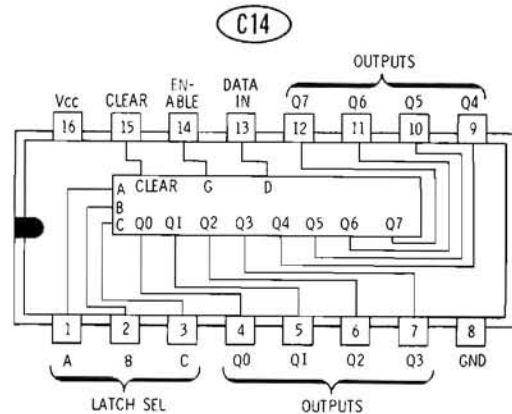
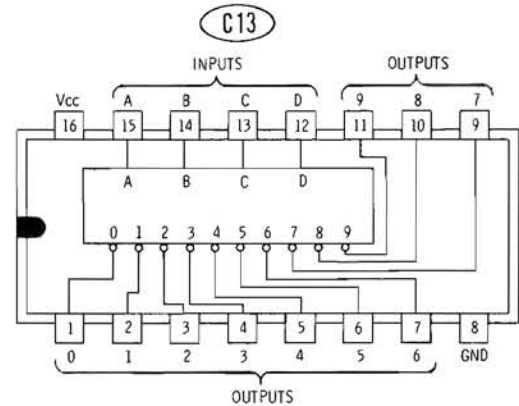
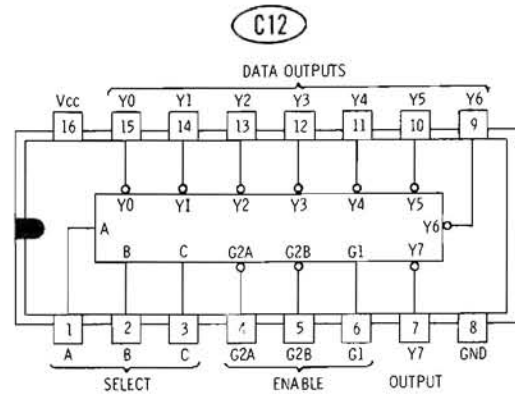
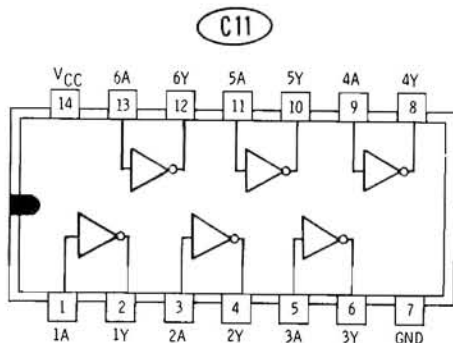
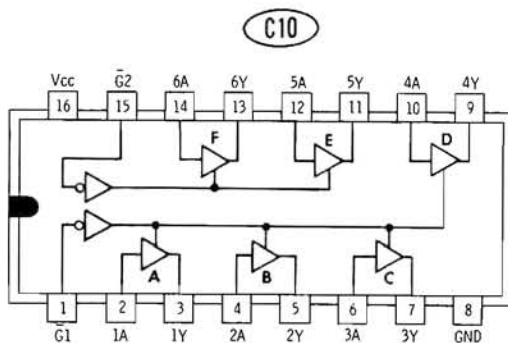
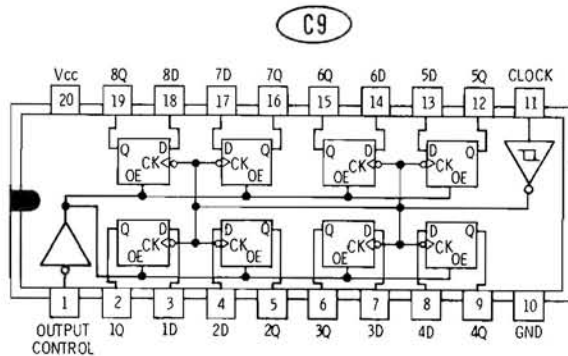


C8



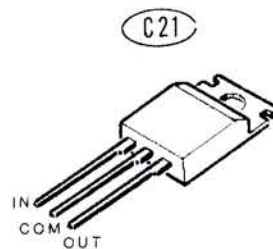
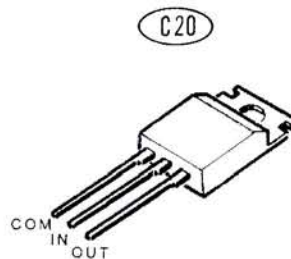
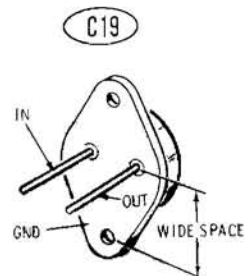
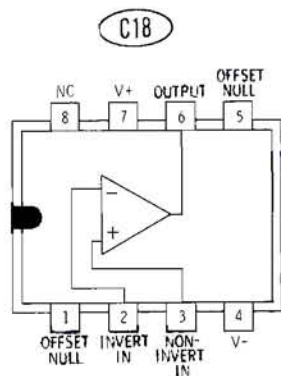
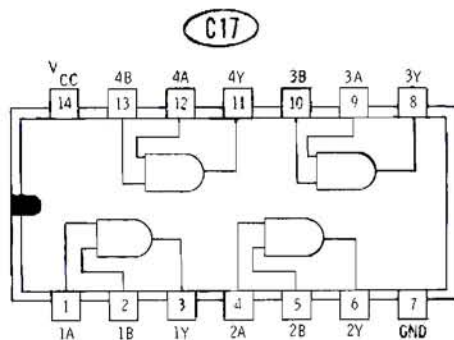
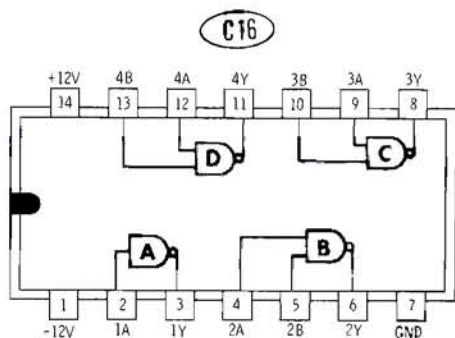
Integrated Circuits (continued)

COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	KEY NUMBER
U114	443-863	74LS374	C9
U117	443-875	74LS32	C3
U118	443-857	74LS367	C10
U119	443-755	74LS04	C11
U121	443-755	74LS04	C11
U122	443-863	74LS374	C9
U123	443-875	74LS32	C3
U124	443-1075	74F138	C12
U125	443-807	74LS42	C13
U126	443-804	74LS259	C14
U127	443-804	74LS259	C14
U128	443-804	74LS259	C14
U129	443-804	74LS259	C14
U131	443-804	74LS259	C14
U132	443-804	74LS259	C14
U133	443-795	75189	C15



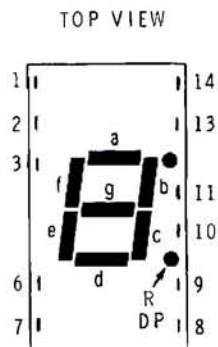
Integrated Circuits (continued)

COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	KEY NUMBER
U134	443-794	MC1488/75188	C16
U135	443-780	74LS08	C17
U136	442-22	N5741	C18
U137	442-30	UA309	C19
U138	442-613	MC7915	C20
U139	442-63	UA7815	C21



LEDs

V101	411-831
V102	411-875
V103	411-875
V104	411-875
V105	411-875
V106	411-875
V107	412-654
V108	412-654
V109	412-654
V111	412-654
V112	412-654
V113	412-654
V1	412-640



PIN	
1.....	SEGMENT a
2.....	SEGMENT f
3.....	COMMON ANODE
4	NOT USED
5	NOT USED
6	NOT USED
7.....	SEGMENT e
8.....	SEGMENT d
9.....	RIGHT DECIMAL POINT
10.....	SEGMENT c
11.....	SEGMENT g
12	NOT USED
13.....	SEGMENT b
14....	COMMON ANODE

NOTE: PINS 3 AND 14 ARE
INTERNALLY CONNECTED TOGETHER.

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath/Zenith Computers and Electronics 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/ZENITH COMPUTER AND ELECTRONICS CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath/Zenith Computer and Electronics 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/Zenith Computer and Electronics 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.

Heath/Zenith Computer and Electronics 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 Heath/Zenith Computers and Electronics center. For warranty parts replacement, supply a copy of the invoice or sales slip.

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

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

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

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

Heath Company
Service Department
Benton Harbor, Michigan 49022



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

LITHO IN U.S.A.