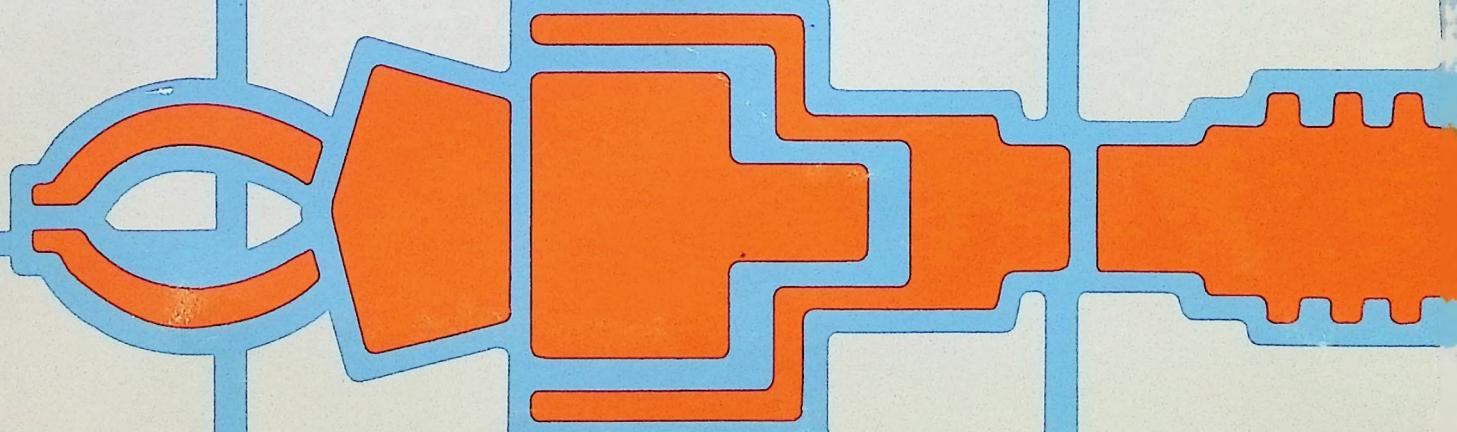


# ET-18

# ROBOT

## VOICE MANUAL



Heathkit



Educational Systems

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

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**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.

# **HERO ROBOT**

**Model ET-18-2**

## **Speech Accessory Manual**

**595-2887-02**

**HEATH COMPANY  
BENTON HARBOR, MICHIGAN 49022**

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## INTRODUCTION

Hero can talk — once you have assembled and installed this Model ET-18-2 Speech Accessory. With its speech synthesizer programmed in phonemes, your Robot will have a virtually unlimited vocabulary with accents. You can program it to speak words or phrases in response to keyboard commands or from various sound, light, or motion sensors in the Robot.

For instance, you might program your Robot to say, "Your wish is my command" when you turn it on or

after it completes a command. Or you could have it say "I see you" or "I hear you" in response to light or sound. And, you can change the "voice" from a booming bass to a soft soprano by adjusting the Pitch and Volume controls.

This Manual contains the Parts List, Step-by-Step Assembly, Installation, Initial Test, and basic Operation instructions for the Speech Accessory. Complete Programming and Operation is described in the ET-18 Robot Owner's Manual.

**Heathkit®****PARTS LIST**

Check each part against the following list and the "Parts Pictorial" (Illustration Booklet, Page 1). The key numbers correspond to the numbers on the "Parts Pictorial." Return any part that is packed in an individual envelope, with the part number on it, back into its envelope 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.
------------	-------------------	------------------	----------------------

**1/4 WATT, 5% RESISTORS — CONTROLS**

A1	6-229-12	1	2.2 Ω (red-red-gold)	R513
A1	6-511-12	2	510 Ω (grn-brn-brn)	R505, R506
A1	6-681-12	2	680 Ω (blu-gry-brn)	R504, R511
A1	6-222-12	1	2200 Ω (red-red-red)	R514
A1	6-272-12	1	2700 Ω (red-viol-red)	R501
A1	6-472-12	2	4700 Ω (yel-viol-red)	R508, R512
A1	6-562-12	1	5600 Ω (grn-blk-red)	R502
A1	6-103-12	1	10 kΩ (brn-blk-org)	R509
A2	10-312	1	10 kΩ control	R515
A2	10-390	1	20 kΩ control	R503

**CAPACITORS**

B1	20-115	1	300 pF mica	C501
B2	21-75	1	100 pF ceramic	C504
B2	21-143	1	.05 μF ceramic	C506
B3	27-85	1	.22 μF Mylar	C502
B4	25-924	1	2.2 μF electrolytic	C505
B4	25-880	1	10 μF electrolytic	C510
B5	25-905	3	470 μF electrolytic	C507, C508, C509
B6	25-907	1	4.7 μF non-polarized electrolytic	C503

**DIODE — TRANSISTORS**

C1	56-56	1	1N4149 diode	D501
C2	417-801	1	MPSA20 transistor	Q502
C2	417-865	1	MPSA55 transistor	Q501

KEY No.	HEATH Part No.	QTY. DESCRIPTION	CIRCUIT Comp. No.
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**INTEGRATED CIRCUITS**

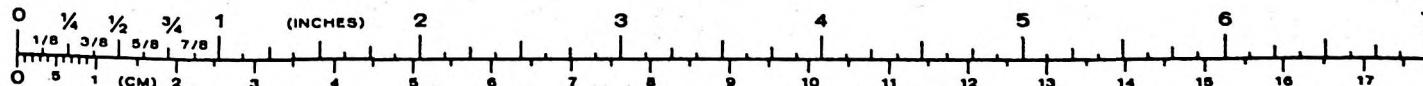
CAUTION: An integrated circuit packaged in a foam pad is a "protected IC" and can be damaged by static electricity if it is not handled properly. DO NOT remove the IC from its foam pad until you are instructed to install it in a step. Then follow the directions carefully.

C3	443-995	1	SC01 integrated circuit	U501
C3	442-762	1	LM388N-1 integrated circuit	U502

**MISCELLANEOUS**

D1	432-779	1	12-pin connector	P501
D2	432-923	1	4-pin connector	P502
D3	434-298	1	14-pin IC socket	
D3	434-377	1	24-pin IC socket	
D4	75-144	3	Circuit board spacer (see note)	
D5	73-180	1	Rubber grommet	
D6	75-737	1	Adhesive insulator	
D7	401-176	1	Speaker	
D8	45-47	1	2 mH RF choke	L501
	344-95	12"	Green wire	
	85-2694-2	1	Speech circuit board	
		1	Blue and white label	
	331-6	1	Solder	
			Manual (See Page 1 for part number)	
	597-2952	1	Dictionary	

NOTE: Place the circuit board spacers in water until you are ready to use them. Otherwise they may be brittle and break when you install them.



**STEP-BY-STEP ASSEMBLY****START** ▶

**NOTE:** Your circuit board may have one or more blank edges, separated by a scored line. If so, break away and discard the blank edge before you begin to assemble the circuit board.

Position the circuit board as shown and install the following components.

- ( ) R501: 2700  $\Omega$  (red-viol-red).

**NOTE:** When you install a diode, position its banded end over the band mark on the circuit board as shown. Then insert the leads through the holes so the body of the diode is against the circuit board.



- ( ) D501: 1N4149 diode (#56-56).

- ( ) R502: 5600  $\Omega$  (grn-blu-red).

- ( ) R508: 4700  $\Omega$  (yel-viol-red).

- ( ) R511: 680  $\Omega$  (blu-gry-brn).

- ( ) R504: 680  $\Omega$  (blu-gry-brn).

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

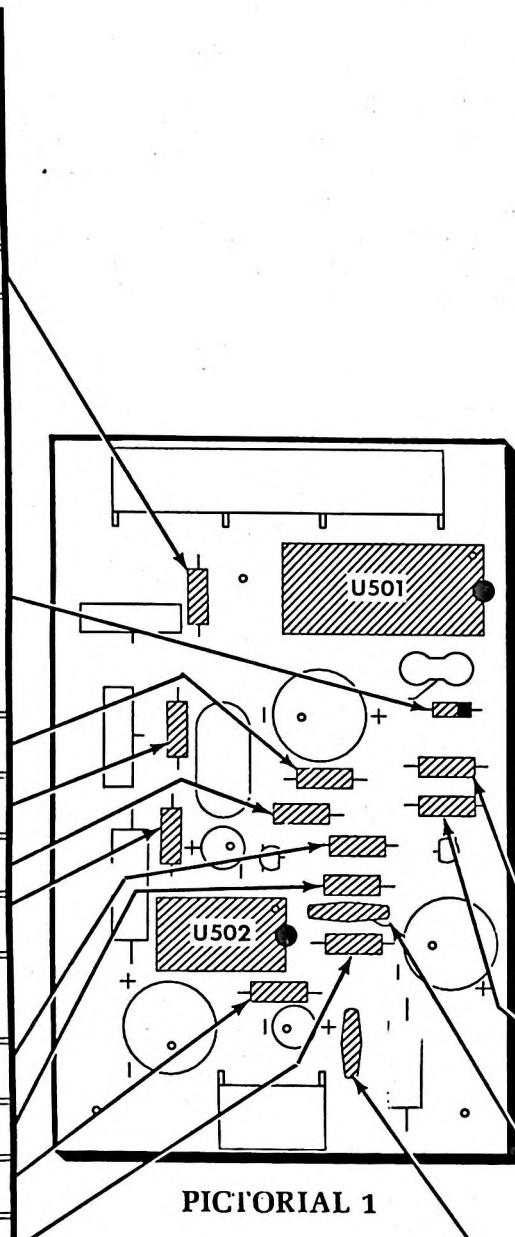
- ( ) R512: 4700  $\Omega$  (yel-viol-red).

- ( ) R509: 10 k $\Omega$  (brn-blk-org).

- ( ) R506: 510  $\Omega$  (grn-brn-brn).

- ( ) R505: 510  $\Omega$  (grn-brn-brn).

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

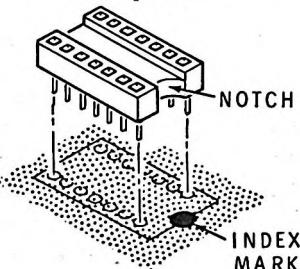
**CONTINUE** ▶

- ( ) Refer to Detail 1A and pull the two end pins from the 24-pin IC socket. Then use diagonal cutters to clip out the center spacers.

- ( ) Carefully clip away the plastic socket at the end pin of both halves as shown.

- ( ) With the cut areas inward, insert the pins of both socket halves through the holes in the circuit board at U501. Turn the circuit board upside down and rest the socket halves on a flat surface, then solder the pins to their foil pads.

- ( ) Install a 14-pin IC socket at U502 as shown below. Be sure to position the end of the socket with the notch or dot toward the index mark on the board. Solder the pins to their foil pads.



- ( ) R514: 2200  $\Omega$  (red-red-red).

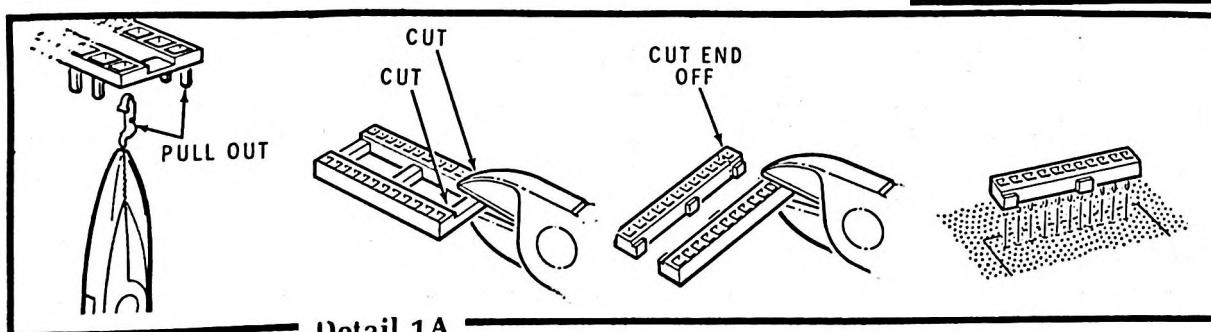
- ( ) R513: 2.2  $\Omega$  (red-red-gold).

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

- ( ) C504: 100 pF ceramic capacitor.

- ( ) C506: .05  $\mu$ F ceramic capacitor.

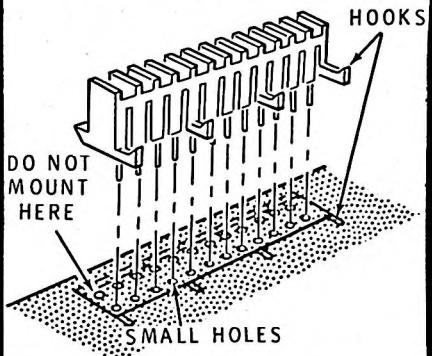
- ( ) Solder the leads to the foil and cut off the excess lead lengths.



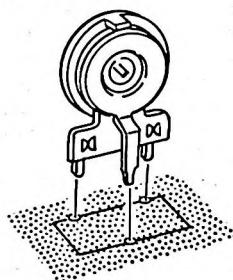
Detail 1A

**START**

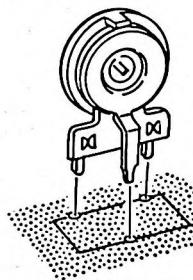
- ( ) P501: Install a 12-pin connector as shown. Insert the connector pins through the smaller holes and solder them to the foil pads.



- ( ) C501: 300 pF mica capacitor. Solder the leads to the foil and cut off the excess lead lengths.



- ( ) R515: 10 kΩ Pitch control (#10-312) as shown.



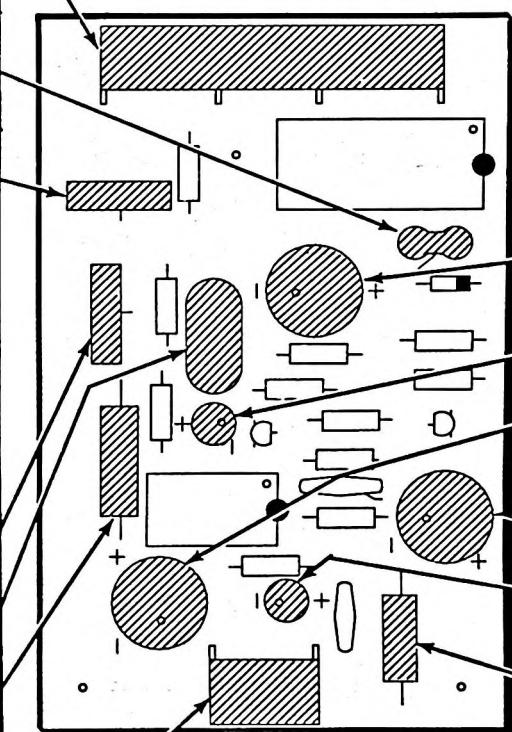
- ( ) R503: 20 kΩ Volume control (#10-390).

- ( ) C502: .22 µF Mylar capacitor.

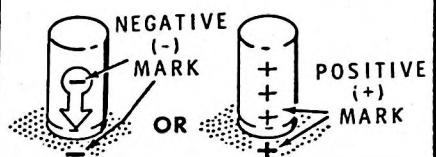
- ( ) C503: 4.7 µF non-polarized electrolytic capacitor. (The board may be marked "4"). This capacitor can be mounted either way.

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

- ( ) P502: 4-pin connector. Insert the pins through the smaller holes and solder them to their foil pads.

**PICTORIAL 2****CONTINUE**

NOTE: When you install an electrolytic capacitor, match the positive (+) or negative (-) lead of the capacitor with the same mark on the circuit board.



- ( ) C508: 470 µF electrolytic capacitor.

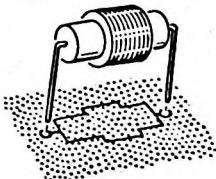
- ( ) C510: 10 µF electrolytic capacitor.

- ( ) C507: 470 µF electrolytic capacitor.

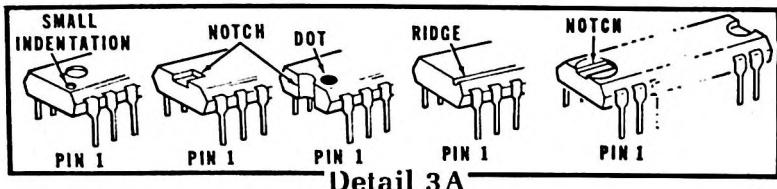
- ( ) C509: 470 µF electrolytic capacitor.

- ( ) C505: 2.2 µF electrolytic capacitor.

- ( ) L501: 2 mH RF choke (#45-47) as shown below.



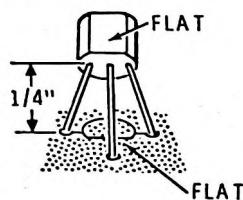
- ( ) Solder the leads to the foil and cut off the excess lead lengths.



Detail 3A

**START**

**NOTE:** When you install a transistor, position its flat over the outline of the flat on the circuit board. Insert the leads into their holes until the transistor is 1/4" above the board, then solder the leads to the foil and cut off the excess lead lengths.



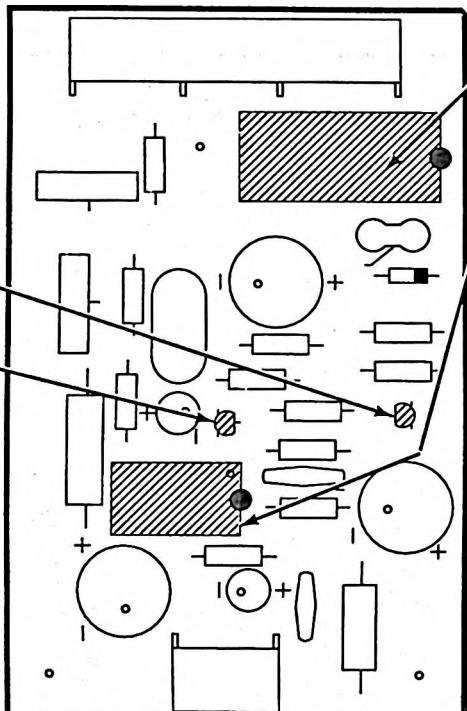
( ) Q501: MPSA55 transistor (#417-865).

( ) Q502: MPSA20 transistor (#417-801).

**CAUTION:** When you install a "protected IC", be sure it does not get damaged by static electricity. Once you remove its foam pad, DO NOT let go of the IC until you install it in its socket. Read the entire step before you pick up the IC.

1. Pick up the IC and touch the foam pad with both hands.
2. Hold the IC with one hand and remove the foam pad with the other.
3. Continue holding the IC with one hand while you straighten any bent pins with the other hand.
4. Pick up the circuit board with your free hand.
5. Align the pin 1 end of the IC with the index mark on the circuit board and push the IC pins into the IC socket.

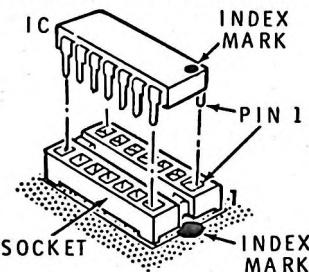
Once in the socket, the IC is protected.



PICTORIAL 3

**CONTINUE**

Refer to Detail 3A to identify the pin 1 end of an IC. Match the pin 1 end to the index mark on the circuit board and insert the IC pins in the socket.



( ) U501: SC01 protected IC (#443-995).

( ) U502: LM388N-1 integrated circuit (#442-762).

**CIRCUIT BOARD CHECK-OUT**

Carefully inspect the foil side of the circuit board for any of the following most commonly made errors.

- ( ) Unsoldered connections.
- ( ) Poor solder connections.
- ( ) Solder bridges between foils.
- ( ) Protruding leads which could touch together.

On the component side of the circuit board, check for the following conditions and compare them with the Pictorials to be sure.

- ( ) Resistors and capacitors for correct value.
- ( ) Electrolytic capacitors for correct position of the positive (+) or negative (-) leads.
- ( ) Diode for position of the banded end.
- ( ) Transistors for proper type and installation.
- ( ) Integrated circuits for proper installation.

This completes the assembly of the Speech Accessory circuit board. Proceed with the Installation on the next page.

**FINISH**

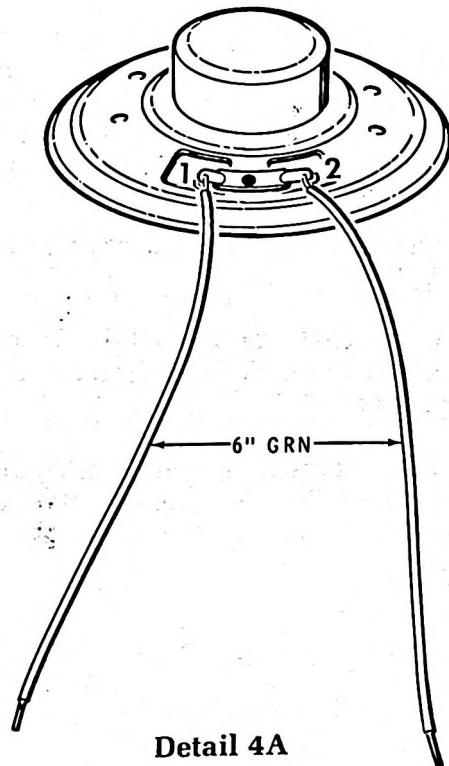
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## INSTALLATION

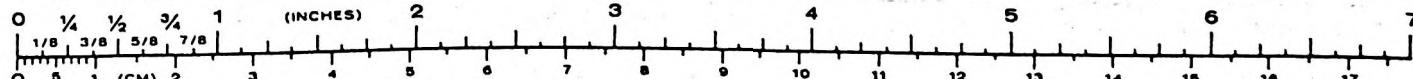
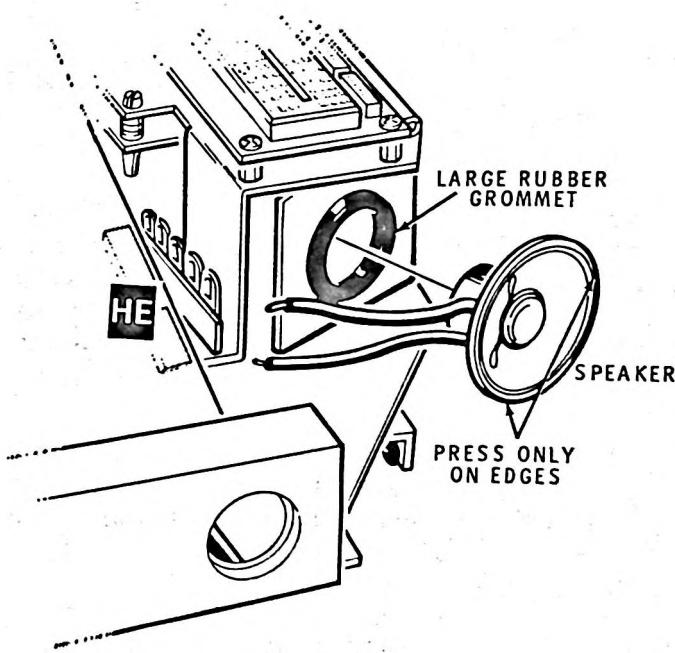
If you were referred to this Manual from the Robot Assembly Manual, you have not yet installed the covers on your Robot; so skip the first step below. However, if you are adding the Speech Accessory to a Robot that is already assembled, proceed as follows.

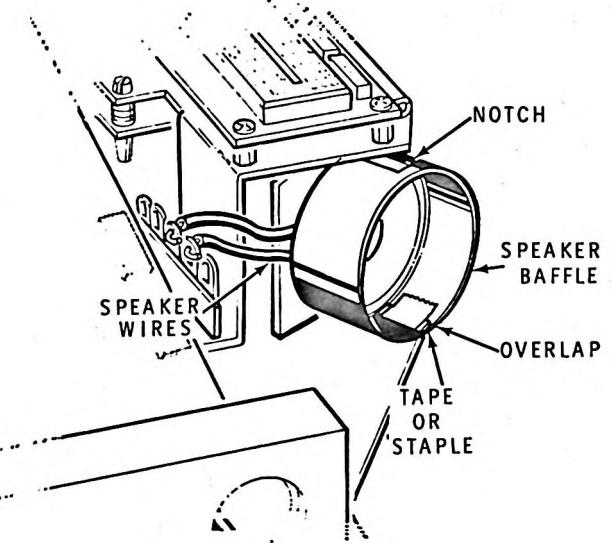
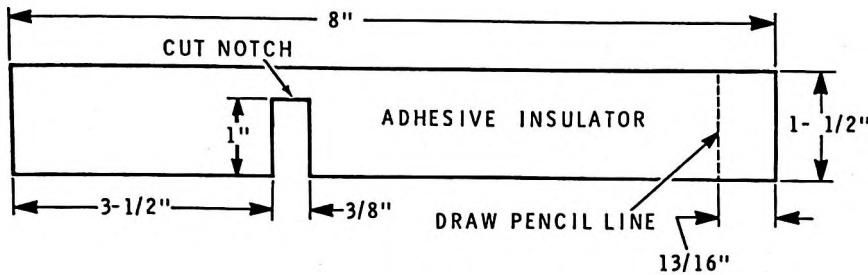
Refer to Pictorial 4 (Illustration Booklet, Page 2) for the following steps.

- ( ) Remove the rear cover from the Robot torso and the top cover from the head. Set the covers aside.
- ( ) Remove the three circuit board spacers from the water and dry them on a cloth or paper towel. Then install the spacers at the three indicated locations for the speech board.
- ( ) Mount the Speech circuit board on connectors P501 and P502 and on the spacers as shown. Press the connectors firmly onto the connector pins until the board is seated on the pins.



- ( ) Prepare two 6" green wires. First remove 1/4" of insulation from each end of the wire. Then twist the ends of the wire and apply a thin film of solder to hold the fine wire strands together.
- ( ) Connect and solder one 6" green wire to lug 1 of the speaker and the other wire to lug 2 as shown in Detail 4A.
- ( ) Refer to Detail 4B and install a large rubber grommet in hole A. Then press the rear of the speaker into the grommet. Press only on the edges of the speaker so you do not damage the paper cone.
- ( ) At terminal strip HE connect and solder either speaker wire to lug 4 (S-2), and the other speaker wire to lug 3 (S-1). There should already be a wire connected to lug 4. Be sure to solder both wires.



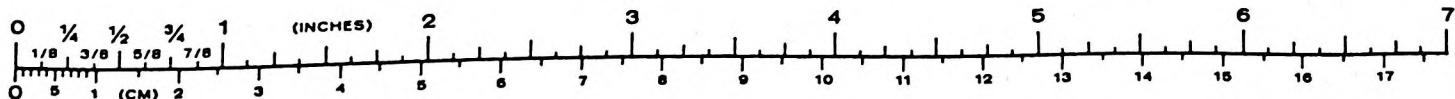
**Detail 4C**

- ( ) Refer to Detail 4C and prepare a speaker baffle from the sheet of adhesive insulator. First cut a strip  $1\frac{1}{2}'' \times 8''$  and cut a notch  $\frac{3}{8}'' \times 1''$  as shown. Then draw a pencil line  $1\frac{13}{16}''$  from one end.
- ( ) Remove the paper backing from the strip and form the strip in a circle so it overlaps to the pencil line. Press the adhesive to the end of the

strip and secure it with masking tape or a staple.

- ( ) Carefully slide the formed baffle over the speaker so the notch clears the hardware under the bracket.

This completes the assembly and installation of your Speech Accessory. Proceed to the "Initial Tests" on the next page.

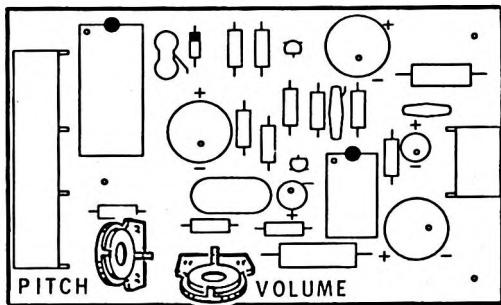


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## INITIAL TESTS

Perform the following steps to test the operation of your Robot Speech Accessory. If you do not obtain the indicated results as you perform a step, place the Robot Main Power switch in the OFF position and refer to the "In Case of Difficulty" section of this Manual.

- ( ) Rotate the Pitch and Volume controls (on the Speech circuit board) to their mid-positions. See Detail 4D.



**Detail 4D**

- ( ) Press the Main Power switch to turn on the Robot. You should hear the voice comment "ready" and the display should read "HERO 1.0" for about ten seconds, then change to a moving dash.
- ( ) Press and release the RESET button; "ready" should repeat.
- ( ) Repeatedly press and release the RESET button while you adjust the Volume and Pitch controls for a satisfactory loudness and pitch of the voice.

- ( ) Enter the following test program. Press and release each keyswitch in the order given and observe the display after each key is pressed.

<u>KEY</u>	<u>DISPLAY</u>
A	A.
A	---Ad.
0	0---Ad.
2	02--Ad.
0	020-Ad.
0	0200--
7	02007-
2	0201--
F	0201F-
A	0202--
4	02024-
B	0203--
3	02033-
A	0204--
RESET	HERO1.0
A	A.
D	---do.
0	0---do.
2	02--do.
0	020-do.
	Blank.

As soon as you entered the last zero, the Robot should have said "Hello, my name is Hero". You can repeat the message if you start at "RESET" in the above listing and press the keys in the same sequence.

This completes the Initial Test of your Speech Accessory.

## OPERATION

This section will present a very basic description of the Speech Accessory operation. Complete instructions for programming it to speak longer words and sentences are detailed in the Robot User's Manual.

A speech synthesizer on the Speech circuit board can generate 64 different sounds, that you can program to output in any given sequence to produce a word or a sentence.

Refer to the Dictionary supplied with this Speech Accessory for an alphabetical listing of about 800 basic words. Notice that a group of two-character alphanumeric codes is shown with each word listed. These codes specify the sounds that must be synthesized to produce the word.

Take the word "sleep", for example. The Dictionary shows the codes: 1F, 18, 3C, 29, and 25. To make the Robot speak the word "sleep," you must enter the command to speak, and then the codes for the sounds to be spoken. The speak command and the codes make up a simple program.

( ) Make the following keyboard entries in the order given:

<u>ENTRY</u>	<u>DISPLAY</u>	<u>COMMENTS</u>
A	A.	Enter the Repeat Mode
A	---Ad.	Increment addresses
0	0---Ad.	Enter
2	02--Ad.	starting
0	020-Ad.	address
0	0200--	of program
7	02007-	Enter the
2	0201--	"speak" command
0	02010-	Enter the
2	0202--	starting address
0	02020-	of the
5	0203--	sound codes
2	02032-	Wait
0	0204--	here
F	0204F-	until
E	0205--	Reset
1	02051-	Enter
F	0206--	the
1	02061-	sound
8	0207--	codes
3	02073-	"
C	0208--	"
2	02082-	"
9	0209--	"
2	02092-	"
5	020A--	"
F	020AF-	End of
F	020B--	phoneme list

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You have now entered a simple speech program which, when executed, will cause the Robot to speak the word "sleep".

( ) Execute the program as follows:

<u>KEY</u>	<u>DISPLAY</u>	<u>COMMENT</u>
RESET	HEro 1.0	The word "ready" will be spoken
A	A.	Enter the Repeat Mode
D	---do.	Enter the
0	0---do.	starting address
2	02--do.	of the program
0	020-do.	to be executed
0	blank	The word "sleep" will be spoken

This program may be repeated as often as desired. It will be stored in memory until the main power switch is turned off.

In the same manner, you can enter any word or group of words from the Dictionary. Simply enter the code groups for the desired words. A more detailed operating procedure is given in the Robot Operation Manual.

If your Robot Speech Accessory is operating properly, you may skip the following section and proceed to "Final Assembly" on Page 13.

## IN CASE OF DIFFICULTY

This section will help you locate and repair a problem that might occur as you performed the Initial Tests. If this information does not lead you to the problem, you will find more detailed information, with Troubleshooting Charts, in your Robot Technical Manual.

Poor soldering and incorrectly installed components account for most of the problems encountered by kit builders. Therefore, you should first reexamine your work on the Speech circuit board and then the connections to the Robot.

Carefully inspect the foil side of the circuit board for any of the following most commonly made errors.

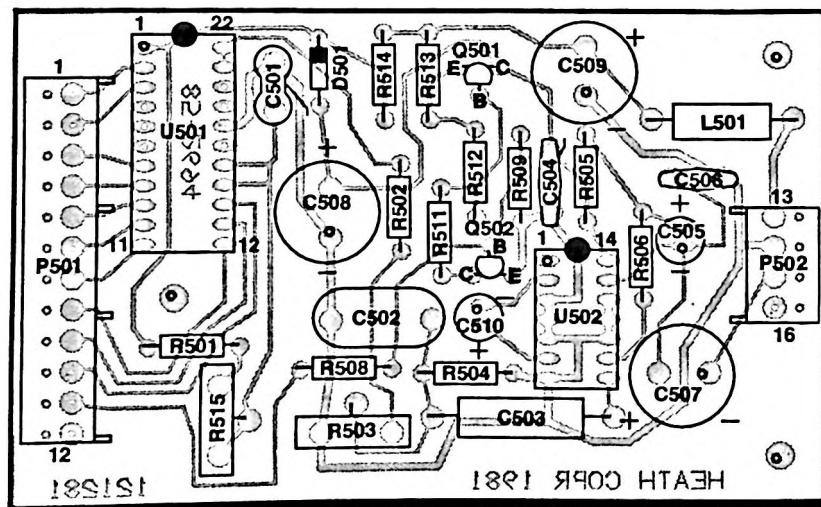
- ( ) Unsoldered connections.
- ( ) Poor solder connections.
- ( ) Solder bridges between foils.
- ( ) Protruding leads which could touch together.

On the component side of the circuit board, check the following and compare with the Pictorials to be sure.

- ( ) Resistors and capacitors for correct value.
- ( ) Electrolytic capacitors for correct position of the positive (+) or negative (-) leads.
- ( ) Diode for position of the banded end.
- ( ) Transistors for proper type and installation.
- ( ) Integrated circuits for proper installation.

If you have not found and corrected the problem, recheck the wiring to the speaker and the wiring to the connectors on which the Speech circuit board is mounted. Refer to the Torso section of the Assembly Manual to recheck the wire colors at the Speech circuit board connectors.

Your Robot Technical Manual has additional information, including a Schematic Diagram, X-Ray View, and Troubleshooting Charts.



**Heathkit®**

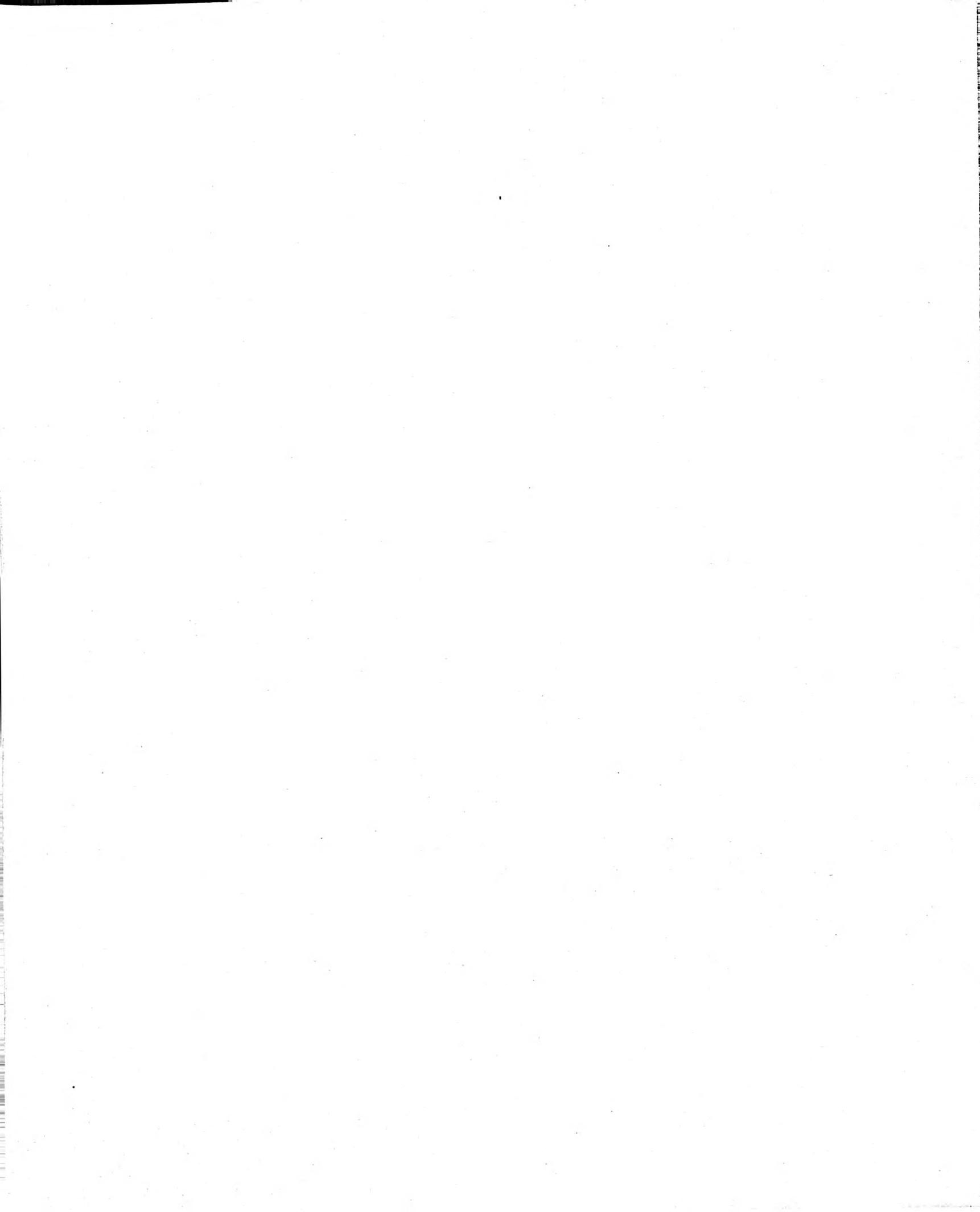
## FINAL ASSEMBLY

If you have another accessory to assemble or install, proceed to the Manual for that accessory. Otherwise, replace the rear panel on the torso and the top panel on the head as shown in Pictorial 4 (Illustration Booklet, Page 2). Then proceed to the Robot User's Manual.

The blue and white label supplied shows the model and series numbers of your Speech Accessory. Be sure to mention these numbers in any correspondence you may have with Heath Company about this kit.

For convenient reference, you may either install the label next to the speech circuit board on the door of your Hero Robot, or you may affix it to the title page of your Speech Accessory Manual.

- ( ) In either case, remove the paper backing and press the label into place.



# CUSTOMER SERVICE

## REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath/Zenith Computers and Electronics center. 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 COMPUTERS AND ELECTRONICS CENTER

For your convenience, "over the counter" replacement parts are available from the Heath/Zenith Computers and Electronics center 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 Computers 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 Computers 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 any portions of your Robot that need service. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.) Identify the questionable area by using the "Troubleshooting" section of your Technical Manual and Heath's Technical Consultants (if necessary), then return only the questionable portion for service. Never send a complete Robot unless you are instructed to do so by a Technical Consultant.

**If it is convenient, deliver the questionable portion personally to a Heath/Zenith Computers and Electronics center. For warranty parts replacement, supply a copy of the invoice or sales slip.**

If you should need to ship some portion of the Robot to the factory, attach a letter containing the following information directly to that portion of the Robot:

- 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.)

Package any portions of the Robot that you wish to ship in a strong carton with at least THREE INCHES of resilient packing material (shredded paper, excelsior, etc.) on all sides. Contact the Heath Company for instructions for sending the entire Robot or large portions of it.

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

595-2887-02