

# HEATHKIT<sup>®</sup> MANUAL

for the  
**TNC STATUS INDICATOR**

Model HDA-4040-1

595-3486



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

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## 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.

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

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

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

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

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

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

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

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

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

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

# Heathkit® Manual

*for the*

## TNC STATUS INDICATOR

Model HDA-4040-1

595-3486

HEATH COMPANY  
BENTON HARBOR, MICHIGAN 49022

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## INTRODUCTION

The Heathkit Model HDA-4040-1 TNC Status Indicator provides a visual indication of the link status and the operating mode of either the Model HD-4040 Heath Packet Radio Terminal Node Controller (TNC) or the "TAPR-1" TNC. It also indicates whether the transmit buffer is active and if a frame reject condition exists. The link states are: Connected, Connect Attempt, Disconnect in Progress, and Disconnected. The Operating modes are: Converse (CONV) and Command (CMD:).

The Frame Reject (FRMR) indicator is included as a safeguard. It is unlikely that two TNCs in communication could ever generate this Frame Reject condition. But as more home computers are used, the likelihood increases that the AX.25 protocol will

be used incorrectly and thus produce an error. This would then activate the FRMR indicator.

The Buffer indicator shows that the transmit buffer is active, and that not all of the packets generated have been transmitted. An audible alarm is also provided to let you know with a several-second tone when you connect to someone else, or someone connects to you. This feature allows you to turn your attention to other activities, yet signals you when someone wishes to talk to you.

The TNC Status Indicator is a passive device, drawing its power from the TNC, which keeps you aware of the ongoing conditions of your Terminal Node Controller at all times.

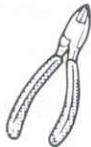
## ASSEMBLY NOTES

### TOOLS

You will need these tools to assemble your kit.



LONG-NOSE  
PLIERS



DIAGONAL  
CUTTERS



WIRE  
STRIPPERS

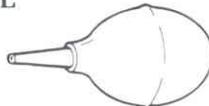


#2 PHILLIPS  
SCREWDRIVER

### OTHER HELPFUL TOOLS



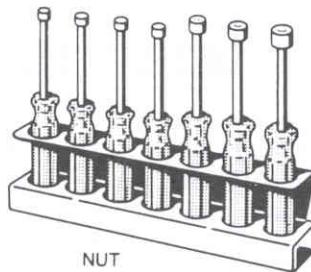
NUT STARTER  
(May Be Supplied  
With Kit)



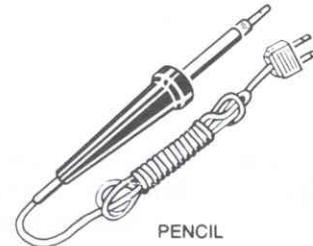
DESOLDERING  
BULB\*



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. Refer to the separate "Illustration Booklet" for the Pictorials and Details. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in the proper sequence, as called for in the steps.
3. 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.
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.

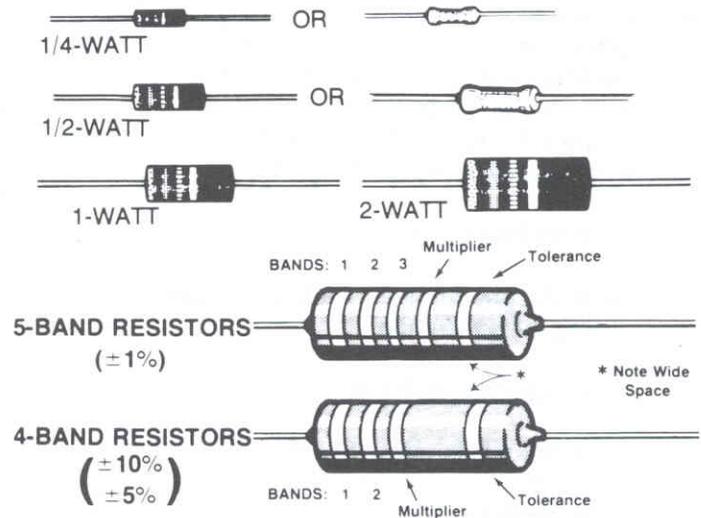
It is easy to make a good solder connection if you follow a few simple rules:

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.

**PARTS**

**Resistors** are identified in Parts Lists and steps by their resistance value in  $\Omega$  (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. These colors (except for the last band, which indicates a resistor's "tolerance") will be given in the steps in their proper order. Therefore, the following color code is given for information only. NOTE: Occasionally, a "precision" or "power" resistor may have the value stamped on it.



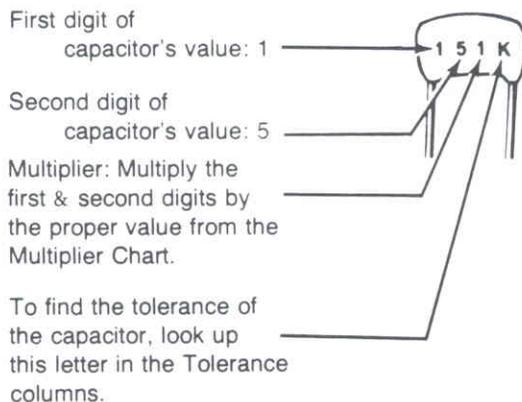
Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	$\pm 10\%$
Brown	1	Brown	1	Brown	1	Brown	10	Gold	$\pm 5\%$
Red	2	Red	2	Red	2	Red	100	Red	$\pm 2\%$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

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

EXAMPLES:

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

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



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

## PARTS LIST

Open the Parts Pack and check each part against the following list. The key numbers correspond to the numbers on the Parts Pictorial. **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 its envelope until that part is called for in a step. Do not throw any packing materials away 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.
---------	----------------	------	-------------	-------------------

### CAPACITORS

A1	21-176	7	.01 $\mu$ F ceramic	C101, C106-C112
A1	21-192	1	.1 $\mu$ F (104) ceramic	C102
A2	25-930	1	2.2 $\mu$ F electrolytic	C103
A3	25-880	1	10 $\mu$ F electrolytic	C104
A3	25-959	1	33 $\mu$ F electrolytic	C105

### LEDs (Light-Emitting Diodes)

B1	412-637	2	Red LED	D1, D5
B1	412-641	4	Amber LED	D2, D3, D6, D8
B1	412-642	2	Green LED	D4, D7

### TRANSISTORS-INTEGRATED CIRCUITS (ICs)

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

1. Part number.
2. Type number (on integrated circuits, this refers only to the numbers printed in **bold** type; the letters may be different or missing).
3. Part number and type number.
4. Part number with a type number other than the one listed.

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

C1	417-801	2	MPSA20 transistor	Q102, Q103
C1	417-865	1	MPSA55 transistor	Q101
C2	442-53	1	NE555 IC	U101
C2	443-87	1	SN74145 IC	U102

### METAL PARTS

D1	90-1357-1	1	Cabinet top
D2	200-1509-1	1	Chassis
D3	204-1856	1	Speaker bracket

### HARDWARE

E1	250-1307	4	#6 $\times$ 1/4" sheet metal screw
E2	250-1280	5	6-32 $\times$ 3/8" screw
E3	252-3	9	6-32 nut
E4	254-1	9	#6 lockwasher

### CONNECTORS-PINS-SOCKETS

F1	432-866	18	Spring connector (2 extra)
F2	432-1030	8	2-hole shell
F3	432-1031	8	Female pin (1 extra)
F4	432-1028	1	RS-232 connector
F5	434-230	1	8-pin IC socket
F6	434-299	1	16-pin IC socket

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

G1	73-1	1	Rubber grommet	
G2	73-133	4	1/2" Nylon gasket	
G3	75-743	8	3/4" x 1" paper insulator	

**MISCELLANEOUS**

	85-3100-1	1	Printed circuit board	
H1	261-29	4	Foot	
	347-55	3'	8-conductor cable	
H2	354-5	2	Cable tie	

H3	401-204	1	Speaker	SP1
H4	475-35	1	RF core	
		1	Blue and white label	
	597-260	1	Parts Order Form	
		1	Assembly Manual (See the title page for the part number.)	
			Solder	

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

**RESISTORS**

NOTE: The following resistors are rated at 1/4-watt, with a 5% tolerance, unless otherwise noted. The 5% tolerance is indicated by a fourth color-band of gold.

6-221-12	1	220 Ω (red-red-brn)	R108
6-561-12	4	560 Ω (grn-blu-brn)	R107, R109, R112, R113
6-102-12	1	1000 Ω (brn-blk-red)	R101

6-472-12	2	4700 Ω (yel-viol-red)	R102, R104
6-103-12	4	10 kΩ (brn-blk-org)	R103, R106, R111, R114
6-223-12	1	22 kΩ (red-red-org)	R105

**DIODE**

56-56	1	1N4149	D101
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## STEP-BY-STEP ASSEMBLY

### CIRCUIT BOARD

Refer to Pictorial 1-1 as you read the following notes and perform the following steps.

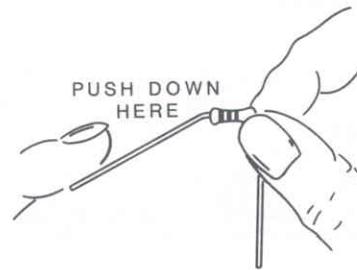
#### NOTES:

1. In the following assembly steps, you will install parts in a left-to-right, top-to-bottom 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 (R101, C103, or D101, for example).
  2. 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.
  3. In general, solder instructions are given only at the end of a series of similar steps; you may solder more often if you wish.
- ( ) 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.

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 as you install the remaining parts on the board.

Note that the circuit board has foil patterns on one side and the other side has outlines of components (parts) shown on it. The foil side of the board will be referred to as such, and the side with the outlines will be referred to as the "component side" of the board.

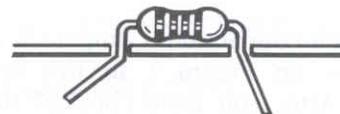
- ( ) Position the circuit board on your work area in front of you with the component side up as shown in Pictorial 1-1. NOTE: Always install parts on the component side of the circuit board and solder the leads or wires to the circuit board foils unless a step directs you to do otherwise.
- ( ) Cut the first part, a 560 Ω (grn-blu-brn) resistor from the Taped Component Chart as outlined in the Chart instructions. Bend the resistor leads as shown to fit the hole spacing at R107 on the circuit board.



- ( ) R107: Start the leads into the holes at the resistor's location near the top center of the circuit board. The end with the color bands may be positioned either way. NOTE: Resistors are identified by the following outline:

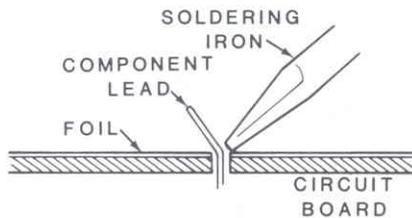


- ( ) Press the resistor down against the top of the circuit board. Then bend the leads outward slightly to hold it in place.

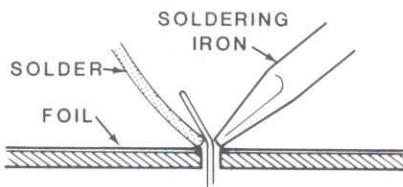


( ) Solder the resistor leads to the circuit board as follows:

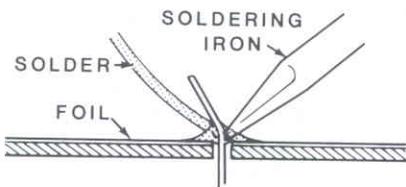
1. Push the soldering iron against both the lead and the circuit board foil. Heat **both** for two or three seconds.



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



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



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

( ) Check each connection. Compare it to the illustrations on Figure 1 in the Illustration Booklet. After you have checked the solder connections, proceed with the assembly on this and on the following pages. Use the same soldering technique for each connection.

Start at the top of the circuit board and install the following parts. The sequence of the steps matches the location of the components on the circuit board. **NOTE:** Make sure you installed R107 in an earlier step.

( ) R113: 560  $\Omega$  (grn-blu-brn) resistor.

**NOTE:** When you install the diode in the following step, be sure to match the banded end of the diode with the outline of the band printed on the circuit board. **Your kit will not operate properly if a diode is installed backward.**

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



( ) D101: 1N4149A diode (#56-56).

( ) R106: 10 k $\Omega$  (brn-blk-org) resistor.

( ) R108: 220  $\Omega$  (red-red-brn) resistor.

( ) R109: 560  $\Omega$  (grn-blu-brn) resistor.

( ) R104: 4700  $\Omega$  (yel-viol-red) resistor.

( ) R101: 1000  $\Omega$  (brn-blk-red) resistor.

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

( ) R102: 4700  $\Omega$  (yel-viol-red) resistor.

( ) R105: 22 k $\Omega$  (red-red-org) resistor.

( ) R103: 10 k $\Omega$  (brn-blk-org) resistor.

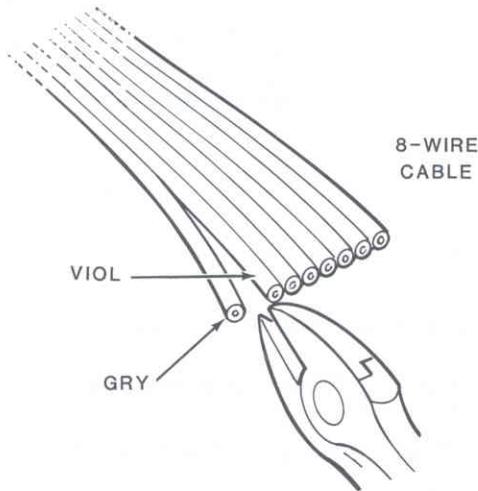
( ) R111: 10 k $\Omega$  (brn-blk-org) resistor.

( ) R114: 10 k $\Omega$  (brn-blk-org) resistor.

( ) R112: 560  $\Omega$  (grn-blu-brn) resistor.

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

- ( ) Locate the 8-wire flat cable supplied with your kit. Cut a 12" length from this cable and set it aside temporarily.
- ( ) From the remaining 2-foot cable, using diagonal cutters, carefully cut between the gray and the violet wires as shown. Then pull on the gray wire to completely separate it from the cable. Set the remaining 7-wire cable aside until it is called for later.



NOTE: To prepare a jumper wire, as in the following step, use the gray wire you removed from the flat cable. Cut the jumper wire to the length indicated and remove 1/4" of insulation from each wire end. Then tightly twist the bare wire ends and add a small amount of solder to hold the fine strands together.

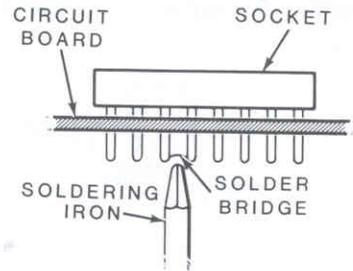
- ( ) Prepare a 1-1/2" and a 1-3/4" piece of gray wire.

NOTE: As you install the jumper wires in the next two steps, solder them to the foil and cut off the excess wire ends.

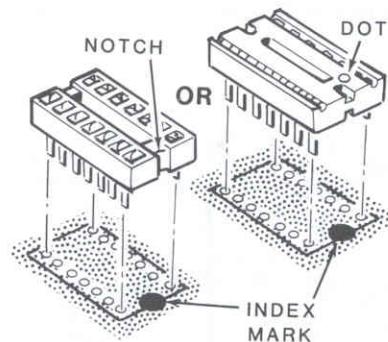
- ( ) W101: 1-1/2" jumper wire.
- ( ) W102: 1-3/4" jumper wire.

As you install IC sockets, be very careful that you do not bridge solder between socket pins. (Solder that is bridged between two pins that are on the same foil is all right.) If a solder bridge should occur, hold the circuit board bottom side down as shown.

Then hold your soldering iron tip between the two points where solder is bridged. The solder will flow down the iron. Also, you can use desoldering braid (not supplied).



NOTE: Before you install 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 start the pins into the circuit board holes and solder them to the foil. The sockets supplied in your kit may have fewer or a greater number of pins than shown here.



- ( ) 16-pin IC socket at U102.
- ( ) 8-pin IC socket at U101.

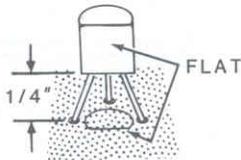
Refer to Pictorial 1-2 for the following steps.

NOTE: Before you mount the integrated circuits in the next two steps, refer to Figure 2 in the Illustration Booklet and become familiar with the techniques for handling and installing these devices. Then proceed with the following steps.

- ( ) U102: SN74145 IC (#443-87).
- ( ) U101: NE555 IC (#442-53).

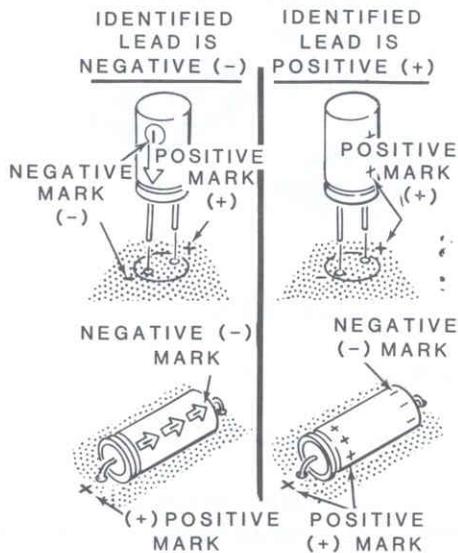


When you install transistors in the next three steps, first bend the center lead rearward as shown. Then, as you mount the transistor onto the circuit board, be sure to match the flat on the transistor with the outline of the flat on the circuit board.



- ( ) Q103: MPSA20 transistor (#417-801).
- ( ) Q102: MPSA20 transistor (#417-801).
- ( ) Q101: MPSA55 transistor (#417-865).

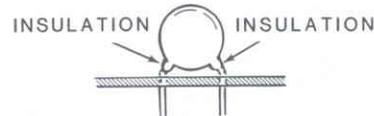
NOTE: When you install electrolytic capacitors in the following steps, always match the negative (-) mark on the capacitor with the negative (-) mark on the circuit board, OR match the positive (+) mark on the capacitor with the positive (+) mark on the board.



- ( ) C105: 33  $\mu$ F (vertical) electrolytic (#25-959).
- ( ) C104: 10  $\mu$ F (vertical) electrolytic (#25-880).

- ( ) C103: 2.2  $\mu$ F (horizontal) electrolytic (#25-930).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: When you mount ceramic capacitors, do not push the leads all the way down through the circuit board holes. These leads may have a thin coating of insulation that may keep you from making a good solder connection.



- ( ) C101: .01  $\mu$ F ceramic capacitor.
- ( ) C102: .1  $\mu$ F (104) ceramic capacitor.

Install .01  $\mu$ F ceramic capacitors at the following six locations:

- ( ) C111.
- ( ) C108.
- ( ) C109.
- ( ) C112.
- ( ) C113.
- ( ) C107.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

Refer to Pictorial 1-3 for the following steps.

- ( ) Refer to Part A of Detail 1-3A and cut the 12", 8-wire flat cable (set aside earlier) into one 5" and one 7" piece. Cut the 7" piece into two 3-1/2" lengths.



- ( ) Refer to Part B of Detail 1-3A and, on the 5" flat cable, using diagonal cutters, cut between the red and the orange wires. Pull the red-brn wire pair from the cable. Save this pair of wires for use in the following steps. The remaining 5" 6-wire piece of cable will not be used.
- ( ) Refer to Part C of Detail 1-3A and prepare the 5" brn-red cable-pair as shown. Prepare the wire ends as described for the jumper wires in a previous step.

Refer to the Pictorial and install the prepared brn-red wire pair on the circuit board as follows.

- ( ) Install the brown wire in circuit board hole A and the red wire in hole G. Solder the wires to the foil and cut off the excess ends. The free ends of the wire pair will be connected later.

NOTE: You will prepare two identical 3-1/2" 8-wire cable assemblies in the next two steps. Two check-off spaces are provided for each step. After you have completed one cable, return to the first step and prepare the other assembly.

- ( ) ( ) Refer to Part A of Detail 1-3B and prepare a 3-1/2", 8-wire cable in the manner shown. Prepare the wire ends as previously described. NOTE: At end B of the cable, remove only 1/8" of the insulation as shown.
- ( ) ( ) Refer to Part B of Detail 1-3B and, at end B of the cable, crimp and solder a spring connector onto the end of each wire. NOTE: These are the 1/8" prepared ends.

NOTE: In the following steps you will install the two prepared cables in the circuit board holes. As you install each wire in the cable, solder it to the foil and cut off the excess end. Install the first (either) cable as follows:

- ( ) Brown wire in hole G.
- ( ) Red wire in hole M.

- ( ) Orange wire in hole G.
- ( ) Yellow wire in hole N.
- ( ) Green wire in hole P.
- ( ) Blue wire in hole G.
- ( ) Violet wire in hole C.
- ( ) Gray wire in hole K.

In the same manner, install the other 3", 8-wire cable as follows:

- ( ) Brown wire in hole E.
- ( ) Red wire in hole I.
- ( ) Orange wire in hole B.
- ( ) Yellow wire in hole L.
- ( ) Green wire in hole J.
- ( ) Blue wire in hole D.

NOTE: When you install the next two wires, further separate them from the rest of the cable slightly if necessary.

- ( ) Violet wire to hole F.
- ( ) Gray wire to hole H.

NOTE:

1. In the following steps you will install the spring connectors on the eight wire-pairs of the two cables into the 2-hole shells as shown in Detail 1-3C.
2. Make sure you get each wire into its correct shell hole as directed; in the step, each pair will be called out by color and circuit board connection.

3. As you install each connector into the shell, be sure the small tab on the connector is up and that it is securely latched in the shell.

( ) Red wire from hole M to shell hole 1; brown wire from G to hole 2.

( ) Yellow wire from hole N to shell hole 1; orange wire from G to hole 2.

( ) Green wire from hole P to shell hole 1; blue wire from G to hole 2.

( ) Violet wire from hole C to shell hole 1; gray wire from K to hole 2.

( ) Brown wire from hole E to shell hole 1; red wire from I to hole 2.

( ) Orange wire from hole B to shell hole 1; yellow wire from L to hole 2.

( ) Blue wire from hole D to shell hole 1; green wire from J to hole 2.

( ) Violet wire from hole F to shell hole 1; gray wire from H to hole 2.

( ) Refer to Detail 1-3D and prepare both ends of the 24", 7-wire flat cable in the manner shown. Connect one end of this cable to the circuit board holes in the following steps. NOTE: The free end of the cable will be further prepared later.

NOTE: In the following steps, as you connect each of the flat cable wires, solder it to the foil and cut off the excess ends.

( ) Brown wire to hole 23.

( ) Red wire to hole 18.

( ) Orange wire to hole 4.

( ) Yellow wire to hole 15.

( ) Green wire to hole 2.

( ) Blue wire to hole 16.

( ) Violet wire to hole 25.

### CIRCUIT BOARD CHECKOUT

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

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

Refer to the illustrations where parts are installed as you make the following checks:

( ) Transistors for the proper type and installation.

( ) Electrolytic capacitors for the correct position of the positive (+) or negative (-) marks.

( ) Diode for the correct position of the banded end.

( ) ICs for the proper installation.

Set the circuit board aside temporarily.

### CHASSIS

Refer to Pictorial 1-4 for the following steps.

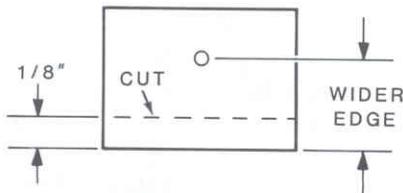
( ) Position the chassis on your work area as shown.

( ) Remove the paper backing from each of the four feet. Then press one foot on the bottom of the chassis near each corner as shown in the Pictorial.

- ( ) Remove the paper backing from the blue and white label and press the label in place near the center of the chassis bottom as shown. NOTE: Be sure to refer to the Model and Series numbers on the blue and white label in any correspondence you have with the Heath Company about your kit.

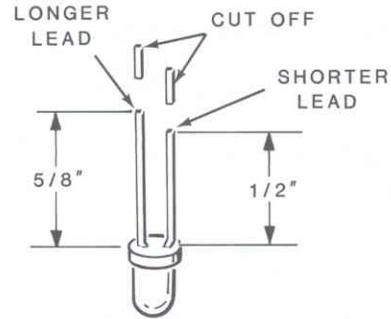
Refer to Pictorial 1-5 for the following steps.

- ( ) Position the chassis on your work area as shown.
- ( ) Refer to the inset drawing and, using the blade of a small screwdriver, install the rubber grommet in oval hole A in the chassis rear panel as shown.
- ( ) From the underside of the chassis, install a 6-32 × 3/8" screw in hole B. Use a #6 lock-washer and a 6-32 nut.
- ( ) In the same manner, install 6-32 screws, #6 lockwashers, and 6-32 nuts in chassis holes C, D, and E.
- ( ) Locate the eight 3/4" × 1" paper insulators furnished with your kit. Cut 1/8" from the **wider edge** of each insulator as shown.



**IMPORTANT:** When you prepare the LEDs in the next step, be sure to keep the identity of the longer and the shorter leads; **prepare each LED exactly as directed.**

- ( ) Locate the eight LEDs (two red, two green, and four amber) furnished with your kit. Note that each LED has one lead shorter than the other. On all eight LEDs, cut the shorter leads to a length of 1/2" as shown. Then cut the longer leads to a length of 5/8".



Install each of the eight LEDs in the chassis front panel in the following manner:

- A. Remove the paper backing from one of the small paper insulators. Push the insulator onto the leads of the LED so its sticky side is against the back of the LED lens.
- B. If necessary, straighten the LED leads so they are parallel, 1/8" apart.
- C. Position the LED into the front panel hole so the longer LED lead is toward the left side of the chassis (as seen in this Pictorial).
- D. Making sure the insulator is parallel with the top (or bottom) edge of the chassis, press the sticky side of the insulator firmly in place all around the back of the LED and on the inside of the front panel. NOTE: In some cases, the insulators may overlap; this is okay.
- E. After you have installed all eight LEDs, it is important that you make sure that each LED's longer lead is **toward the left** as viewed in this Pictorial.

Install the eight LEDs in the following steps.

- ( ) Amber LED in hole F (BUFFER).
- ( ) Red LED in hole G (FRMR).
- ( ) Green LED in hole H (DISCONNECTED).



- ( ) Green LED in hole J (CMD:).
- ( ) Amber LED in hole K (CONV).
- ( ) Amber LED in hole M (DISCONNECT IN PROGRESS).
- ( ) Amber LED in hole P (CONNECT ATTEMPT).
- ( ) Red LED in hole R (CONNECTED).

NOTE: When you install the circuit board in the following steps, try not to bend any of the LED leads on the inside of the front panel. If you do, make sure you straighten the leads to their former positions, exactly parallel and 1/8" apart.

- ( ) Place a #6 lockwasher on the end of each of the four chassis screws at B through E.
- ( ) Fold the two short cables (with the eight connector shells) sharply rearward, over the tops of the circuit board components; this will help prevent you from bending the LED leads.
- ( ) Carefully lower the circuit board onto the four chassis screws in the manner shown. Position the long 7-wire cable nearest to the rear panel. Secure the circuit board to the screws with four 6-32 nuts.
- ( ) Push the free end of the long 7-wire cable through rear panel grommet A as shown. Pull the cable all the way through, leaving just enough slack inside the chassis to clear the ceramic capacitors on the rear of the circuit board.

Refer to Pictorial 1-6 for the following steps.

- ( ) Cut a 2-5/8" piece of the nylon gasket.
- ( ) Form the gasket as shown in the Pictorial. Then work the gasket into the hole in the speaker bracket.

- ( ) Position the speaker, cone side down, into the speaker bracket. Be sure the two speaker lugs are exposed beyond the end of the bracket as shown.
- ( ) Connect the brn-red wire cable ends to the speaker lugs as follows: Brown wire to lug 1 and the red wire to lug 2. Solder both wires to the lugs and cut off any excess wire ends. Check and make sure neither wire is touching the speaker bracket.
- ( ) Secure the speaker bracket and speaker to the chassis at hole S with a 6-32 × 3/8" screw, a #6 lockwasher, and a 6-32 nut. Position the bracket parallel to the rear panel.

NOTE: When you install the 2-hole connector shells on the LEDs in the following steps, be sure the slots on all of the connectors are positioned up; **hole 1** of each connector will mate with the **longer** LED lead in each case. Each pair of cable wires in the connector will be designated by color and the holes in the board where they originate. Note that some of the wire-pairs will cross others.

<u>Circuit Bd. Holes</u>	<u>Wire Colors</u>	<u>LED No.</u>	<u>LED Name</u>
( ) P-G	Grn-Blu	D8	BUFFER
( ) B-L	Org-Yel	D5	FRMR
( ) K-C	Gry-Viol*	D4	DISCONNECTED
( ) N-G	Yel-Org	D7	CMD:
( ) M-G	Red-Brn	D6	CONV
( ) D-J	Blu-Grn	D3	DISCONNECT IN PROGRESS
( ) I-E	Red-Brn	D2	CONNECT ATTEMPT
( ) F-H	Viol-Gry	D1	CONNECTED

\* Separate the wires further, if necessary.

Prepare the external 7-wire cable coming from rear panel grommet A in the following steps.

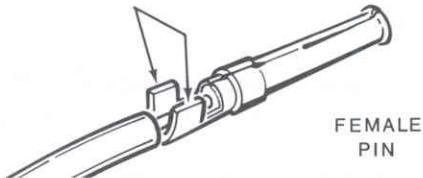
- ( ) Pass a cable tie around the cable and pull it snug, 3" away from the free wire ends.



# Heathkit®

- ( ) Push the free ends of the 7-wire cable through the center of the large RF core as shown. Push the RF core all the way up against the cable tie.
- ( ) Pass the other cable tie around the cable next to the RF core. Push it up against the end of the core and pull the cable tie tight.
- ( ) Cut off both excess cable tie ends.
- ( ) Crimp and solder a female pin on the end of each wire in the following manner:
  - A. Push the full length of the wire into the hole in the back of the female pin.
  - B. Crimp the tabs on the rear of the pin tightly around the bare portion of the wire.
  - C. Add a **small amount** of solder to the crimped connection.

CRIMP TABS TIGHTLY  
AROUND BARE WIRE  
END AND SOLDER



Refer to Detail 1-6A and install the wires in the rear of the RS-232 connector in the following steps. Push the female pin on each wire end into the connector until it latches; tug on each wire as you install it to make sure it is fully inserted in its connector hole.

<u>Wire Color</u>	<u>Connector Hole No.</u>
( ) Green	2
( ) Orange	4
( ) Yellow	15
( ) Blue	16
( ) Red	18
( ) Brown	23
( ) Violet	25

Except for the "Final Assembly," this completes the "Step-by-Step Assembly" of your kit.

## INITIAL TESTS

NOTE: In the following steps, if you fail to obtain the correct results, refer to the "In Case of Difficulty" section of this Manual. Do not attempt to use your TNC Status Indicator until you have found and corrected the problem.

You will need a high input impedance volt-ohmmeter for the following tests.

Refer to Pictorial 2-1 for the following steps.

- ( ) Set your ohmmeter to its  $\times 1000$  range. Connect the common (ground) lead of the ohmmeter to any convenient ground point on the chassis (the speaker bracket, for example).
- ( ) With the positive ohmmeter probe, check the RS-232 connector, pin 23, for greater than  $2000 \Omega$ .
- ( ) Check the RS-232 parallel port on the HD-4040-1 TNC Status Indicator, pins 2, 15, and 16, for a resistance of greater than  $1000 \Omega$ .
- ( ) Plug the RS-232 connector into parallel port P1 on the back of the TNC unit. Turn on the TNC; the CMD: light should come on.
- ( ) With the voltmeter, check pin 23 (hole 23 on the Status Indicator circuit board) for +5 volts DC.
- ( ) Check to make sure the DISCONNECTED LED comes on. This LED will **not** come on when the TNC is only turned on; connect to someone and then disconnect for this check.
- ( ) If the TNC is in the command mode, the CMD: LED should light. Go to the converse mode and make sure the CONV LED comes on and CMD goes out.
- ( ) Connect to and disconnect from someone; the link status LEDs should each come on at the appropriate time.
- ( ) To check the FRMR LED, perform the last step once again. Then take a wire and ground pin 4 of IC U102. The FRMR light should come on.
- ( ) Whenever you connect, the speaker should sound for approximately 1-2 seconds.

This completes the "Initial Tests."

## FINAL ASSEMBLY

- ( ) Refer to Pictorial 3-1 and position the cabinet top down over the chassis assembly as shown. Secure it on its two sides with four #6 × 1/4" sheet metal screws.

## OPERATION

Refer to Pictorial 4-1 as you read the following information.

Plug the RS-232 connector into the parallel port at J1 on the rear panel of your Model HD-4040 Packet Radio Terminal Node Controller.

Model HDA-4040-1 TNC Status Indicator is a "passive" instrument; it serves as an indicator for the ongoing conditions of your Terminal Node Controller (TNC). Eight front panel LEDs will light at various stages of the TNCs operation to indicate the following conditions:

- **CMD:** — Command mode of operation. CMD: will not light if the TNC is powered up, never went to the CONV mode. It will light if the TNC is placed in the CONV mode and then returned to the CMD: mode.
- **CONV** — Converse mode of operation. When the CONV mode is initiated automatically, via a connect, the status indicator will still display the CMD: mode even though you are actually in CONV.

NOTE: Your Status Indicator will indicate "CONV" when you are in the "transparent" mode. When you are connecting to another station and your TNC automatically switches to the CONV mode, the Status

Indicator will continue to indicate "CMD:." "CONV" will only be indicated if you enter a Control-C, followed by **CONV**. This information has been transferred to TAPR and may be fixed in software version 4.0.

- **BUFFER** — Indicates that the transmit buffer is active, and that not all of the packets generated have been transmitted.
- **FRMR** — The frame reject indicator which tells you that an incorrect implementation of the AX.25 protocol has occurred.
- **CONNECTED** — A link indicator to tell you that a link has been made with someone.
- **CONNECT ATTEMPT** — Indicates that you are attempting to make a link with someone. The light will remain on until a link has been made or the unit times out.
- **DISCONNECT IN PROGRESS** Indicates that you are disconnecting from someone after a successful connection.
- **DISCONNECTED** Indicates that a disconnect is accomplished, and that you may proceed with other operations if you so desire.

## IN CASE OF DIFFICULTY

The first part of this section of the Manual, titled "Visual Checks," tells you what to do about any difficulties that occur right after your unit is assembled. If the "Visual Checks" fail to clear up the problems, or if difficulties occur after your unit has been in use for some time, refer to the "Troubleshooting Chart."

NOTE: Refer to the "Circuit Board X-Ray View" for the physical locations of parts.

### 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 you have consistently overlooked.
2. About 90% of the kits that are returned to the Heath Company for service 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 instructions on Figure 1 in the Illustration Booklet.
3. Closely examine the circuit board foil in a good light to see that no solder bridges exist between adjacent connections. Remove any solder bridges by holding a clean, hot soldering iron tip between the two points that are bridged until the excess solder flows down onto the tip. Compare your foil patterns with those shown on the "Circuit Board X-Ray View."
4. Check to be sure each transistor is in the proper location (correct part number and/or type number). Make sure each transistor lead is connected to the proper point.
5. Make sure the diode band is positioned above the diode band printed on the circuit board.
6. Check each capacitor value. Make sure that a capacitor of the correct value is installed at each capacitor location. Check electrolytic capacitors to be sure their positive (+) and negative (-) leads are at the correct positions.
7. Check each resistor value carefully. Be sure, in each step, that the proper part has been wired into the circuit as directed in the step. It would be easy, for example, to install a 22 k $\Omega$  (red-red-org) resistor where a 220  $\Omega$  (red-red-brn) resistor should have been installed.
8. Be sure all the wires and leads connected to the circuit boards have been trimmed as close as possible to the circuit board foils.
9. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.

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.

## Troubleshooting Chart

The following Troubleshooting Chart provides you with information that will help you locate and correct difficulties that may occur in your kit. The "Problem" column describes a specific problem and the "Possible Cause" tells what component or condition may be causing the problem.

PROBLEM	POSSIBLE CAUSE
Resistance checks are not correct.	<ol style="list-style-type: none"> <li>1. Solder bridge on circuit board.</li> <li>2. IC U102 installed incorrectly.</li> </ol>
Do not get correct indication on LEDs.	<ol style="list-style-type: none"> <li>1. Solder bridge on circuit board.</li> <li>2. Incorrect wiring on board.</li> <li>3. RS-232 plug wired incorrectly.</li> <li>4. Problem in TNC.</li> </ol>

## SPECIFICATIONS

Dimensions (overall) .....	5-1/2" wide × 5-1/4" deep × 2-1/2" high (14 × 13.3 × 6.4 cm).
Net weight .....	0.9 lb. (0.41 kg).

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

## CIRCUIT DESCRIPTION

Refer to the Schematic Diagram as you read the following Circuit Description.

The TNC Status Indicator decodes the binary information supplied by the Terminal Node Controller parallel user port IC, U13. This port is used as a general-purpose I/O port to provide status information.

Parallel port lines 2, 15, and 16 supply information to the Status Indicator that ultimately appear as link status and frame reject information. Lines 4 and 18 contain information on the mode of operation and the status of the transmit buffer, and to enable the audio connect alarm.

Audio alarm IC U101 and its associated components, consisting of resistors R101 and R102 with capacitor C102, set the pitch of the alarm. Capacitor C103 couples the signal to speaker SP1.

The trigger circuit formed by transistor Q101 includes resistors R103, R104, R105, and R106 and capacitors C104 and C105. When you connect to another TNC, the updated information at the parallel port will be routed to IC U102 where it will be decoded, causing its pin 6 to go low. This low condition is routed to the base of transistor Q101 to turn it on. When Q101 turns on and conducts, capacitor C105 charges to bring pin 4 of IC U101 high, causing

it to oscillate. As capacitor C105 discharges and pin 4 of U101 starts to go low, the oscillations eventually cease. The oscillations produced at output pin 3 are routed through capacitor C103, causing the audio tone to be heard in the speaker.

IC U102 is a 1-of-10 binary decoder. When the binary information of one of the link states is present at one of its input pins 13, 14, or 15, the IC decodes the information and causes one of the 10s-output pins (pins 2 through 6) to go low. As any one of the pins goes low, it causes its corresponding front panel LED to conduct and to light up, indicating the status of the TNC.

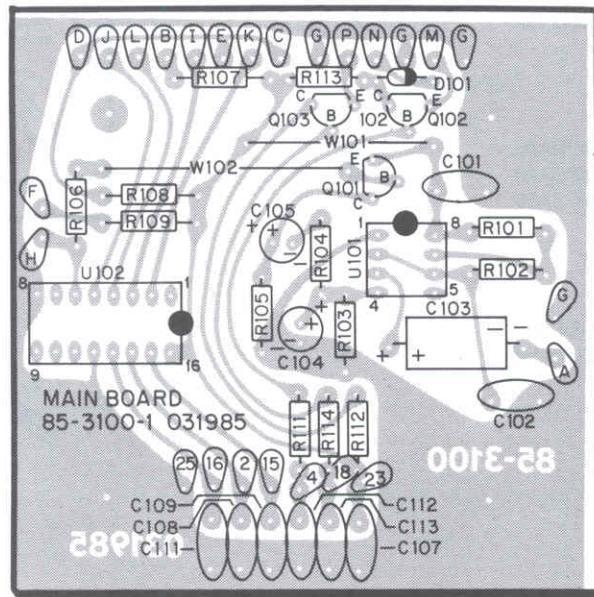
When the TNC is in the CONV mode, a logic 1 (high) is present on pin 4 of the port. This signal is routed to the base of transistor Q102, causing it to turn on and conduct. As Q102 conducts, a high level is present on its emitter, which causes LED D6 to conduct and to light up. When the logic level at pin 4 of the port is 0 (low), transistor Q102 is turned off, allowing the collector to rise sufficiently to forward bias diode D101 and causing LED D7 to light up.

When the TNC transmit buffer contains data, pin 18 of the port goes high, turning transistor Q103 on. As Q103 conducts, it causes LED D8, in its emitter circuit, to conduct and to light.

## CIRCUIT BOARD X-RAY VIEW

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

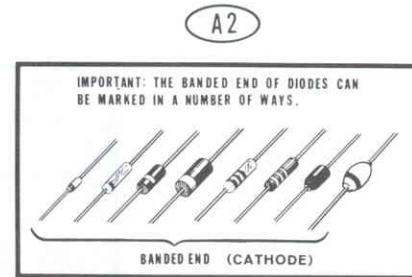
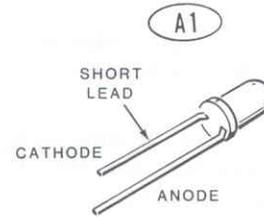
- A. Find the circuit component part number (R102, C106, U101, etc.) on the X-Ray view.
- B. Locate the same number in the "Circuit Component Number" column of the "Parts List" in the front of the Manual.
- C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



(Shown from the component side)

## SEMICONDUCTOR IDENTIFICATION

<u>COMPONENT NUMBER</u>	<u>HEATH PART NUMBER</u>	<u>MAY BE REPLACED WITH</u>	<u>KEY NUMBER</u>
<b>DIODES</b>			
D1	412-637	NSL5076A	A1
D2	412-641	SY405D	A1
D3	412-641	SY405D	A1
D4	412-642	SG205D	A1
D5	412-637	NSL5076A	A1
D6	412-641	SY405D	A1
D7	412-642	SG205D	A1
D8	412-641	SY405D	A1
D101	56-56	1N4149A	A2

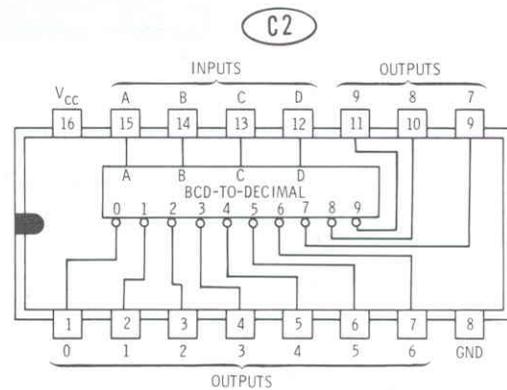
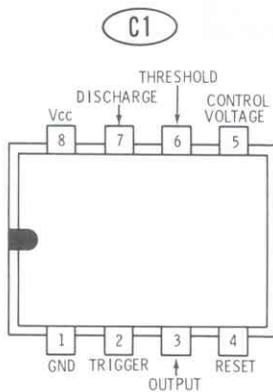
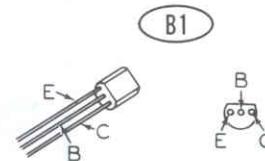


### TRANSISTORS

Q101	417-865	MPSA55	B1
Q102	417-801	MPSA20	B1
Q103	417-801	MPSA20	B1

### INTEGRATED CIRCUITS

U101	442-53	NE555	C1
U102	443-87	SN74145	C2



# CUSTOMER SERVICE

## REPLACEMENT PARTS

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

## ORDERING FROM THE FACTORY

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

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

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

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

## OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

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

## TECHNICAL CONSULTATION

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

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

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

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

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

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

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

## REPAIR SERVICE

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

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

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

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

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

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

Heath Company  
Service Department  
Benton Harbor, Michigan 49022



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

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