HEATHKIT® MANUAL

for the

RTTY TERMINAL INTERFACE

Model HD-3030

595-3100-01

HEATH COMPANY • BENTON HARBOR, MICHIGAN

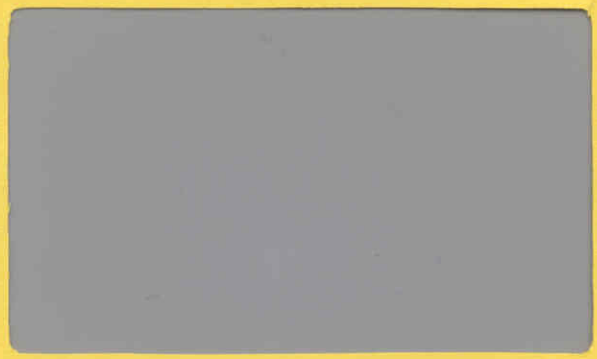
HEATH COMPANY PHONE DIRECTORY

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

R/C, Audio, and Electronic Organs	(616) 982-3310
Amateur Radio	(616) 982-3296
Test Equipment, Weather Instruments and Home Clocks	(616) 982-3315
Television	(616) 982-3307
Aircraft, Marine, Security, Scanners, Automotive, Appliances and General Products	(616) 982-3496
Computers — Hardware	(616) 982-3309
Computers — Software: Operating Systems, Languages, Utilities	(616) 982-3860
Computers — Software: Application Programs	(616) 982-3884
Heath Craft Wood Works	(616) 982-3423



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 Heathkit Electronic 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 componen, 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.

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.

Heathkit® Manual

for the

RTTY TERMINAL INTERFACE

Model HD-3030

595-3100-01

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS INSTRUMENT TO RAIN OR MOISTURE.

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

Table of Contents

INTRODUCTION

Radioteletype, abbreviated RTTY, is becoming a very popular mode of communication. There are many excellent Teletype® (TTY) printers available, as well as computers, software, and other devices for RTTY communications. This Model HD-3030 RTTY Terminal Interface will provide the important link between your radio communications equipment and a computer and/or TTY printer. Whether you are an amateur or commercial operator, or a shortwave listener, you will find this Interface convenient, efficient, and easy to use.

Demodulation of CW (continuous wave), RTTY, and ASCII (American Standard Code for Information Interchange) signals at RTTY speeds of up to 300 baud is provided by the internal circuitry, and it is fully RS-232 and TTL compatible for use with most present day computers. A built-in loop supply permits the operation of noncomputer RTTY machines that use 20 mA or 60 mA current loop circuits.

Audio frequency shift keying (AFSK) is another feature, with the additional capability for full FSK for transmitters that are so equipped. Auto-start operation is also featured.

Front panel pushbutton switches give the operator full control. In addition to the Power On/Off pushbutton, with an LED (light emitting diode) indicator, other pushbuttons include: Operate/Standby, Send/Receive, CW/RTTY, Reverse Shift for both Send and Receive, Preselect/Bypass for the optional 170 Hz Preselector, and selection of one of three Audio Frequency Shift filters, two of which are optional accessories.

Also on the front panel is a bar graph indicator and two LEDs that make it easy to "tune in" CW and RTTY signals, and status indicators for "Send", "Received Data Available", "Mark", and "Space".

Optional accessories include the Model HDA-3030-2, 425 /850 Hz Filter and the Model HDA-3030-4, 170 Hz Preselector.

UNPACKING INSTRUCTIONS

DO NOT UNPACK YOUR KIT PARTS UNTIL YOU ARE INSTRUCTED TO DO SO.

Your kit is packed in a large shipping container which is divided into several sections. Each section is identified as a "pack", and contains the parts, hardware, circuit board, etc. needed for the assembly of one portion of the kit.

The "Pack Index Sheet", shows the location of the packs in the carton. Notice that in addition to Packs 1 through 7, there is a section called the "Final Pack". This section contains metal parts, hardware, and components that will be used for the chassis assembly after you have completed the circuit boards.

Do not unpack the entire kit. When you come to an instruction to remove a pack from the carton, refer to the Pack Index Sheet and remove ONLY the indicated pack.

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. This will prevent intermixing of parts and aid in parts identification. Do not throw away any packing material until you account for all the parts.

The Manual has a Parts List for each pack. Each Parts List has its own unpacking instructions, which you should read carefully.

ASSEMBLY NOTES

TOOLS

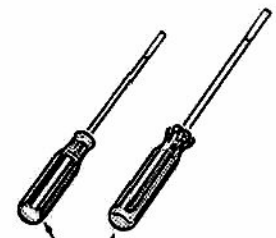
You will need these tools to assemble your kit:

PLIERS

LONG-NOSE PLIERS

DIAGONAL CUTTERS

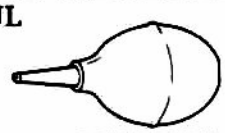
WIRE STRIPPERS



1/8" & 1/4"-BLADE SCREWDRIVERS

PHILLIPS SCREWDRIVER

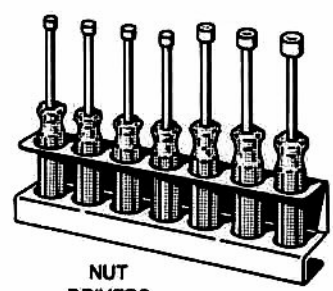
OTHER HELPFUL TOOLS



DESOLDERING BULB*

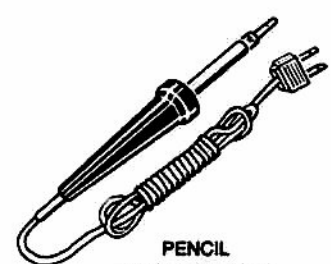
NUT STARTER (May Be Supplied With Kit)

DESOLDERING BRAID*



NUT DRIVERS

*To Remove Solder From Circuit Connections.



PENCIL SOLDERING IRON (22 to 25 WATTS)

ASSEMBLY

1. Follow the instructions carefully. Read the entire step before you perform each operation.

2. The illustrations in the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.

3. Most kits use a separate "Illustration Booklet" that contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.

4. Position all parts as shown in the Pictorials.

5. Solder a part or a group of parts only when you are instructed to do so.

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

   — In the Parts List,

   — At the beginning of each step where a component is installed,

   — In some illustrations,

   — In the Schematic,

   — In the section at the rear of the Manual.

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

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

SOLDERING

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

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

1. Use the right type of soldering iron. A 22 to 25-watt pencil soldering iron with a 1/8" or 3/16" chisel or pyramid tip works best.

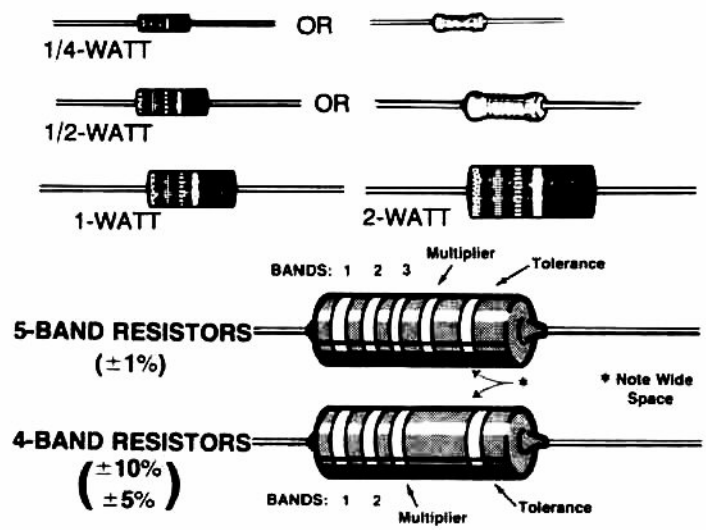
2. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When solder tends to "ball" or does not stick to the tip, 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.

Heathkit

PARTS

Resistors are identified in Parts Lists and steps by their resistance value in Ω (ohms), kΩ (kilohms), or MΩ (megohms). They are usually identified by a color code and four or five color bands, where each color represents a number. These colors (except for the last band, which indicates a resistor's "tolerance") will be given in the steps in their proper order. Therefore, the following color code is given for information only. NOTE: Occasionally, a "precision" or "power" resistor may have the value stamped on it.



Band 1 1st Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

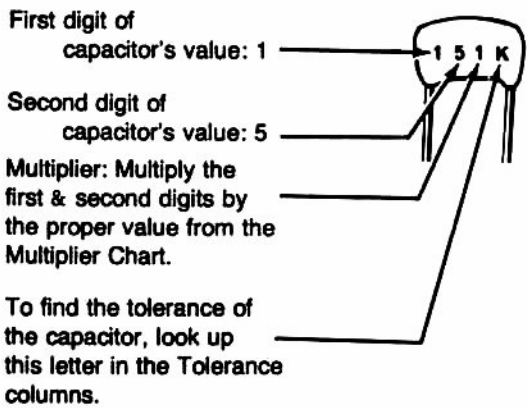
Band 2 2nd Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Band 3 (if used) 3rd Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Multiplier	
Color	Multiplier
Black	1
Brown	10
Red	100
Orange	1,000
Yellow	10,000
Green	100,000
Blue	1,000,000
Silver	0.01
Gold	0.1

Resistance Tolerance	
Color	Tolerance
Silver	± 10%
Gold	± 5%
Red	± 2%
Brown	± 1%
Green	± .5%
Blue	±.25%
Violet	± .1%
Gray	±.05%

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:



EXAMPLES:

151K = 15 × 10 = 150 pF
759 = 75 ×0.1 = 7.5 pF

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

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

*DuPont Registered Trademark

SPECIAL ASSEMBLY NOTES

NOTE: The following suggestions will not necessarily improve the operation of your kit. They will, however, help you troubleshoot it (if it ever becomes necessary), and help you perform the "Circuit Board checkout" steps at the end of the assembly sections of this Manual. And you will have a more professionally-built kit when you finish.

1. When you install resistors, always position each resistor so you can read the bands on the resistor in the same direction as you can read the printing on the circuit board (see Figure 1). For resistors that have the value printed on them instead of color bands, install these resistors so the values are facing away from the circuit board and read in the same direction as the printing on the circuit board.

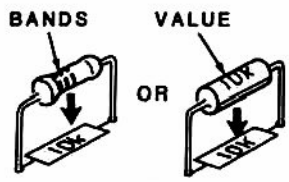


Figure 1

2. When you install ceramic, Mylar, or mica capacitors, always position each capacitor so you can read the value on the capacitor in the same direction as you can read the printing on the circuit board (see Figure 2).

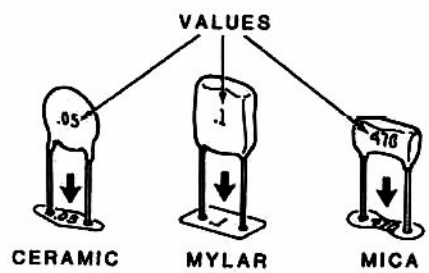


Figure 2

3. When you install electrolytic or other tubular capacitors, always position each capacitor so the value is facing away from the circuit board (see Figure 3). Be sure to observe the correct polarity when you install electrolytic capacitors (as you will be directed in the steps). Other, non-polarized, capacitors should be installed so you can read the values in the same direction as the printing on the circuit board.

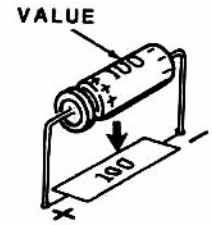


Figure 3

4. Install diodes so the type numbers or part numbers are facing away from the circuit board. Be sure to match the band on one end of each diode with the band mark on the circuit board.

DISPLAY CIRCUIT BOARD

PARTS LIST

Remove the parts from Pack 1 and check each part against the following list. The key numbers correspond to the numbers on the "Display Circuit Board Parts Pictorial" (Illustration Booklet, Page 1). 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."

RESISTORS

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

All resistors are 1/4-watt.

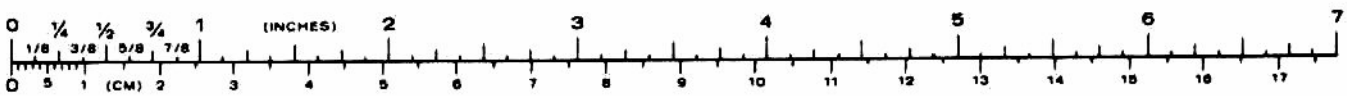
KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
A1	6-331-12	1	330 Ω (org-org-brn)	R1
A1	6-102-12	1	1000 Ω (brn-blk-red)	R2

LEDS (Light Emitting Diodes)

A2	412-637	5	NSL5076A LED	D1, D2, D3, D4, D5
A3	412-655	1	10-segment bar display	

MISCELLANEOUS

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
	85-2859-1	1	Display circuit board
	347-55	4"	Flat ribbon cable
B1	432-1085	1	15-pin connector
	75-103	1	Paper insulator (packed with Manual)
	390-1255	1	Fuse replacement label
		1	Blue and white label
	597-260	1	Parts Order Form
		1	Manual (see Page 1 for part number)
			Solder



STEP-BY-STEP ASSEMBLY

Refer to Pictorial 1-1 (Illustration Booklet, Page 1) for the following steps.

NOTES:

1. Pictorial 1-1 shows the location of all the parts that you will install on the circuit board in the first series of steps. Refer to this illustration whenever you are instructed to install a part.

2. All specially mounted parts are followed in the step by a special illustration. Refer to the illustration and its circuit board location in the Pictorial before you install the part.

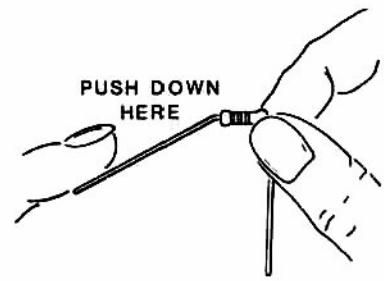
3. Check off each step as you perform it. You may also wish to place a check mark near each component on the Pictorial as you install it.

4. In general, solder instructions are given only at the end of a series of similar steps. You may solder more often if you desire.

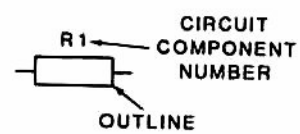
In the following steps, you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on a circuit board.

( ) Note that the circuit board has foil on both sides, but only one side has the component outlines shown on it. This side of the circuit board 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 a step specifically directs you otherwise.

( ) R1: Hold a 330 Ω (org-org-brn) resistor by the body as shown and bend the leads straight down with your finger to fit the hole spacing on the circuit board.



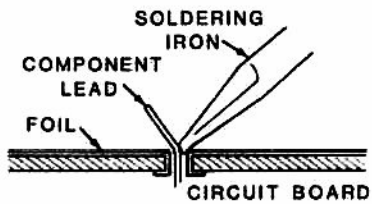
( ) Start the leads into the holes at the resistor's circuit board location. The end with color bands may be positioned either way. NOTE: Resistors are identified by the type of circuit board outline shown below. Other types of components use similar outlines.



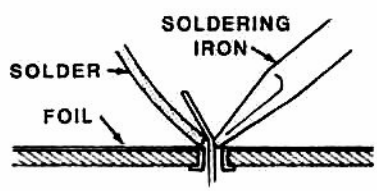
( ) Press the resistor against the circuit board and bend the leads outward slightly to hold it in place.

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

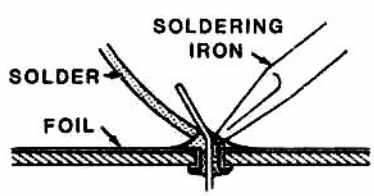
1. Push the soldering iron tip against both the lead and the circuit board foil. Heat **both** for two or three seconds.



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



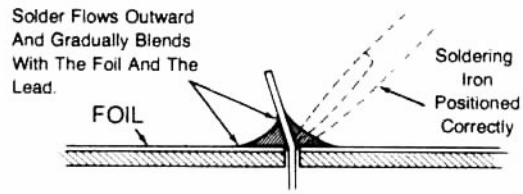
3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.



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

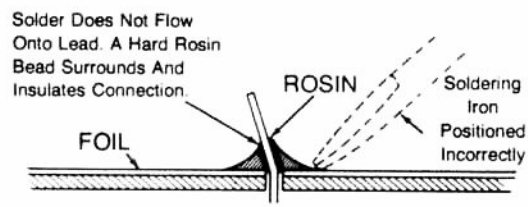
( ) Check each connection. Compare it to the illustrations on Page 12. After you have checked the solder connections, proceed with the assembly. Use the same soldering procedure for each connection.

A GOOD SOLDER CONNECTION

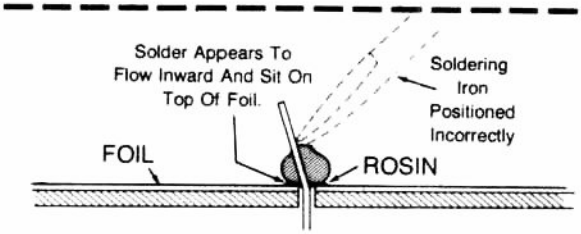


When you heat the lead and the circuit board foil at the same time, the solder will flow evenly onto the lead and the foil. The solder will make a good electrical connection between the lead and the foil.

POOR SOLDER CONNECTIONS



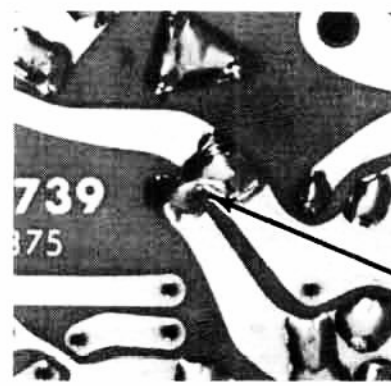
When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.



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

SOLDER BRIDGES

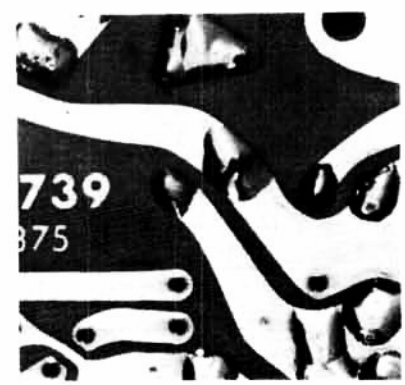
A solder bridge between two adjacent foils is shown in photograph **A**. Photograph **B** shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. A good rule to follow is: always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when the foils are small and close together. NOTE: It is alright for solder to bridge two connections on the same foil.



A

SOLDER BRIDGE

B



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.

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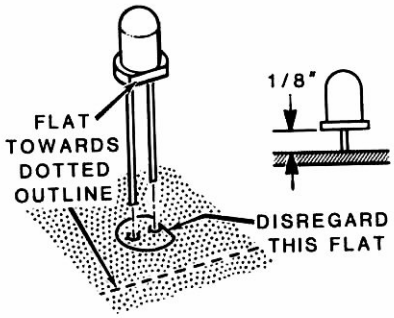
Install the following components on the circuit board.

( ) R2: 1000 Ω (brn-blk-red). Solder the leads to the foil and cut off the excess lead lengths.

NOTE: When you mount each of the LEDs in the following steps, position the case flat towards the dotted outline on the circuit board. Ignore the flats shown on the LED outlines. Space the LEDs so the bottom of the case is 1/8" from the circuit board; then solder the leads to the foil and cut off the excess lead lengths. Keep the LEDs straight.



Install five NSL5076A (#412-637) LEDs as follows:

( ) SPACE.
( ) MARK.
( ) RDA.
( ) SEND.
( ) POWER.

Refer to Pictorial 1-2 (Illustration Booklet, Page 1) for the following steps.

( ) Cut and discard a 3-pin section from the 15-pin connector. Save the 12-pin connector.

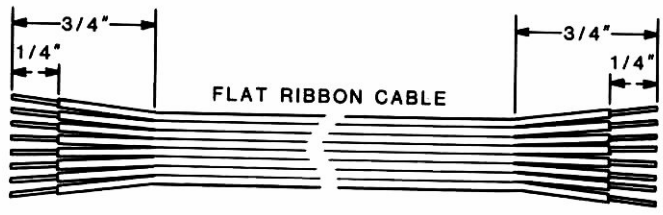
( ) Insert the short pins on the 12-pin connector into the 10-segment display bar circuit board holes opposite the component side. Press the connector body against the circuit board and solder the pins to the foils.

( ) Mount the 10-segment display bar circuit board to the display circuit board as shown. Insert the connector pins into the circuit board holes so the connector body is tightly against the circuit board. Make sure both circuit boards are parallel with each other, then solder the pins to the foil and cut off the excess pin lengths.

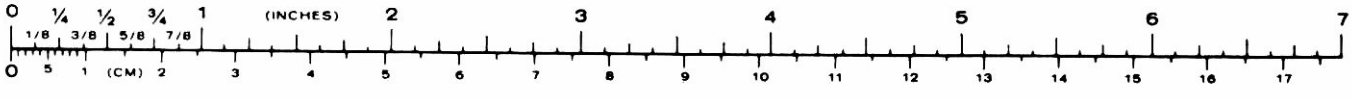
( ) Cut the flat ribbon cable to 4".

( ) Refer to Detail 1-2A and separate the individual wires at both ends of the flat ribbon cable for 3/4". Use a knife or a pair of wire cutters to start separating the wires.

( ) Refer to Detail 1-2A and remove 1/4" of insulation from each of the wire ends. When you have removed the insulation from a wire, twist the wire strands tightly together and apply a small amount of solder to the wire end to hold the strands together.



Detail 1-2A



Insert the wires from the flat ribbon cable into the display circuit board holes from the side opposite the components as follows. Position each wire with the insulation 1/16" above the foil as shown in the inset drawing, and solder the wire to the foil after you install it. On the other side of the board, cut off each excess wire end.

( ) Brown wire at hole 1.

( ) Red wire at hole 2.

( ) Orange wire at hole 3.

( ) Yellow wire at hole 4.

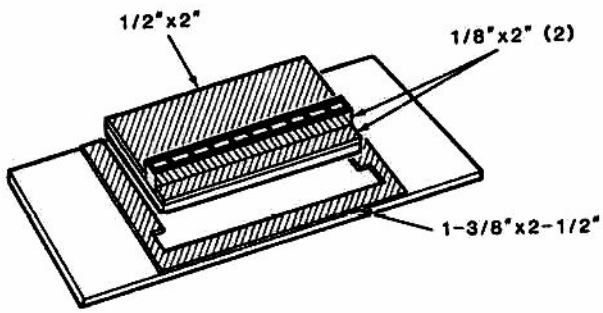
( ) Green wire at hole 5.

( ) Blue wire at hole 6.

( ) Violet wire at hole 7.

( ) Gray wire at hole 8.

You will connect the other end of the flat ribbon cable later. Perform the following "Circuit Board Checkout" before you prepare and install insulator paper on the display circuit board.



Detail 1-2C

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following problems:

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together. Trim all leads as close to the foil pads as possible.

( ) Check the LEDs for proper positioning of the case flat.

( ) Refer to Detail 1-2B (Illustration Booklet, Page 1) and prepare the following pieces of insulator paper. You can use the Detail as a template. Then cut each piece with a sharp knife or scissors.

One 1/2" × 2"
Two 1/8" × 2"
One 1-3/8" × 2-1/2"

( ) Remove the paper backing from one of the pieces of insulator paper. Then refer to Detail 1-2C and press the adhesive side onto the assembly at the location shown.

( ) In the same manner, install the remaining three pieces of prepared insulator paper.

This completes the display circuit board assembly. Set it aside until it is called for later.

RTTY DEMODULATOR CIRCUIT BOARD

PARTS LIST

Remove the parts from Pack 2 and check each part against the following list. Do not remove components that are supplied on a tape from the tape until you use them in a step. 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."

TAPED COMPONENTS

Refer to the enclosed "Taped Components Chart" and follow the instructions at the top of that chart to check the components under "RTTY Demodulator Circuit Board." The taped parts are in assembly sequence. It is not necessary to check them against the Parts List.

RESISTORS

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

All resistors are 1/4-watt.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
6-222-12	2	2200 Ω (red-red-red)	R10, R11
6-472-12	1	4700 Ω (yel-viol-red)	R14
6-153-12	2	15 kΩ (brn-grn-org)	R7, R15
6-333-12	6	33 kΩ (org-org-org)	R4, R5, R6, R8, R9, R13
6-563-12	1	56 kΩ (grn-blu-org)	R3
6-104-12	2	100 kΩ (brn-blk-yel)	R1, R2
6-394-12	1	390 kΩ (org-wht-yel)	R16
6-474-12	1	470 kΩ (yel-viol-yel)	R12

DIODES

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
56-56	7	1N4149	D1 – D7

NON-TAPED PARTS

The following parts are not taped on strips. The key numbers correspond to the numbers on the "RTTY Demodulator Parts Pictorial" (Illustration Booklet, Page 2).

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
CAPACITORS				
Ceramic				
A1	21-22	1	220 pF	C2
A1	21-176	2	.01 µF	C6, C7
Electrolytic				
A2	25-961	2	3.3 µF	C3, C4
Mylar®				
A3	27-118	1	.15 µF	C1
A4	27-85	1	.22 µF	C5

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
INTEGRATED CIRCUITS (ICs)				

NOTE: 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.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

B1	442-21	1	MC1458	IC2
B1	442-743	1	HA4741-5	IC1
MISCELLANEOUS				
	85-2860-1	1	RTTY demodulator circuit board	
C1	432-1111	1	5-hole right angle socket	
C2	432-1023	1	10-hole right angle socket	
C3	434-230	1	8-pin IC socket	
C3	434-298	1	14-pin IC socket	
		1	Taped component chart	

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 2-1 (Illustration Booklet, Page 2) as you read the following notes and steps.

NOTES:

1. The circuit board steps will have you install parts in a low-to-high (physical size) component sequence for ease of assembly. Check off each step as you perform it and place a check mark near each component on the Pictorial after you install it.

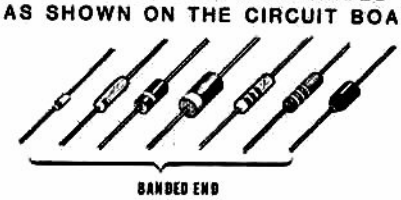
2. Refer to the components under "RTTY Demodulator Circuit Board" on the "Taped Components Chart" before you begin. These components are in the assembly sequence.

Start at the top of the circuit board and install the following components. NOTE: In order to make assembly easier, you may wish to precut all the parts from a section and, as you do, prebend the leads. Lay the parts on your work surface in the order of assembly. Then you can hold the circuit board while you install the parts in sequence without interruption.

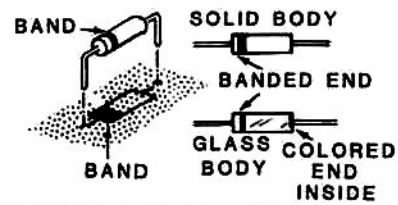
( ) Position the demodulator circuit board with the component side facing up.

NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board. **The circuit will not work if a diode is installed backwards.**

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD.



If your diode has a solid body, the band is clearly defined. If your diode has a glass body, do not mistake the colored end in side the diode for the banded end. Look for a band painted on the outside of the glass.



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

( ) D2: 1N4149 diode (#56-56).

( ) D1: 1N4149 diode (#56-56).

( ) R2: 100 kΩ (brn-blk-yel).

( ) R1: 100 kΩ (brn-blk-yel).

( ) R3: 56 kΩ (grn-blu-org).

( ) R16: 390 kΩ (org-wht-yel).

( ) R15: 15 kΩ (brn-grn-org).

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

( ) D3: 1N4149 diode (#56-56).

( ) D4: IN4149 diode (#56-56).

( ) R4: 33 kΩ (org-org-org).

( ) R5: 33 kΩ (org-org-org).

( ) R7: 15 kΩ (brn-grn-org).

( ) R8: 33 kΩ (org-org-org).

( ) R6: 33 kΩ (org-org-org).

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

( ) R10: 2200 Ω (red-red-red).

( ) R11: 2200 Ω (red-red-red).

( ) R9: 33 kΩ (org-org-org).

( ) D5: 1N4149 diode (#56-56).

( ) D6: 1N4149 diode (#56-56).

( ) D7: 1N4149 diode (#56-56).

( ) R12: 470 kΩ (yel-viol-yel).

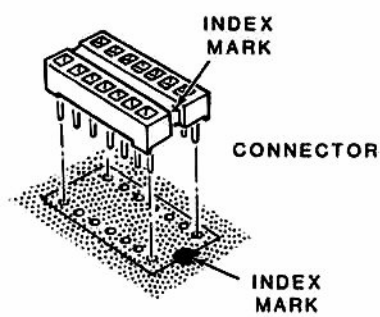
( ) R13: 33 kΩ (org-org-org).

( ) R14: 4700 Ω (yel-viol-red).

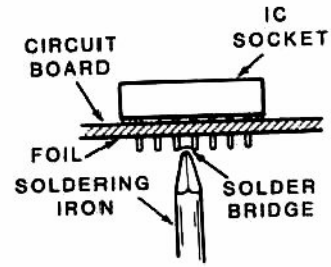
( ) Solder the leads to the foil and cut off the excess lead lengths.

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

NOTE: The IC sockets you will install in the following steps will have either an open or solid center strip. The socket with the solid center strip will have an indentification mark on one end (an arrow, a dot, or a notch). Always position this end of the socket toward the index mark on the circuit board. Then solder one pin at each end of the socket. Check to make sure the socket is tight against the circuit board; then solder the remaining pins. IC sockets are identified on the circuit board by the following outline:



NOTE: It is very easy to create a solder bridge between foils on the circuit board. After each solder step, carefully inspect the foil for solder bridges. If a solder bridge has occurred, hold the circuit board foil-side-down as shown, and hold the soldering iron tip between the two points that are bridged. The solder will flow down the soldering iron tip.

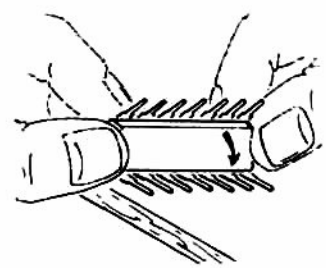


( ) Install a 14-pin IC socket at IC1.

( ) Install an 8-pin IC socket at IC2.

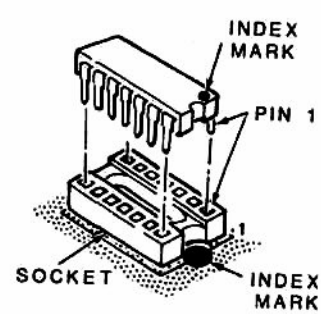
Use the following procedure to install the ICs in their sockets:

1. Be sure the pins are straight. Then lay the IC down on one of its rows of pins as shown, and roll it over until the pins are at right angles or bent in slightly. Repeat this process for the other row of pins.

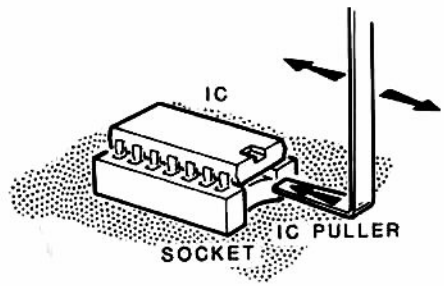


2. Position the pin 1 end of the IC over the index mark on the circuit board.

3. Be sure each IC pin is properly started into the socket. Then push the IC down. NOTE: An IC pin that is bent under the IC will look as though it is correctly installed in the socket.



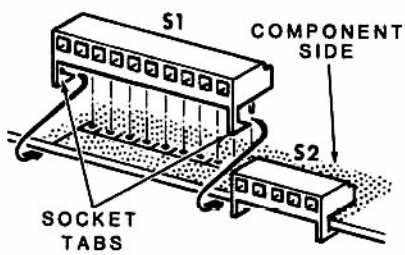
4. Should it ever become necessary to remove an IC, use an IC puller or a small screwdriver. Insert the tip beneath the IC; then gently rock it up and down to lift the IC.



( ) Install an HA4741-5 (#442-743) at IC1.

( ) Install an MC1458 (#442-21) at IC2.

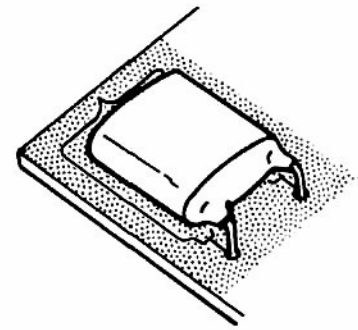
NOTE: When you install the following right angle sockets, hook the socket tabs over the edge of the circuit board and insert the pins into the circuit board holes. Keep the socket body against the circuit board and solder the pins to the foil.



( ) S1: 10-hole right angle socket.

( ) S2: 5-hole right angle socket.

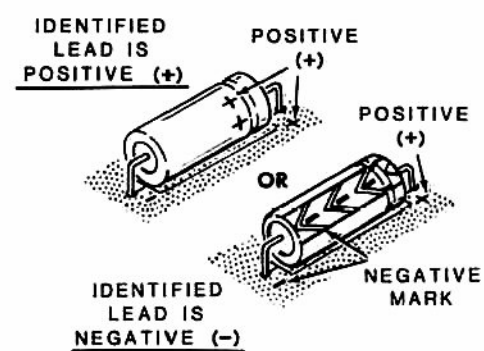
( ) C1: Insert the leads of a .15 µF Mylar capacitor into the circuit board holes and bend the capacitor back against the circuit board so it is inside the outline. Then solder the leads to the foil and cut off the excess lead lengths.



( ) C5: Mount the .22 µF Mylar capacitor in the same manner as you did the previous one and bend it back against the circuit board inside the capacitor outline before you solder it to the foil.

Refer to Pictorial 2-3 (Illustration Booklet, Page 2) for the following steps.

NOTE: When you install an electrolytic capacitor, look at it and identify the lead markings. One lead will have a positive (+) mark or a negative (−) mark beside it. Be sure to install the positive-marked (+) lead in the positive-marked hole, or the negative-marked (−) lead in the negative-marked hole.



( ) C3: 3.3 µF electrolytic.

( ) C4: 3.3 µF electrolytic.

NOTE: When you install ceramic capacitors, do not push the insulated portion of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.

( ) C7: .01 μF ceramic.

( ) C6: .01 μF ceramic.

( ) C2: 220 μF ceramic.

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

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following problems.

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

( ) Check the integrated circuits for the proper installation.

( ) Check each diode for the proper positioning of the banded end.

( ) Check the electrolytic capacitors for the correct position of the positive (+) and negative (−) marks.

This completes the RTTY demodulator circuit board assembly. Set it aside until it is called for later.

CW DEMODULATOR CIRCUIT BOARD

PARTS LIST

Remove the parts from Pack 3 and check each part against the following list. Do not remove components that are supplied on a tape from the tape until you use them in a step. 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."

TAPED COMPONENTS

Refer to the enclosed "Taped Components Chart" and check the components under "CW Demodulator Circuit Board." The taped parts are in assembly sequence. It is not necessary to check them against the Parts List.

RESISTORS

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

All resistors are 1/4-watt.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
6-152-12	3	1500 Ω (brn-grn-red)	R2, R5, R8
6-222-12	2	2200 Ω (red-red-red)	R17, R18
6-103-12	2	10 kΩ (brn-blk-org)	R12, R16
6-223-12	1	22 kΩ (red-red-org)	R14
6-333-12	1	33 kΩ (org-org-org)	R11
6-563-12	2	56 kΩ (grn-blu-org)	R4, R7
6-623-12	1	62 kΩ (blu-red-org)	R1
6-104-12	2	100 kΩ (brn-blk-yel)	R10, R19
6-244-12	3	240 kΩ (red-yel-yel)	R3, R6, R9
6-394-12	1	390 kΩ (org-wht-yel)	R13
6-474-12	1	470 kΩ (yel-vio-yel)	R15

DIODE

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
56-56	2	1N4149	D1, D2

NON-TAPED PARTS

The following parts are not taped on strips. The key numbers correspond to the numbers on the "CW Demodulator Circuit Board Parts Pictorial" (Illustration Booklet, Page 3).

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
CAPACITORS				
Ceramic				
A1	21-176	2	.01 µF	C9, C10
Mylar				
A2	27-227	1	.005 µF	C7
A2	27-161	6	.01 µF	C1 – C6
A3	27-118	1	.15 µF	C8
TRANSISTOR – INTEGRATED CIRCUITS				
B1	417-987	1	MPF111 transistor	Q1
B2	442-21	3	MC1458 integrated circuit	U1, U2, U3
MISCELLANEOUS				
C1	10-1102	3	500 Ω control	P1, P2, P3
	85-2863-1	1	CW demodulator circuit board	
C2	432-1111	1	5-hole right angle socket	
C3	432-1023	1	10-hole right angle socket	
C4	424-230	3	8-pin IC socket	

NOTE: The transistor 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.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

STEP-BY-STEP ASSEMBLY

Refer to the components under "CW Demodulator Circuit Board" on the "Taped Components Chart" before you begin. The components are in assembly sequence.

Refer to Pictorial 3-1 (Illustration Booklet, Page 3) for the following steps.

( ) Position the CW demodulator circuit board with the component side facing up as shown.

( ) R1: 62 kΩ (blu-red-org).

( ) R15: 470 kΩ (yel-viol-yel).

( ) D2: 1N4149 diode (#56-56). NOTE: Remember to position the banded end of the diode over the band indicated on the circuit board.

( ) R16: 10 kΩ (brn-blk-org).

( ) R17: 2200 Ω (red-red-red).

( ) R18: 2200 Ω (red-red-red).

( ) R19: 100 kΩ (brn-blk-yel).

( ) R2: 1500 Ω (brn-grn-red).

( ) R3: 240 kΩ (red-yel-yel).

( ) R4: 56 kΩ (grn-blu-org).

( ) R5: 1500 Ω (brn-grn-red).

( ) R6: 240 kΩ (red-yel-yel).

( ) R7: 56 kΩ (grn-blu-org).

( ) R8: 1500 Ω (brn-grn-red).

( ) R9: 240 kΩ (red-yel-yel).

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

( ) D1: 1N4149 diode (#56-56).

( ) R10: 100 kΩ (brn-blk-yel).

( ) R11: 33 kΩ (org-org-org).

( ) R12: 10 kΩ (brn-blk-org).

( ) R13: 390 kΩ (org-wht-yel).

( ) R14: 22 kΩ (red-red-org).

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

Refer to Pictorial 3-2 (Illustration Booklet, Page 3) for the following steps.

Install three 8-pin IC sockets as follows. Make sure you position the identification mark on the socket over the index mark shown on the circuit board. Solder the pins to the foil after you install each IC socket. Be careful not to let solder bridge the pins.

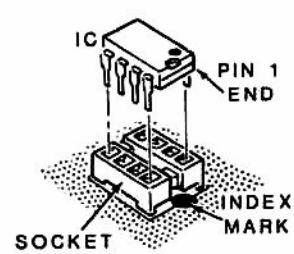
( ) U1.
( ) U2.
( ) U3.

( ) 10-hole right angle socket at S1.

( ) 5-hole right angle socket at S2.

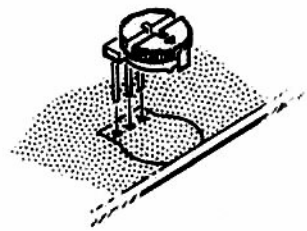
( ) Solder the socket pins to the foil.

Install three MC1458 (#442-21) ICs as follows. Make sure to position the pin 1 end as shown.



( ) U1.
( ) U2.
( ) U3.

Install each of the 500 Ω controls in the next three steps in the following manner. Bend the pins of the controls 90° as shown. Then insert the control pins into the circuit board holes and hold the control against the circuit board. Solder the pins to the foil and cut off the excess pin lengths:

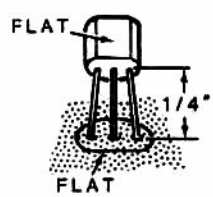


( ) P1.
( ) P2.
( ) P3.

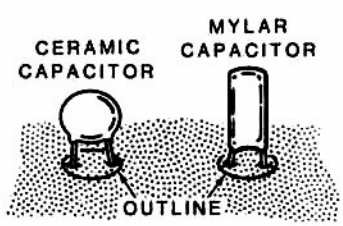
( ) C8: Install a .15 µF Mylar capacitor at C8. Bend this capacitor back against the circuit board inside the outline before you solder it.

Refer to Pictorial 3-3 (Illustration Booklet, Page 3) for the following steps.

( ) Q1: MPF111 transistor (#417-987). Install the transistor as shown. Insert the transistor leads into the corresponding holes, solder them to the foils, and cut off the excess lead lengths.



Install two .01 µF **ceramic** capacitors as follows. Mylar and ceramic capacitors are identified on the circuit board by the following out line:



( ) C9.
( ) C10.

Install six .01 µF Mylar capacitors as follows.

( ) C1.
( ) C2.
( ) C3.
( ) C4.
( ) C5.
( ) C6.

( ) C7: .005 µF Mylar.

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

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following problems.

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

( ) Check the transistor and the ICs for the proper installation.

( ) Check each diode for the proper positioning of the banded end.

This completes the CW demodulator circuit board assembly. Set it aside until it is called for later.

ACTIVE FILTER (2295 HZ) CIRCUIT BOARD

PARTS LIST

Remove the parts from Pack 4 and check each part against the following list. Do not remove components that are supplied on a tape from the tape until you use them in a step. 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."

TAPED COMPONENTS

Refer to the enclosed "Taped Components Chart" and check the components under "2295 Hz Filter Circuit Board." The taped parts are in assembly sequence. It is not necessary to check them against the Parts List.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
RESISTORS			
All 5% resistors have four color bands (last band gold). The last band (gold) will not be called out.			
All resistors are 1/4-watt.			
6-621-12	3	620 Ω (blu-red-brn)	R5, R8, R12
6-103-12	1	10 kΩ (brn-blk-org)	R10
6-223-12	3	22 kΩ (red-red-org)	R2, R3, R4
6-303-12	1	30 kΩ (org-blk-org)	R11
6-333-12	1	33 kΩ (org-org-org)	R7
6-224-12	3	220 kΩ (red-red-yel)	R6, R8, R13
6-474-12	1	470 kΩ (yel-viol-yel)	R14
DIODE			
56-56	5	1N4149	D1 and control lines

NON-TAPED PARTS

The following parts are not taped on strips. The key numbers correspond to the numbers on the "2295 Hz Active Filter Circuit Board Parts Pictorial" (Illustration Booklet, Page 4).

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
CAPACITORS				
A1	21-176	2	.01 µF ceramic	C9, C10
A2	27-227	8	.005 µF Mylar	C1 – C8
TRANSISTOR – INTEGRATED CIRCUIT (IC)				
B1	417-967	1	**MPF111** transistor	Q1
B2	442-21	2	**MC1458** integrated circuit	IC1, IC2
MISCELLANEOUS				
C1	10-1102	3	500 Ω control	P1, P2, P3
	85-2862-1	1	Active filter circuit board	
C2	432-1111	1	5-hole right angle socket	
C3	432-1023	1	10-hole right angle socket	
C4	434-230	2	8-pin IC socket	

NOTE: The transistor 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.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

STEP-BY-STEP ASSEMBLY

Refer to the components under "2295 Hz Filter Circuit Board" on the "Taped Components Chart" before you begin. The components are in assembly sequence.

Refer to Pictorial 4-1 (Illustration Booklet, Page 4) for the following note and steps.

NOTE: The circuit board drawing for the resistor and diode installation, as shown in Pictorial 4-1, is divided into two sections. These sections show you which area you will be working in for a specific series of steps. The assembly is in a top-to-bottom, left-to-right sequence.

( ) Position the circuit board with the component side facing up as shown.

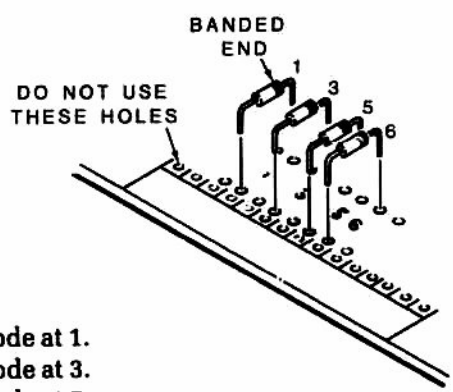
Refer to Section 1 of the Pictorial for the following steps.

( ) R4: 22 kΩ (red-red-org).

( ) R3: 22 kΩ (red-red-org).

( ) R2: 22 kΩ (red-red-org).

Install four 1N4149 diodes (#56-56) as follows. Position the banded ends as shown with the diodes over their callouts. Make sure to use the correct circuit board holes.



( ) Diode at 1.
( ) Diode at 3.
( ) Diode at 5.
( ) Diode at 6.

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

Refer to Section 2 of the Pictorial for the following steps.

( ) R5: 620 Ω (blu-red-brn).

( ) R6: 220 kΩ (red-red-yel).

( ) R7: 33 kΩ (org-org-org).

( ) R8: 620 Ω (blu-red-brn).

( ) R9: 220 kΩ (red-red-yel).

( ) R10: 10 kΩ (brn-blk-org).

( ) R11: 30 kΩ (org-blk-org).

( ) R12: 620 Ω (blu-red-brn).

( ) R13: 220 kΩ (red-red-yel).

( ) D1: 1N4149 diode (#56-56).

( ) R14: 470 kΩ (yel-viol-yel).

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

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

( ) Install a 10-hole right angle socket at S1.

( ) Install a 5-hole right angle socket at S2.

( ) Solder the 15 socket pins to the foil.

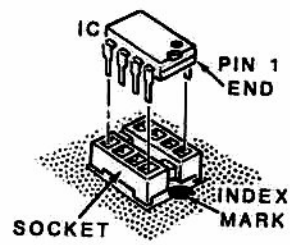
Install two 8-pin IC sockets as follows. Make sure you match the socket identification mark with the index mark on the circuit board. Solder the pins to the foil after you install each socket.

( ) IC1.
( ) IC2.

Install three 500 Ω controls as follows. As in a previous step, bend the control pins 90° to keep the controls flat against the circuit board. Solder the pins to the foil and cut off the excess pin lengths.

( ) P1.
( ) P2.
( ) P3.

Install two MC1458 ICs (#442-21) as follows. Remember to position the pin 1 end as shown.



( ) IC1.
( ) IC2.

Refer to Pictorial 4-3 (Illustration Booklet, Page 4) for the following steps.

( ) Q1: MPF111 transistor (417-987). Remember to position the flat of the transistor over the flat on the circuit board. Solder the leads to the foil and cut off the excess lead lengths.

Install two .01 µF ceramic capacitors as follows:

( ) C9.
( ) C10.

Install eight .005 µF Mylar capacitors as follows:

( ) C1.
( ) C2.
( ) C3.
( ) C4.
( ) C5.
( ) C6.
( ) C7.
( ) C8.

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

( ) Use a permanent marker and write "2295" in the indicated circuit board square.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following problems.

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

( ) Check the transistor and the ICs for proper installation.

( ) Check each diode for the proper positioning of the banded end.

This completes the active filter (2295 Hz) circuit board assembly. Set it aside until it is called for later.

ACTIVE FILTER (2125 HZ) CIRCUIT BOARD

PARTS LIST

Remove the parts from Pack 5 and check each part against the following list. Do not remove components that are supplied on a tape from the tape until you use them in a step. 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."

TAPED COMPONENTS

Refer to the enclosed "Taped Components Chart and check the components under "2125 Hz Filter Circuit Board." The taped parts are in assembly order. It is not necessary to check them against the Parts List.

RESISTORS

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

All resistors are 1/4-watt.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
6-621-12	3	620 Ω (blu-red-brn)	R5, R8, R12
6-103-12	1	10 kΩ (brn-blk-org)	R10
6-623-12	2	62 kΩ (blu-red-org)	R7, R11
6-683-12	1	68 kΩ (blu-gry-org)	R1
6-274-12	3	270 kΩ (red-viol-yel)	R6, R9, R13
6-474-12	1	470 kΩ (yel-viol-yel)	R14

DIODE

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
56-56	6	1N4149	D1 and control lines

NON-TAPED PARTS

The following parts are not taped on strips. The key numbers correspond to the numbers on the "Active Filter (2125) Circuit Board Parts Pictorial" (Illustration Booklet, Page 5).

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
CAPACITORS				
A1	21-176	2	.01 µF ceramic	C9, C10
A2	27-227	6	.005 µF Mylar	C3 – C8
TRANSISTOR – INTEGRATED CIRCUIT (IC)				
B1	417-987	1	MPF111 transistor	Q1
B2	442-21	2	MC1458 integrated circuit	IC1, IC2
MISCELLANEOUS				
C1	10-1102	3	500 Ω control	P1, P2, P3
	85-2862-1	1	Active filter circuit board	
C2	432-1111	1	5-hole right angle socket	
C3	432-1023	1	10-hole right angle socket	
C4	434-230	2	8-pin IC socket	

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

1. Part number.
2. Type number. (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.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

STEP-BY-STEP ASSEMBLY

Refer to the components under "2125 Hz Filter Circuit Board" on the "Taped Components Chart" before you begin. The components are in assembly sequence.

Refer to Pictorial 5-1 (Illustration Booklet, Page 5) for the following steps.

( ) Position the active filter circuit board with the component side facing up as shown.

( ) R1: 68 kΩ (blu-gry-org).

( ) R5: 620 Ω (blu-red-brn).

( ) R6: 270 kΩ (red-viol-yel).

( ) R7: 62 kΩ (blu-red-org).

( ) R8: 620 Ω (blu-red-brn).

( ) R9: 270 kΩ (red-viol-yel).

( ) R10: 10 kΩ (brn-blk-org).

( ) R11: 62 kΩ (blu-red-org).

( ) R12: 620 Ω (blu-red-brn).

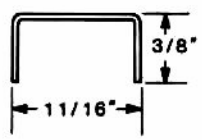
( ) R13: 270 kΩ (red-viol-yel).

( ) D1: 1N4149 diode (#56-56).

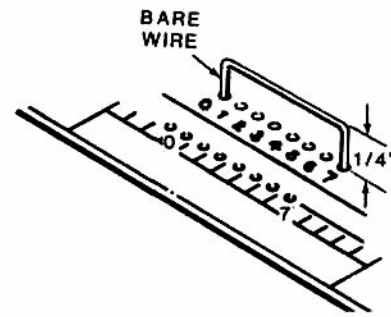
( ) R14: 470 kΩ (yel-viol-yel).

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

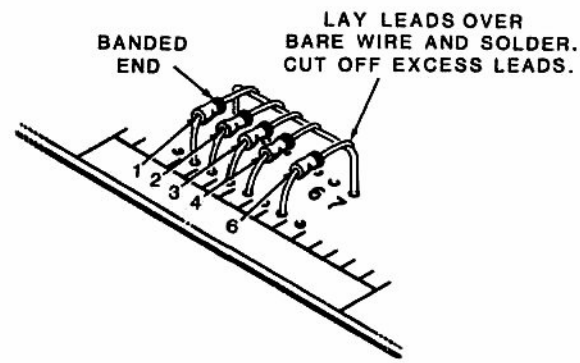
( ) Locate a cutoff component lead that is at least 1-1/2" long and bend it as shown in the drawing. The drawing is shown full size so you can use it as a template.



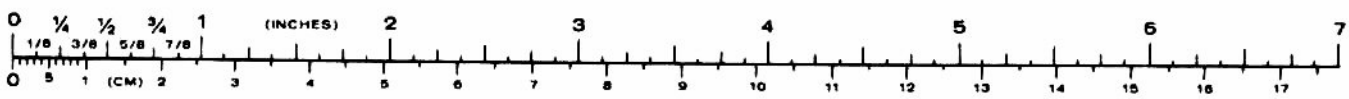
( ) Insert the prepared lead into the indicated holes between 0 and 7. Position the top of the lead 1/4" above the circuit board and solder it to the foil. Cut off the excess lead lengths.



Install five 1N4149 diodes (#56-56) as follows. Insert the leads at the unbanded ends into the circuit board holes and the leads at the banded ends over the bare wire as shown. Do not wrap the banded leads around the wire since they may have to be removed at a later time. Solder the diode leads to the foil and to the bare wire after you install it.



( ) Diode at location 1.
( ) Diode at location 2.
( ) Diode at location 3.
( ) Diode at location 4.
( ) Diode at location 6.



Refer to Pictorial 5-2 (Illustration Booklet, Page 5) for the following steps.

( ) Install a 10-hole right angle connector at S1.

( ) Install a 5-hole right angle connector at S2.

( ) Solder the 15 socket pins to the foil.

Install three 500 Ω controls as follows. Bend the control pins 90° to keep the controls flat against the circuit board. Solder the pins to the foil and cut off the excess pin lengths.

( ) P1.
( ) P2.
( ) P3.

Install two 8-pin IC sockets as follows. Make sure you match the socket identification mark with the index mark on the circuit board. Solder the pins to the foil after you install each socket.

( ) IC1.
( ) IC2.

Install two MC1458 ICs (#442-21) as follows. Remember to position the pin 1 end properly.

( ) IC1.
( ) IC2.

Refer to Pictorial 5-3 (Illustration Booklet, Page 5) for the following steps.

( ) Q1: MPF111 transistor (417-987). Remember to position the flat of the transistor over the flat on the circuit board outline. Solder the leads to the foil and cut off the excess lead lengths.

Install two .01 µF ceramic capacitors as follows:

( ) C9.
( ) C10.

Install six .005 µF Mylar capacitors as follows:

( ) C3.
( ) C4.
( ) C5.
( ) C6.
( ) C7.
( ) C8.

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

( ) Use a permanent marker and write "2125" in the indicated circuit board square.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following problems.

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

( ) Check the transistor and the ICs for proper installation.

( ) Check each diode for the proper positioning of the banded end.

This completes the active filter (2125 Hz) circuit board assembly. Set it aside until it is called for later.

AFSK CIRCUIT BOARD

PARTS LIST

Remove the parts from Pack 6 and check each part against the following list. Do not remove components that are supplied on a tape from the tape until you use them in a step. 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."

TAPED COMPONENTS

Refer to the enclosed "Taped Components Chart" and check the components under "AFSK Circuit Board." The taped parts are in assembly order. It is not necessary to check them against the Parts List.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
RESISTORS			
All 5% resistors have four color bands (last band gold). The last band (gold) will not be called out.			
All resistors are 1/4-watt.			
6-221-12	1	220 Ω (red-red-brn)	R2
6-391-12	1	390 Ω (org-wht-brn)	R5
6-681-12	1	680 Ω (blu-gry-brn)	R6
6-333-12	1	33 kΩ (org-org-org)	R7
6-474-12	2	470 kΩ (yel-viol-yel)	R3, R4
6-225-12	1	2.2 MΩ (red-red-grn)	R1
DIODE			
56-56	4	1N4149	

NON-TAPED PARTS

The following parts are not taped on strips. The key numbers correspond to the numbers on the "AFSK Circuit Board Parts Pictorial" (Illustration Booklet, Page 6).

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
CAPACITORS				
Ceramic				
A1	21-84	3	24 pF	C1, C2, C8
A1	21-184	1	750 pF	C4
A1	21-176	3	.01 µF	C5, C6, C7
Mylar®				
A2	27-85	1	.22 µF	C3
INTEGRATED CIRCUITS				

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

1. Part number.
2. Type number. (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.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

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

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	442-22	1	**NS741**	IC5
B1	443-1155	1	**4069**	IC1
B1	443-1156	3	**40193**	IC2, IC3, IC4
MISCELLANEOUS				
C1	9-133	1	Resistor pack (4700 Ω × 9) (472)	
C2	10-1138	1	10 kΩ control	
	85-2861-1	1	AFSK circuit board	
C3	404-672	1	5.5080 MHz crystal	
C4	432-1111	1	5-hole right angle socket	
C5	432-1023	1	10-hole right angle socket	
C6	434-230	1	8-pin IC socket	
C6	434-298	1	14-pin IC socket	
C6	434-299	3	16-pin IC socket	

STEP-BY-STEP ASSEMBLY

Refer to the components under "AFSK Circuit Board" on the "Taped Components Chart" before you begin. The components are in assembly sequence.

Refer to Pictorial 6-1 (Illustration Booklet, Page 6) for the following steps.

( ) Position the AFSK circuit board with the component side facing up as shown.

( ) R1: 2.2 MΩ (red-red-grn).

( ) R2: 220 Ω (red-red-brn).

Install four 1N4149 diodes (#56-56) as follows. Position the banded ends as shown on the circuit board.

( ) Diode at location 1.
( ) Diode at location 2.
( ) Diode at location 4.
( ) Diode at location 6.

( ) R3: 470 kΩ (yel-viol-yel).

( ) R4: 470 kΩ (yel-viol-yel).

( ) R5: 390 Ω (org-wht-brn).

( ) R6: 680 Ω (blu-gry-brn).

( ) R7: 33 kΩ (org-org-org).

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

( ) Install a 10 kΩ control at the indicated location. Press the control flat over the outline and against the circuit board. Solder the pins to the foil and cut off the excess pin lengths.

Refer to Pictorial 6-2 (Illustration Booklet, Page 6) for the following steps.

NOTE: When you install the following IC sockets, solder the pins to the foil after you install each socket. Make sure you position each socket identification mark toward the circuit board index mark.

( ) Install a 14-pin IC socket at IC1.

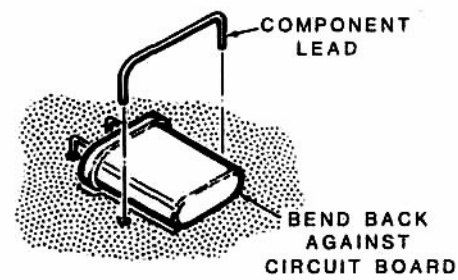
( ) Install a 16-pin IC socket at IC2.

( ) Install a 16-pin IC socket at IC3.

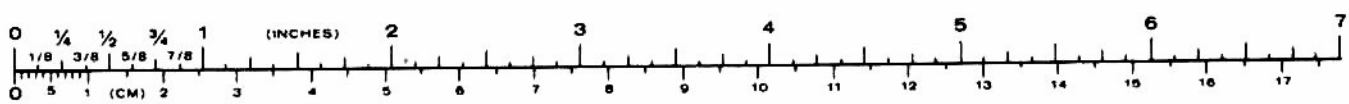
( ) Install a 16-pin IC socket at IC4.

( ) Install an 8-pin IC socket at IC5.

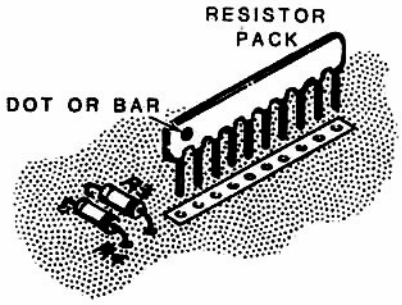
( ) Install a 5.5080 MHz crystal at the CRYSTAL location. Insert the leads into the circuit board holes and bend the crystal body back against the circuit board so it is inside the circuit board outline as shown. Solder the leads to the foil and cut off the excess lead lengths.



( ) Locate a cutoff component lead that is at least 1-1/4" long and form it over the crystal as shown. Insert the lead into the two circuit board holes on both sides of the crystal and solder it to the foil. Cut off the excess lead lengths.



( ) Resistor pack (#9-133) (472). Install the resistor pack with the end that has the dot or bar in the direction shown in the illustration. Solder the pins to the foil and cut off the excess pin lengths.



( ) Install a 10-hole right angle socket at S1.

( ) Install a 5-hole right angle socket at S2.

( ) Solder the 15 socket pins to the foil.

( ) C3: .22 µF Mylar. Insert the leads into the circuit board holes and bend the capacitor body against the circuit board inside the outline. Solder the leads to the foil and cut off the excess lead lengths.

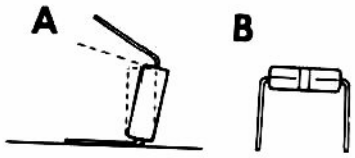
CAUTION: Some of the ICs you will install in the following steps are CMOS (complementary metal oxide semiconductor) devices. Be sure they do not get damaged by static electricity. Once you remove the foam pad from an IC, DO NOT let go of the IC until it is installed in its socket. Install it as follows. Read the entire step before you pick up the IC.

1. Pickup 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 hand.

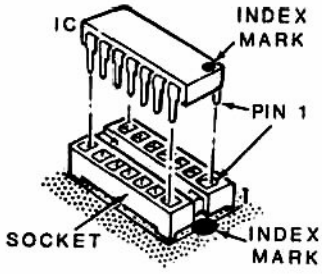
3. Continue to hold the IC with one hand and straighten any bent pins with the other hand.

4. Be sure the pins are straight. Then lay the IC down on one of its rows of pins, as shown at A, and roll it over until the pins are at right angles or bent in slightly as shown at B. Repeat this process for the other row of pins.



5. Pick up the circuit board in your other hand.

6. Align the pin 1 end of the IC with the index mark on the circuit board.



7. Then push the IC pins into the IC socket. Once in the socket, the IC is protected.

( ) Install a **4069** IC (#443-1155) at IC1.

Install three **40193** ICs (#443-1156) as follows:

( ) IC2.
( ) IC3.
( ) IC4.

( ) Install an NS**741** (#442-22) at IC5.

Refer to Pictorial 6-3 (Illustration Booklet, Page 6) for the following steps.

NOTE: When you install the next two ceramic capacitors, use the two outer holes as shown.

( ) C1: 24 pF ceramic.

( ) C2: 24 pF ceramic.

( ) C7: .01 µF ceramic.

( ) C8: 24 pF ceramic. Use the two outer holes as before.

( ) C6: .01 µF ceramic.

( ) C5: .01 µF ceramic.

( ) C4: 750 pF ceramic.

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

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following problems.

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

( ) Check the ICs for the proper type and installation.

( ) Check each diode for the proper positioning of the banded end.

This completes the AFSK circuit board assembly. Set it aside until it is called for later.

MAIN CIRCUIT BOARD

PARTS LIST

Remove the parts from Pack 7 and check each part against the following list. Do not remove components that are supplied on a tape from the tape until you use them in a step. 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."

TAPED COMPONENTS

Refer to the "Taped Components Chart" and check the components under "Main Circuit Board." The taped parts are in assembly order. It is not necessary to check them against the Parts List.

RESISTORS

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

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

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
6-101-12	2	100 Ω (brn-blk-brn)	R38, R39
6-101	1	100 Ω, 1/2-watt (brn-blk-brn)	R32
6-221	1	220Ω, 1/2-watt (red-red-brn)	R35
6-271-12	2	270 Ω (red-viol-brn)	R36, R37
6-331-12	2	330 Ω (org-org-brn)	R5, R8
6-391-12	1	390 Ω (org-wht-brn)	R42
6-681-12	1	680 Ω (blu-gry-brn)	R51
6-102-12	5	1000 Ω (brn-blk-red)	R2, R3, R20, R25, R53,
6-222-12	3	2200 Ω (red-red-red)	R4, R7, R12
6-272-12	11	2700 Ω (red-viol-red)	R13, R18, R19, R21, R22, R24, R26, R28, R29, R30, R55
6-332-12	1	3300 Ω (org-org-red)	R17
6-472-12	11	4700 Ω (yel-viol-red)	R9, R10, R15, R16, R34, R43, R44, R61, R64, R65, Rx
6-103-12	3	10 kΩ (brn-blk-org)	R11, R14, R23

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HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
Resistors (cont'd.)			
6-153-12	3	15 kΩ (brn-grn-org)	R1, R6, R50
6-183	1	18 kΩ, 1/2-watt (brn-gry-org)	R33
6-223-12	1	22 kΩ (red-red-org)	R31
6-473-12	2	47 kΩ (yel-viol-org)	R40, R41
6-563-12	1	56 kΩ (grn-blu-org)	R27
6-104-12	6	100 kΩ (brn-blk-yel)	R45, R48, R54, R56, R58, R60
6-154-12	1	150 kΩ (brn-grn-yel)	C70
6-224-12	3	220 kΩ (red-red-yel)	R46, R49, R52
6-274-12	2	270 kΩ (red-viol-yel)	R57, R59
6-394-12	1	390 kΩ (org-wht-yel)	R47
6-825-12	2	8.2 MΩ (gry-red-grn)	R62, R63

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
DIODES			
56-16	1	1N5231B zener	CR6
56-56	20	1N4149	CR1 – CR5, CR13 – CR27
57-27	6	1N2071	CR7 – CR12
CAPACITOR			
25-197	2	1 µF tubular tantalum	C26, C27

NON-TAPED PARTS

The following parts are not taped on strips. The key numbers correspond to the numbers on the "Main Circuit Board Parts Pictorial" (Illustration Booklet, Page 7).

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
CAPACITORS				
Ceramic				
A1	21-71	2	.001 µF	C19, C20
A1	21-176	16	.01 µF	C5 – C17, C21, C22, C23
A2	21-752	4	.1 µF (104)	C1, C2, C4, C31
Electrolytic				
A3	25-863	4	4.7 µF	C3, C28, C29, C30
A4	25-913	1	47 µF	C18
A4	25-942	1	220 µF	C24
A4	25-891	1	470 µF	C25

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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.)
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	417-294	1	MPSA42 transistor	Q11
B1	417-295	1	MPSL51 transistor	Q4
B1	417-811	1	MPSL01 transistor	Q5
B1	417-874	2	2N3906 transistor	Q3, Q6

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
Transistors – Integrated Circuits (cont'd.)				
B1	417-875	8	2N3904 transistor	Q1, Q2, Q7, Q8, Q9, Q13, Q14, Q15
B1	417-986	1	MPSA92 transistor	Q10
B2	442-743	1	HA4741-5 integrated circuit	U4
B2	443-751	1	MC14081 integrated circuit	U2
B2	443-1157	2	MC1416 or 2004 integrated circuit	U1, U3
CONNECTOR – PLUG – SOCKETS				
C1	432-1195	1	25-pin connector	
C2	432-1039	5	15-pin plug	
C3	434-298	2	14-pin IC socket	
C3	434-299	2	16-pin IC socket	

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
HARDWARE				
D1	250-1176	2	4-40 × 1-3/8" screw	
D2	252-99	2	4-40 nut	
D3	253-1	2	Fiber flat washer	
D4	254-9	2	#4 lockwasher	
MISCELLANEOUS				
E1	9-133	1	4700 Ω (472) resistor pack	
E2	10-312	1	10 kΩ control	R66
E3	54-1024	1	Power transformer	T1
E4	64-936	1	Pushbutton switch assembly	
E5	69-75	1	Relay	
	85-2920-1	1	Main circuit board	

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 7-1 (Illustration Booklet, Page 8) for the following notes and steps.

NOTES:

1. The main circuit board is divided into several sections, such as shown in Pictorial 7-1. Each series of steps will refer you to a specific section.

2. In most cases, each series of steps will have you install parts in a top-to-bottom, left-to right sequence. However, since the lowest (physical size) components are installed first to ease assembly, you will install some of the components out of order. Check off each step after you perform it and place a check mark near each component on the Pictorial as well.

3. Refer to the components under "Main Circuit Board" on the "Taped Components Chart" before you begin. The components are in assembly sequence.

( ) Position the main circuit board with the component side facing up as shown in the Pictorial.

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Refer to Section 1 to install components on the circuit board in the following steps.

( ) R65: 4700 Ω (yel-viol-red).

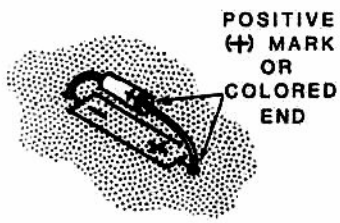
( ) R64: 4700 Ω (yel-viol-red).

( ) R63: 8.2 MΩ (gry-red-grn).

( ) CR27: 1N4149 diode (#56-56).

( ) CR26: 1N4149 diode (#56-56).

NOTE: When you install a tubular tantalum capacitor, be sure to position the positive-marked or colored end of the capacitor at the positive-marked end of the outline on the circuit board as shown.



( ) C27: 1μF tubular tantalum.

( ) R62: 8.2 MΩ (gry-red-grn).

( ) R61: 4700 Ω (yel-viol-red).

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

Install three 1N4149 diodes (#56-56) in the following steps. Remember to position the banded end of each diode over the band shown on the circuit board outline.

( ) CR25.
( ) CR24.
( ) CR23.

( ) R60: 100 kΩ (brn-blk-yel).

( ) R59: 270 kΩ (red-viol-yel).

( ) R58: 100 kΩ (brn-blk-yel).

( ) R57: 270 kΩ (red-viol-yel).

( ) R56: 100 kΩ (brn-blk-yel).

( ) R55: 2700 Ω (red-viol-red).

( ) R54: 100 kΩ (brn-blk-yel).

( ) R53: 1000 Ω (brn-blk-red).

( ) R52: 220 kΩ (red-red-yel).

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

Refer to Section 2 to install components on the circuit board in the following steps.

( ) C26: 1 μF tubular tantalum. Position the positive-marked or colored end toward the positive-marked end of the capacitor outline.

( ) R51: 680 Ω (blu-gry-brn).

( ) CR22: 1N4149 diode (#56-56).

( ) CR21: 1N4149 diode (#56-56).

( ) R50: 15 kΩ (brn-grn-org).

( ) R49: 220 kΩ (red-red-yel).

( ) R48: 100 kΩ (brn-blk-yel).

( ) R47: 390 kΩ (org-wht-yel).

( ) CR20: 1N4149 diode (#56-56).

( ) R46: 220 kΩ (red-red-yel).

( ) R45: 100 kΩ (brn-blk-yel).

( ) CR19: 1N4149 diode (#56-56).

( ) R44: 4700 Ω (yel-viol-red).

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

Install four 1N4149 diodes (#56-56) as follows:

( ) CR18.
( ) CR17.
( ) CR16.
( ) CR15.

( ) R43: 4700 Ω (yel-viol-red).

( ) R42: 390 Ω (org-wht-brn).

( ) R41: 47 kΩ (yel-viol-org).

( ) R40: 47 kΩ (yel-viol-org).

( ) R39: 100 Ω (brn-blk-brn).

( ) R38: 100 Ω (brn-blk-brn).

( ) R37: 270 Ω (red-viol-brn).

( ) R36: 270 Ω (red-viol-brn).

( ) CR14: 1N4149 diode (#56-56).

( ) CR13: 1N4149 diode (#56-56).

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

Refer to Section 3 to install components on the circuit board in the following steps.

Install four 1N2071 diodes (#57-27) as follows:

( ) CR12.
( ) CR11.
( ) CR10.
( ) CR9.

( ) R35: 220 Ω, **1/2-watt** (red-red-brn).

( ) R32: 100 Ω, **1/2-watt** (brn-blk-brn).

( ) R31: 22 kΩ (red-red-org).

( ) R26: 2700 Ω (red-viol-red).

( ) R25: 1000 Ω (brn-blk-red).

NOTE: You will install a resistor at R_X later on.

( ) R20: 1000 Ω (brn-blk-red).

( ) R17: 3300 Ω (org-org-red).

( ) R16: 4700 Ω (yel-viol-red).

( ) R15: 4700 Ω (yel-viol-red).

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

( ) CR5: 1N4149 diode (#56-56).

( ) R14: 10 kΩ (brn-blk-org).

( ) R13: 2700 Ω (red-viol-red).

( ) R12: 2200 Ω (red-red-red).

( ) R11: 10 kΩ (brn-blk-org).

( ) R10: 4700 Ω (yel-viol-red).

( ) R9: 4700 Ω (yel-viol-red).

( ) R6: 15 kΩ (brn-grn-org).

( ) R4: 2200 Ω (red-red-red).

( ) R1: 15 kΩ (brn-grn-org).

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

( ) R29: 2700 Ω (red-viol-red).

( ) R27: 56 kΩ (grn-blu-org).

( ) R23: 10 kΩ (brn-blk-org).

( ) R21: 2700 Ω (red-viol-red).

( ) R18: 2700 Ω (red-viol-red).

( ) CR4: 1N4149 diode (#56-56).

( ) CR3: 1N4149 diode (#56-56).

( ) R8: 330 Ω (org-org-brn).

( ) R7: 2200 Ω (red-red-red).

( ) R5: 330 Ω (org-org-brn).

( ) R3: 1000 Ω (brn-blk-red).

( ) R2: 1000 Ω (brn-blk-red).

( ) CR2: 1N4149 diode (#56-56).

( ) CR1: 1N4149 diode (#56-56).

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

Refer to Section 4 to install components on the circuit board in the following steps.

NOTE: You will not install diodes at CR7 or CR8 at this time.

( ) CR6: 1N5231B diode (#56-16).

( ) R34: 4700 Ω (yel-viol-red).

( ) R33: 18 kΩ, **1/2-watt** (brn-gry-org).

Install five 2700 Ω (red-viol-red) resistors as follows:

( ) R30.
( ) R28.
( ) R24.
( ) R22.
( ) R19.

NOTE: Set aside the remaining two resistors and two diodes. You will use them later.

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

Refer to Section 1 of the Pictorial 7-2 (Illustration Booklet, Page 9) to install components in the followings steps.

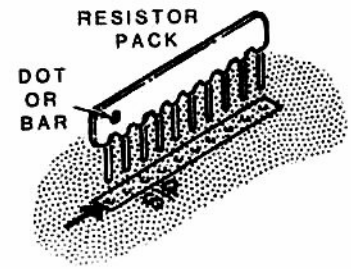
( ) Install a 14-pin IC socket at U4. Position the socket identification mark (notch, dot, arrow, etc.) over the circuit board index mark. Solder the pins to the foil after you install the socket.

( ) Install a 16-pin IC socket at U3.

( ) Install a 14-pin IC socket at U2.

( ) Install a 16-pin IC socket at U1.

( ) Install a resistor pack (#9-133) (472) at SIP. Position the resistor pack with the dot or bar next to the arrow shown on the circuit board. Press the pins firmly into their circuit board holes and solder the pins to the foil. Cut off the excess pin lengths.



NOTE: Some of the following ICs may be packed in protective foam. Do not remove any of these ICs from the foam until they are called for in a step. Install them as you installed the other protected ICs on Page 36.

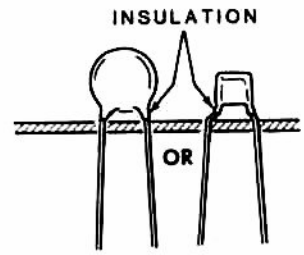
( ) U4: HA**4741-5** (#442-743).

( ) U3: MC**1416** (#443-1157).

( ) U2: MC**14081** (#443-751).

( ) U1: MC**1416** (#443-1157).

NOTE: When you install the following ceramic capacitors, do not push the insulated portion of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



( ) C23: .01 µF ceramic.

( ) C22: .01 µF ceramic.

( ) C21: .01 µF ceramic.

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

Refer to Section 2 to install components on the circuit board in the following steps.

( ) Q13: 2N3904 transistor (#417-875). Position the case flat over the flat on the circuit board outline.

( ) Q6: 2N3906 transistor (#417-874).

( ) Q3: 2N3906 transistor (#417-874).

( ) C4: .1 µF (104) ceramic.

( ) Q2: 2N3904 transistor (#417-875).

( ) C1: .1 µF (104) ceramic.

( ) Q1: 2N3904 transistor (#417-875).

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

Refer to Section 3 to install components on the circuit board in the following steps.

( ) C20: .001 µF ceramic.

( ) C19: .001 µF ceramic.

( ) Q11: MPSA42 transistor (#417-294).

( ) Q10: MPSA92 transistor (#417-986).

( ) Q9: 2N3904 transistor (#417-875).

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

( ) Q8: 2N3904 transistor (#417-875).

( ) Q7: 2N3904 transistor (#417-875).

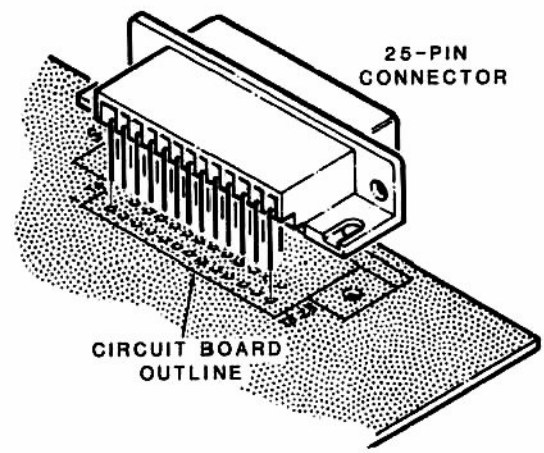
( ) Q5: MPSL01 transistor (#417-811).

( ) Q4: MPSL51 transistor (#417-295).

( ) C2: .1 µF (104) ceramic.

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

( ) S1: Install the 25-pin connector over the circuit board outline at S1 with the pins in the circuit board holes. Hold the connector against the circuit board and solder two pins to the foil at opposite ends of the connector. Make sure the connector is tight against the board; then solder the remaining pins to the foil.



Install seven .01 µF ceramic capacitors as follows:

( ) C17.
( ) C16.
( ) C15.
( ) C14.
( ) C13.
( ) C12.
( ) C11.

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

Install six .01 µF ceramic capacitors as follows:

( ) C10.
( ) C9.
( ) C8.
( ) C7.
( ) C6.
( ) C5.

( ) C3: 4.7 µF electrolytic. Remember to position the (+) and (−) lead ends as shown on the circuit board.

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

Refer to Section 1 of Pictorial 7-3 (Illustration Booklet, Page 10) to install components on the circuit board in the following steps.

( ) Q14: 2N3904 transistor (#417-875).

( ) Q15: 2N3904 transistor (#417-875).

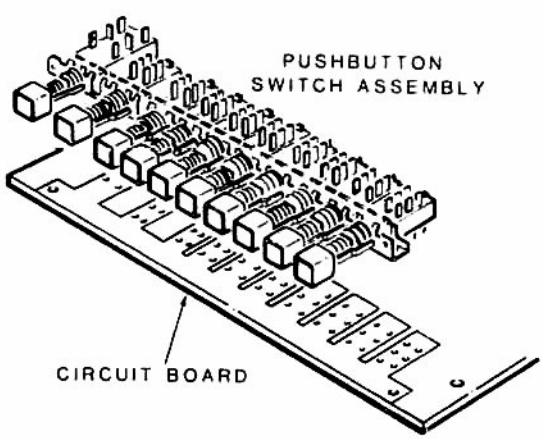
( ) C31: .1 µF (104M) ceramic.

Install three 4.7 µF electrolytic capacitors as follows:

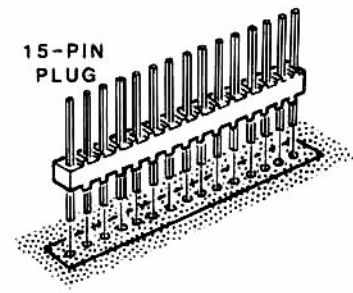
( ) C30.
( ) C28.
( ) C29.

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

( ) Install the pushbutton switch assembly on the circuit board. Carefully insert all of the tapered pins into their holes until the switch posts are against the circuit board. Solder the pins to the foil, keeping the switch firmly in place against the circuit board as you solder the pins. Cut off the excess pin lengths.



Install five 15-pin plugs on the circuit board in the following steps. Insert each of the plugs with the short pin ends into the circuit board holes and press the plug body against the circuit board as shown. Solder the pins to the foil and cut off the excess pin lengths.

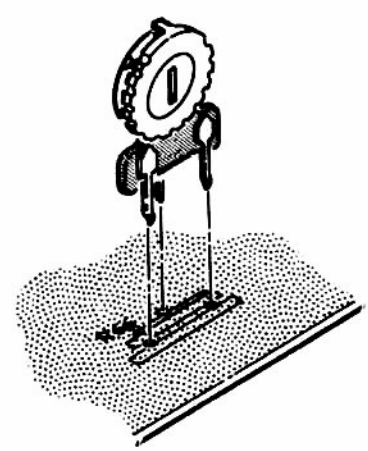


( ) CW DEMOD.
( ) RTTY DEMOD.
( ) 2125 HZ.
( ) 2295 HZ.
( ) AFSK.

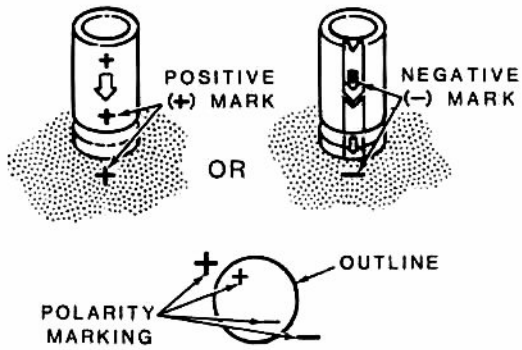
NOTE: The remaining three plug locations are for the optional Accessory circuit boards and are installed in those Manuals.

Refer to Section 2 to install components on the circuit board in the following steps.

( ) R66: Install a 10 kΩ control at R66. Insert the control pins into the circuit board holes, keeping the control perpendicular to the circuit board, and solder the pins to the foil.



NOTE: When you install the following electrolytic capacitors, match the positive (+) mark on the capacitor with the positive (+) mark of the circuit board or the negative (−) mark on the capacitor with the negative (−) mark on the circuit board. Insert the leads in the board holes, solder the leads to the foil, and cut off the excess lead lengths.

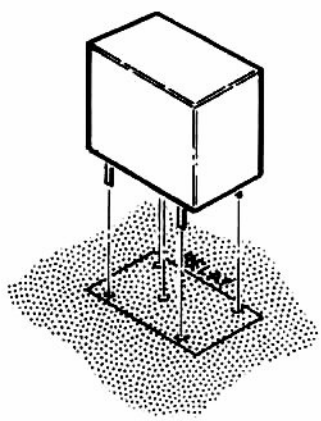


( ) C24: 220 µF electrolytic.

( ) C25: 470 µF electrolytic.

( ) C18: 47 µF electrolytic.

( ) RELAY: Insert the pins into the circuit board holes and press the relay against the circuit board. Solder the pins to the foil and cut off the excess pin lengths.



( ) T1: Power transformer. Refer to Detail 7-3A (Illustration Booklet, Page 10) and insert the transformer pins, whose numbers correspond to those shown on the circuit board, into their circuit board holes. The transformer pins have the numbers stamped next to them. Secure the transformer to the circuit board with two 4-40 × 1-3/8" screws, two fiber flat washers, two #4 lockwashers, and two 4-40 nuts. Then solder the pins to the foil and cut off the excess pins lengths. Do not overtighten the mounting hardware.

Connect the free wire ends on the flat ribbon cable (from the display board) to the main circuit board as follows. You may find it easier to insert all of the ribbon cable wires into the circuit board holes before you solder them since they are all in line.

( ) Brown wire to hole 1.

( ) Red wire to hole 2.

( ) Orange wire to hole 3.

( ) Yellow wire to hole 4.

( ) Green wire to hole 5.

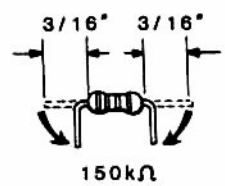
( ) Blue wire to hole 6.

( ) Violet wire to hole 7.

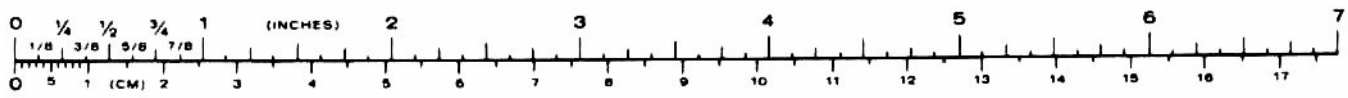
( ) Gray wire to hole 8.

( ) Turn the circuit board over so the foil side faces up.

( ) Cut the leads of a 150 kΩ (brn-grn-yel) resistor to 3/16" and bend them down as shown.



( ) R70: Solder the leads of the prepared 150 kΩ resistor to the foil pads at capacitor C18 as shown in the inset drawing on Pictorial 7-3. Cut off any excess lead lengths. Bend the resistor down against the bottom of the board.



RESISTOR R_x

Review the requirements of your printer and computer/program to determine your RS-232 or TTL compatibility requirements.

Resistor R_x is a "pull-up" resistor which you must install if you are using RS-232 – RS-232, RS-232 – TTL, or TTL – TTL interface ports.

Resistor R_x must **NOT** be installed if you are using TTL – TTY or TTY – TTY interface ports. In that case, omit the next step and save the 4700 Ω (yel-viol-red) resistor for possible future use.

To install resistor R_x, refer to Pictorial 7-3 (Illustration Booklet, Page 10) and perform the following step.

( ) R_x: Locate the 4700 Ω resistor (yellow-violet-red). Install this resistor at R_x on the main board, solder the leads to the foil, and cut off the excess lead lengths.

Current Loop (TTY) Operation

This information pertains only to the use of a TTY printer. If you do not intend to use a TTY printer, disregard this section and proceed to "Circuit Board Checkout." If you are going to use a TTY printer, perform the following steps.

( ) CR7: Install a 1N2071 diode (#57-27) with its banded end over the band mark on the circuit board as shown in Pictorial 7-3. Solder the leads to the foil and cut off the excess lead lengths.

( ) CR8: In the same manner, install the other diode.

NOTE: Jumper J1 must be installed for 60 mA current loop output, or omitted for 20 mA output. If your TTY printer requires a 60 mA loop current, perform the following step.

( ) J1: Form a 1" length of #22 solid wire (a cutoff resistor or diode lead) into a "U" shape. Then insert the ends of the wire through the holes at J1. Solder the wire ends to their foil pads and cut off the excess lengths.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following problems.

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

( ) Check the transistors and the ICs for the proper type and installation.

( ) Check each diode for the proper positioning of the banded end.

( ) Check the electrolytic capacitors for the correct position of the positive (+) or negative (−) marks.

This completes the main circuit board assembly. Set it aside until it is called for later.

CHASSIS

PARTS LIST

Remove the remaining parts from from the carton and check each part against the following list. The key numbers correspond to the numbers on the "Chassis Parts Pictorial" (Illustration Booklet, Pages 11 and 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."

METAL PARTS

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
A1	90-1314-1	1	Cabinet top
A2	90-1313-1	1	Cabinet bottom
A3	203-2175-2	1	Front panel
A4	203-2176-1	1	Back panel
A5	203-2177	1	Left side panel
A6	203-2178	1	Right side panel
A7	204-2704	1	Circuit board support

HARDWARE

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

#4 Hardware

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
B1	250-371	2	4-40 × 1/4" nylon screw
B2	250-1469	2	4-40 × 5/16" black phillips screw
B3	252-99	2	4-40 nut

#6 Hardware

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
C1	250-1325	6	6-32 × 1/4" black phillips screw
C2	250-1307	6	#6 × 1/4" black phillips self-tapping screw
C3	250-1419	12	#6 × 3/16" black phillips flat-head screw
C4	250-1280	1	6-32 × 3/8" black phillips screw
C5	250-1425	1	6-32 × 1/2" screw
C6	252-3	15	6-32 nut
[illegible]	[illegible]	[illegible]	[illegible]
C8	254-1	13	#6 lockwasher
C9	254-6	1	#6 external tooth lockwasher
C10	259-1	3	#6 solder lug

Other Hardware

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
D1	252-76	1	Control nut
D2	253-75	1	Control flat washer
D3	254-5	1	Control lockwasher

Discard the Two Leftover press-on nuts.

Heathkit

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

WIRE – SLEEVING – TUBING

344-2	6"	Black stranded wire
344-52	4"	Red solid wire
344-32	2½"	Green wire
344-219	3"	White wire
346-20	1½"	Heat shrinkable sleeving
346-60	1	Clear tubing
344-53	18"	Black solid wire

TRANSISTOR – INTEGRATED CIRCUITS (ICs)

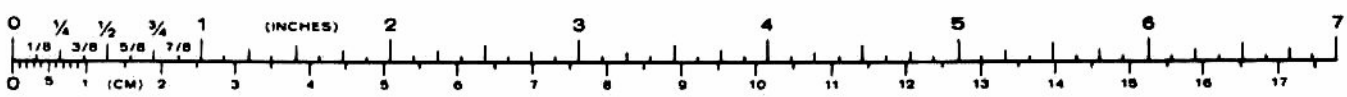
NOTE: The transistor and integrated circuits may be marked for identification in any one of the following four ways:

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.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

E2	417-988	1	MJE350 transistor	Q12
E3	442-603	1	**78M05** integrated circuit	U7
E4	442-674	1	**UA7812** integrated circuit	U5
E5	442-675	1	**UA7912** integrated circuit	U6

MISCELLANEOUS

F1	27-60	1	.22 µF Mylar capacitor	C1
F2	75-30	1	Strain relief	
F3	75-139	2	Insulator	
	89-54	1	Line cord	
F4	210-136	1	Bezel	
F5	261-29	4	Foot	
F6	352-13	1	Grease	
F7	421-35	1	1/4-ampere slow-blow fuse	F1
F8	422-1	1	Fuseholder	
F9	432-1032	1	25-pin connector	
F10	432-1033	19	Gold pins	
F11	434-148	1	AC socket	
F12	436-20	1	Phone jack	
F13	446-747-1	1	Display window	



STEP-BY-STEP ASSEMBLY

Refer to Pictorial 8-1 (Illustration Booklet, Page 13) for the following steps.

( ) Place a soft cloth on your work surface to help prevent scratching the painted metal parts during the assembly.

( ) Position the back panel as shown.

NOTE: Before you install the following three solder lugs, use a piece of sandpaper or a screwdriver blade to scrape any paint or burrs from the inside of the back panel around the mounting holes.

( ) Mount a #6 solder lug at A with a 6-32 × 1/4" black phillips screw, and a 6-32 nut. Bend the solder lug 90° from the panel to make connections easier. Position the solder lug as shown.

( ) Similarly mount a #6 solder lug at B.

( ) Mount a #6 solder lug at C with a 6-32 × 1/2" black phillips screw, two #6 lockwashers, and two 6-32 nuts. Mount the screw from the inside of the back panel as shown. Position one lockwasher between the 6-32 nuts. Tighten the inside nut securely but leave the outer nut only finger tight.

( ) Scrape any paint from around the inside of the back panel at hole E. Then mount the phone jack at E with the control flat washer, control lockwasher, and control nut. Position the jack with the lugs as shown.

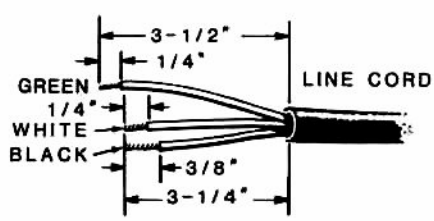
( ) Remove and discard the ground screw from the AC socket.

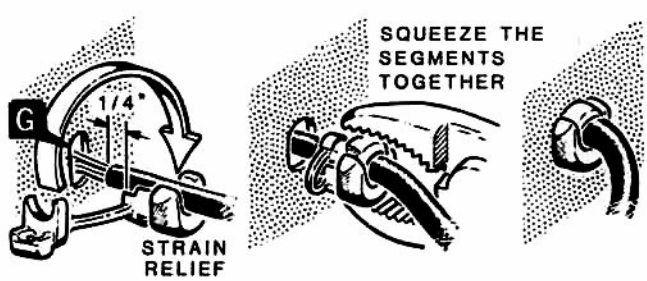
( ) Position the AC socket with the lugs as shown and then press it into cutout F until it snaps into place.

( ) Refer to Detail 8-1A and prepare the line cord as follows:

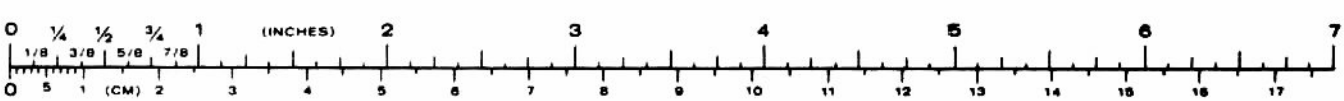
1. Remove 3-1/2" of outer insulation from the free end. Be careful so you do not cut into the inner lead insulation.
2. Cut the black lead to 3-1/4", and remove 3/8" of insulation from the end.
3. Cut the white lead to 3-1/4" and remove 1/4" of insulation from the end.
4. Twist the fine wire strands of each lead tightly together, and apply a small amount of solder to the wire strands to hold them together.

( ) Refer to Detail 8-1A and install the strain relief around the line cord 1/4" from the end of the outer insulation. Then insert the leads through back panel hole G and insert the strain relief into the hole. Use a pair of pliers to grip the strain relief.





Detail 8-1A



Refer to Pictorial 8-2 (Illustration Booklet, Page 13) for the following steps.

( ) Prepare the following stranded wires. To prepare a stranded wire, cut it to the indicated length and remove 1/4" of insulation from each end. Then twist the fine wire strands tightly together and apply a small amount of solder to the bare end to hold the strands together.

2" green. Remove an extra 1/8" (3/8" total) of insulation from each end.
5" black. Remove an extra 1/8" of insulation from one end.
3" white. Remove an extra 1/8" of insulation from one end.

NOTE: In the following steps, (NS) means not to solder because other wires will be added later. "S-" with a number following it, such as (S-3), means to solder the connection. The number three tells you that there are three wires and/or leads in the connection.

Connect the prepared wires as follows. You will connect the wires in the same order as you prepared them.

Whenever you connect a wire to the AC socket in the following steps, make the connection mechanically secure as shown in inset drawing #1.

( ) Connect one end of the 2" green wire to AC socket lug 2 (S-1) and the other end to solder lug B (S-1). Make a mechanically secure connection at both ends of this wire.

( ) Connect the 3/8" end of the 5" black wire to AC socket lug 1 (S-1). The other end will be connected later.

( ) Connect the 3/8" end of the 3" white wire to AC socket lug 3 (S-1). The other end will be connected later.

( ) Cut two 3/4" pieces of heat-shrinkable sleeving.

( ) Slide one piece of 3/4" heat-shrinkable sleeving over the free end of the white AC socket wire and the other 3/4" piece of heat-shrinkable sleeving over the black AC socket wire. Slide both pieces of sleeving over the socket lugs, then shrink the sleeving over the lugs with a lighter or a match. Do not use too much heat or you will split the sleeving.

( ) Bend the three AC socket lugs over 90° as shown in inset drawing #2.

( ) Prepare a 1-3/4" solid black wire and a 4" solid red wire.

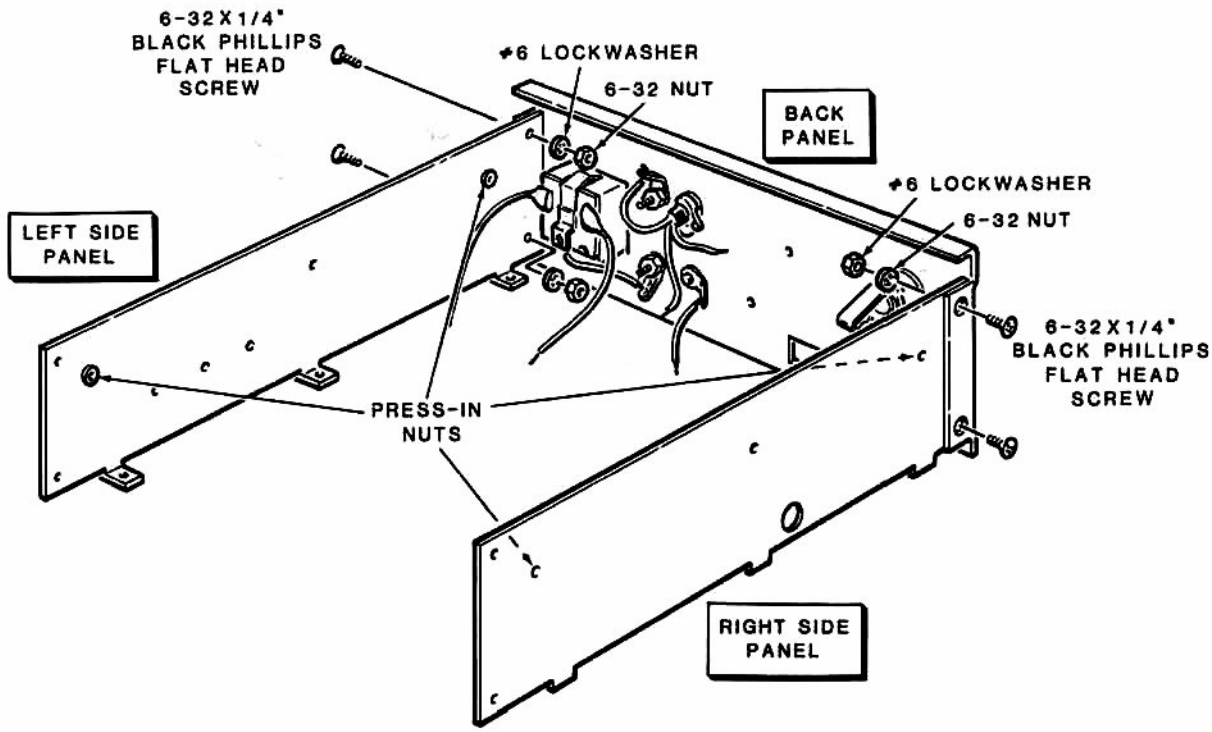
( ) Connect one end of the 1-3/4" black wire to solder lug C (S-1).

( ) Connect one end of the 4" red wire to phone socket E lug 1 (NS).

( ) C1: Connect one lead of the .22 µF Mylar capacitor to phone socket E lug 1 (S-2) and the other lead to lug 2 (S-1).

( ) Connect the green line cord lead to solder lug A (S-1). Make this connection mechanically secure.

NOTE: You will the connect the free wire ends later.



PICTORIAL 8-3

Refer to Pictorial 8-3 for the following steps.

( ) Mount the left side panel to the back panel with two 6-32 × 1/4" black phillips flat head screws, two #6 lockwashers, and two 6-32 nuts. Position the side panel with the press-in nuts as shown.

( ) Mount the right side panel to the back panel with two 6-32 × 1/4" black phillips flat head screws, two #6 lockwashers, and two 6-32 nuts. Position the side panel with the press-in nuts as shown.

Refer to Pictorial 8-4 (Illustration Booklet, Page 14) for the following steps.

( ) Mount the main circuit board to the chassis as follows:

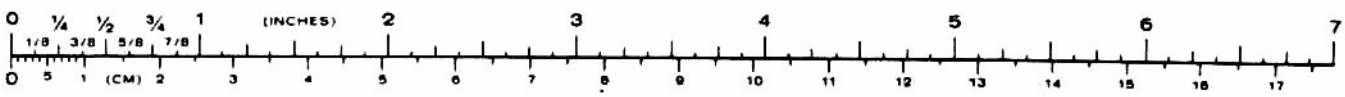
1. Position the main circuit board on your work suface as shown.

2. Carefully lower the chassis assembly onto the circuit board so the six chassis tabs align with the six circuit board mounting holes. Then turn the chassis upside down with the circuit board facing up and secure the circuit board to it with six #6 × 1/4" black phillips self-tapping screws. Turn the chassis right-side-up after you have tightened the screws.

( ) Open the pod of grease as shown in the inset drawing on Pictorial 8-4.

( ) U7: Spread a small amount of grease on the bare metal side of a 78M05 (#442-603) integrated circuit and set the grease aside. Insert the IC leads into the circuit board holes at U7 and mount it to the left side panel with a 6-32 × 1/4" black phillips screw, a #6 lockwasher, and a 6-32 nut.

( ) U5: Similarly, mount a UA7812 (#442-674) integrated circuit at left side panel hole U5.



( ) U6: Mount an UA7912 (#442-675) integrated circuit on the left side panel at U6 as follows:

1. Spread a small amount of the grease over one side of the insulator and press the greased side of the insulator against the left side panel so the mounting holes align as shown.

2. Spread a small amount of grease on the bare metal side of the IC. Then insert the IC leads into the circuit board holes at U6 and mount it with the bare metal side against the insulator with a 4-40 × 1/4" black **nylon** screw, and a 4-40 nut. Do not use a lockwasher and do not over-tighten the hardware.

( ) Q12: Similarly, mount an MJE350 (#417-988) transistor on the back panel at Q12 with a 4-40 × 1/4" black **nylon** screw and a 4-40 nut. Do not use a lockwasher at this location. Press the transistor against the back panel before you tighten the hardware.

Turn the unit over and solder the following transistor and IC leads to the foil. Cut off any excess lead lengths. Then return the unit to its upright position.

( ) U5.
( ) U6.
( ) U7.
( ) Q12.

( ) Mount a fuseholder at D with a 6-32 × 3/8" black phillips screw, a #6 lockwasher, a #6 external tooth lockwasher, and a 6-32 nut. Position the fuseholder as shown.

( ) Refer to Detail 8-4A and cut the piece of clear tubing to the indicated dimensions.

( ) Refer to Detail 8-4A and slide the prepared clear tubing over the 1/4-ampere slow-blow fuse and press the fuse into the fuseholder clips.

( ) Write "1/4-ampere slow-blow" on the fuse replacement label.

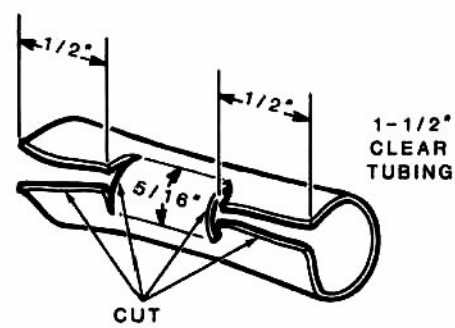
( ) Remove the backing from the fuse replacement label and press the label onto the inside of the back panel above the fuseholder.

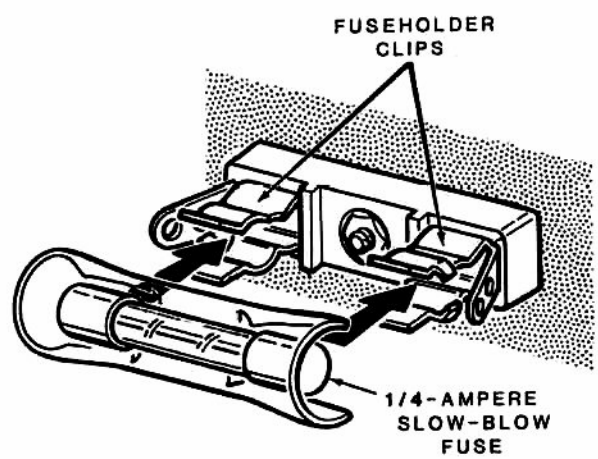
( ) Install the window into the bezel with the markings as shown. Then mount the bezel to the front panel with two press-on nuts. Slide the nuts over the pins at opposite corners of the bezel. Make sure the bezel fits snugly against the front panel and that the press-on nuts do not show in the window.

Read important Notice #3

( ) Mount the front panel to the side panels with four 6-32 × 1/4" black phillips flat head screws, four #6 lockwashers, and four 6-32 nuts. Carefully guide the pushbutton switches through their front panel holes.

( ) Mount the display circuit board to the front panel with two 4-40 × 5/16" black phillips screws. Position the circuit board so the LEDs are parallel with the top and bottom of the front panel cutout and the flat ribbon cable is at the top. Dress the ribbon cable over the switches.





Detail 8-4A

Refer to Pictorial 8-5 (Illustration Booklet, Page 15) for the following steps.

Connect the free end of the wires coming from the back panel to the main circuit board as follows. When you connect a wire to the circuit board, solder the connection and cut off the excess lead length from the foil side.

( ) Black wire coming from AC socket lug 2 to hole L1A.

( ) White wire coming from AC socket lug 3 to hole L2A.

( ) Black line cord lead to hole L1.

( ) White line cord lead to hole L2.

( ) Black wire coming from solder lug C to hole GND.

( ) Red wire coming from phone jack E lug 1 to S2.

( ) Prepare an 8" and a 7" black solid wire. Then connect one end of the 8" wire to fuseholder D lug 2 (S-1). Make a mechanically secure connection before you solder.

( ) In the same manner, connect one end of the 7" black solid wire to fuseholder D lug 1 (S-1).

( ) Route the 8" black wire from lug 2 past lug 1 and loosely twist the two wires together to form a pair.

( ) Connect and solder either of the two black solid wires to the main board at either hole F1. Then connect and solder the other black wire to the other hole F1.

( ) Route this pair of wires as shown in Pictorial 8-5.

Mount the plug-in circuit boards to the main circuit board as follows. Make sure you insert all of the plug pins into the socket holes.

( ) CW demodulator circuit board at plug CW DEMOD.

( ) Demodulator circuit board at plug RTTY DEMOD.

( ) 2125 active filter circuit board at plug 2125 HZ.

( ) 2295 active filter circuit board at plug 2295 HZ.

( ) AFSK circuit board at plug AFSK.

NOTE: The PRESELECTOR, 2250 HZ, and 2975 HZ plug positions are for the accessory circuit boards. If you have purchased one or more of the accessories, you will assemble and install them at one of more of these positions later.

( ) If you do not intend to install any of the accessories in your Terminal, mount the circuit board holder so the rear circuit board corners fit into the holder slots. Secure the holder to the chassis with two 6-32 × 1/4" black screws.

( ) Remove the backing from the blue and white label and press the label onto the side panel at the indicated location. Refer to the numbers on this label any correspondance you may have with the Heath Company regarding this kit.

This completes the "Chassis Step-By-Step Assembly." Recheck your wiring for poor or unsoldered connections and then proceed to "Initial Tests."

INITIAL TESTS

Before you connect the line cord plug to an AC power receptacle, make the following tests. They will help assure you that the power supply circuits will operate properly and avoid possible damage to your unit. You will need a volt/ohmmeter for these tests.

CAUTION

If you have the loop supply enabled (diodes CR7 and CR8 installed), you must connect a TTY machine to the LOOP jack on the rear panel, or insert a shorting plug in the jack. Failure to do so will result in damage to the loop supply circuit.

RESISTANCE TESTS

If you do not obtain the indicated result as you perform each resistance test, check the wiring and soldering of the line cord and fuseholder. Be sure to locate and correct any problem before you proceed to the voltage tests.

( ) Release all of the front panel pushbutton switches to the "out" position.

( ) Set your ohmmeter to its R x 100 ohm range. Then refer to Pictorial 9-1 (Illustration Booklet, Page 16) and perform the following tests:

CONNECT THE METER LEADS	READING
( ) To the line cord plug, from one flat prong to the other flat prong.	Open (infinite)
( ) To the line cord plug, from the center prong to either flat prong.	Open (infinite)
( ) To the line cord plug, from the center prong to the other flat prong.	Open (infinite)
( ) From the chassis to one flat prong of the line cord plug.	Open (infinite)
( ) From the chassis to the other flat prong of the line cord plug.	Open (infinite)
( ) From the chassis to the center prong of the line cord plug.	Short (0 ohms)
( ) Press in the POWER pushbutton switch. Then set your ohmmeter to R × 10 and measure the resistance from one flat prong to the other flat prong of the line cord plug.	55 ohms (or greater)

( ) Set your ohmmeter to R x 100 and connect the common lead to the chassis. Then measure the resistance at each of the following points:

( )	+12	>800 ohms
( )	−12	>500 ohms
( )	+5	>1000 ohms

( ) Release the POWER pushbutton to OFF.

If you obtained the correct resistance readings, proceed with the following voltage tests.

VOLTAGE TESTS

> WARNING: In the following steps, when power is applied to your unit, take all precautions to keep your hands away from the "High Voltage Areas" shown in Pictorial 9-1 (Illustration Booklet, Page 16) and in Part B of Pictorial 11-2 (Illustration Booklet, Page 17). THE VOLTAGES IN THESE AREAS ARE POTENTIALLY LETHAL. Keep one hand in your pocket as you make any checks, with the meter probe in your other hand.

( ) Set your voltmeter to a 15 volt range and connect its common lead to the chassis of your Terminal Interface.

( ) Connect the Interface line cord plug to a 120 volt AC receptacle and press the POWER pushbutton in (On). The Power LED should light and the RDA LED should light for a few seconds, then go out.

( ) Measure the voltage at each of the three test points shown in Pictorial 9-1. Be sure to reverse the polarity of your voltmeter or reverse the test leads when you measure the −12 volt test point. Each reading should be within ±5%.

( ) +12
( ) +5
( ) −12

If you obtained the correct results in these Initial Tests, release the POWER pushbutton to the Off (out) position and unplug the line cord plug from its receptacle. Then proceed with the "Alignment" section that follows.

ALIGNMENT

Correct alignment of your RTTY Terminal Interface will help produce maximum operating efficiency. You will need an AC voltmeter (1.5 volt rms full scale) or an oscilloscope to perform the alignment of the filters and CW demodulator, as described separately in this section of the Manual.

NOTE: Do not connect the line cord plug until you are told to do so.

( ) Set the RDA control (R66) to the center of its rotation.

( ) Be sure the Interface is sitting on a wooden or other insulated surface, and positioned as shown in Pictorial 10-1 (Illustration Booklet, Page 16).

( ) Bend a 1" length of #22 solid wire (a cutoff resistor lead) to form a "U" shape. Then refer to the inset drawing of Pictorial 10-1 and insert the wire into pins 12 and 13 of the I/O connector on the rear panel.

NOTE: This jumper wire will connect the audio output of the audio frequency shift keyer (AFSK) to the audio input of the demodulator to provide a signal for use in the alignment.

( ) Adjust the AFSK LEVEL control to the center of its rotation.

( ) Adjust all trimmer controls (P1, P2, P3), on all of the active filter boards and the CW demodulator circuit board to the centers of their rotation.

CAUTION: If you have installed diodes CR7 and CR8 or omitted resistor R_x, you **MUST** either connect a loop machine to the LOOP jack or insert a shorting plug while you perform this alignment.

RTTY FILTER ALIGNMENT

( ) Release all front panel pushbutton switches to their out position. Then press in the POWER, SEND, and 170 Hz pushbuttons.

( ) Connect the Interface line cord plug to a 120 volt AC receptacle.

( ) Connect your AC voltmeter (or oscilloscope) common lead to the chassis. Be sure the instrument is turned on and set to measure 10 volts.

NOTE: As you align each filter in the following steps, connect the test probe of your meter (or oscilloscope) to test point TP of the filter board you are tuning. As you peak the adjustments on each board, you may have to readjust the AFSK LEVEL to keep the reading at approximately 0.5 volts.

( ) MARK Filter (2125 Hz): Adjust the three trimmers for maximum reading.

( ) SPACE Filter (2295 Hz for 170 Hz shift): Press in the REVERSE SEND pushbutton on the front panel. Then adjust the three trimmers for maximum reading. Readjust AFSK GAIN for a reading of approximately 0.5 volts.

Optional Filter Boards

Instructions for aligning the optional filter board accessories are presented here for those who might be using this Alignment section to realign their Interface after a period of use. If you do not have the options assembled and installed, bypass the next two steps. Complete alignment instructions are given in the accessory manuals.

( ) 2550 Hz Filter for 425 Hz shift: Press the 425 Hz pushbutton and adjust the three trimmer controls on the 2550 Hz board for maximum reading. Readjust the AFSK LEVEL as before.

( ) 2975 Hz Filter for 850 Hz shift: Select 850 Hz on the front panel and adjust the three trimmer controls on the 2975 Hz board for maximum reading. Use the same procedure as before.

NOTE: Final adjustment of the AFSK Level trimmer must be made according to your transmitter audio input requirements (and VOX if used). You can make this adjustment with your transmitter microphone gain at its normal setting or at mid-range. Adjust the AFSK LEVEL trimmer for normal transmitter output when operating.

( ) Disconnect your meter and/or oscilloscope leads from the terminal interface.

( ) Remove the jumper wire that you inserted at pins 12 and 13 of the I/O connector on the rear panel.

CW DEMODULATOR ALIGNMENT

Prepare your Terminal Interface as instructed in the following steps.

( ) Preset the three tuning controls on the CW Demodulator board to their midpositions.

( ) Be sure the line cord plug is connected to an AC receptacle and the POWER push-button is On (in).

( ) Press CW/RTTY to CW, and leave all of the other pushbuttons in their normal receive (out) positions.

NOTE: Two methods of alignment for the CW Demodulator are presented. The first is titled "With Signal Generator" and can be used if you have an audio sine wave signal generator. If you do not have such a generator, proceed to the method titled "Without a Signal Generator".

WITH SIGNAL GENERATOR

Refer to Pictorial 10-1 as you perform the following steps.

( ) Connect an AC voltmeter (or oscilloscope) common lead to the chassis. Then connect its test probe to the test point (TP) on the CW Demodulator circuit board.

( ) Set your sine wave audio signal generator at 750 Hz and connect its common lead to the chassis. Then connect its signal lead to pin 13 of the I/O connector on the rear panel.

( ) Observe the voltmeter (or oscilloscope) and adjust the signal generator output for a reading between .5 and 1 volt.

( ) Adjust each control on the CW Demodulator board for a maximum reading on the meter (or oscilloscope). Readjust the output of the signal generator to keep the reading between .5 and 1 volt.

( ) Repeat the preceding step until you obtain no further increase in output as you adjust the controls. Then disconnect the signal generator and the AC voltmeter (or oscilloscope).

This completes the alignment of the CW Demodulator with a signal generator. Proceed to "RDA Threshold Adjustment" on Page 60.

WITHOUT A SIGNAL GENERATOR

You can align the CW Demodulator very close to the required 750 Hz without using an audio signal generator by performing the following steps.

( ) Set each of the three controls to the center of rotation.

( ) Connect your receiver audio output to the audio input (pin 13) of the I/O connector on the rear panel (see Pages 63 and 64).

( ) Use your receiver crystal calibrator, or tune in a steady carrier on your receiver, to supply an audio tone.

NOTE: You can use the bar graph on the front panel of your Interface to make the following adjustments. However, you may want to use an AC voltmeter or an oscilloscope for greater accuracy. If so, connect its common lead to the chassis and the test probe to TP on the CW Demodulator board. Adjust the receiver audio signal for a reading between .5 and 1 volt, or so the bar graph reads approximately mid-range.

( ) Adjust the receiver tuning dial so the bar graph (or AC voltmeter or oscilloscope) indicates peak signal strength. Then adjust each of the three controls for a maximum indication.

This completes the CW Demodulator alignment.

RDA THRESHOLD ADJUSTMENT

The RDA (received data available) threshold control sets the level at which the circuit, and the autostart relay, recognizes a signal in the bandpass of the mark filter. If you have an accurate audio signal generator, you can adjust the RDA THRESHOLD control (R66) at this time. Otherwise, wait until you have connected your receiver and perform this adjustment as directed in the Operation section of this Manual.

( ) Turn the RDA THRESHOLD control (R66) fully clockwise.

( ) Connect your signal generator to pin 13 of the I/O connector and set it to the mark frequency (2125 Hz). Adjust the generator output so the bar graph on the Interface front panel shows about 1/2 to 3/4 of full scale.

( ) If the RDA indicator on the front panel glows, wait about five seconds until it goes out. Then, slowly turn R66 counterclockwise until the RDA indicator just lights.

You may want to experiment with the setting of the RDA THRESHOLD control for optimum operation and your preference.

This completes the alignment and adjustment of your Interface. If you do not have an optional accessory, proceed to 'Installation' on Page 61.

If you have either the 170 Hz Preselector Accessory or the 425/850 Hz Filter Accessory, refer to the Manual for the accessory and assemble it at this time. Alignment instructions for the accessories are contained in their manuals. You will later return to this Manual for the Installation, Operation, Circuit Description, and other information.

INSTALLATION

A typical installation with a transceiver, computer, and printer is shown in Pictorial 11-1 (Illustration Booklet, Page 17). Before you begin your installation, read the following paragraphs to determine whether or not you will have to modify the main circuit board to suit your specific equipment.

MAIN CIRCUIT BOARD MODIFICATION

NOTE: If you determined your computer/program and printer requirements when you assembled the main circuit board, and treated resistor Rx and diodes CR7 and CR8 accordingly, you can bypass this section and proceed to "Cable Preparation" on Page 63.

The following information is presented here in case you want to change your equipment from one type of computer/program and/or printer to another. In that case, you must be sure that resistor Rx and diodes CR7 and CR8 are either installed or not installed, according to the needs of your equipment.

Review the requirements of your computer/program to determine your RS-232 or TTL compatibility requirements. The two modifications you may need are the installation of resistor R_x and current loop diodes CR7 and CR8, depending on your computer and/or printer.

RESISTOR R_x

Resistor R_x is a "pull-up" resistor which you must install if you are using RS-232 – RS-232, RS-232 – TTL, or TTL – TTL interface ports.

If your setup requires that R_x be installed, refer to Part A of Pictorial 11-2 and perform the following step:

( ) R_x: Install the 4700 Ω resistor (yel-viol-red) at R_x. Solder the leads to the foil and cut off the excess lead lengths.

If you are going to use a TTL compatible computer and a TTY (loop) printer, R_x must be out of the circuit. If it is not installed, do not install it. If R_x is installed, perform the following step:

( ) Refer to Part B of Pictorial 11-2 and locate the pads for R_x on the foil side of the main circuit board. Heat one of the pads with your soldering iron and carefully lift the lead of resistor R_x from its hole. Leave the other lead soldered and position the body of the resistor straight up.

Current Loop (TTY) Operation (Diodes CR7 and CR8)

This information pertains only to the use of a TTY (current loop) printer. If you do not intend to use a TTY printer and have not installed diodes CR7 and CR8 on the main circuit board, disregard this section and proceed to "Cable Preparation" on the next page.

IMPORTANT: If you have installed diodes CR7 and CR8 and now decide not to use a TTY printer, you must either insert a shorting plug in the LOOP jack on the rear panel, or remove the diodes from the circuit in the following manner:

( ) Refer to Part B of Pictorial 11-2 and heat one of the indicated pads on the foil side of the circuit board, then lift the diode lead from its hole. Lift the other diode leads in the same manner and remove the diodes. Place the diodes in a small envelope and save them for reuse in case you later decide to use a TTY printer.

If you intend to use a TTY printer with your setup and have not installed diodes CR7 and CR8, perform the following steps:

( ) Cut both leads of a 1N2071 diode (#57-27) to 1/2" and bend the leads as shown in Part B of Pictorial 11-2.

( ) CR7: Position the banded end of the diode as shown and insert the leads into the circuit board holes on the foil side. Then solder both leads to the foils.

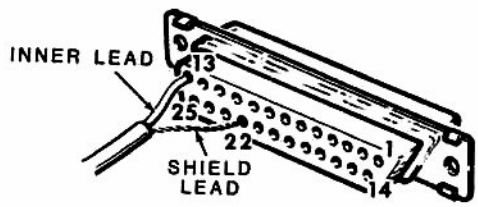
( ) CR8: In the same manner, install the other 1N2071 diode (#57-27).

NOTE: Jumper J1 must be installed for 60 mA current loop output, or omitted for 20 mA output. If your TTY printer requires a 60 mA loop current, perform the following step.

( ) J1: Form a 1" length of #22 solid wire (a cutoff resistor or diode lead) into a "U" shape. Then insert the ends of the wire through the holes at J1. Solder the wire ends to their foil pads and cut off the excess lengths.

CAUTION: With the loop supply enabled (diodes CR7 and CR8 installed), you **must** connect a TTY machine to the LOOP jack on the rear panel, or insert a shorting plug in the jack. Failure to do so will result in damage to the loop supply circuit. If you later find that you will not need the loop supply, you must disable the supply. Either unsolder and lift one end of each diode from the circuit board, or, for short periods of unuse, insert a shorting plug into the LOOP jack.

CABLE PREPARATION



PICTORIAL 11-3

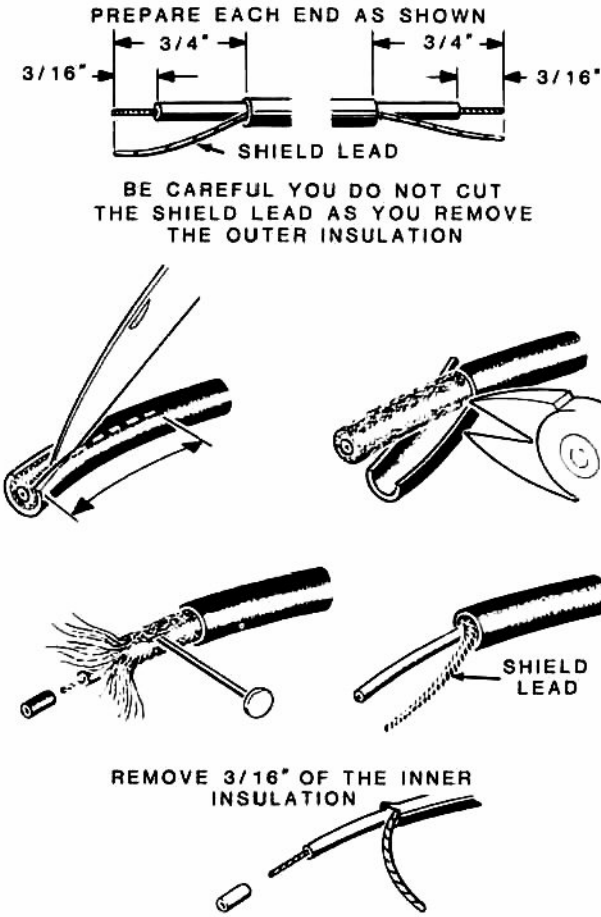
Since requirements differ for different manufacturers' equipment, you must refer to their specific manuals for the connections to use for your installation.

When you make the connections, use shielded cable (such as RG-174/U) wherever possible. Refer to Pictorial 11-3 and Detail 11-3A and prepare the cables as follows.

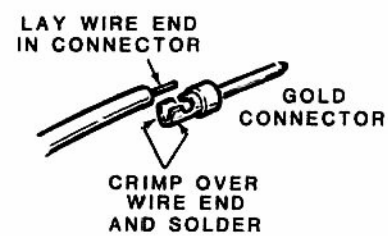
( ) Cut the cable to a length sufficient to reach from your equipment to the I/O connector on the rear panel of your Interface. Allow enough extra length to be able to route the cable around and behind other equipment.

( ) Prepare the ends of the cable as shown in Detail 11-3A. Then solder each lead at one end to a male connector pin as shown in Detail 11-3B. Bend the tabs around the soldered end of the wire and insert the pin into the correct numbered hole of the male connector housing. Push on the wire until the pin locks into the hole.

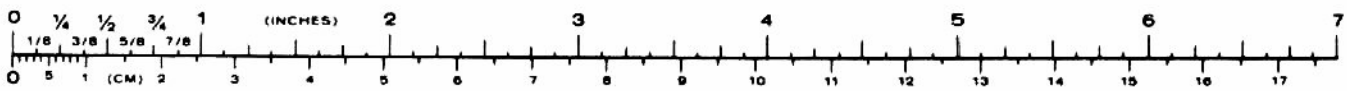
( ) Connect the other end of the cable to your equipment. Either use an appropriate plug or connector, or connect it directly, depending on the requirements of your equipment.



Detail 11-3A



Detail 11-3B



RECEIVER CONNECTIONS

( ) Solder a male connector pin to the center lead at one end of a cable and insert the pin into hole 13 of the 25-pin male plug.

( ) In the same manner, solder a pin to the shield lead and insert the pin into hole 22.

( ) At the other end of this cable, connect the center lead to the ungrounded (+) terminal on your receiver speaker. Then connect the shield lead to the other terminal of the speaker.

TRANSMITTER CONNECTIONS

Actual connections to your transmitter will depend on its design and on the modes of operation you will use. Refer to your transmitter manual for the proper connections to make. Be sure your transmitter is rated for continuous operation.

The following paragraphs will identify the pins (holes) of the 25-pin male plug (for the I/O connector) and the type of signal supplied or required. In each of the following, only the "signal" pin is identified. Shield leads or ground returns can be connected to pins 15 through 22.

AFSK (Audio Frequency Shift Keying), pin 12 — Connects to transmitter microphone audio input.

PTT (Push to Talk), pin 10 — Connects to transmitter PTT, and is not required if VOX (voice controlled transmit) operation is used. NOTE: If the transmitter requires that a negative voltage be pulled to ground, use pin 11 instead of pin 10.

FSK (Frequency Shift Keying), pin 14 — Connects to the FSK input of the transmitter.

INTERFACE CONNECTIONS

The Interconnection Chart (Illustration Booklet, Page 18) shows the interface signals required or produced at each pin of the I/O connector on the rear panel of the Interface. At the right of the chart are the pin numbers of a typical computer I/O connector. In order to make the right connections, perform the following steps.

( ) Refer to your computer manual and the documentation supplied with its software to identify the signals into or out of its I/O connector. Then use a lead pencil to note those signals next to the computer connector pin numbers on the chart.

( ) Determine which pins of the computer and Interface must be connected to each other. Then draw a line on the chart for each interconnection.

( ) Prepare the cables or wires and connect them according to the drawing that you made.

NOTE: Full support documentation and interconnect information for the Heath H-8 and H-89/Z-89 computers is included in the "Super RTTY" (HDP-1020) and "Super CW" (HDP-1010) Disk Operating Systems. These optional programs are available from Heath Company. Write for prices or see your current Heathkit catalog.

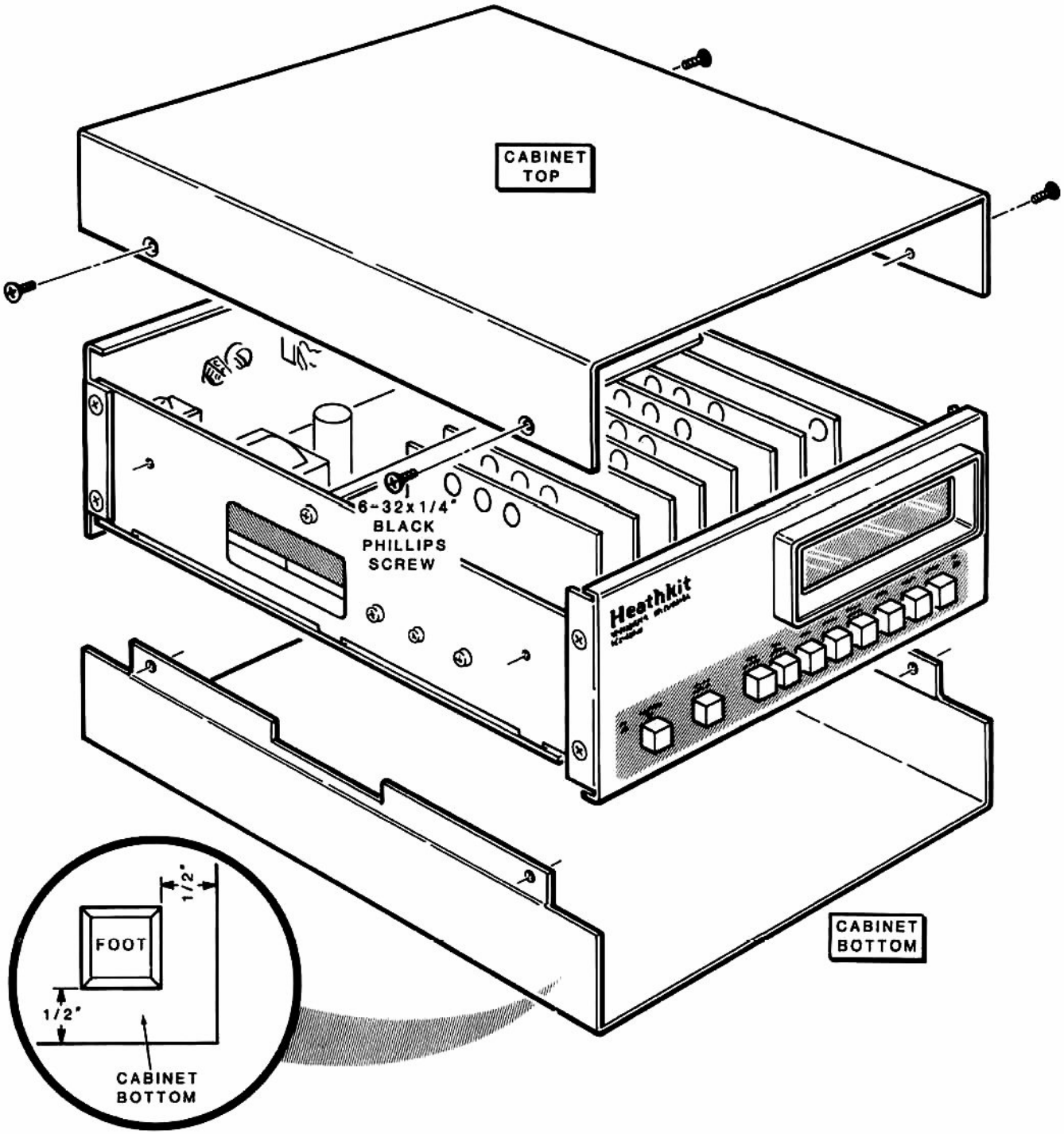
Signal pin identifications for interfacing TTL compatible or RS-232C compatible computers or other devices are shown below. Refer to the manual of the specific device for the proper connections.

TTL COMPATIBLE INTERFACE

Pin 3	Demodulator output
Pin 5	AFSK input
Pin 9	Send N (remote transmit)

RS-232-C COMPATIBLE INTERFACE

Pin 4	Demodulator output
Pin 6	AFSK input
Pin 25	Send P (remote transmit)



PICTORIAL 12-1

FINAL ASSEMBLY

Refer to Pictorial 12-1 for the following steps.

( ) Position the cabinet bottom upside down on your work surface. Then remove the paper backing from one of the feet and press the foot at one of the four corner locations, using the indicated dimensions.

( ) Similarly install the remaining three feet at the other three cabinet bottom locations.

( ) Mount the unit in the cabinet bottom. Then place the cabinet top over the unit so the four mounting holes align. Secure the cabinet with four 6-32 × 1/4" black phillips flat head screws.

This completes the "Final Assembly."

OPERATION

Pictorial 13-1 (Illustration Booklet, Page 19) shows the front panel of your Terminal Interface and briefly describes the function of each pushbutton and indicator. The following pages will describe the operation of the unit and use of the Interface to receive and transmit RTTY in a typical setup.

Be sure you are thoroughly familiar with your communications equipment and its operation. Review the manufacturer's specifications for stability and drift. For a transmitter, be sure it has the ability to handle "key down" operation (continuous transmission of a CW carrier).

GENERAL

Radioteletype (RTTY) amateur transmissions are generally within the frequencies shown below.

80 Meter band:	3600 – 3680 kHz
40 Meter band:	7075 – 7100 kHz
20 Meter band:	14075 – 14110 kHz
15 Meter band:	21075 – 21100 kHz
10 Meter band:	28075 – 28100 kHz

RTTY amateur transmissions use lower sideband.

Federal Communications Commission (FCC) regulations require that amateur RTTY transmissions can be in either ASCII or Baudot code. The FCC also limits the baud rate as follows:

Frequency Range	Maximum Baud Rate
3.5 to 21.25 MHz	300 baud
28.0 to 225 MHz	1200 baud
Above 420 MHz	19600 baud

Most amateurs use Baudot code, (60–75 or 100 words per minute) and 170 Hz shift.

Amateur Radio Relay League station W1AW transmits bulletins on 7095 kHz and 14095 kHz in Baudot code, 60 words per minute, 170 Hz shift, and in ASCII code, 100 baud, 170 Hz shift. Information on these transmissions and their schedules can be obtained from the ARRL or from their "QST" magazine.

Several amateur stations conduct message storage operations (MSO) on the 80, 40, and 20 meter bands. These are called "nets" or "mailboxes", which store messages from one station to another for later retrieval or relay.

RECEIVING RTTY

Radioteletype, abbreviated RTTY, is easily distinguished from code signals by the tones (birdie sounds) of RTTY. With your receiver speaker output and your computer and/or printer connected as described in the "Installation" section of this Manual and in your equipment manufacturer's manuals, receiving RTTY is very easy.

First, release all of the pushbuttons to their "out" position. Then press in the POWER button and the 170 Hz AUDIO FREQUENCY SHIFT button. The Power On indicator will light and the RDA indicator will glow momentarily and then go out. NOTE: If you have not adjusted the RDA THRESHOLD control, the RDA indicator might either glow continuously or not at all. You will adjust the RDA THRESHOLD control later.

Set the receiver audio level for normal listening and notice that the first few LEDs on the bar graph will flicker, even with no signal present. Tune your receiver across the band until you locate an RTTY signal and observe the bar graph and the Mark and Space indicators. Note that the bar graph will peak to nearly full scale and then lessen as you tune through 2125 Hz to 2295 Hz (170 Hz shift hi-tones).

If you look closely, you will see three peaks as you tune through an RTTY signal (two peaks for a CW signal). Only the center peak is correct. When the signal is properly tuned, both the Mark and Space LEDs will flicker as the RTTY signal changes from Mark to Space. However, if the RTTY station is in a steady Mark condition (not sending characters), then only the Mark LED will be lit. Only when a signal of the correct shift is properly tuned in will the Mark and Space LEDs blink complementarily (alternately). When a signal is detected in the Mark channel filter, the RDA indicator will glow and the autostart relay will be energized.

You may experience times when the received signal is garbled, even though signal and frequency shift appears correct. This can occur if the station is sending "upside down" (reverse shift), or at a different baud rate than your equipment is set for. Try using the REVERSE SHIFT on your Interface, and check your receiver to be sure it is set to receive lower side band. Also try selecting a different baud rate. With a little practice, you will soon learn to identify a properly tuned 170 Hz RTTY signal, speeds, and other shifts that you will normally use.

If the station you have tuned in is near the same frequency of another, and being interfered with, and you have an optional 170 Hz Preselector filter installed, you can press in the PRESELECT pushbutton to narrow the bandpass and probably eliminate the interfering station. Preselect is used only with the 170 Hz filter and is bypassed when other shift frequencies are used. The preselector should not be used when CW is selected, and it is not recommended for 300 baud and above because of its narrow bandwidth.

RDA THRESHOLD ADJUSTMENT

The RDA (received data available) THRESHOLD control sets the level at which the circuit, and the autostart relay, recognizes a signal in the bandpass of the mark filter. If you did not adjust this control when you aligned the Terminal Interface, or if you feel it needs readjustment, use the following procedure.

( ) If the bottom cover shell is installed, remove it so you can access the RDA THRESHOLD control (R66) through the hole in the side of the chassis.

( ) Use a narrow-blade screwdriver to rotate R66 fully clockwise. Then tune your receiver so that a steady carrier signal is in the mark filter channel.

( ) Set the receiver volume control so the bar graph shows 1/2 scale. If the RDA indicator on the front panel is lit, wait about 5 seconds until it goes out. Then, slowly turn R66 counterclockwise until the RDA indicator just lights again.

( ) Replace the bottom cabinet shell on your Interface.

Once you adjust the RDA THRESHOLD, you will seldom need to adjust it again unless you desire a different degree of sensitivity. Turn R66 clockwise for less sensitivity or counterclockwise for more sensitivity.

RECEIVING CW

To receive CW, simply select CW on the front panel and set all other pushbuttons to their normal receive positions. Then tune in the CW station until the bar graph tuning indicator indicates peak signal and the Mark indicator flashes with the keyed tone. Be sure the PRESELECT/BYPASS button is in the BYPASS position, as the 170 Hz filter will not pass the CWs 750 Hz tones.

CW will not be properly decoded and displayed on a computer unless you have the proper CW program loaded. Also, CW pulses from the HD-3030 will not be printed by an RTTY mechanical machine.

SENDING RTTY

Because of the different makes and models of transmitters, and their modes of operation, you must consult your transmitter manual for information on your particular unit. Interconnect your equipment and the Terminal Interface as described in the "Installation" section and in the manuals for your equipment. The following basic considerations may or may not apply to your setup.

Lower sideband is normally used for RTTY on the HF bands, with Mark low and Space high. If you use FSK (frequency shift keying), most newer transmitters automatically limit the power output and switch to lower sideband for the FSK mode.

VHF and UHF RTTY equipment connects and operates the same as HF except that FSK is seldom used and AFSK (audio frequency shift keying) is typical. Be sure your transmitter is rated for continuous operation.

You can place the equipment in the transmit mode by the remote transmit connections at Send N or Send P of the I/O connector. Or you can use the bipolar PTT output of the relay (Xmit N and Xmit P), or press the Send button on the front panel.

If the AFSK mode is used and your transmitter has VOX (voice operated transmit) capability, you can eliminate the PTT connection to the transmitter since the AFSK output is active only during transmit and will key the transmitter. Regardless of how the transmit mode is selected, the Send indicator will light and the Mark and Space indicators will blink to indicate keying from the keyboard device.

NOTE: You may have to adjust the AFSK LEVEL control (on the main board inside your Interface) to suit the audio input (and VOX) requirements of your transmitter. You can make this adjustment with your transmitter's microphone gain control at its normal setting or at midrange. Adjust the AFSK LEVEL control for normal output when transmitting.

Additional operating information for some of the front panel pushbuttons are provided in the paragraphs below.

Operate/Standby — For normal operation, this pushbutton must be out (Operate position). When it is pressed in, it places the Interface in "Standby," which prevents an incoming signal from keying your printer.

CW/RTTY — Selects either the RTTY demodulator and RTTY filters, or the CW demodulator using a 750 Hz filter. Both positions share the same outputs on the I/O connector (DMOUT-TTL and DMOUT-RS232). The Send N or Send P remote keying lines can isolate TTL or RS232 keying lines (from computers), to key high voltage CW keying inputs of a transmitter which, in turn, key bipolar keying outputs Xmit N or Xmit P.

Reverse Shift — Allows you to copy or send to a station that is "upside down" (tones reversed). Send and Receive shift can be reversed independently, so that you can communicate with stations that are transmitting or receiving "up-side-down". Conventionally, lower sideband is used, with Mark low and Space high, although there are no set rules.

Preselect/Bypass — When this pushbutton is pressed in, the optional 170 Hz preselector filter is activated. Preselect is used only with the 170 Hz filter and must be bypassed when other shift frequencies are used. The preselector should not be used if CW is selected, and it is not recommended for 300 baud and above because of its narrow bandwidth.

Since the filter boards contain frequency selection circuits for the AFSK, only the tones that match the installed and selected filter are transmitted. The Mark frequency is always 2125 Hz, and Space frequency is above the Mark frequency.

Sending CW

Normally, you would have your transmitter connected for VOX operation for RTTY and bi-polar keying (Xmit-P or Xmit-N) for CW, since most transmitters will permit both circuits to be keyed simultaneously. In the CW mode, the microphone audio input is disabled, and in the RTTY (lower sideband) mode the CW key is disabled. This allows a computer to use both RTTY and CW programs without having to change input or output connections, depending on the computer and software used.

IN CASE OF DIFFICULTY

Begin your search for any problem that may occur by carefully following the steps in the "Visual Tests" below. Then, if you have not found the trouble, refer to the "Troubleshooting Chart". If you are a qualified technician, you can use the "Voltage Chart" for further help in locating a problem.

You may find it helpful to refer to the Schematic Diagram and Circuit Description as you circuit trace to locate the cause of a problem. Refer to the "Circuit Board X-Ray views" (Illustration Booklet, Pages 22 and 23) for the physical location of parts on the circuit boards.

VISUAL TESTS

1. Check to see that all circuit boards are properly seated on their connectors, and at the right locations.

2. Recheck the assembly steps. Mark each step with a colored pencil on the Pictorial as you check it. Have someone else check your work: Someone who is not familiar with the unit may notice something that you have consistently overlooked.

3. About 90% of the kits that are returned to the Heath Company for repair do not work because of poor connections and soldering. Therefore, you can eliminate many troubles by reheating all connections to make sure they are properly soldered and that there are no solder bridges between foils. Refer to the "soldering" information on Pages 11 and 12.

4. Check to be sure that all transistors and diodes are properly installed in their correct locations. Make sure that each diode is positioned with its banded end over the band mark on the circuit board.

5. Check electrolytic capacitors for the correct position of the positive (+) or negative (−) leads.

6. Check to see that all ICs are properly installed at their correct locations and that no pins are bent under an IC.

7. Check to see that you installed the correct value of a part in each step on the Pictorials. It would be easy, for example, to mistake a 22 kΩ (red-red-orange) resistor for a 2200 Ω (red-red-red) resistor.

8. Check for bits of solder or wire ends that may have become lodged in the wiring or in the switch lugs.

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 chart lists conditions and possible causes of several specific malfunctions. If a particular part (U5, for example) is mentioned as a possible cause, check that part to see that it is installed and/or soldered correctly. It is also possible, on rare occasions, that a part may be faulty and require replacement. In that case, refer to "Replacement Parts" printed inside the rear cover of this Manual.

SYMPTOM	POSSIBLE CAUSE
1. Power lamp not lit	1. Fuse blown. 2. Power switch. 3. Power lamp. 4. ICs U5, U6, U7.
2. No +5 V or +12 V	1. Diodes CR9, CR10, CR11, CR12. 2. Capacitors C24, C25, C28. 3. ICs U5, U7. 4. Power transformer T1. 5. Fuse F1 on main board.
3. No −12 V.	1. Diodes CR9, CR10, CR11, CR12. 2. Capacitors C24, C30. 3. IC U6.
4. No 100 V (loop).	1. Diodes CR6, CR7, CR8. 2. Capacitor C18. 3. Transistors Q10, Q12.
5. No RTTY/CW at computer.	1. I/O Interconnect.
6. CW does not work.	1. Computer program. 2. CW pushbutton. 3. 170 Hz Preselector filter selected.
7. RTTY does not work.	1. Computer program. 2. Wrong shift filter selected. 3. Wrong baud rate. 4. Reverse shift.

VOLTAGE CHART

Voltage measurements in your Interface should be made only by a skilled technician or a person experienced in the service of semiconductor and integrated circuit equipment.

This chart lists the correct voltages at various points on the main board and on the chassis of your Interface. All measurements are made with a high impedance input voltmeter with a 15-volt scale from the chassis to the indicated point. The voltages may vary, but should be within ±10%.

Refer to Pictorial 14 (Illustration Booklet, Page 24) and to the Schematic Diagram and X-Ray Views for the location of the test points listed. Touch your voltmeter test probe ONLY to the test point. Do not let it slip and touch or short against other points. Unless your test probe has a very slender tip, you may want to attach a short piece of #22 wire to its tip.

Before you begin the voltage measurements, remove all of the plug-in circuit boards and set the front panel pushbuttons as follows:

POWER	In
OPERATE/STANDBY	In
SEND/RECEIVE	In
REVERSE SHIFTs	Out
All remaining	Out

INPUT/OUTPUT CONNECTOR (on the rear panel)

PIN	VOLTS	PIN	VOLTS
1	+5	9	+6
2	+5	10	0
3	+5	11	0
4	0	12	0
5	+5	13	0
6	0	14	−10
7	0	15 through	
8	0	22	0 (ground)

REGULATOR OUTPUTS

+5 −12 +12

At the test points shown

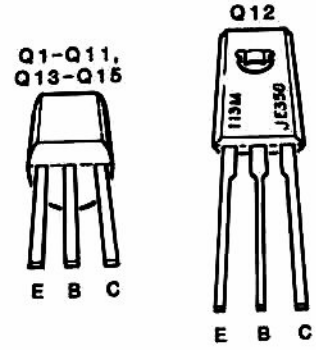
INTEGRATED CIRCUITS

PINS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
U1	+9	0	+.1	0	0	0	0	0	+8	+3.7	+3.7	+3.7	+3.7	+9	+9	+.6
U2	+9	+.1	0	0	+12	+.6	0	+12	+.6	0	0	+.1	+.6	+12		
U3	0	+.1	+11	+.1	+11	0	0	0	+19	+5	+19	+.6	+12	+.6	+12	−.6
U4	−10	+11	−7	+12	−4	0	−10	0	0	0	−12	+3	+.1	+11		

TRANSISTORS

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	+5.8	+6.5	+12
Q2	+.8	+1.5	+6.5
Q3	0	−.7	0
Q4	0	0	0
Q5	0	−.7	0
Q6	+12	+12	−.7
Q7	0	+.7	0
Q8	0	+.7	0
Q9	0	0	+4.3
Q10	+14.2	+14.2	+5
Q11	0	0	+ 14.2
Q12	+14.2	+14.2	0
Q13	0	+.7	0
Q14	0	+.7	0
Q15	0	0	+6

TRANSISTOR IDENTIFICATION



SPECIFICATIONS

INPUTS:

KEY-N	TTL compatible, active in Send only. Requires pull-down to enable AFSK downshift for CW ID.
AFSKIN-TTL	TTL compatible, Mark high. Requires pull-down for Space.
AFSKIN-RS	RS-232 compatible bipolar input. Mark = −3 V min., Space = +3 V min.
SEND-N	TTL compatible. Requires active pull-down to place Interface in Send mode.
SEND-P	RS-232 compatible bi-polar input. Requires active pull-up to place Interface in Send mode. Transmit = +3 V min., Receive = −3 V min.
RECV AUDIO	Receiver audio input. Connects to any source between 4 ohm and 600 ohm impedance, 100 mV minimum level.

OUTPUTS:

DMOUT-TTL	TTL compatible demodulator keying output. Mark high.
DMOUT-RS	RS-232 compatible bi-polar demodulator output. Mark = −6 V min., Space = +6 V min. into 3000 Ω load.
XMIT-P	Positive keying for PTT or CW. 50 mA maximum. Toggled by Send-N or Send-P inputs.
XMIT-N	Negative keying for PTT or CW. 50 mA maximum. Toggled by Send-N or Send-P inputs.

SCOPE MARK	50 kΩ impedance Mark filter output, phase corrected for accurate "+" display on oscilloscope.
SCOPE SPACE	50 kΩ impedance Space filter output, phase corrected for accurate "+" display on oscilloscope.
SEND AUDIO	AFSK audio output, adjustable 0 to 2 volts RMS, 600 Ω impedance.
FSK	Frequency shift keying bipolar output. Mark = −6 V min., Space = +6 V Min. into 3000 Ω load.
RDA OUTPUT	TTL compatible active pull-down output. Indicates presence of received signal in Receive mode. Locked off during Send.
LOOP OUTPUT	(Rear panel jack): 100 V, 60 mA or 20 mA current loop output. Internal jumper required for 60 mA.
AUX POWER	(Rear panel receptacle): 3 Ampere relay contact output supplies 120 VAC when triggered by "Autostart".

DISPLAYS:

Tuning	Ten segment LED "bar graph" signal strength indicator. Displays output level of filters.
Power	Indicates when AC line voltage is applied and Power pushbutton On.
Send	Indicates when Interface is in the Send mode.
RDA	(Receive Data Available) indicates presence of received signal and autostart relay triggered.
Mark	Indicates presence of Mark filter output signal in RTTY Receive mode, and CW filter output in CW Receive mode. In RTTY Send mode, indicates presence of Mark on AFSK control input.
Space	Indicates presence of Space filter output signal when in RTTY Receive mode. In Send mode, indicates presence of Space on the AFSK control input.

CW DEMODULATOR:

Center Frequency	750 Hz.
−3 dB bandwidth	70 Hz.
−20 dB bandwidth	250 Hz.

170 Hz PRESELECTOR (Optional):

−3 dB bandwidth	350 Hz.
−20 dB bandwidth	665 Hz.

GENERAL:

Dimensions	7-1/2" wide × 3" high × 10" deep (19 × 7.6 × 25.4 cm).
Net Weight	16 lbs, 14 oz (3.1 kg).

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.

CIRCUIT DESCRIPTION

Circuits in the RTTY Terminal Interface include the main circuit board with its inputs, outputs, switching, and various logic and control circuits, and the plug-in circuit boards that function as filters, demodulators, and audio frequency shift keyers. Each of the circuits will be described separately.

Refer to the Block Diagram (Illustration Booklet, Page 21) and to the Schematic Diagram (Fold-in) as you read this Circuit Description.

MAIN CIRCUIT BOARD

RECEIVE CIRCUITS

Signals from your receiver audio output contain the audio frequency shifted TTY signal. This signal, with a minimum level of 100 mV, is applied to pin 13 of the I/O connector and goes directly to the Preselect/Bypass switch. In the Preselect position, the audio signal passes through the optional 170 Hz Preselector circuit board which will be described later.

Audio signals from the Preselector (if installed and selected), or directly from Recv Audio pin 13 of the I/O connector if the Preselector is bypassed, are coupled through capacitor C4 and resistor R8 to a receive audio amplifier circuit consisting of transistors Q1 and Q2. Voltage divider resistors R6 and R7 provide base bias for Q2. Transistor Q1 is an emitter-follower which drives signal level clipping diodes CR1 and CR2. The clipped audio signal drives all active filter inputs, which are plug-in circuit boards for 170 Hz, and 425/850 Hz filters, and the CW demodulator.

Mark and space signals from the selected filter are coupled through the Receive Normal/Reverse switch to the CW and RTTY demodulator boards (which will be described later). The RTTY/CW switch selects the output of either the RTTY demodulator or the CW demodulator for a DMOUT RS-232 signal to pin 4 of the I/O connector. The signal also couples through Q9 to provide a DMOUT TTL signal to pin 3 of the connector, and through Q11 to key the loop circuit of Q10 and Q12.

Mark and space signals are also detected by diodes CR13 and CR14 and coupled to the bar graph display, which acts as a tuning meter. The detected signal is filtered by the network of diodes, capacitors, and resistors and coupled to threshold amplifier U4. Threshold control R66 sets the level at which the signal will turn on the RDA (Receive Data Available) LED and activate the autostart relay through U4A and U3F.

Mark and Space LEDs are turned on and off by the corresponding signals through CR13 and CR14 respectively and sections of U1 on received signals.

OTHER CIRCUITS

Some of the other circuits on the main circuit board, which are described below, function in both the receive and transmit mode.

Mark LED

A front panel LED (light emitting diode) is turned on by either of two different circuits, depending on whether the Interface is in the transmit or receive mode. In the receive mode, the lamp (LED) is driven by the audio output of the mark filter, rectified and inverted by CR13 and U1, and coupled through R38 to the LED. In the transmit mode, the Mark LED is controlled by the condition of the AFSK input signal, gated through U2 pin 3. This drives inverter U1 and turns on the LED through R37 and R38 which are current limiting resistors.

Space LED

Control of the Space LED is similar to the control of the Mark LED that was described above.

RDA (Receive Data Available)

This front panel indicator glows when there is a mark filter output signal present. Diode CR25 rectifies the mark audio output, which is then summed and filtered by C26. This voltage is then compared to a 4-volt reference voltage level set by R1 and R66 at pin 13 of U4D. When the peak output of the mark filter exceeds 4 volts, the output at pin 14 of U4D will go approximately 10 volts negative. This causes C29 to discharge through R50 and CR21 and, when the decaying voltage drops below 6 or 7 volts negative, the output of U4A switches positive, driving the input of U3G (pin 7) to pull the RDA output low. The comparator circuit is forced to the RDA "on" state by CR27 when the Interface is in the transmit mode, and is disabled when the Standby pushbutton is pressed in.

Autostart Relay

Circuits that control the RDA indicator also operate the autostart relay. The presence of a mark signal is detected, rectified, and compared to turn on the RDA LED and to close the contacts of the relay. An AC receptacle on the rear panel is thus energized to the power line voltage for automatic start of a printer or other device.

Loop Supply

Most TTY printers, paper tape punches, and some other devices require a current loop supply for operation. Such a supply is provided at the Loop jack on the rear panel of the Interface.

Power transformer voltage is rectified by diodes CR7 and CR8, filtered by capacitor C18, and applied through 20 mA current limiting resistor R35 to the emitter of loop keying transistor Q12. With jumper J1 installed, R32 parallels R35 and increases the maximum current to 60 mA. The collector of Q12 is in series with the Loop jack (and whatever device is connected to it). Control of Q12 and the current loop output occurs as follows.

When the Interface is idle or in the mark condition, the RTTY demodulator output is negative and transistor Q9 is off, which allows its collector to be pulled high. This high, through resistor R28, causes transistor Q11 to turn on and drive the base of Q12 through R33. When Q12 is on, zener diode CR6 regulates its base voltage at 5.1 volts below the 100-volt supply voltage. Q12 then conducts current through the loop load (which MUST be connected) until the voltage drop across the Q12 emitter resistor(s) is approximately 4.4-volts below the supply voltage. This 4.4 volt drop also drives the base of Q10, which monitors the loop status and keys the AFSK keying input.

ACTIVE FILTERS

Active filters in the Interface include a 2295 Hz filter for 170 Hz shift and a 2125 Hz Mark filter. Optional filters are available for 2550 Hz (425 Hz shift) and for 2975 Hz (850 Hz shift). These filters can be selected by pushbuttons on the front panel in both the receive and transmit mode. Each filter consists of three two-pole active bandpass, low-gain, low Q stages which cascade to result in a very stable high Q filter.

On all filter boards except the one tuned for 2295 Hz, resistor R1 couples the signal to the first stage of the active filter (one half of IC1), which is tuned by trimmer potentiometer P1. The second and third stages of the filter use the other half of IC1 and half of IC2, each independently tuned. The second half of IC2 is used as a voltage comparator that switches the gate bias voltage for field effect transistor Q1 which, in turn, switches the active filter output to the output bus on the main board. IC2B compares the levels at pins 5 and 6. When inverting input pin 6 is higher than non-inverting input pin 5, the output of IC2 (pin 7) is approximately minus 10 volts and Q1 is switched off. When the input levels are reversed, pin 7 changes to plus 10 volts and Q1 is switched on.

On the 170 Hz filter board (tuned to 2295 Hz), a phase shift network, made up of R2, R3, and R4, and capacitors C1 and C2, replaces resistor R1. This provides an additional delay to the signal passing through so the proper phase relationship exists for the mark and space signals, which can be observed on an oscilloscope for tuning.

Frequency select diodes 0 through 7 are used to select the desired output of the audio frequency shift keyer (AFSK). Different combinations of these diodes are used for different filter frequencies.

AUDIO FREQUENCY SHIFT KEYER (AFSK)

A crystal-controlled oscillator, programmable frequency divider, and a bandpass filter are contained on the audio frequency shift keyer (AFSK) circuit board. The 5.508 MHz crystal and a CMOS 4069 inverter form the oscillator, which is connected to the input of the first programmable divider, IC2. IC2 and IC3 provide frequency division by any integer between 2 and 256. IC4 is a divide-by-sixteen divider which is enabled or disabled by an external connection that is used to turn the AFSK on or off. The output of IC4 is a symmetrical square wave which connects to the input of low-pass filter IC5. This low-pass filter has a relatively flat response in the 2000 to 3000 Hz range, and its audio output can be adjusted by Level control P1.

RTTY DEMODULATOR

The demodulator consists of a discriminator, low pass filter, signal balance restorer, slicer, and mark hold circuit. Diodes D1 and D2, along with resistors R1, R2, and R15, comprise the discriminator circuit. The output of the discriminator is a pulsating DC voltage whose polarity depends on which filter signal (mark or space) is dominant.

This pulstating DC is connected through a low-pass filter R-C filter network and IC1 B or D to the signal balance restorer circuit, using the three remaining sections of IC1. The space output of the low-pass filter is negative, and the mark output is positive. These outputs, rectified by diodes D3 and D4, alternately charge capacitors C3 and C4 and are summed by resistors R4 and R5. Any difference in the level of the mark and space voltages at the output of the low-pass filter appears as an error voltage at the output of IC1C. This error voltage from the signal balance restorer is summed with the output of the low pass filter, through R6, to offset signal level differences between the mark and space filter outputs.

The output from the signal balance restorer provides a bias voltage which will center the output levels of the low pass filter at the input of the slicer, IC2A. This is a positive feedback, or hysteresis type, slicer which has a dead band determined by the ratio of resistors R9 and R10. The slicer will only change state when the input level exceeds the hysteresis level. This circuit prevents low level signal fluctuations from generating erroneous output signals.

The mark hold circuit returns the Interface output to the mark state whenever a space signal is longer than approximately 150 milliseconds. The output of the slicer is a positive-going voltage which, coupled through C5, raises the voltage across R12 to approximately +12 volts and then decays toward zero as C5 charges. Since the initial positive-going signal is greater than the voltage level set by voltage divider R13 and R14 on the noninverting input of IC2B, the output of IC2B goes positive. As C5 charges through R12, the voltage at the noninverting input of IC2B decays toward zero. When this decaying voltage crosses the threshold level set by resistors R13 and R14, the output of IC2B switches negative. Normally, the length of time that the output of the slicer is negative is less than the time required for C5 to charge through R12. Therefore, the mark hold circuit will have no effect on the output signal. Only when the space signal from the slicer exists for a longer period will the mark hold circuit take effect.

CW DEMODULATOR

Circuits of the CW demodulator include a three-section 750 Hz filter, an FET switch, a low-pass filter, and a level translator. Audio signals that appear at pin 11 of the demodulator board are filtered by IC1 A and B, and IC2A. Each of the filters is independently tuned to 750 Hz. Transistor Q1 is an FET switch that is turned on by an enable signal from pin 12 through IC2B and diode D2. The filtered signal is then coupled through diode D1 to the low pass filter circuit of IC3A. IC3B is a level translator that supplies the demodulated CW signal to the RTTY/CW pushbutton switch, through pin 15 of the circuit board.

OPTIONAL 170 Hz PRESELECTOR

Four stages of two-pole active filters comprise the optional 170 Hz preselector. Each state is a low-gain, low-Q filter, independently tuned to the 170 Hz signal. The cascaded result is a high-Q narrow-band filter that is very stable.

TRANSMIT CIRCUITS

Because of the several inputs and outputs that have different effects on the transmit circuits, a typical signal flow type of circuit description would be quite confusing. Therefore, each input and output signal at the I/O connector will be described for its circuit and its effect on the operation of the Terminal Interface.

DM OUT – TTL — Pin 3: This output is derived from the demodulator circuit board through transistor Q9. Q9 is driven to a low state when a space output is passed by the demodulator, or pulled to a high TTL level when a mark signal is presented by the demodulator.

DM OUT RS-232 — Pin 4: The same demodulator output is passed through resistor R20 to pin 14. This is a bipolar output with the mark signal at −10 volts and the space signal at +10 volts (no load).

SCOPE MARK — Pin 7: A monitor output from the mark filter, through R41, for observing the mark signals on an oscilloscope.

SCOPE SPACE — Pin 8: Audio output from the selected space filter, through R40, for observing space signals on an oscilloscope.

XMIT-P — Pin 10: This output will "pull to ground" a transmitter's positive PTT or CW keying voltage. It can be keyed from the front panel Send/Receive pushbutton, the SEND-N input (pin 9), or the SEND-P input (pin 25). With any of those three keyed, the output of inverter U3 drives the base of Q6 through R14. The collector of Q6 then pulls high to drive the bases of Q3 and Q5 through R12. When driven, Q5's collector is at ground potential.

XMIT-N — Pin 11: This output is keyed from the same sources as XMIT-P, but Q3 acts as an inverter to drive Q4, which will pull to ground a transmitter's negative PTT or CW keying voltage.

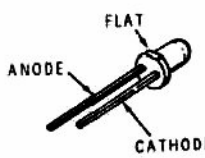
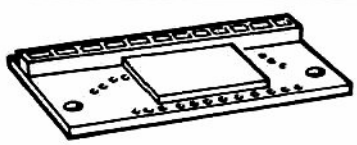
KEY-N — Pin 2: This input must be pulled low to switch the AFSK to the downshift CW ID frequency when the Interface is in the transmit mode. It is a TTL compatible input, connected to inverter transistor Q8, which isolates CMOS inverter U3. This inverter enables the CW ID frequency select diodes on the AFKS circuit board and also connects through gates to disable the mark and space frequency control.

AFSK IN-TTL — Pin 5: This is a TTL compatible input that causes the AFSK to switch between mark and space frequencies when in the transmit mode. This imput must be high for mark frequency output and low for space frequency output. The AFSK-TTL signal connects to inverter transistor Q7 for isolation of CMOS inverter U1. The output of U1 pin 14 is ORed with the output of U1 pin 15 which is the bipolar serial input for the AFSK. The Reverse shift of a send signal is accomplished by selecting either the AFSK-TTL or AFSK-RS-232 signal.

AFSK IN RS-232 — Pin 6: An RS-232 compatible input that requires a bipolar input signal. It too provides the determination of the mark and space output frequencies when the Interface is in the transmit mode. The signal is ORed with the AFSK-TTL signal.

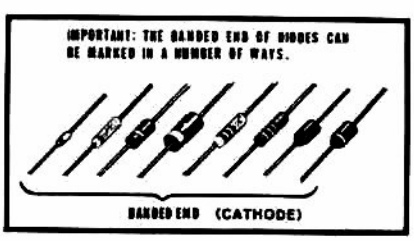
SEMICONDUCTOR IDENTIFICATION CHARTS

DISPLAY CIRCUIT BOARD

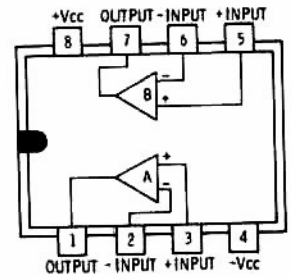
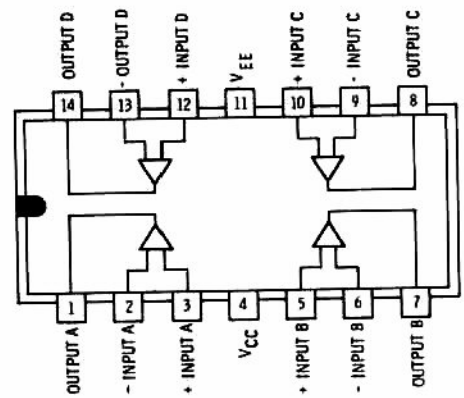
CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
D1, D2 D3, D4, D5	412-637	NSL5076 LED	
	412-655	NSM3914 BAR DISPLAY	

RTTY DEMODULATOR CIRCUIT BOARD

Diode

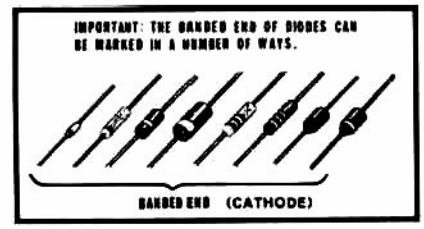
CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
D1 – D7	56-56	1N4149	

Integrated Circuits

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION (TOP VIEW)
IC2	442-21	MC1458	
IC1	442-743	HA4741-5	

CW DEMODULATOR CIRCUIT BOARD

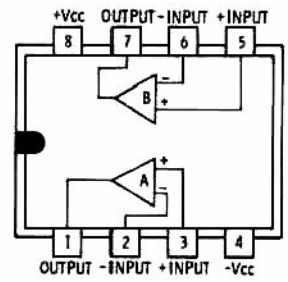
Diode

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
D1, D2	56-56	1N4149	

Transistor

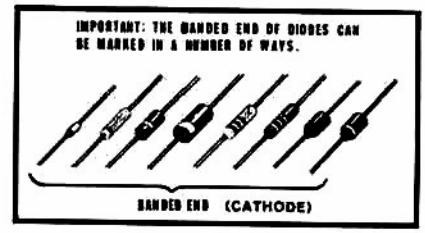
CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
Q1	417-987	MPF111	

Integrated Circuit

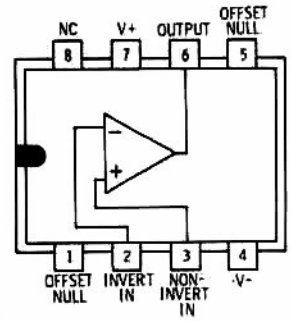
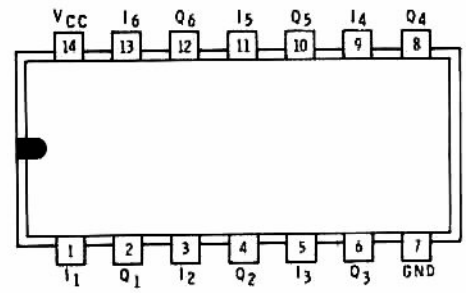
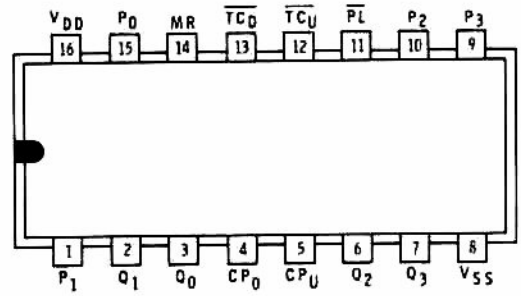
CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION (TOP VIEW)
U1, U2, U3	442-21	MC1458	

AFSK CIRCUIT BOARD

Diode

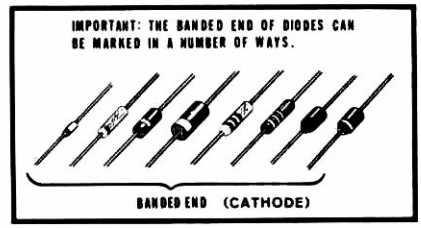
CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
	56-56	1N4149	

Integrated Circuits

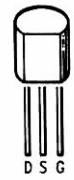
CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION (TOP VIEW)
IC5	442-22	N5741	
IC1	443-1155	4069	
IC2, IC3, IC4	443-1156	40193	

425 (2125) HZ ACTIVE FILTER

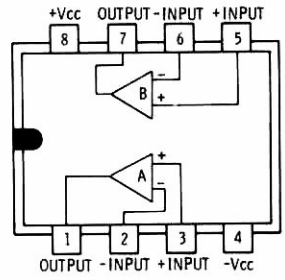
Diode

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
	56-56	1N4149	

Transistor

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
Q1	417-987	MPF111	

Integrated Circuit

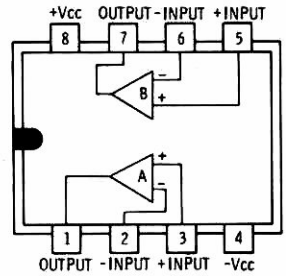
CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION (TOP VIEW)
IC1, IC2	442-21	MC1458	

850 (2295) HZ ACTIVE FILTER

Transistor

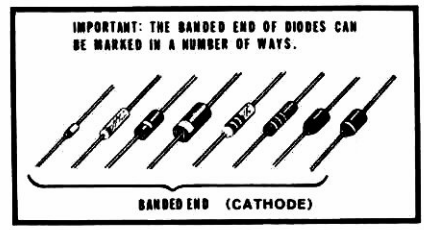
CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
Q1	417-987	MPF111	

Integrated Circuit

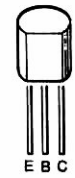
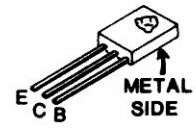
CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION (TOP VIEW)
IC1, IC2	442-21	MC1458	

MAIN CIRCUIT BOARD

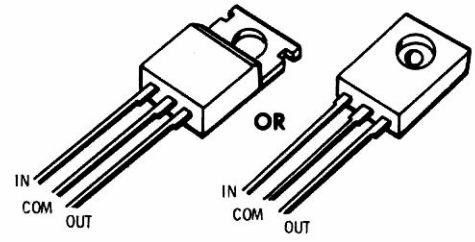
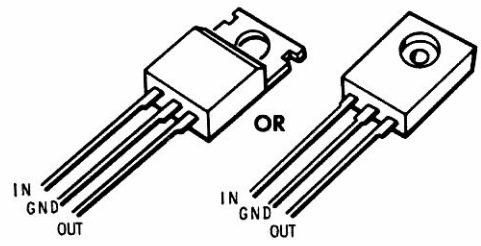
Diodes

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
CR6	56-16	1N5231B zener	
CR1 – CR5, CR13 – CR27	56-56	1N4149	
CR9 – CR12	57-27	1N2071	

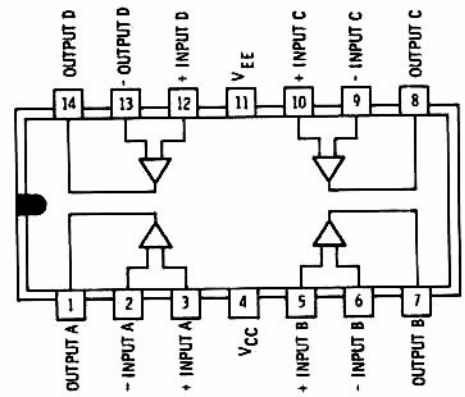
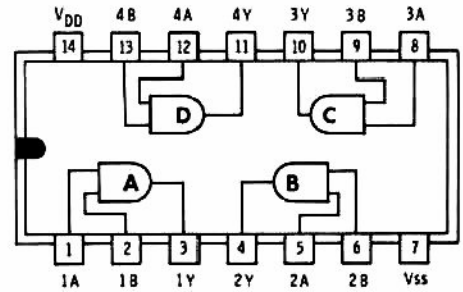
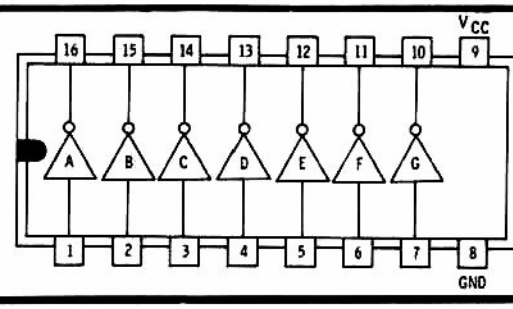
Transistors

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
Q11	417-294	MPSA42	
Q4	417-295	MPSL51	
Q5	417-811	MPSL01	
Q3, Q6	417-874	2N3906	
Q1, Q2, Q7, Q8, Q9, Q13, Q14, Q15	417-875	2N3904	
Q10	417-986	MPSA92	
Q12	417-988	MJE350	

Integrated Circuits

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION (TOP VIEW)
U7	442-603	78MO5	
U5	442-674	UA7812	
U6	442-675	UA7912	

Integrated Circuits (cont'd.)

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION (TOP VIEW)
U4	442-743	HA4741-5	
U2	443-751	MC14081	
U1, U3	443-1157	MC1416	

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

ZENITH

HEATH COMPANY • BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

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