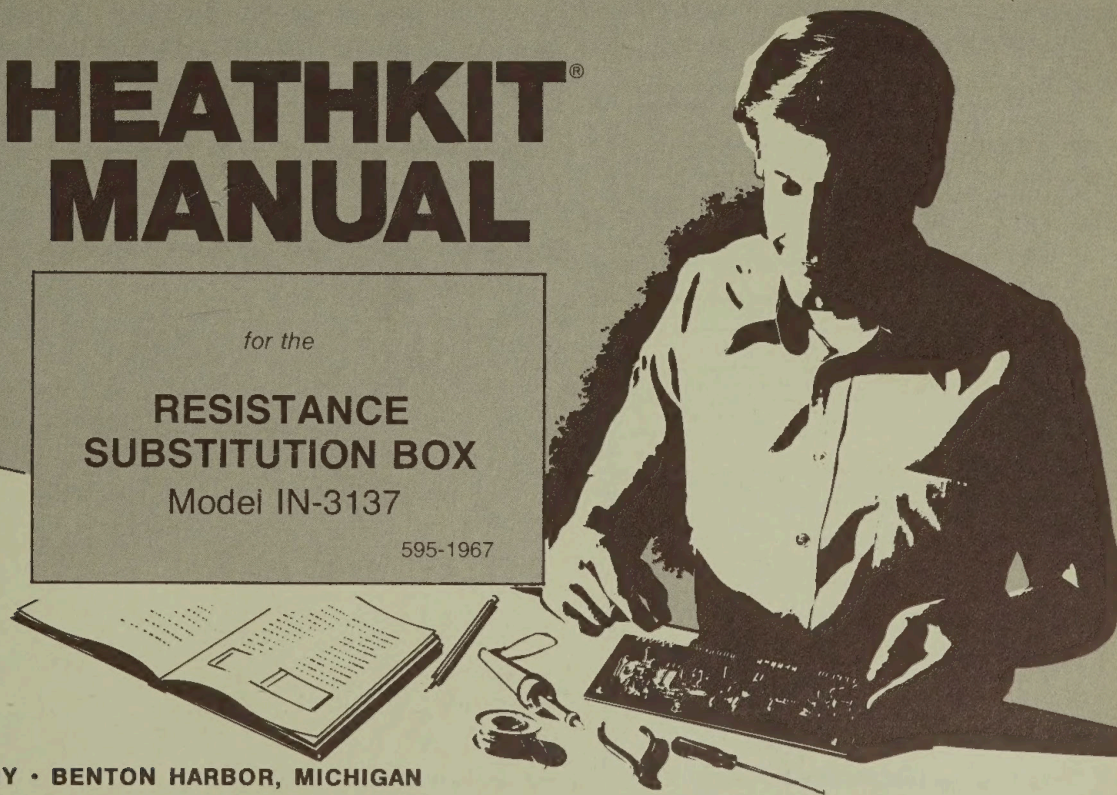
HEATHKIT® MANUAL

for the

RESISTANCE SUBSTITUTION BOX

Model IN-3137

595-1967



HEATH COMPANY • BENTON HARBOR, MICHIGAN

YOUR HEATHKIT 90-DAY FULL WARRANTY

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

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

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

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

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

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

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

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for incidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HEATH COMPANY
BENTON HARBOR, MI. 49022

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:	
R/C, Audio, and Electronic Organs	(616) 982-3310
Amateur Radio	(616) 982-3296
Test Equipment, Strobe Lights, Calculators, Clocks, Weather Instruments	(616) 982-3315
Television	(616) 982-3307
Automotive, Marine, Appliances, Security, General Products	(616) 982-3496

Prices and specifications subject to change without notice.

Assembly and Operation

of the

HEATHKIT

RESISTANCE SUBSTITUTION BOX

MODEL IN-3137

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

TABLE OF CONTENTS

SPECIFICATIONS

Range	15 ohms to 10 megohms.
Accuracy	±10% EIA values.
Power Rating	1 watt, all values.
Voltage Rating	500 volts continuous.
Dimensions	6" long x 3" wide x 3" high.
Net Weight	1 lb.

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

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

DESCRIPTION

The Model IN-3137 Resistance Substitution Box was designed to provide a rapid and flexible means of determining the resistance value required in electronic circuits.

The "shorting type" switches with make-before-break action permit smooth selection of the resistance values without opening or shorting the circuit.

The HI-LO switch makes it possible to switch from one range switch to the other for high or low value resistances. Each resistance value that can be selected is marked by value on the front panel. All values are EIA standards so that resistors of the same values can be obtained.

PARTS LIST

Unpack the kit carefully and check each part against the Parts List. The numbers in parentheses in the Parts List correspond to the numbers of the parts drawings to aid in quick and positive parts identification.

To order a replacement part, 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 the Manual. For pricing information, refer to the separate "Heath Parts Price List."

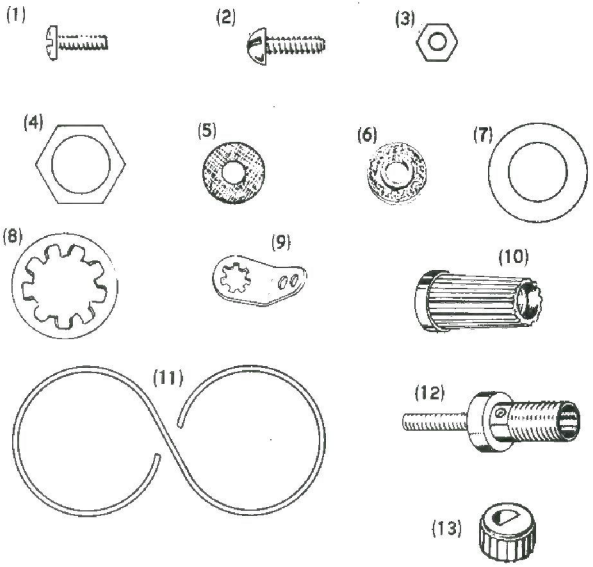
PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS (1 Watt)		
(1) 1-12-1	1	15 Ω (brown-green-black)
1-13-1	1	22 Ω (red-red-black)
1-14-1	1	33 Ω (orange-orange-black)
1-15-1	1	47 Ω (yellow-violet-black)
1-16-1	1	68 Ω (blue-gray-black)
1-17-1	1	100 Ω (brown-black-brown)
1-18-1	1	150 Ω (brown-green-brown)
1-19-1	1	220 Ω (red-red-brown)
1-20-1	1	330 Ω (orange-orange-brown)
1-1-1	1	470 Ω (yellow-violet-brown)
1-21-1	1	680 Ω (blue-gray-brown)
1-2-1	1	1000 Ω (brown-black-red)
1-22-1	1	1500 Ω (brown-green-red)
1-23-1	1	2200 Ω (red-red-red)
1-3-1	1	3300 Ω (orange-orange-red)
1-24-1	1	4700 Ω (yellow-violet-red)

(1) 

PART No.	PARTS Per Kit	DESCRIPTION
Resistors (1 Watt) (cont'd.)		
1-25-1	1	6800 Ω (blue-gray-red)
1-9-1	1	10 KΩ (brown-black-orange)
1-26-1	1	15 KΩ (brown-green-orange)
1-5-1	1	22 KΩ (red-red-orange)
1-27-1	1	33 KΩ (orange-orange-orange)
1-7-1	1	47 KΩ (yellow-violet-orange)
1-8-1	1	68 KΩ (blue-gray-orange)
1-28-1	1	100 KΩ (brown-black-yellow)
1-29-1	1	150 KΩ (brown-green-yellow)
1-30-1	1	220 KΩ (red-red-yellow)
1-31-1	1	330 KΩ (orange-orange-yellow)
1-32-1	1	470 KΩ (yellow-violet-yellow)
1-33-1	1	680 KΩ (blue-gray-yellow)
1-34-1	1	1 megohm (brown-black-green)
1-35-1	1	1.5 megohm (brown-green-green)
1-36-1	1	2.2 megohm (red-red-green)
1-37-1	1	3.3 megohm (orange-orange-green)
1-38-1	1	4.7 megohm (yellow-violet-green)
1-39-1	1	6.8 megohm (blue-gray-green)
1-40-1	1	10 megohm (brown-black-blue)

PART No.	PARTS Per Kit	DESCRIPTION
HARDWARE		
(1) 250-213	4	4-40 x 5/16" screw
(2) 250-9	2	6-32 x 3/8" screw
(3) 252-3	2	6-32 nut
(4) 252-7	2	Control nut
(5) 253-1	2	Fiber flat washer
(6) 253-2	2	Fiber shoulder washer
(7) 253-10	2	Control flat washer
(8) 254-4	2	Control lockwasher
(9) 259-1	2	Solder lug
MISCELLANEOUS		
60-4	1	SPDT slide switch
63-451	2	Rotary switch
(10) 100-16-2	2	Binding post cap
203-415-3	1	Front panel
(11) 213-1	1	Resistor mounting ring
408-11	1	Case
(12) 427-3	2	Binding post base
462-999	2	Knob
(13) 455-619	2	Knob bushing
344-59	1	Hookup wire
391-34	1	Blue and white identification label
597-260	1	Parts Order Form
597-308	1	Kit Builders Guide
	1	Manual (See front cover for part number.)
		Solder

PARTS PICTORIAL



ASSEMBLY NOTES

The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning the specified operation. Also read several steps ahead of the actual step being performed. This will familiarize you with the relationship of the subsequent operations. When the step is completed, check it off in the space provided. This is particularly important, as it may prevent errors or omissions, especially if your work is interrupted.

In general, the illustrations in this manual correspond to the actual configuration of the kit; however, in some instances the illustrations may be slightly distorted to facilitate clearly showing all of the parts.

When soldering, position the work, if possible, so that gravity will help to keep the solder where you want it. The joint to be soldered should be heated with the flat side of the soldering iron tip sufficiently to melt the solder. Apply only enough solder to the heated terminal to thoroughly wet the junction. Remove the solder and then the iron when a smooth soldered junction appears. Do not move the leads until the solder is solidified.

ROSIN CORE SOLDER HAS BEEN SUPPLIED WITH THIS KIT. THIS TYPE OF SOLDER MUST BE USED FOR ALL SOLDERING IN THIS KIT. ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE EQUIPMENT IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. IF ADDITIONAL SOLDER IS NEEDED, BE SURE TO PURCHASE ROSIN CORE (60:40 or 50:50 TIN-LEAD CONTENT) RADIO TYPE SOLDER.

STEP-BY-STEP ASSEMBLY

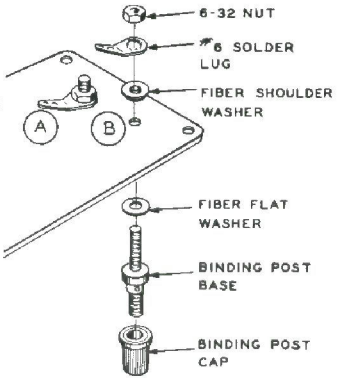
Refer to Pictorial 1 for the following steps.

(✓) Mount binding posts at A and B on the front panel. Use the fiber shoulder washers, fiber flat washers, solder lugs, and 6-32 nuts as shown in Detail 1A. Position the solder lugs as shown.

(✓) Install binding post caps on the binding posts at A and B.

(✓) Mount the SPDT slide switch (#60-4) at location C on the front panel. Use two 6-32 x 3/8" screws.

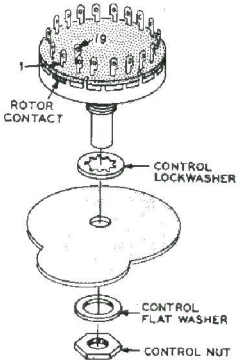
(✓) Look into the edge of each of the two rotary switches and notice the position of the rotor contact. If the rotor contact is not at lug 1, turn the switch shaft with a pair of pliers until the rotor is at lug 1. See Detail 1B.



Detail 1A

(✓) Mount the two rotary switches at D and E with control lockwashers, control flatwashers, and control nuts. Position lugs 1 and 19 of each switch as shown in Pictorial 1.

Refer to Detail 1C and notice that the knob bushing is tapered. Be sure, in the next step, to place this bushing on the shaft with the small end facing out, or the knob will not slide onto it. (Roll the bushing on a flat surface if you are unsure about it; the bushing will gradually turn toward the small end.)



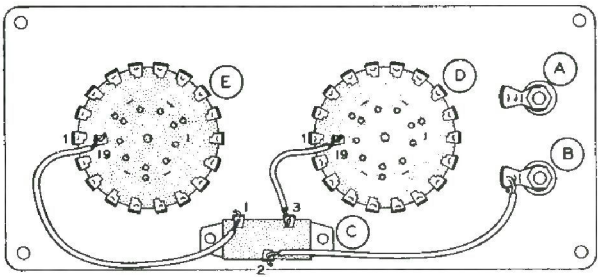
Detail 1B

(✓) Turn each shaft fully counterclockwise.

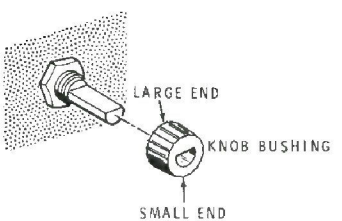
In the following steps you will install knobs on the two switch shafts as shown in Detail 1D. Perform these steps carefully, since it is difficult to remove a bushing from a knob once it is fully inserted.

( ) At the switch location nearest the binding posts, line up the pointer of a knob with the 15 K mark on the panel. Then install the knob as shown in Detail 1D.

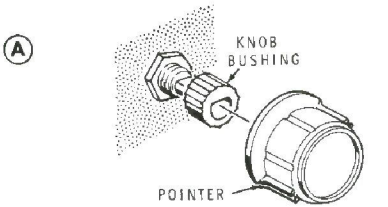
( ) At the other switch location, line up the pointer of a knob with the 15 mark on the panel. Then install the knob as shown in Detail 1D.

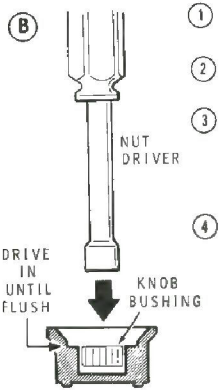


PICTORIAL 1



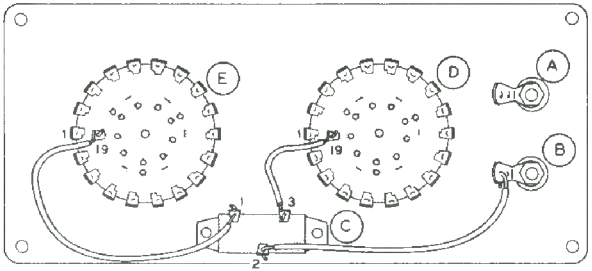
Detail 1C





Detail 1D

1. LINE UP THE POINTER AS CALLED OUT IN THE STEP.
2. PUSH THE KNOB PART WAY ONTO THE BUSHING.
3. NOW CAREFULLY REMOVE BOTH THE BUSHING AND THE KNOB. DO NOT ALLOW THE KNOB TO COME OFF THE BUSHING.
4. PLACE THE KNOB ON A TABLE OR OTHER FIRM SURFACE. PLACE A SOFT CLOTH UNDER THE KNOB TO PREVENT IT FROM BEING MARRED. THEN USE A NUTDRIVER OR A LARGE SCREWDRIVER AND DRIVE THE BUSHING INTO THE KNOB AS SHOWN. DO NOT DRIVE IT IN TOO FAR.
5. REPLACE THE KNOB ON THE CONTROL FROM WHICH IT WAS REMOVED.



Pictorial 1
(Repeat)

( ) Cut three hookup wires, one 1-1/2", one 3-3/4", and one 3". Remove 1/4" of insulation from the ends of these wires.

( ) Solder a 1-1/2" wire from lug 19 of switch D to lug 3 of switch C.

( ) Solder a 3-3/4" wire from lug 19 of switch E to lug 1 of switch C.

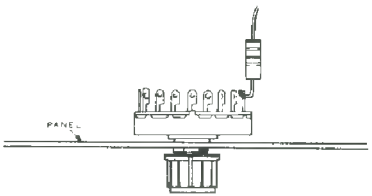
( ) Solder a 3" wire from lug 2 of switch C to binding post base B.

Refer to Pictorial 2 for the following steps.

NOTE: The major portion of the wiring consists of connecting the resistors between the rotary switches and the resistor mounting ring. This wiring should be done as neatly as possible, and as instructed.

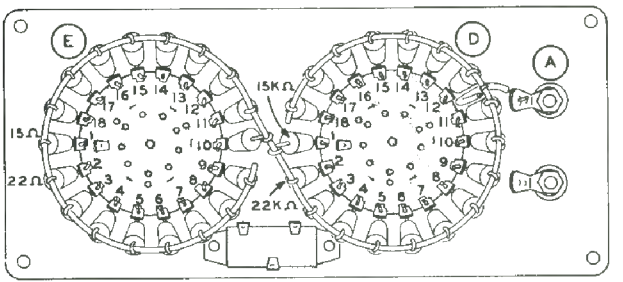
( ) Cut one lead of each resistor to 3/8". The other lead of the resistor should not be cut.

( ) Form a hook in the cut lead of each resistor. Refer to Detail 2A.



Detail 2A

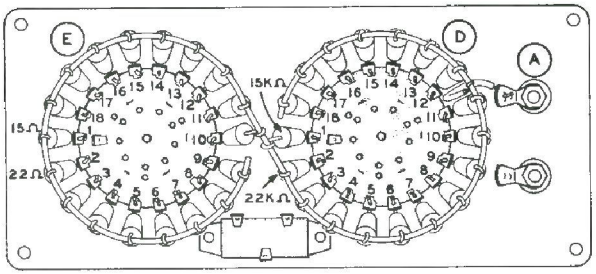
( ) Arrange the resistors in order starting with the lowest value, 15 Ω (brown-green-black) and proceed to the highest value, 10 megohm (brown-black-blue). The resistors are listed in this sequence in the Parts List.



PICTORIAL 2

Connect the resistors to rotary switch E according to the following chart. Position each resistor so that the resistor lead hooks into the switch lug from the outside, then solder. Refer to Detail 2A. The resistor mounting ring will be installed after all the resistors are connected to the switches.

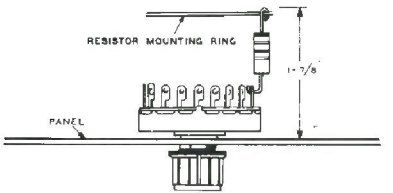
CONNECT A	TO LUG
15 Ω (brown-green-black)	1
22 Ω (red-red-black)	2
33 Ω (orange-orange-black)	3
47 Ω (yellow-violet-black)	4
68 Ω (blue-gray-black)	5
100 Ω (brown-black-brown)	6
150 Ω (brown-green-brown)	7
220 Ω (red-red-brown)	8
330 Ω (orange-orange-brown)	9
470 Ω (yellow-violet-brown)	10
680 Ω (blue-gray-brown)	11
1000 Ω (brown-black-red)	12
1500 Ω (brown-green-red)	13
2200 Ω (red-red-red)	14
3300 Ω (orange-orange-red)	15
4700 Ω (yellow-violet-red)	16
6800 Ω (blue-gray-red)	17
10 KΩ (brown-black-orange)	18



Pictorial 2
(Repeat)

In the same manner, install the remaining resistors on rotary switch D, as follows:

CONNECT A	TO LUG
( ) 15 KΩ (brown-green-orange)	1
( ) 22 KΩ (red-red-orange)	2
( ) 33 KΩ (orange-orange-orange)	3
( ) 47 KΩ (yellow-violet-orange)	4
( ) 68 KΩ (blue-gray-orange)	5
( ) 100 KΩ (brown-black-yellow)	6
( ) 150 KΩ (brown-green-yellow)	7
( ) 220 KΩ (red-red-yellow)	8
( ) 330 KΩ (orange-orange-yellow)	9
( ) 470 KΩ (yellow-violet-yellow)	10
( ) 680 KΩ (blue-gray-yellow)	11
( ) 1 megohm (brown-black-green)	12
( ) 1.5 megohm (brown-green-green)	13
( ) 2.2 megohm (red-red-green)	14
( ) 3.3 megohm (orange-orange-green)	15
( ) 4.7 megohm (yellow-violet-green)	16
( ) 6.8 megohm (blue-gray-green)	17
( ) 10 megohm (brown-black-blue)	18

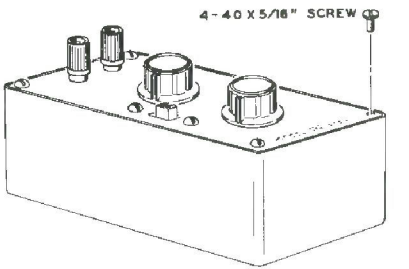


Detail 2B

(✓) Slip the resistor mounting ring over the resistor mounted on the rotary switches. The resistors should be placed on the inside of each circle as shown in Detail 2B. The mounting ring should be pushed close to the resistor bodies and the leads bent around the mounting ring to make a good mechanical connection. Cut off the excess resistor lead lengths. Now flow solder smoothly over each joint.

( ) Solder a 2" wire from binding post base A to the resistor mounting ring.

NOTE: The blue and white identification label shows the Model Number and Production Series Number of your kit. Refer to these numbers in any communications with the Heath Company: this assures you that you will receive the most complete and up-to-date information in return.



PICTORIAL 3

(✓) Carefully peel away the backing paper from the identification label. Then press the label into position on the inside of the case.

( ) Refer to Pictorial 3 and mount the front panel in the case with the 4-40 x 5/16" screws. Do not overtighten the screws or you may damage the case.

This completes assembly.

APPLICATIONS

In radio or television service work, the Heathkit Resistance Substitution Box will prove of great assistance in experimentally determining the desired value of a charred or unmarked resistor through temporary substitution. It can also be substituted for any resistor in a circuit so that the value of the resistor may be changed during operation in order to determine the desired resistance value that will provide maximum circuit performance. No attempt will be made to detail all of the various applications; through continued usage many additional applications of the Resistance Substitution Box will suggest themselves to the serviceman.

In laboratory or circuit development work, the Resistance Substitution Box will prove invaluable. The advantages of using several Resistance Substitution Boxes are obvious, as any change in a circuit constant usually requires a corresponding change in some other component. By having Resistance Substitution Boxes connected in the plate, grid, cathode or screen supply circuits, the entire experimental setup can be quickly changed.

Because the Heathkit Resistance Substitution Box kit uses standard EIA values, it is possible to select from your working stock the exact resistor needed for any application. The resistors used are all rated at 1 watt and this rating should not be exceeded in use. The continuous operating voltage rating of 500 volts should be observed to prevent a flashover within the unit.

IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.

2. It is interesting to note that about 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered properly.

3. Check the values of the component parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.

4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.

5. An ohmmeter can be used to check the resistance values as the switches are turned to each position. Make sure the knob pointers line up properly with the markings on the panel.

Refer to the Kit Builders Guide for Service and Warranty information.

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

CUT ALONG DOTTED LINE

FOR PARTS REQUESTS ONLY

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

SEND TO:

HEATH COMPANY
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only):
616 982-3571

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

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

Total enclosed $_____

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

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

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

Model # _____ Invoice # _____

Date Purchased _____ Location Purchased _____

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

THIS FORM IS FOR U.S. CUSTOMERS ONLY — OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

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.

Replacement parts are maintained specifically to repair Heath products. Parts sales for other reasons will be declined.

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.

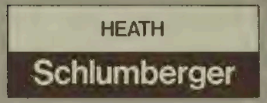
If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- 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



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