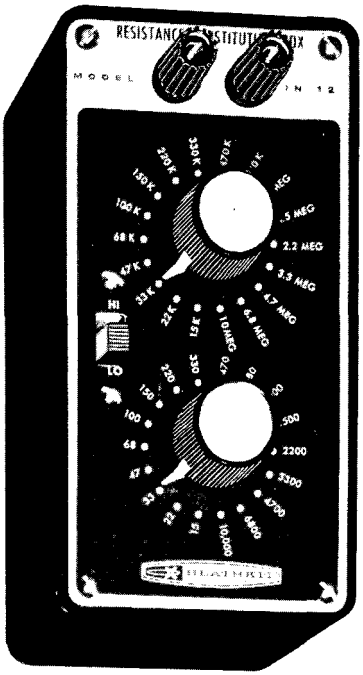
HEATHKIT

RESISTANCE SUBSTITUTION BOX

MODEL IN-12



SPECIFICATIONS

Range	15 ohms to 10 megohms
Power Rating	1 watt -- all values
Accuracy	± 10% RTMA values
Voltage Rating	500 volts (continuous duty all values)
Dimensions overall	6" long x 3" wide x 3" high.
Shipping Weight	3 lbs.

2/28/63

PRICE $1.00

HEATHKIT®
ASSEMBLY MANUAL

HEATHKIT® by DAYSTROM

RESISTANCE SUBSTITUTION BOX

MODEL IN-12

ASSEMBLY AND OPERATION OF THE HEATHKIT RESISTANCE SUBSTITUTION BOX IN-12

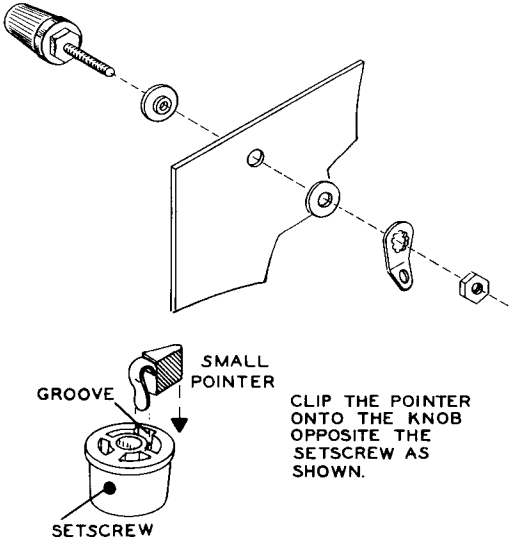
The Heathkit Resistance Substitution Box provides a rapid and flexible method of determining resistance values when working on electronic circuits. Its usefulness will many times repay a little extra care devoted to its construction. Upon receiving the kit, unpack it carefully and check each part against the parts list. In this way you will become familiar with the various components and also will avoid throwing away any parts with the packing material.

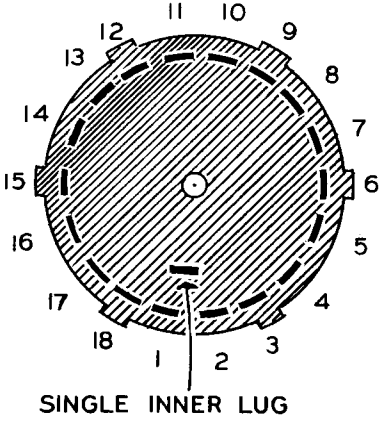
NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

CONSTRUCTION

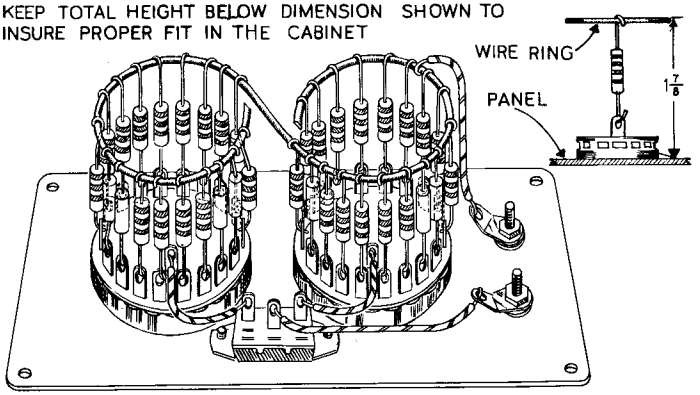
The construction of this kit is extremely simple. Reference to the notes below should prove helpful as they explain the method which was found to be most convenient for wiring.

1. Refer to the detail drawing below and mount the terminals to the panel. Both terminals are insulated from the panel with fiber washers. Keep the solder lugs pointed in the direction shown in the Pictorial. Install a cap on each terminal.
2. Mount the SPDT slide switch on the panel. See the pictorial for proper positioning of the switch lugs.
3. The major portion of wiring concerns connecting resistors to the rotary switches and figure 8 ring. The resistors for each switch group should be first identified by referring to the color code chart on Page 4 and then arranged in logical installation sequence so that they can be readily installed. The switch leads of all resistors should be cut so that a maximum length of 3/8" remains. Do not cut the other resistor lead at this time.





4. The resistors are connected to the rotary switches before the switches are mounted on the panel. One switch should be completely wired before the second is started. To help in getting the resistors in the proper sequence, the lugs around the outer edge of the rotary switches should be regarded as numbered in the manner as shown in the drawing. The single inner lug of the switch should be used as a reference starting point. When viewing the switch from the rear, the numbering system should be visualized as counterclockwise, starting from the locating inner lug with the lowest resistance value. See the Chart on Page 4.
5. Begin the actual wiring by first connecting a 1-1/2" wire to the single inner lug. sistor lead and dressing the lead through the switch lug. After the resistors have been mounted on one switch, proceed to wire the second switch in a similar manner. Solder connections.
6. Mount the switches on the panel using a control lockwasher between the switch and panel. The switch with the group of resistors from 15K to 10 megohms should be located nearest the two terminals. Position the switches so that the single inner lugs are as shown in the pictorial.



WIRING PICTORIAL

7. Slip the figure 8 wire ring over the leads of the resistors so that the resistor leads are inside of each of the figure 8 loops. The loops should be pushed close to the resistor bodies and then the leads bent partially around the wire loops so as to make a good mechanical joint. Flow solder smoothly over each joint and trim off excess resistor leads.
8. Following the pictorial, connect the two wire leads from the rotary switches to the proper lugs on the SPDT switch, a wire from the figure 8 ring to the input terminal shown, a lead from the center lug on the SPDT switch to the other input terminal.
9. Refer to the knob preparation detail and snap the knob pointers onto the knobs as shown.
10. The knobs should now be put on the switch shafts so that they index properly. One easy method, which does not require measuring equipment, is to look at the edge of the rotary switch and note the setting of switch lug contact wiper. It can easily be spotted if the shaft is rotated. For example, if the wiper is in contact with the lug on which the 6.8 megohm resistor is mounted, set the pointer to the 6.8 megohm panel marking and then tighten the knob setscrew. This procedure should be followed for the mounting of both knobs.
11. Place the entire assembly in the cabinet, run the four long screws through the panel and tighten them so as to hold the assembly firmly in place. This completes construction of the kit.

CHART NO. 1 RANGE 15 to 10K

Switch Position	Value	Color Code
1	15	Brown Green Black
2	22	Red Red Black
3	33	Orange Orange Black
4	47	Yellow Violet Black
5	68	Blue Grey Black
6	100	Brown Black Brown
7	150	Brown Green Brown
8	220	Red Red Brown
9	330	Orange Orange Brown
10	470	Yellow Violet Brown
11	680	Blue Grey Brown
12	1000	Brown Black Red
13	1500	Brown Green Red
14	2200	Red Red Red
15	3300	Orange Orange Red
16	4700	Yellow Violet Red
17	6800	Blue Grey Red
18	10,000	Brown Black Orange

CHART NO. 2 RANGE 15K to 10 Meg.

Switch Position	Value	Color Code
1	15 K	Brown Green Orange
2	22 K	Red Red Orange
3	33 K	Orange Orange Orange
4	47 K	Yellow Violet Orange
5	68 K	Blue Grey Orange
6	100 K	Brown Black Yellow
7	150 K	Brown Green Yellow
8	220 K	Red Red Yellow
9	330 K	Orange Orange Yellow
10	470 K	Yellow Violet Yellow
11	680 K	Blue Grey Yellow
12	1 Meg.	Brown Black Green
13	1.5 Meg.	Brown Green Green
14	2.2 Meg.	Red Red Green
15	3.3 Meg.	Orange Orange Green
16	4.7 Meg.	Yellow Violet Green
17	6.8 Meg.	Blue Grey Green
18	10 Meg.	Brown Black Blue

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 radio 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, and through continued usage many additional applications of the Resistance Substitution Box will suggest themselves to the service man.

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 invariably 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 RTMA values, it is then 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.

SERVICE

In event continued operational difficulties of the completed instrument are experienced, the facilities of the Daystrom, Limited Service Department are at your disposal, or you may contact our Technical Consultation Department by mail. You will be charged a minimal service fee, plus the price of any additional material or parts that may be required. THESE SERVICE POLICIES APPLY ONLY TO THE COMPLETED INSTRUMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned NOT repaired.

REPLACEMENTS

Material supplied with Heathkits has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to Daystrom, Limited and supply all of the following information:

A. Thoroughly identify the part in question by using the part number and description found in the manual parts list.
B. Identify the type and model number of kit in which it is used.
C. Mention date of purchase.
D. Describe the nature of defect or reason for requesting replacement.

Daystrom, Limited will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SHIPPING INSTRUCTIONS

In the event that your instrument must be returned for service, these instructions should be carefully followed.

Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: DAYSTROM, LIMITED
Cooksville, Ontario

ATTACH A LETTER TO THE OUTSIDE OF THE CARTON BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Also, include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by insured parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in HIS OPINION, the article is inadequately packed for shipment.

PARTS LIST
MODEL IN-12

PART No.	PARTS Per Kit	DESCRIPTION
Resistors		
1-1A	1	470 Ω
1-2A	1	1000 Ω
1-3A	1	3300 Ω
1-5A	1	22 KΩ
1-7A	1	47 KΩ
1-8A	1	68 KΩ
1-9A	1	10 KΩ
1-12A	1	15 Ω
1-13A	1	22 Ω
1-14A	1	33 Ω
1-15A	1	47 Ω
1-16A	1	68 Ω
1-17A	1	100 Ω
1-18A	1	150 Ω
1-19A	1	220 Ω
1-20A	1	330 Ω
1-21A	1	680 Ω
1-22A	1	1500 Ω
1-23A	1	2200 Ω
1-24A	1	4700 Ω
1-25A	1	6800 Ω
1-26A	1	15 KΩ
1-27A	1	33 KΩ
1-28A	1	100 KΩ
1-29A	1	150 KΩ
1-30A	1	220 KΩ
1-31A	1	330 KΩ
1-32A	1	470 KΩ
1-33A	1	680 KΩ
1-34A	1	1 megohm
1-35A	1	1.5 megohm
1-36A	1	2.2 megohm
1-37A	1	3.3 megohm
1-38A	1	4.7 megohm
1-39A	1	6.8 megohm
1-40A	1	10 megohm

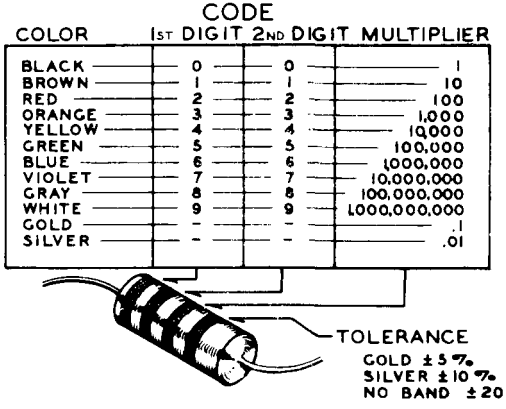
PART No.	PARTS Per Kit	DESCRIPTION
Hardware		
250-27	4	6-32 x 2" screw
250-9	2	6-32 x 3/8" screw
252-3	2	6-32 nut
252-7	2	Control nut
253-1	2	#6 flat fiber washer
253-2	2	#6 fiber shoulder washer
253-10	2	Control flat washer
254-4	2	Control lockwasher
259-1	2	#6 solder lug
Miscellaneous		
344-1	1	Length hookup wire
408-M3	1	Case
427-2	2	Binding post base
462-139	2	Knob
463-27	2	Knob pointer
60-4	1	SPDT slide switch
63-38	2	Rotary switch
100-M16B	2	Binding post cap
213-M1	1	Figure 8 resistor mounting unit
203-M28F782, 783 784	1	Panel
331-6		Solder
595-571	1	Manual

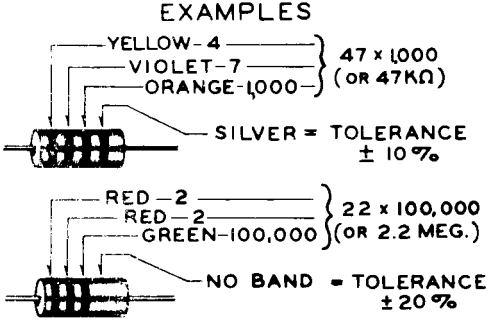
RESISTOR COLOR CODES

The colored bands around the body of a color coded resistor represent its value in ohms. These colored bands are grouped toward one end of the resistor body. Starting with this end of the resistor, the first band represents the first digit of the resistance value; the second band represents the second digit; the third band represents the number by which the first two digits are multiplied. A fourth band of gold or silver represents a tolerance of ±5% or ±10% respectively. The absence of a fourth band indicates a tolerance of ±20%.

The physical size of a composition resistor is related to its wattage rating. Size increases progressively as the wattage rating is increased. The diameters of 1/2 watt, 1 watt and 2 watt resistors are approximately 1/8", 1/4" and 5/16", respectively.

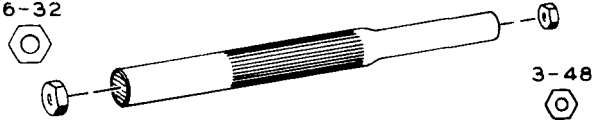
The color code chart and examples which follow provide the information required to identify color coded resistors.





USING A PLASTIC NUT STARTER

A plastic nut starter offers a convenient method of starting the most used sizes: 3/16" and 1/4" (3-48 and 6-32). When the correct end is pushed down over a nut, the pliable tool conforms to the shape of the nut and the nut is gently held while it is being picked up and started on the screw. The tool should only be used to start the nut.



WARRANTY

Daystrom, Limited warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Daystrom, Limited shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Daystrom, Limited and in no event shall Daystrom, Limited be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

NOTE: The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

DAYSTROM, LIMITED

SPECIFICATION CHANGES

All prices are subject to change without notice. Daystrom, Limited reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

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595-571