ID-22

PRICE $1.00

HEATH COMPANY • BENTON HARBOR, MICHIGAN

# HEATHKIT®
# ASSEMBLY MANUAL

HEATHKIT by Daystrom

## ELECTRONIC SWITCH

MODEL ID-22

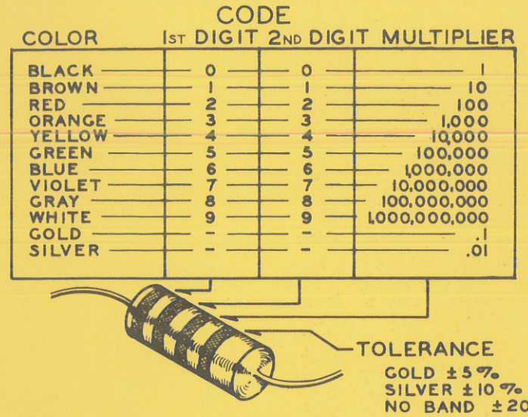
# RESISTOR AND CAPACITOR COLOR CODES

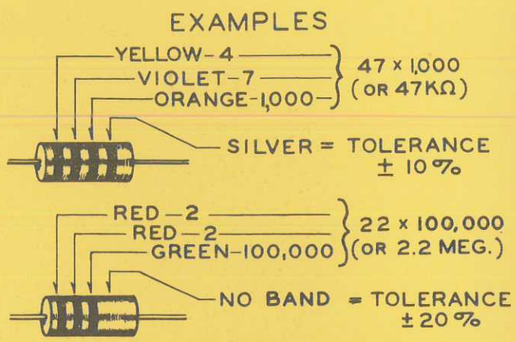
## RESISTORS

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.

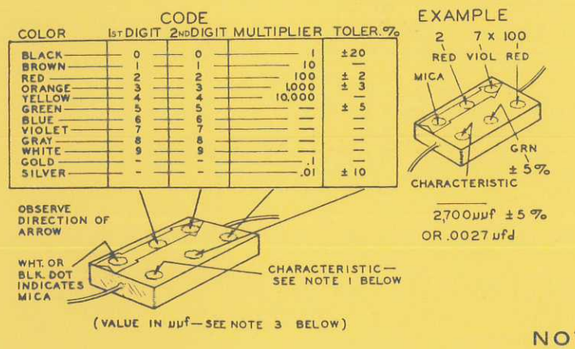



## CAPACITORS

Generally, only mica and tubular ceramic capacitors, used in modern equipment, are color coded. The color codes differ somewhat among capacitor manufacturers, however the codes shown below apply to practically all of the mica and tubular ceramic capacitors that are in common use. These codes comply with EIA (Electronics Industries Association) Standards.

### MICA

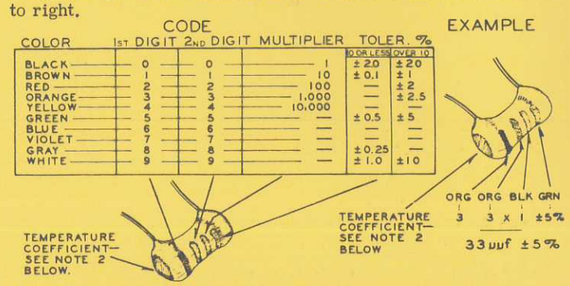






### TUBULAR CERAMIC

Place the group of rings or dots to the left and read from left to right.







### NOTES:

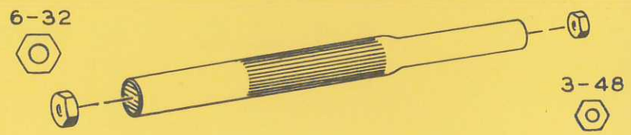
1. The characteristic of a mica capacitor is the temperature coefficient, drift capacitance and insulation resistance. This information is not usually needed to identify a capacitor but, if desired, it can be obtained by referring to EIA Standard, RS-153 (a Standard of Electronic Industries Association.)

2. The temperature coefficient of a capacitor is the predictable change in capacitance with temperature change and is expressed in parts per million per degree centigrade. Refer to EIA Standard, RS-198 (a Standard of Electronic Industries Association.)

3. The farad is the basic unit of capacitance, however capacitor values are generally expressed in terms of μfd (microfarad, .000001 farad) and μμf (micro-micro-farad, .000001 μfd); therefore, 1,000 μμf = .001 μfd, 1,000,000 μμf = 1μfd.

## 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.




# ASSEMBLY AND OPERATION OF THE HEATHKIT ELECTRONIC SWITCH

## MODEL ID-22

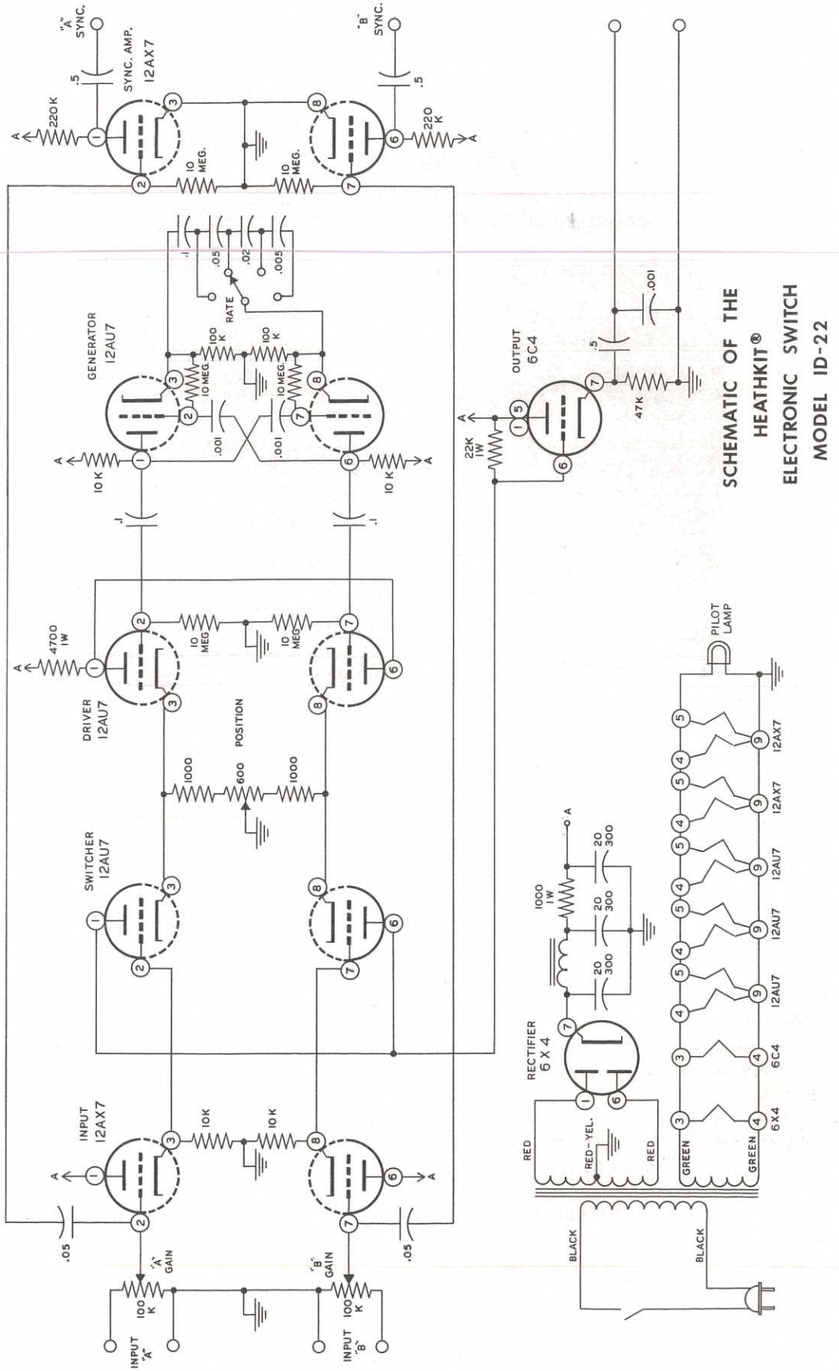

## SPECIFICATIONS

| | |
|---|---|
| Switching Rates: | Approximately 150, 500, 1500 and 5000 cycles |
| Signal Frequency Response: | ±1 db 0-100 kc |
| Input Impedance: | 100 KΩ control |
| Output Impedance: | 1000 Ω shunted by 1000 μμf |
| Maximum Signal Output: | 25 volts peak-to-peak |
| Maximum Signal Gain: | 5 times |
| Maximum Input at Maximum Gain: | 1.8 volts RMS (5 volts peak-to-peak) |
| Switching Transients: | 2 volts peak-to-peak, see NOTE below*. |
| Tube Complement: | 2 - 12AX7 |
| | 3 - 12AU7 |
| | 1 - 6C4 |
| | 1 - 6X4 |
| Power Requirements: | 105-125 volts, 50-60 cycles, 30 watts |
| Dimensions: | 9 1/2" wide x 6 1/2" high x 5" deep |
| Shipping Weight: | 8 lbs. |

*NOTE: The switching transient may overload high gain oscilloscope amplifiers. Low level signals should be amplified to 0.1-1.0 volt levels before connection to the Electronic Switch.



7/20/62




SCHEMATIC OF THE HEATHKIT® ELECTRONIC SWITCH MODEL ID-22



## INTRODUCTION

The Heathkit Electronic Switch model ID-22 is a device which permits simultaneous observation of two signals on your oscilloscope screen.

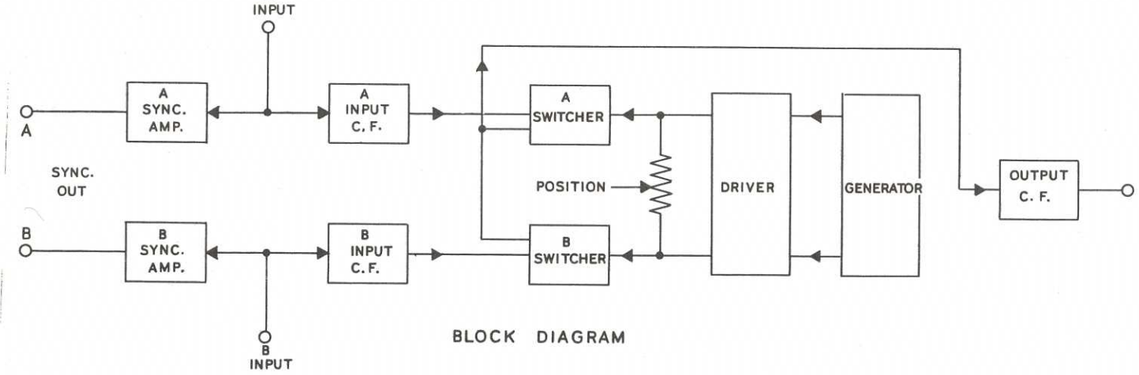
Careful assembly of this kit will provide you with an instrument that for many years will deliver the fine performance of which this design is capable. Such careful assembly is most readily achieved by using as your helpers:

The identification aids on the inside covers of this manual.
The large scale pictorials included with this manual.
The instructions on soldering on Page 8.
The step-by-step assembly and wiring instructions in this manual.
The highest skill and workmanship that only you can provide.

Instrument quality performance requires instrument quality construction.

## CIRCUIT DESCRIPTION

The Heathkit Electronic Switch will accommodate two signals and alternately present either one to the output terminals. The alternation from one signal to the other may be made at any one of four switching rates. These rates are determined by four wide-tolerance condensers and thus the chance that they will be harmonically related is negligibly small. It will, therefore, be possible to select a rate sufficiently different from the signal frequency to prevent both the signal and the switching pulse from appearing statically on your oscilloscope screen.

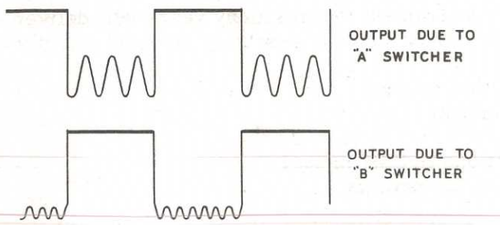



BLOCK DIAGRAM

The Block Diagram shows the basic circuit. A signal applied to the A input may be attenuated to a suitable level. It is then fed to both a sync amplifier and a cathode follower. The sync amplifier output may be used to lock the oscilloscope sweep or time base to the signal frequency through the external sync connection. The cathode follower is directly coupled to the grid of the switching tube.

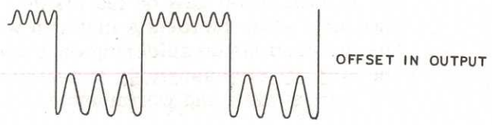
The switch generator produces square waves in the plate circuits of the twin triode. The square wave of one plate is coupled to the grid of one half of the switch driver twin triode. The cathode of the switch driver tube is directly connected to the cathode of the switcher tube. The square wave alternately permits the switcher tube to operate normally or drives it into cut-off. The square wave of the other plate of the generator performs similarly for the other half of the switch driver and the switcher for the B signal.

When the A switcher is amplifying normally, the B switcher is cut off. When the A switcher is cut off, the B switcher is amplifying normally. The plates of the A and B switchers are connected together and fed through a common load resistor. Thus the A and B signals will appear alternately across the load resistor. See Sketch 1.



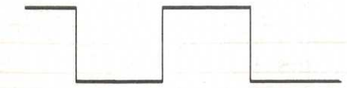

Sketch 1

If the switcher tubes operate with different bias values the normal plate currents will vary, as will the plate voltages and the outputs will be offset. See Sketch 2.

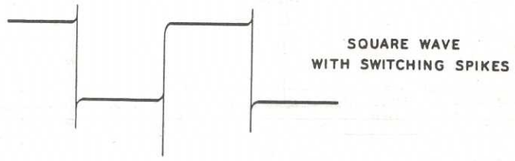



Sketch 2

If the outputs are offset and the A and B signals are both zero, the output will be a square wave. See Sketch 3.



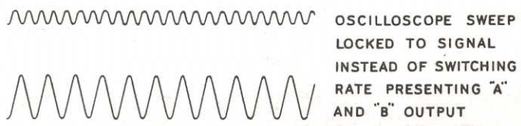

Sketch 3




Sketch 4

The transition from one tube to the other tube does not occur instantaneously and thus a switching transient is generated, which appears as a fine spike on the trace. The actual magnitude of the spike varies with the individual tube used. See Sketch 4.

Using an asynchronous switching rate and locking the oscilloscope sweep to the signal frequency rather then the switching rate will mask the switching wave and transients and present only the A and B signals.




Sketch 5

The position control varies the operating bias and the offset. The traces may thus be separated or made to overlap each other on the oscilloscope screen.

The signals at the switcher plates are directly coupled to the grid of a cathode follower tube. The output of the cathode follower is fed through a large condenser to the output binding post.

The output terminals are shunted by a condenser to reduce the switching transients. The high frequency response is restricted by this condenser. Increased high frequency response (and larger transient spikes) may be obtained by omitting the condenser. Conversely, for low frequency applications a larger value condenser may be used to effectively eliminate the transients. Values larger than .01 μfd will do little to reduce the transient but may impair the quality of the presentation by rounding and tilting of the switching square wave.



## STEP-BY-STEP ASSEMBLY

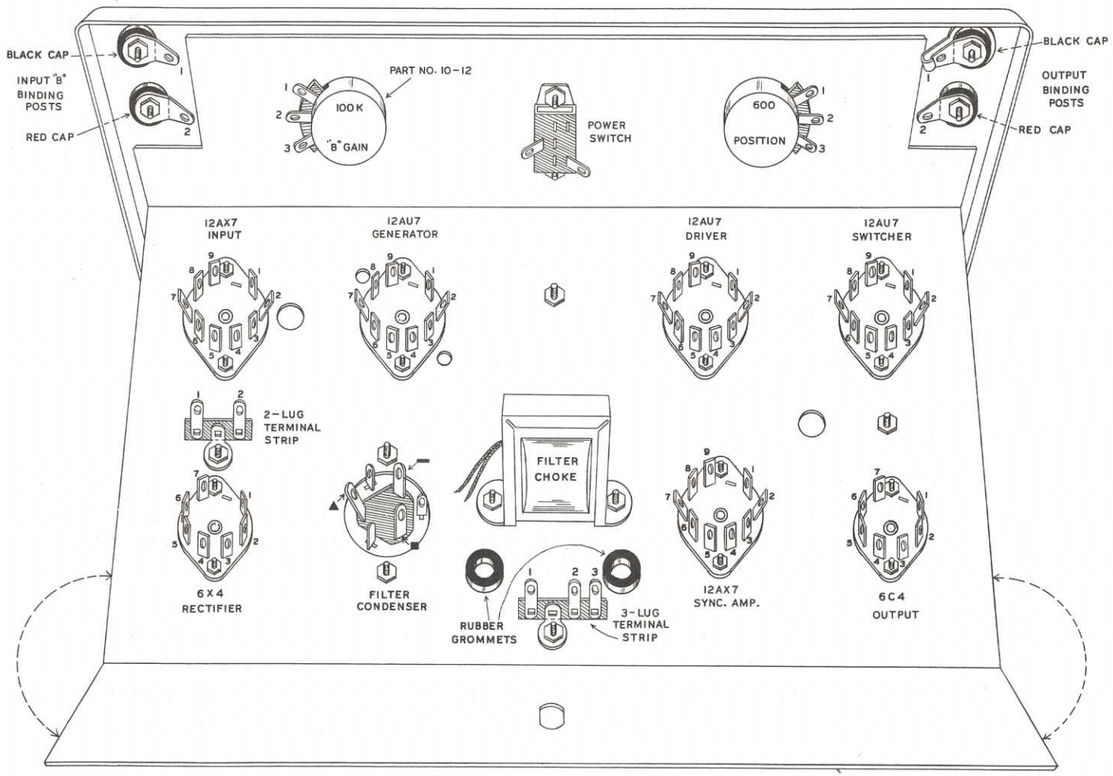
A kit of parts can be assembled into the finished product in a variety of ways; from pictorials, photographs or the circuit diagram alone. However, even skilled and professional persons have discovered that a combination of pictorials and step-by-step written instructions provide the fastest, most convenient way. It also guards against the disappointment of failure to operate after construction is completed, because of a single, hard-to-find omission.

The written assembly instructions in this manual are divided into small operations or steps. Each step is a complete operation. Read the entire step through, then do that operation and check it off as it is completed. After an interruption, it is easy to find where you left off by the check marks. Read over the last checked step and you are all ready to continue.

The major pictorials in this manual are reproduced on large scale separate sheets. Fasten the appropriate pictorial on the wall over your work space. This will save you paging back and forth in the manual.

In the mechanical assembly, use lockwashers under all 6-32 nuts and between all controls or switches and the mounting surface.

In the wiring (S) means solder this connection; (NS) means do not solder yet as more wires will be connected to this point. If more than one wire is soldered to one point, soldering instructions will read as follows: (S-3) meaning solder this connection which has three wires running to it. This will provide a running check on multiple connections.




PICTORIAL 1

( ) Form the heavy bare wire as shown in Figure 8 and install by slipping the hook around the two solder lugs (S-3) on output binding post 1. Full size bus template appears on fold-ins.

( ) Bend all the upright leads around the bus and solder all eleven connections. See Figure 9. Cut off excess leads.

( ) Connect a short bare wire between lug 2 (S) on the POSITION control and the ground bus (S).

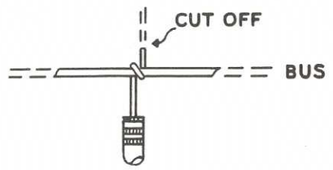


Figure 9

( ) Connect another short bare wire between the solder lug (S-2) on input B binding post 1 and the ground bus (S).

( ) Connect a 5" wire between lug 3 (S-2) on the A GAIN control and the ground bus (S).

( ) Twist two 5" lengths of wire together and connect one end to the slide switch with a wire to each lug (S). Connect the other end to the 3-lug terminal strip with one wire to lug 2 (NS) and the other wire to lug 3 (S-2).

( ) Install the line cord through the hole in the rear of the chassis. Connect one lead to lug 1 (S-2) and the other lead to lug 2 (S-2) on the 3-lug terminal strip.

( ) Refer to the inset of Pictorial 4 and install the line cord strain relief.

( ) Connect an 8" wire with one end to pin 7 (S-2) on the sync amplifier socket. Leave the other end loose.

( ) Cut the spirashield and large sleeving to 8".

( ) Unwind about 2" of the Spirashield. (CAUTION: This is copper wire, do not stretch.) Slip the large sleeving over it. The unwound part will be the ground connection.

( ) Slip the shield over the wire with the ground connection last. Now connect the wire to lug 1 (S-2) on the 2-lug terminal strip near the input socket.

( ) Connect an 8" wire between pin 2 (S-2) on the sync amplifier socket and after placing it through the Spirashield to lug 2 (S-2) on the 2-lug terminal strip.

( ) Connect the ground connection of the Spirashield to the ground bus (S).

This completes the wiring of the instrument.

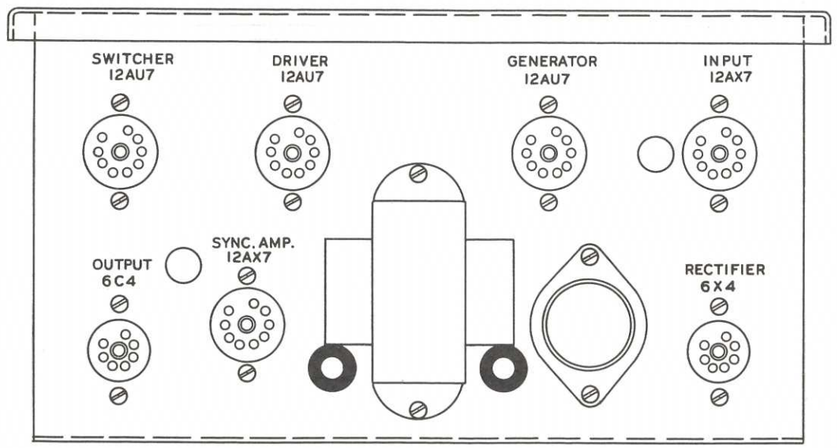


Figure 10



( ) Install the tubes in their proper sockets. See Figure 10 on Page 16.

( ) Install the handle on the cabinet with #10 x 1/2" sheet metal screws.

( ) Install the rubber feet in the four holes in the bottom of the cabinet. See Figure 11. Use 6-32 x 1/2" screws, #8 flat washers, #6 lockwashers, and 6-32 nuts.

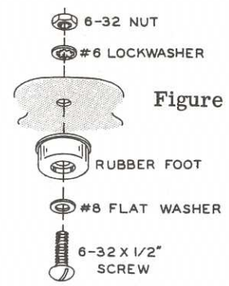


Figure 11

## INITIAL TESTS

Shake out all wire trimmings and loose particles of solder. Inspect the wiring carefully for lead dress or positioning of the wiring. Inspect each solder joint.

Plug the line cord into a 105-125 volt 50-60 cycle AC outlet. DO NOT plug into a source of higher voltage or lower frequency, or a DC outlet, as an incorrect power source will damage the transformer. Turn the power switch on and observe the tubes and the pilot lamp light up. If they do not, turn the power off and investigate the filament circuit wiring.

Testing the instrument for switching:
Connect the output terminals of the instrument to the vertical input terminals of an oscilloscope. Observe a pair of horizontal lines that can be merged into one line by adjustment of the POSITION control on the electronic switch. Set the POSITION control for two lines and adjust the oscilloscope to show the square wave. Inspect the wave shape for all four switching RATE positions. This shape may not be fully square during this initial test but after a few hours of operation, it will be found that the tubes adjust themselves to the circuit and produce a substantially square wave on all RATE settings.

Testing the amplifier and sync channel:
Apply a test signal to the instrument. This signal may be obtained from an audio generator or from the filament supply of the electronic switch. If a generator is not available, connect a lead between the red A INPUT binding post and a lug on the pilot light socket. Turn the A GAIN control 1/3 on. If no change is observed on the oscilloscope, try the other lug on the pilot light.

Adjust the oscilloscope for a presentation of several nearly stationary cycles of the signal frequency. Connect the A SYNC OUT to the external sync input on the oscilloscope and switch to external sync. Note that the signal wave can readily be "locked-in."

Vary the switching rate and observe that the signal remains stationary with varying appearances of the line trace. At least one rate should give an adequate simulation of a continuous line. Repeat these tests for the B channel.

Install the instrument in the cabinet with two #6 sheet metal screws through the back of the cabinet into the chassis.

## APPLICATION

An electronic switch is generally used to observe two signals, related in frequency, simultaneously on an oscilloscope screen. The oscilloscope must be synchronized with one of the two signals, NOT with the switching rate. If the signal frequencies are not identical, the oscilloscope sweep rate should be selected to operate at a sub-multiple of both signal frequencies.

Example: A is 200 cycles. B is 500 cycles.
Oscilloscope sweep speed of 100 cycles will present 2 cycles of A and 5 cycles of B.
Sync may be obtained from A or B. Use the one that gives the best results.

Interesting observations of this type may be obtained by using input and output signals of a harmonic distortion meter for A and B.

Two related transients, particularly recurrent phenomena, may be observed. For instance, a flashing light may provide a pair of signals: a signal derived from the closing of the switch and a second signal derived through photocell and amplifier caused by the light itself. The time lag between the two signals may be measured by inserting blanking pulses into oscilloscope trace.

Even low frequency phenomena (DC) signals may be partly observed on an AC-coupled oscilloscope. The Electronic Switch is directly coupled up to the switcher tube and DC inputs will have the same effect as the positioning control. Thus a DC signal will show as an offset in the traces. The operation will not fully equal the DC oscilloscope because the base line (the other trace) will be displaced an equal amount in the opposite direction.

## IN CASE OF DIFFICULTY

If difficulties are experienced in the initial testing of the completed instrument, proceed as outlined below:

1. Check the wiring step-by-step. If possible, have a friend check it for you. Even though unskilled, he will frequently spot a mistake consistently overlooked by the constructor.
2. Inspect visually for malfunctioning, such as tubes lighting, discoloring of resistors due to overheating, etc.
3. Inspect electrically with a voltmeter. The nominal voltages between tube socket pins and chassis are tabulated below. These voltages were measured with a vacuum tube voltmeter with 11 megohm input resistance. Lower resistance meters may give lower readings. Normal deviations due to line voltage and component variation may reach ±20%.

| TUBE | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 |
|---|---|---|---|---|---|---|---|---|---|
| 6X4 Rectifier | 210AC | NC | 6.3AC | 0 | NC | 210AC | 280 | | |
| 12AX7 Input | 250 | 0 | 2.5 | 6.3AC | | 250 | 0 | 2.5 | 0 |
| 12AU7 Generator | 230 | NS | 180 | 6.3AC | | 230 | NS | 180 | 0 |
| 12AU7 Driver | 180 | NS | 14 | 6.3AC | | 180 | NS | 14 | 0 |
| 12AU7 Switcher | 140 | 2.5 | 14 | 6.3AC | | 140 | 2.5 | 14 | 0 |
| 12AX7 Sync. Amp. | 100 | 0 | 0 | 6.3AC | | 100 | 0 | 0 | 0 |
| 6C4 Output | 250 | NC | 6.3AC | 0 | 250 | 140 | 140 | | |

NS - not significant, as the measurement alters the operation. NC - no connection.

4. Discrepancies of indicated voltages warrant investigation of the particular circuit involved. Wiring errors or faulty components may be found with inspection or resistance measurements.
5. Consider the characteristics of the circuit as outlined in the circuit description. An under-

## BIBLIOGRAPHY

There are many different ways in which the design of an electronic switch may be approached successfully. Descriptions of other methods may be of interest and therefore some of the many articles published are listed on Page 19. Most libraries either have, or can get for you, the publications listed.


Electronics, April 1946, p. 150
Radio and Television News, April 1950, p.38
Electronics, April 1951, p. 136
Radio and Television News, July 1951, p. 32
Radio Electronics, May 1954, p. 54
Radio Electronics, January 1949, p. 42
Audio Engineering, April 1951, p. 2
Electronics, May 1951, p. 136
Electronics, November 1951, p. 136
Electronics, July 1952, p.139; Nov. 1952, p.172




## SERVICE

If, after applying the information in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, YOU MUST QUALIFY for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under In Case Of Difficulty. Possibly it will not be necessary to write.

2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units, and anything else that might help to isolate the cause of trouble.

3. Report fully on the results obtained when testing the unit initially and when following the suggestions under In Case Of Difficulty. Be as specific as possible and include voltage readings if test equipment is available.

4. Identify the kit model number and date of purchase, if available. Also mention the date of the kit assembly manual. (Date at bottom of Page 1.)

5. Print or type your name and address, preferably in two places on the letter.

With the preceding information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed equipment to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a minimal service fee, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by Authorized HEATHKIT Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service for your HEATHKIT equipment. Although charges for local service are generally somewhat higher than for factory service, the amount of increase is usually offset by the transportation charge you would pay if you elected to return your kit to the Heath Company.

HEATHKIT Service Centers will honor the regular 90 day HEATHKIT Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company; however, it will be necessary that you verify the purchase date of your kit.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if the Service Center assists you in locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT dealer in order to be eligible for parts replacement under the terms of the Warranty.

THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.

## REPLACEMENTS

Material supplied with HEATHKIT products has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally, improper operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to the Heath Company 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.

The Heath Company 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: HEATH COMPANY
Benton Harbor, Michigan

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.



## WARRANTY

Heath Company 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, Heath Company 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 Heath Company and in no event shall Heath Company 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.

HEATH COMPANY

## PARTS LIST

| PART No. | PARTS Per Kit | DESCRIPTION |
|---|---|---|
| **Resistors** | | |
| 1-9 | 2 | 1000 Ω |
| 1-20 | 4 | 10 KΩ |
| 1-25 | 1 | 47 KΩ |
| 1-26 | 2 | 100 KΩ |
| 1-29 | 2 | 220 KΩ |
| 1-40 | 6 | 10 megohm |
| 1-2A | 1 | 1000 Ω 1 watt |
| 1-24A | 1 | 4700 Ω 1 watt |
| 1-5A | 1 | 22 KΩ 1 watt |
| **Condensers** | | |
| 21-14 | 3 | .001 μfd disc |
| 23-2 | 1 | .005 μfd paper |
| 23-8 | 1 | .02 μfd paper |
| 23-59 | 3 | .05 μfd paper |
| 23-28 | 3 | .1 μfd paper |
| 23-56 | 3 | .5 μfd paper |
| 25-9 | 1 | 20-20-20 μfd 300 volt elec. |
| **Controls-Switches** | | |
| 10-34 | 1 | 600 Ω control |
| 10-40 | 1 | 100 KΩ control 1/4" |
| 10-12 | 1 | 100 KΩ control 3/8" |
| 60-1 | 1 | SPST slide switch |
| 63-88 | 1 | 4-pos. rotary switch |

| PART No. | PARTS Per Kit | DESCRIPTION |
|---|---|---|
| **Wire** | | |
| 89-1 | 1 | Line cord |
| 206-4 | 1 | length Spirashield |
| 340-2 | 1 | length #20 bare wire |
| 340-3 | 1 | length #16 bare wire |
| 344-1 | 1 | length Hookup wire |
| 346-1 | 1 | length Sleeving |
| 346-5 | 1 | length 1/4" sleeving |
| **Sheet Metal Parts** | | |
| 90-235 | 1 | Cabinet |
| 200-M94 | 1 | Chassis |
| 203-82 | F797, 798, 799 | |
| | 1 | Panel |
| 211-15 | 1 | Handle |
| **Binding Posts-Terminals-Sockets** | | |
| 100-M16B | 3 | Binding post cap, black |
| 100-M16R | 5 | Binding post cap, red |
| 427-2 | 8 | Binding post base |
| 75-17 | 16 | Insulator bushing |
| 431-15 | 1 | 1-lug terminal strip |
| 431-2 | 2 | 2-lug terminal strip |
| 431-3 | 1 | 3-lug terminal strip |
| 434-15 | 2 | 7-pin wafer socket |
| 434-16 | 5 | 9-pin wafer socket |
| 434-22 | 1 | Pilot light socket |