

# RC167

## "The Substitutor"

### SERVICE MANUAL



**SENCORE**

**"the all american line"**

## SENCORE SAFETY REMINDERS

When testing electronic equipment, there is always a danger present. Unexpected high voltages can be present at unusual locations in defective equipment. The technician should become familiar with the device he is working on and observe the following precautions.

1. An isolation transformer should always be used on equipment having one side of the AC line tied to the chassis. If an isolation transformer is not used, a severe shock hazard can result if the chassis of the equipment being serviced is tied to the "hot" side of the AC line.
2. When making test lead connections to high voltage points, remove the power. If this cannot be done, be sure to avoid contact with other equipment or metal objects. Place one hand in your pocket as a safety precaution and stand on an insulated floor to reduce the possibility of shock.
3. Discharge filter capacitors before connecting test leads to them. Capacitors can store a charge that could be dangerous to the technician.
4. Be sure your equipment is in good order. Broken or frayed test leads can be extremely dangerous and can expose the technician to dangerous potentials.
5. Remove the test leads immediately after the test has been completed to reduce the possibility of shock.
6. Do not work alone when working on hazardous circuits. Always have another person close by in case of accident. Remember, even a minor shock can be the cause of a more serious accident, such as falling against the equipment, or coming in contact with higher voltages.

## SENCORE SAFETY REMINDERS

When testing electronic equipment, there is always a danger present. Unexpected high voltages can be present at unusual locations in defective equipment. The technician should become familiar with the device he is working on and observe the following precautions.

1. An isolation transformer should always be used on equipment having one side of the AC line tied to the chassis. If an isolation transformer is not used, a severe shock hazard can result if the chassis of the equipment being serviced is tied to the "hot" side of the AC line.
2. When making test lead connections to high voltage points, remove the power. If this cannot be done, be sure to avoid contact with other equipment or metal objects. Place one hand in your pocket as a safety precaution and stand on an insulated floor to reduce the possibility of shock.
3. Discharge filter capacitors before connecting test leads to them. Capacitors can store a charge that could be dangerous to the technician.
4. Be sure your equipment is in good order. Broken or frayed test leads can be extremely dangerous and can expose the technician to dangerous potentials.
5. Remove the test leads immediately after the test has been completed to reduce the possibility of shock.
6. Do not work alone when working on hazardous circuits. Always have another person close by in case of accident. Remember, even a minor shock can be the cause of a more serious accident, such as falling against the equipment, or coming in contact with higher voltages.

## TABLE OF CONTENTS

SENCORE SAFETY REMINDERS	1
TABLE OF CONTENTS	2
DESCRIPTION	2
FEATURES	3
SPECIFICATIONS	4
OPERATION	4
Carbon Resistors	4
Wire Wound Resistors	5
Tubular Capacitors	6
Rectifiers	7
Electrolytic Capacitors	8
MOUNTING THE RC167	9
DISASSEMBLY INSTRUCTIONS	10
RC167 SCHEMATIC AND PARTS LIST	11
SERVICE AND WARRANTY	12

## DESCRIPTION

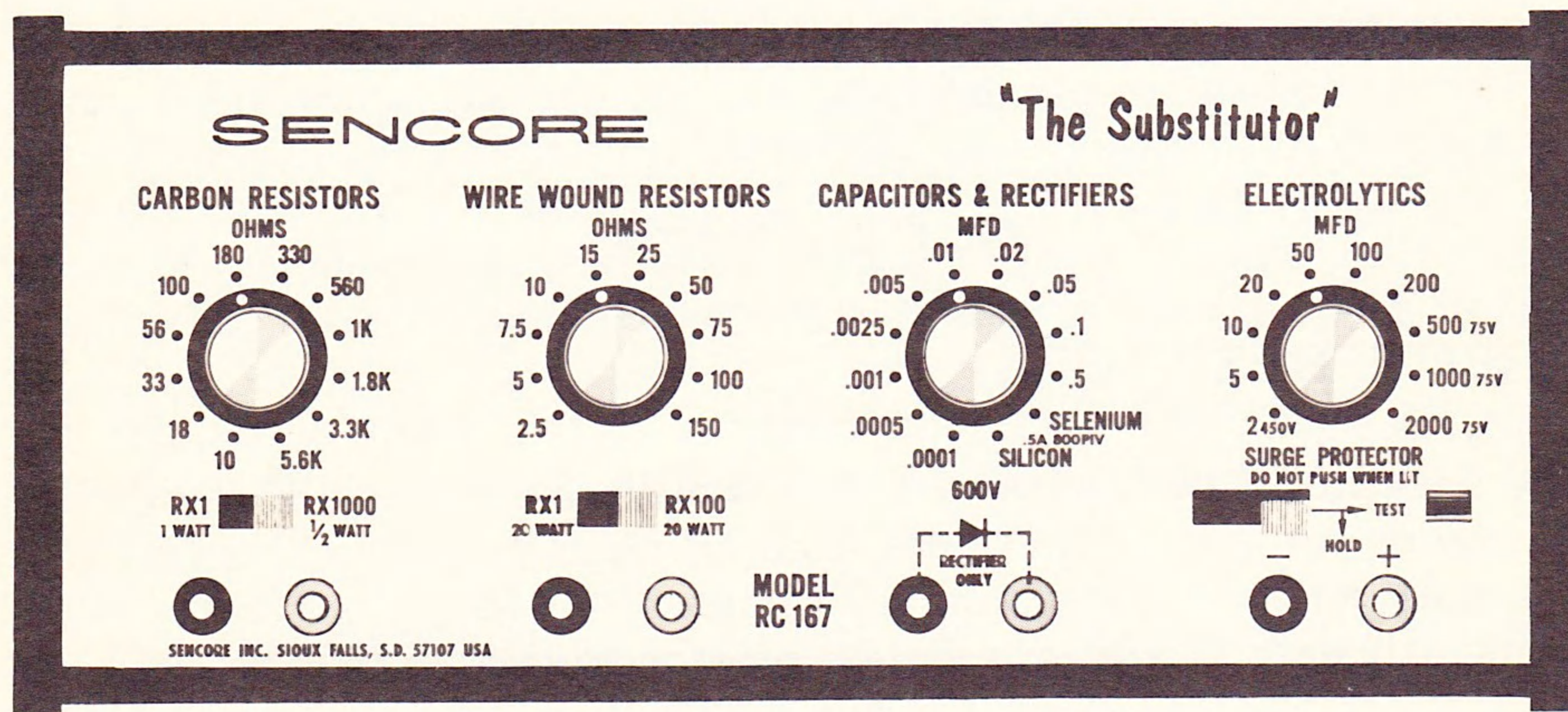
“The Substitutor”, model RC167, by Sencore offers a complete range of carbon resistors, wire wound resistors, tubular capacitors, rectifiers, and electrolytic capacitors including three high capacity 75 volt types for substitution in transistor circuits. “The Substitutor” has an application as broad as electronics itself, and saves time and trouble by eliminating the need to search out a part, tack it into the circuit and then restock the part after substitution.

Each section of “The Substitutor” can be used independently, so it is possible to substitute for several components at a time. For example, it is possible to build a complete power supply consisting of a carbon resistor, rectifier, electrolytic capacitor, and wire wound resistor, just by interconnection of the sections of the RC167.

The RC167 has two exclusive protection features built-in to make substitution a trouble-free means of servicing. A Surge Protector is employed for all electrolytics to limit the charging current to a safe level. The low voltage electrolytics capacitors are further protected by an over voltage warning light, which indicates an unsafe condition should these capacitors be connected across a potential of over 75 volts.

## FEATURES

- \* FULL RANGE OF ELECTROLYTICS including three low voltage, high capacity values for solid state substitution.
- \* EXCLUSIVE SURGE PROTECTOR to prevent arcing or heating of electrolytics.
- \* EXCLUSIVE OVERLOAD INDICATOR to prevent accidental damaging of low voltage electrolytics.
- \* SILICON AND SELENIUM RECTIFIER substitutes to help whip those power supply failures.
- \* FULL RANGE OF CARBON RESISTORS in standard values from 10 ohms to 5.6 meg ohms.
- \* HIGH POWER 20 WATT RESISTORS from 2.5 ohms to 150K ohms for convenient substitution in power circuits.
- \* EXCLUSIVE PARTS DRAWER saves your legs from running after those little extras you always seem to need.
- \* EXCLUSIVE, SPACE SAVING, GIMBAL MOUNT lets you set it on the bench or hang it on the wall or shelf.



*RC167 Front Panel*

## SPECIFICATIONS

### CARBON RESISTORS:

1 Watt, 10% (RX1)	10, 18, 33, 56, 100, 180, 330, 560, 1K, 1.8K, 1.8K, 3.3K, 5.6K
½ Watt, 10% (RX1000)	10K, 18K, 33K, 56K, 100K, 180K, 330K, 560K, 1Meg, 1.8Meg, 3.3Meg, 5.6Meg

### WIRE WOUND RESISTORS:

20 Watt, 10% (RX1)	2.5, 5, 7.5, 10, 15, 25, 50, 75, 100, 150
20 Watt, 10% (RX100)	250, 500, 750, 1K, 1.5K, 2.5K, 5K, 7.5K, 10K, 15K

### TUBULAR CAPACITORS:

600 Volt, 20%	.0001, .0005, .001, .005, .0025, .01, .02, .05, .1, .5mfd
---------------	--

### RECTIFIERS

.5A 800PIV Selenium and Silicon

### ELECTROLYTIC CAPACITORS

450 Volt (+100 -20%)	2, 5, 10, 20, 50, 100, 200mfd
75 Volt (+80 -20%)	500, 1,000, 2,000 (Protected by overvoltage indicator.)

## OPERATION

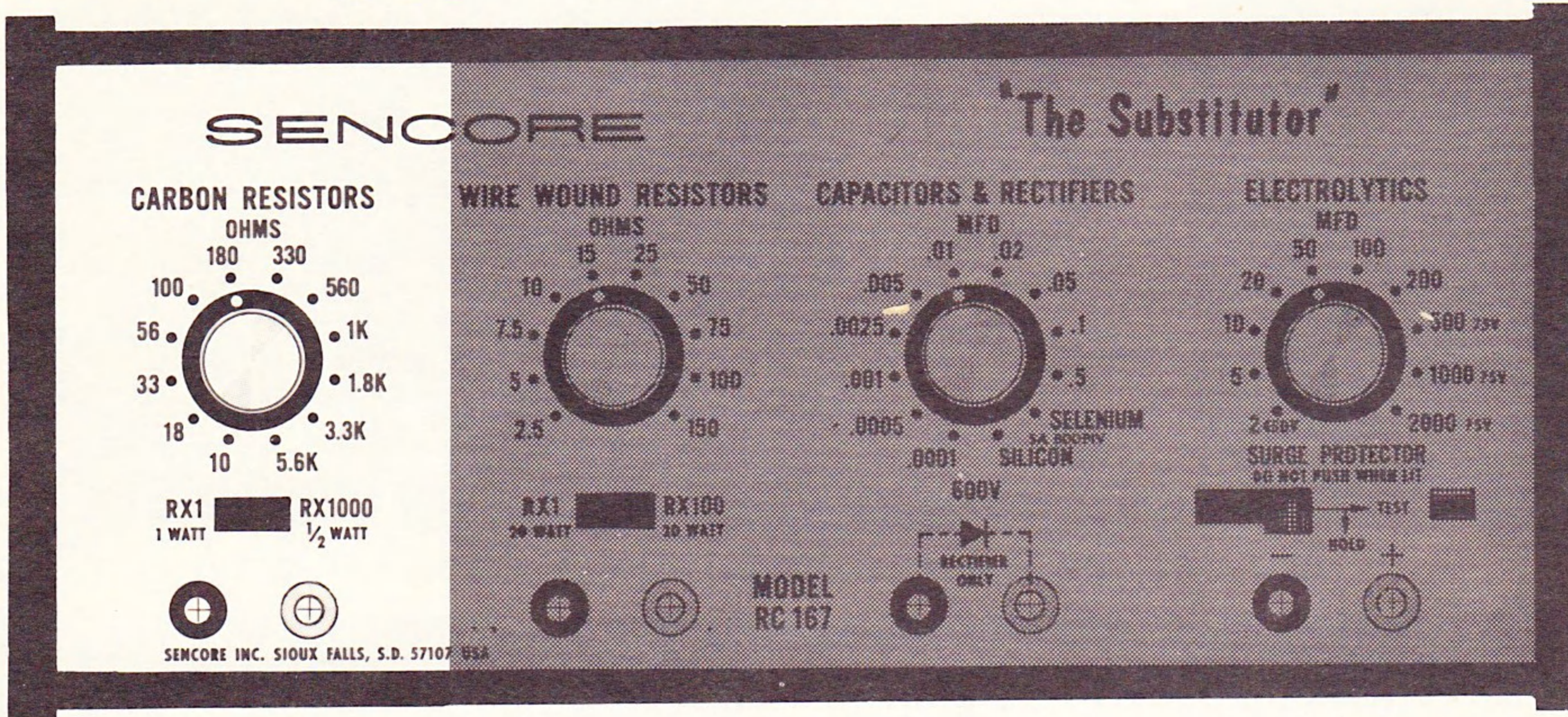
### CARBON RESISTORS:

“The Substitutor” will substitute for virtually every value of standard 10% carbon resistors. The values from 10 ohms to 5.6K ohms (RX1) are 1 watt, and the values from 10K ohms to 5.6 Meg ohms (RX1000) are one half watt. To select a carbon resistor proceed as follows:

1. Set the slide switch under the CARBON RESISTORS section to RX1 if the value is between 10 ohms and 5.6K ohms, and to the RX1000 position if the value is between 10K ohms and 5.6Meg ohms. Select the value desired on the CARBON RESISTORS rotary switch. The

numbers around the switch represent the values for the RX1 range. For the RX1000 range, multiply the value shown by 1,000.

2. Remove the power from the circuit before making substitution. Use one set of banana plug to alligator clip leads to connect the banana jacks below the CARBON RESISTOR section to the circuit for substitution. Reapply power to the circuit.



*Carbon Resistor section of the RC167*

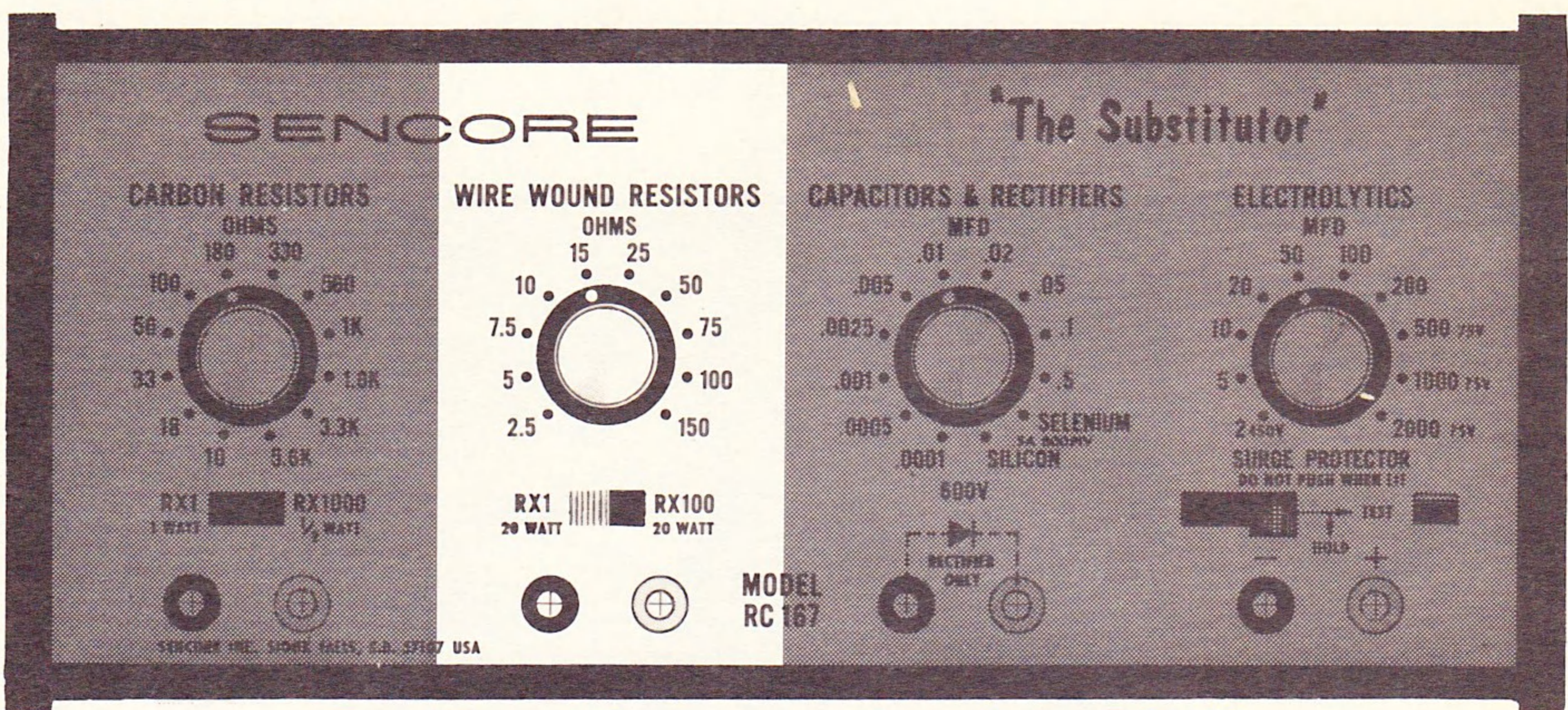
## WIRE WOUND RESISTORS:

“The Substitutor” will substitute for 20 values of 20 watt wire wound resistors. The 20 watt rating is for continuous duty applications. For brief periods, the resistors may be overloaded up to an absolute maximum of 40 watts. Be sure to calculate the power dissipation, and not exceed the 20 watt rating for more than one minute. The wire wound resistor can be substituted in many places: for a fuse resistor; to replace the filament resistor of a tube in series string set; filament replacement when the tube is pulled for test purposes; in place of speakers; etc.

To determine resistor value required to replace series tube filament, simply multiply filament voltage by two and use nearest value. To select a wire wound resistor, proceed as follows:

1. Set the slide switch under the WIRE WOUND RESISTORS section to RX1 if the value is between 2.5 and 150 ohms, and to RX100 if the value is between 250 and 15,000 ohms. Select the value desired with the WIRE WOUND RESISTORS rotary switch. The numbers around the switch represent the values for the RX1 range. For the RX100 range multiply the value indicated by 100.

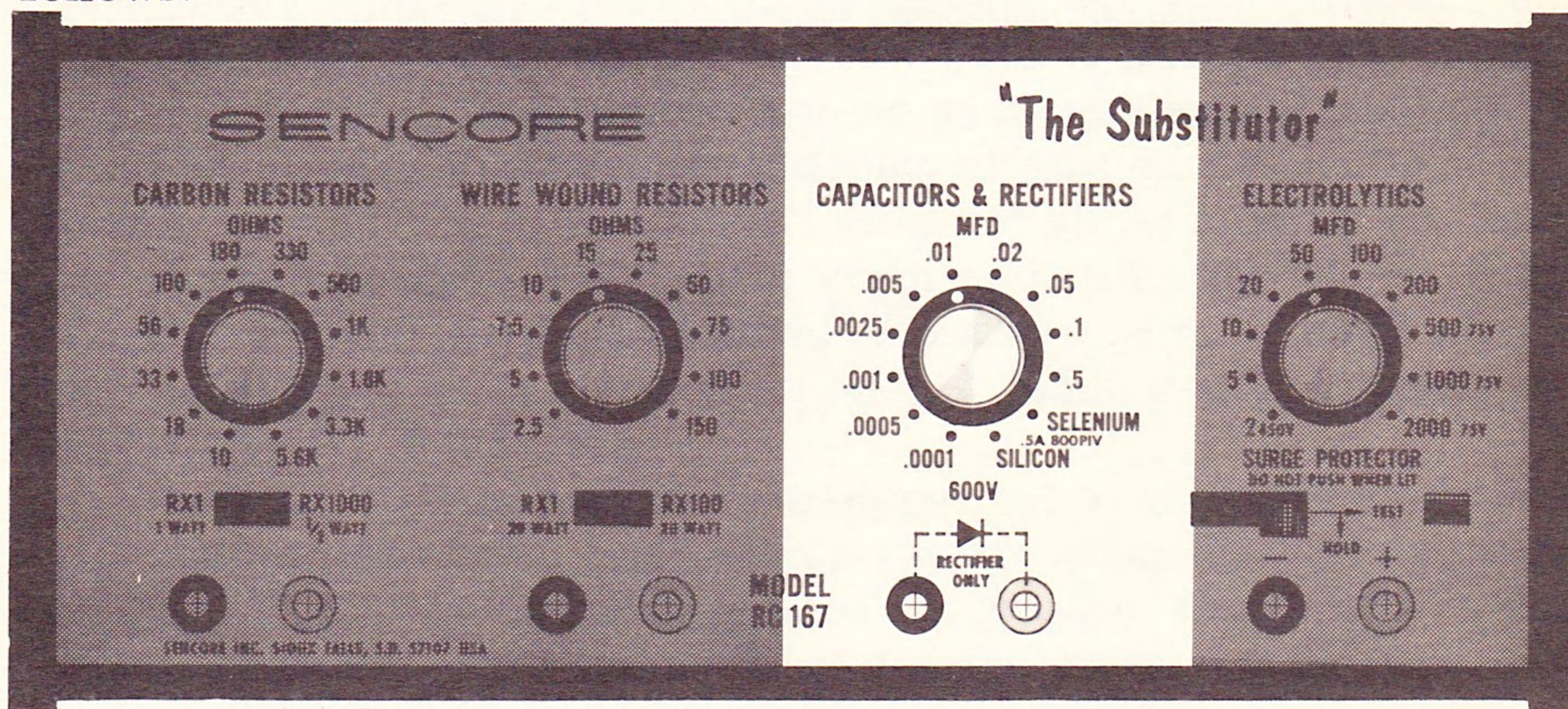
2. Remove power from the circuit before making substitution. Use one set of banana plug to alligator clip leads to connect the banana jacks under the WIRE WOUND RESISTORS section to the circuit. Reapply power to the circuit.



*Wire Wound Resistor section of the RC167*

## TUBULAR CAPACITORS:

“The Substitutor” provides 10 values of tubular capacitors, to substitute for virtually every standard value of capacitor. The rating of these capacitors is 600 volts DC, and should not be exceeded under any circumstances. To substitute a tubular capacitor, proceed as follows:



*Capacitors and Rectifiers section of the RC167*

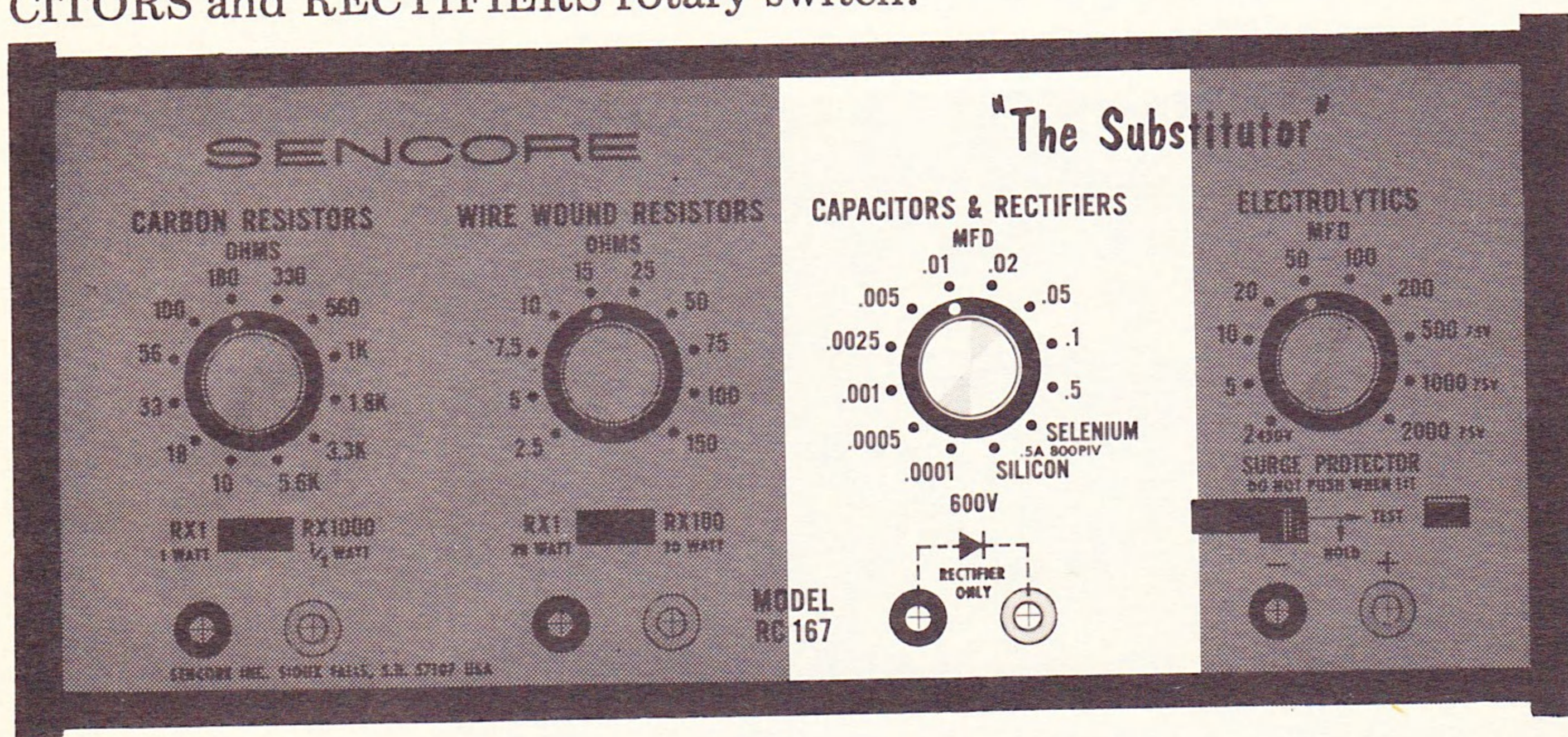
1. Dial the value desired on the CAPACITORS and RECTIFIERS rotary switch. Use caution not to select either the SELENIUM or SILICON rectifier position.

2. Remove power from the circuit before making substitution. Use one set of banana plug to alligator clip leads to connect the banana jacks under the CAPACITORS and RECTIFIERS section to the circuit. Reapply power to the circuit. When the test is complete, be sure to short the leads of "The Substitutor" together to discharge the capacitor used.

## RECTIFIERS:

"The Substitutor" provides a universal, high current substitute for any silicon or selenium rectifier. The rating of this rectifier is .5A at 800 volts peak inverse voltage. Do not exceed this rating, or the rectifier and circuit in which it is connected may be damaged. To substitute a rectifier, proceed as follows:

1. Select either the SELENIUM or SILICON rectifier on the CAPACITORS and RECTIFIERS rotary switch.



*Location of Rectifiers*

2. Remove power from the circuit before making substitution. Observe proper polarity, and use one set of banana plug to alligator clip leads to connect the banana jacks under the CAPACITORS and RECTIFIERS section to the circuit. To substitute the rectifier in a power supply circuit, be sure to connect the cathode of the rectifier (red jack) to the load if a positive output is required. If a negative output is required, connect the anode of the rectifier (black jack) to the load side. NOTE: It is always a good idea to place a resistor in series with the rectifier when substituting in a circuit where a short may exist. Use the WIRE WOUND RESISTOR section of the RC167 and starting with a value of 2500 ohms and gradually decrease the value until you have determined that the circuit is safe for continued operation.



rating of the capacitors is being exceeded. If this light glows remove the power from the circuit, and recheck the connections, or measure the voltage in the circuit, as a defect could cause a higher voltage than normal to be present at that point.) If the warning light does not glow, push the SURGE PROTECTOR switch to the right for TEST, or to the right and down for HOLD.

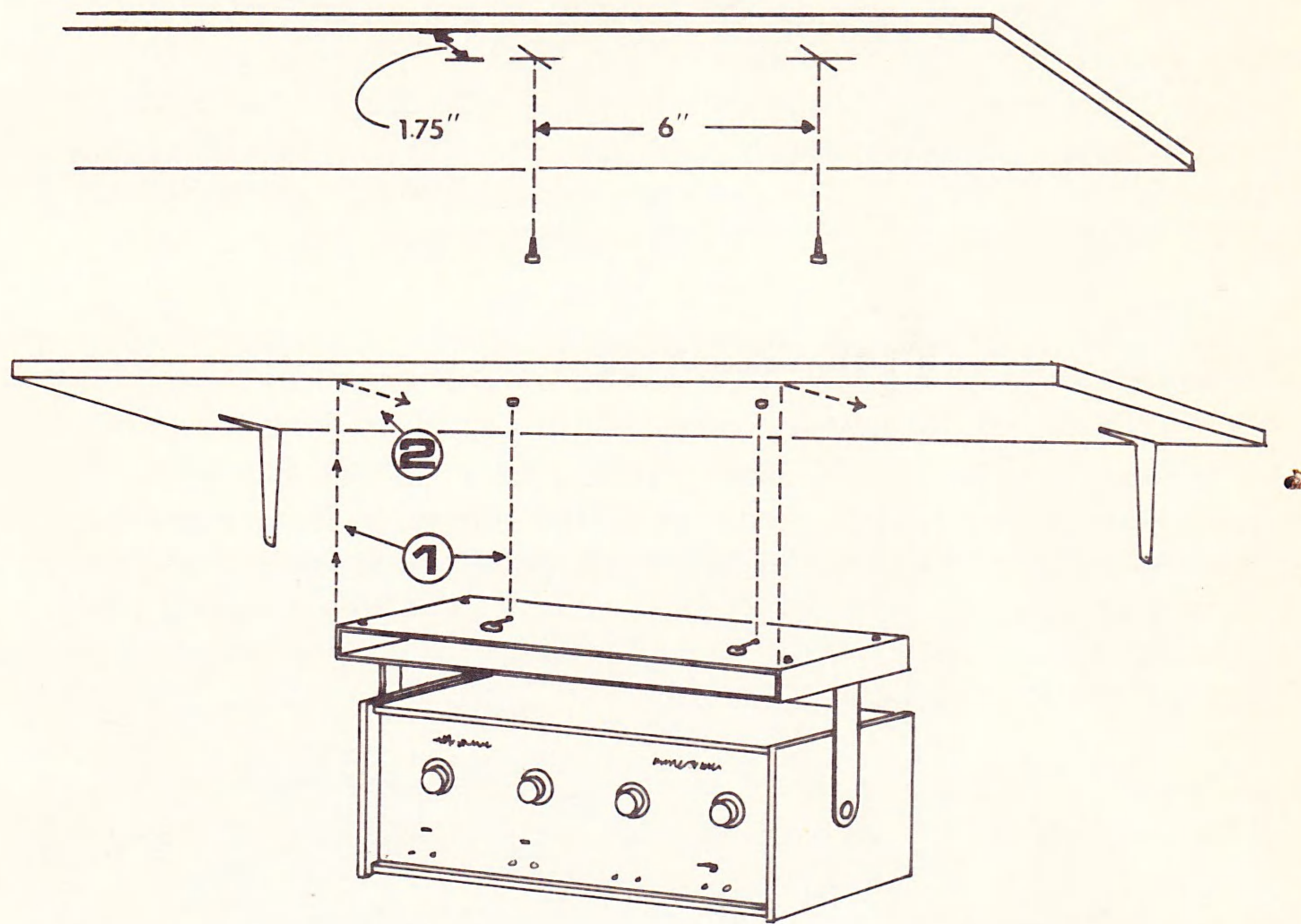
**CAUTION:** Do not change the setting of the ELECTROLYTICS rotary switch when the SURGE PROTECTOR switch is in the HOLD position. Severe damage to the switch by the high charging currents, or destruction of the low voltage capacitors, can occur. To change the setting of the ELECTROLYTICS rotary switch, first return the SURGE PROTECTOR switch to the normal spring return position.

## MOUNTING THE RC167

The bottom of the RC167 base contains two embossed key shaped holes to allow the RC167 to be mounted either under a horizontal shelf, or to a vertical surface. The parts drawer is reversible to allow it to remain useful for under shelf mounting, however, it is not practical to use the drawer when the RC167 is mounted to a vertical surface. To mount the RC167, proceed as follows:

1. Remove the parts drawer from the RC167, and swing the base to the back or top of the RC167 to provide correct mounting position.
2. Place the RC167 in the desired location and draw a line exactly 1.75 inches back from the front edge of the base. (The line would be 1.75 inches below the top edge of the base for vertical mounting.) For easiest access to the parts drawer with shelf mounting, it is advisable to mount the front edge of the base flush with the front edge of the shelf.
3. Mark two points, six (6) inches apart along this line, and drill pilot holes for two number ten (10) pan head wood screws.
4. Insert the number ten (10) screws (supplied) into the pilot holes, leaving a gap of .2" between the mounting surface and the head of the screw. (It may be necessary to adjust this spacing slightly if difficulty is encountered in step 5.)
5. Center the large opening of one of the key shaped holes in the base of the RC167 under one of the number ten screws. Place your thumbs inside the base, one on either side of the key shaped opening,

and push the base firmly toward the mounting surface and back until the head of the number ten screw snaps into the embossed area of the key shaped hole. It may require considerable pressure to accomplish this, however, a tight fit is necessary to insure a firm mount for the RC167. Repeat this procedure for the second mounting screw.



*Mounting the RC167*

## DISASSEMBLY

Should service be required, the RC167 is easily disassembled to gain access to internal components. Proceed as follows:

1. Remove two phillips head screws at the bottom front of unit and two screws on unit back.
2. Tilt top of panel forward and lift it upward to clear bottom of case. Remove panel assembly by sliding it forward and out of case.
3. Reverse above procedure for reassembly.

# SCHEMATIC AND PARTS LIST

REFERENCE NUMBER	PART NUMBER	DESCRIPTION	PRICE
R27	14B49-17	2.5 ohm, 5W, 10%	.25
R28	14B49-18	5 ohm, 5W, 10%	.25
R29	14A52-4	25 ohm, 10W, 10%	.25
R30	14A52-14	250 ohm, 10W, 10%	.25
R31	14B49-19	25 ohm, 5W, 10%	.25
R32	14B49-20	50 ohm, 5W, 10%	.25
R33	14A52-5	250 ohm, 10W, 10%	.25
R34	14A52-1	500 ohm, 10W, 10%	.25
R35	14B49-11	250 ohm, 5W, 10%	.25
R36	14B49-12	500 ohm, 5W, 10%	.25
R37	14A52-6	2.5K, 10W, 10%	.25
R38	14A52-15	5K, 10W, 10%	.25
R39	14B49-21	2.5K, 5W, 10%	.25
R40	14B49-22	5K, 5W, 10%	.25
R41	14B49-2	47 ohm, 5W, 10%	.25
R43	14B48-25	100 ohm, 5W, 10%	.25
CR1, 2	16S5	.5A, 800PIV	.50
I1	20G12	NE-2	.25
C1	24S2	100pF to .01mF	1.50
C2	24G3	.02mF, 600V	.25
C6	24G273	2,3, 112mF, 450V	2.75
C7	24G274	5, 12, 33, 55mF, 450V	2.75
C8	24G276	500, 500mF, 100V	4.25
C9	24G275	1000mF, 100V	2.75
SW1	25G51	2P12P Rotary	2.50
SW2, 4	25G4	1P2P Slide	.50
SW3	25A143	4P10P Rotary	3.00
SW5	25G53	1P12P Rotary	1.50
SW6	25A180	3P10P Rotary	1.75
SW7	25A179	2P3P Slide	.75
Front Panel, .050 Alum.		8B78	2.25
Case Assembly, riveted		110B281	16.25
Drawer assembly, riveted		110B285	6.00
Switch assembly, carbon resistors		125G51	6.50
Switch assembly, Cap. and Rect.		125G53	7.50
Test lead assembly		139G52	5.00

Prices in effect at date of printing and are subject to change without notice. When ordering parts, please specify model number, part number and description. Minimum billing \$2.00.

(Fold out for schematic)

## SERVICE AND WARRANTY

You have just purchased one of the finest substitutors on the market today. The Sencore RC167 has been inspected and tested twice at the factory and has passed a rugged use test by our Quality Assurance Department to insure the best quality instrument to you. If something should happen, the RC167 is covered by a standard 90 day warranty as explained on the warranty policy enclosed with your instrument.

Sencore has three regional offices to serve you. Instruments to be serviced should be returned to the nearest regional office, by UPS if possible. Parcel post should only be used as a last resort. Instruments should be packed with the original packing materials or equivalent, and double boxed to insure safe arrival at the regional office. The blue and white display carton IS NOT an acceptable shipping container. When returning an instrument for service, be sure to state the nature of the problem to insure faster service.

If you wish to repair your RC167 Substitutor, we have included a schematic and parts list. Any of these parts may be ordered directly from the regional office nearest you.

We reserve the right to examine defective components before an in warranty replacement is issued.

### SENCORE REGIONAL OFFICES:

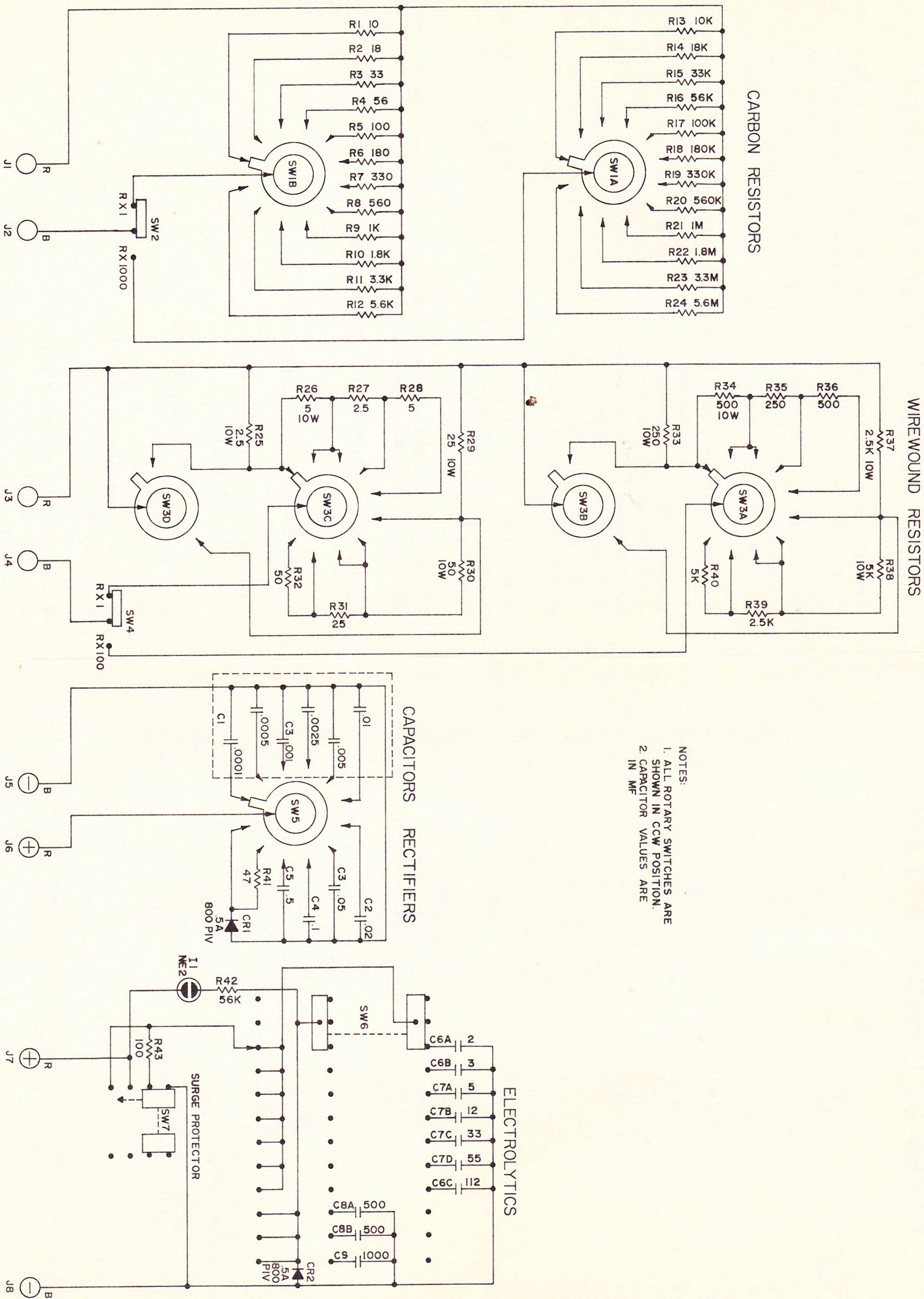
Sencore Eastern Sales and Service  
4105 Duke  
Alexandria, Virginia 22304  
A/C 703 751-3556

Sencore Central Sales and Service  
2711 B Curtis St.  
Ellsworth Ind. Park  
Downers Grove, Illinois 60515  
A/C 312 852-6800

Sencore Western Sales and Service  
3200 Sencore Drive  
Sioux Falls, South Dakota 57107  
A/C 605 339-0100

Form 738

Printed in U. S. A.

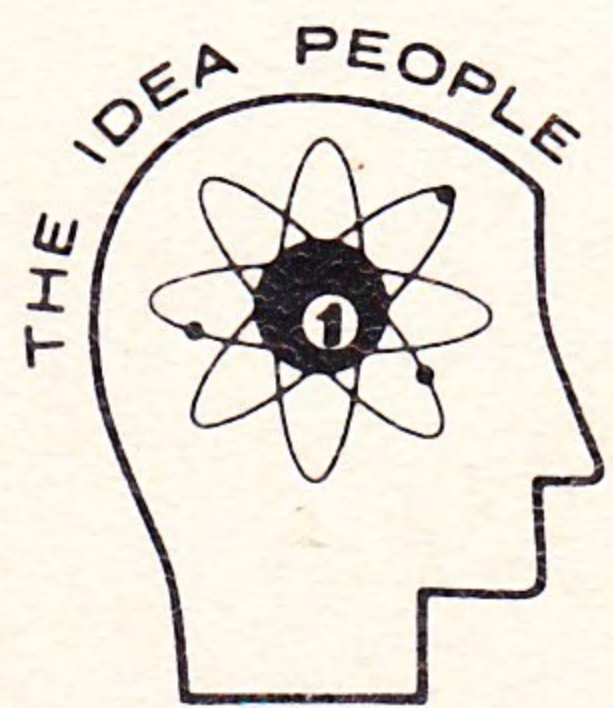


NOTES:  
 1. ALL ROTARY SWITCHES ARE SHOWN IN CCW POSITION.  
 2. CAPACITOR VALUES ARE IN MF

LAST NO.  
 R43  
 C9  
 CR2

**SCHEMATIC DIAGRAM  
 RC167 THE SUBSTITUTOR**

ISSUE DATE: 1-2-73



# SENCORE

3200 SENCORE DRIVE, SIOUX FALLS, SOUTH DAKOTA 57107