MODEL #478

CAPACITY DECADE BOX

INTRODUCTION.

The FOUR DECADES from 100 MMFD to 1.1111 MFD (100 MMFD steps) are equivalent of 10,000 capacitors.

All capacitors are:- well within 1%; SILVER MICA, except for the highest values which are special, low-drift, molded; rated at 600 volts, except for highest range which is 400 volts.
Capacitors used have undergone an extensive series of tests, including: LEAKAGE RESISTANCE (thousands of megohms); ACCURACY measured on Standard Bridges; VOLTAGE BREAKDOWN tests; POWER FACTOR; TEMPERATURE CYCLING, AGING; etc.
PRECISE specially designed low-loss, Government approved wafers to minimize leakage and poor power factor. Silver plated contacts, along with a positive indent action, assures accuracy and durability.
Rugged, bakelite and chrome plated binding posts accept the use of pin plugs, alligator clips, spade lugs or wires.
Easy-to-read, deeply ETCHED aluminum, with a baked-on enamel, is the basis of a modern designed, rub-proof panel.
Sturdy, high-impact bakelite case reduces ground capacity and insures long life. 3 3/4" x 6¼" x 2" (POCKET SIZE)

The Model 478 is an excellent precise instrument for the laboratory or service engineer. It is invaluable for developing new circuits or can be used as a Capacity Substitution Box for experimenting or servicing. It is truly the embodiment of accuracy, range and dependability at the lowest possible cost, commensurate with fine engineering practices.

PARTS LIST

AM'T	DESCRIPTION	AM'T	DESCRIPTION
1	100 PFd Cond. 1%	1	.2 ufd cond. 1%
1	200 " " "	1	.3 " " "
1	300 " " "	1	.4 " " "
1	400 " " "	1	Cabinet
1	1000 " " "	1	Panel
1	2000 " " "	4	6-32x¼ M.S.
1	3000 " " "	4	Small Pointer Knobs
1	4000 " " "	4	Switches w/Nuts & LW
1	.01 ufd " "	2	Binding Posts
1	.02 " " "	2	Nuts
1	.03 " " "	2	Fibre Shoulder Washers
1	.04 " " "	2	Fibre Washers - Flat
1	.1 " " "	2	Solder Lugs
1	Length Bare Wire & Bus Bar	1	Length Spaghetti (1')

Note: 'P' means 'uu' (micro-micro farads). Certain of the smaller valuecapacitors may be marked PF; they are the same as uuFD or MMfd.

The Model 478 Decade Box is very simple to construct. Certain factors, however, should be watched.

Soldering:- When soldering any precision component, it is most important to protect it from excessive heat. This may readily be accomplished by holding a pair of longnose pliers between the joint to be soldered and the component proper. The pliers will conduct the heat away from the precision part. It is equally important that the joint be properly soldered. A "rosin joint" is often properly called a "high resistance joint". Any additional resistance added to the circuit will reduce the accuracy considerably. Under no circumstances should any solder other than rosin core be used. Acid core will eventually pit various of the components and may actually destroy the parts. Although rosin is invaluable in the usual soldering process, and is highly recommended for electronic circuits, care should be taken not to allow the rosin to flow between switch contacts since this could cause leakage. Use a heavy iron when soldering to bus bar. A light iron is used when soldering to contacts.

DISTRIBUTED CAPACITY:- Distributed Capacity, sometimes called "wiring capacity", is caused by wires and components running too close to each other. The following suggestions are made to limit this to as low a value as possible:-

(1) Do nut run wires or parts close to the panel or other metal hardware.
(2) Keep capacitors as far from each other as possible.
(3) Make certain the Black Ring side, outside foil, around the large capacitors, is connected to the same point, such as the bus bar. The capacitors may then be placed close to each other. Electrically there will not be a great change in capacity if they are touching. as long as the outside foils are connected to the same side. The Silver Mica capacitors should be kept as far from each other as possible and also away from other parts.
(4) If wires are run under, or between switches, keep them away from all other contacts and wires.

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SWITCH NUMBERING:- Switches are numbered clockwise, looking at the rear side of the switch. Number 1 is the first contact, clockwise, from the mounting stud (between the three contacts on the rear side). On the rear of the switch (the side farthest away from the panel - there are contacts on #1, #3, #11 and #12. On the side closest to the panel, there are contacts on #1, #3, #5, #6, #7, #8, #9, #10, #11 and #12.
If a contact is on both sides of the switch, it makes no difference which side is used since they are electrically the same.

ASSEMBLY: -

(1) Place the two binding posts into the two lower holes on the panel. The fibre shoulder washer should first be placed over the screw of the binding post. The post is then placed on the other side of the panel and a solder lug slipped on. The entire assembly is then secured with a nut. If the shoulder portion of the washer is properly seated in the panel, the chance of a short between the panel and the binding post is eliminated.

(2) Secure each switch into the four switch holes of the panel. A lockwasher should be between the switch and the panel rather than directly behind the switch nut. position each switch as shown in the drawing. Note that each of the switches has one dead contact, that does not make contact with the rotor regardless of the position to which it is turned. The switch should be positioned so that the dead contacts are toward the center line of the panel.

(3) Cut off a 7 3/4" piece of thick bus bar. Bend as shown in Figure 1. Use sharp bends.

(4) Holding points 'C', 'D', and 'E' flat on the table - bring point 'A' straight up toward you while bending at point 'C'.

(5) Twisting at point 'B', press point 'A' until it is parallel with the table (at same height from table as point 'B'). Figure 2.

(6) Solder point 'D' to pin 3 of S1. Solder point 'A' to solder lug on right hand terminal post. Note: The bus bar should not touch any other contact or switch.

(7) Connect a wire from pins 1 to 5 to 8 on switch S1. (Solder on #1 and 8 only).
(8) " " " " " 1 to 5 to 8 on switch S3. (Solder on #5 and 8 only).
(9) " " " " " 1 to 5 to 8 on switch S2. (Solder on #5 only).
(10) " " " " " 1 to 5 to 8 on switch S4. (Solder on #5 only).

(11) Connect a wire from #6 to #10 on S1 (Solder #6)
(12) " " " " " " " " S3 (Solder #10)
(13) " " " " " " " " S2 (Solder #6).
(14) " " " " " " " " S4 (Solder #6).

(15) Connect a wire from #7 to #9 on S1 (Solder #7).
(16) " " " " " " " " S3 (Solder #9).
(17) " " " " " " " " S2 (Solder #7).
(18) " " " " " " " " S4 (Solder #9).

(19) Connect wire from S1#5 to S2#1. (Solder Both).
(20) " " " S2#8 to S4#1. (Solder Both).
(21) " " " S4#8 to left binding post. (Solder #8 only).
(22) " " " Left Binding Post to S3#1. (Solder Both).

(23) Connect 100 PF from S1#12 to Bus Bar (Solder Both).
" 200 PF from S1#11 to Bus Bar (Solder Both).
" 300 PF from S1#10 to Bus Bar (Solder Both).
" 400 PF from S1#9 to Bus Bar (Solder Both).

(24) Connect 1000 PF from S2#12 to Bus Bar (Solder Both).
" 2000 PF from S2#11 to Bus Bar (Solder Both).
" 3000 PF from S2#10 to Bus Bar (Solder Both).
" 4000 PF from S2#9 to Bus Bar (Solder Both).

(25) Connect .4 MFD from S4#7 to Bus Bar (Solder Both).
" .3 MFD from S4#10 to Bus Bar (Solder Both).
" .2 MFD from S4#11 to Bus Bar (Solder Both).
" .1 MFD from S4#12 to Bus Bar (Solder Both).

(26) Connect .01 MFD from S3#12 to Bus Bar (Solder Both). (Over Switch).
" .02 MFD from S3#11 to Bus Bar (Solder Both). (Over Switch).
" .03 MFD from S3#6 to Bus Bar (Solder Both).
" .04 MFD from S3#7 to Bus Bar (Solder Both).

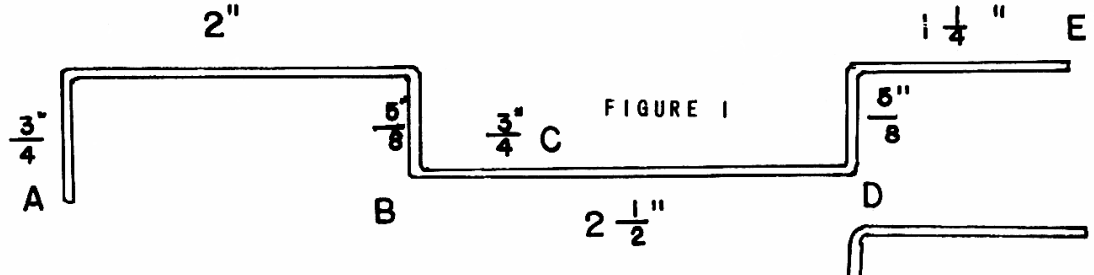


FIGURE 1

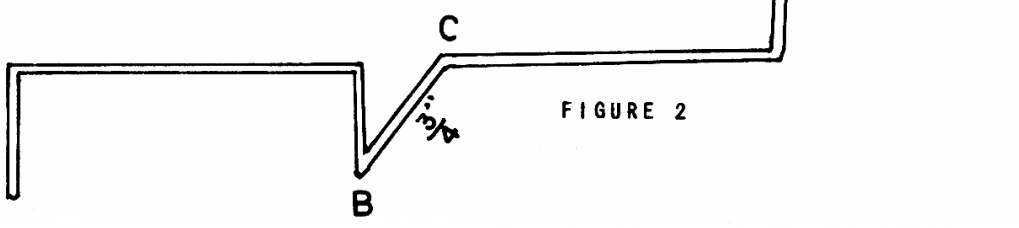
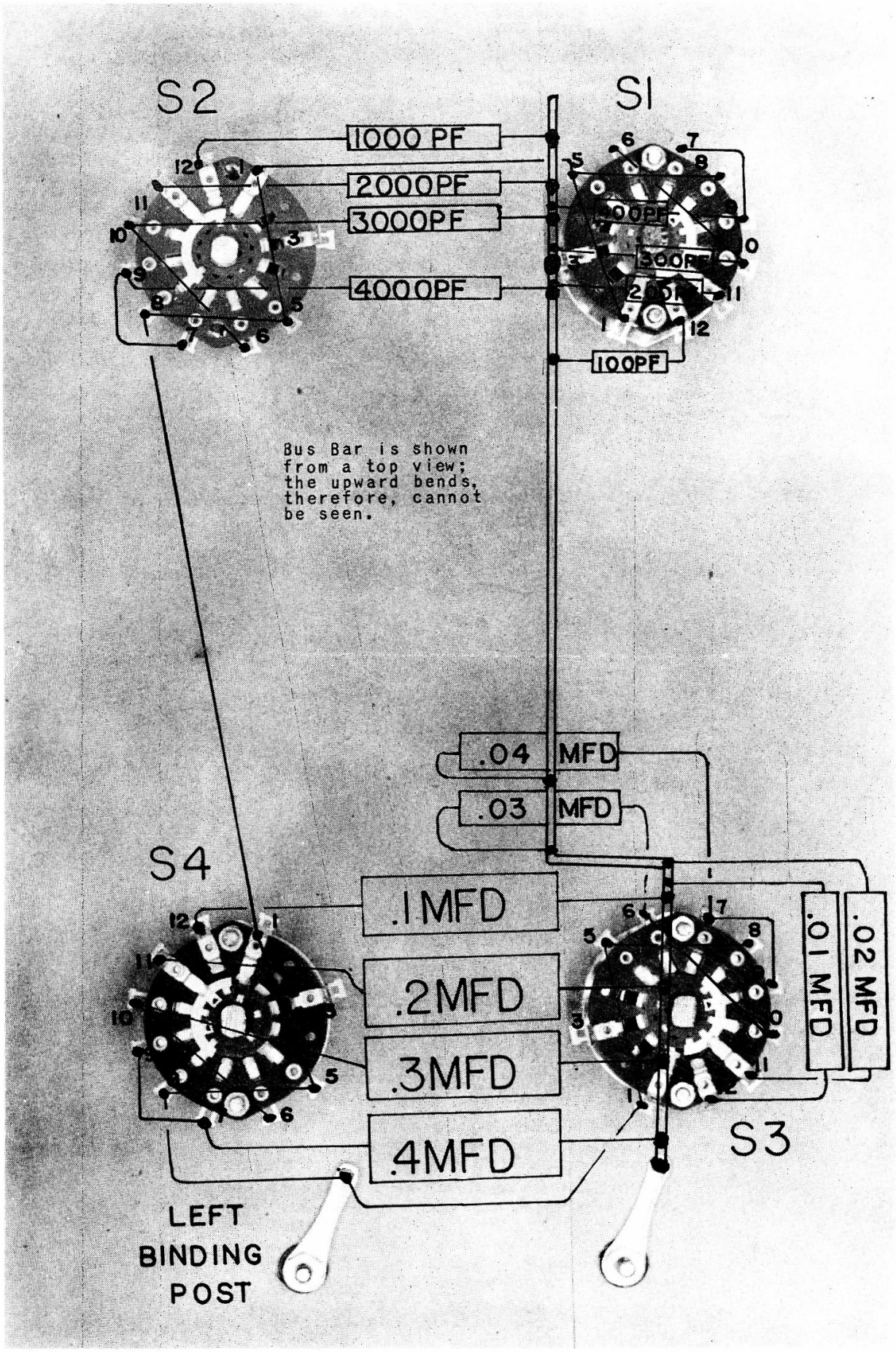


FIGURE 2


S2
S1
1000 PF
2000PF
3000PF
4000PF
100PF
Bus Bar is shown from a top view; the upward bends, therefore, cannot be seen.
.04 MFD
.03 MFD
S4
.1MFD
.2MFD
.3MFD
.4MFD
.01 MFD
.02 MFD
S3
LEFT BINDING POST

You have now completed the wiring of your Model 478. Check all soldering carefully, making certain each connection is soldered and there is no rosin between them. You may, if necessary, clean the contacts with carbon-tetrachloride.
With each switch in its maximum counter-clockwise position (as observed from the front of the panel), place small pointer knobs on shafts with indicator at zero mark. Secure panel to cabinet with four screws.

OPERATION: -

The total capacity will be the addition (SUM) of all the values on each decade. As an example: Assume the switches were as follows:

.1	ufd Switch at #2	.2
.01	ufd at #0	.00
.001	ufd at #6	.006
100	uufd at #5	.0005
		.2065

The total capacity can be read from the dial and would be the sum of all the decades or .2065 ufd.

DISTRIBUTED CAPACITY: -

The distributed capacity (capacity with all switches in the '0' position) should be approximately 18 uufd and may be measured directly if a capacity bridge is available. Once the distributed capacity has been determined, it should be added to the total capacity in order to ascertain the true capacity. If the instrument has 18 PFD in distributed capacity, the true value in the previous example would be .2065 + .000018 or .206518. The 18 PFD may normally be discounted in values above .005 MFD.

CONVERSIONS: -

The following table lists capacity conversions:

MFD is same as ufd.
MMFD is same as uufd.
MMFD is same as pFD.
1 Farad = 1,000,000 ufd = 1,000,000,000,000 PFD.
1 PFD = 1 uufd = .000001 ufd = .000 000 000 001 Farads.

SERVICING: Very little difficulty should be encountered in the construction and use of this instrument. Most cases of trouble have mis-wiring as their source. You may however, return the instrument to the factory for repair at a service charge of $3.50. Please pack carefully.

WARRANTY: All merchandise is warranted to be free from defects in material and workmanship and is fully protected by the standard RMA GUARANTEE.