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R_X and C_X

— easy-to-build substitution boxes

I finally got tired of trying to read the ohmmeter, hold the test leads in place, and turn the potentiometer to find a resistance value that would keep my experimental circuit from going up in smoke.

What I needed was a resistor substitution box. Well, I got out some paper and a pencil and went to work. The circuit shown in Fig. 1 is the result.

By using 28 resistors and switches in the 1-2-3-3 arrangement, I now have at my fingertips—in one-Ohm steps—resistance values of 1 to 9,999,999 Ohms.

Construction of this unit is simple. The resistors are mounted across the switches' terminals. By opening a switch, *that* resistor is connected in circuit.

The switches are arranged in rows of seven across and four down (See Fig. 1). Then the resistor/switch combinations are connected in series. I used slide switches in my unit (I happened to have them on hand).

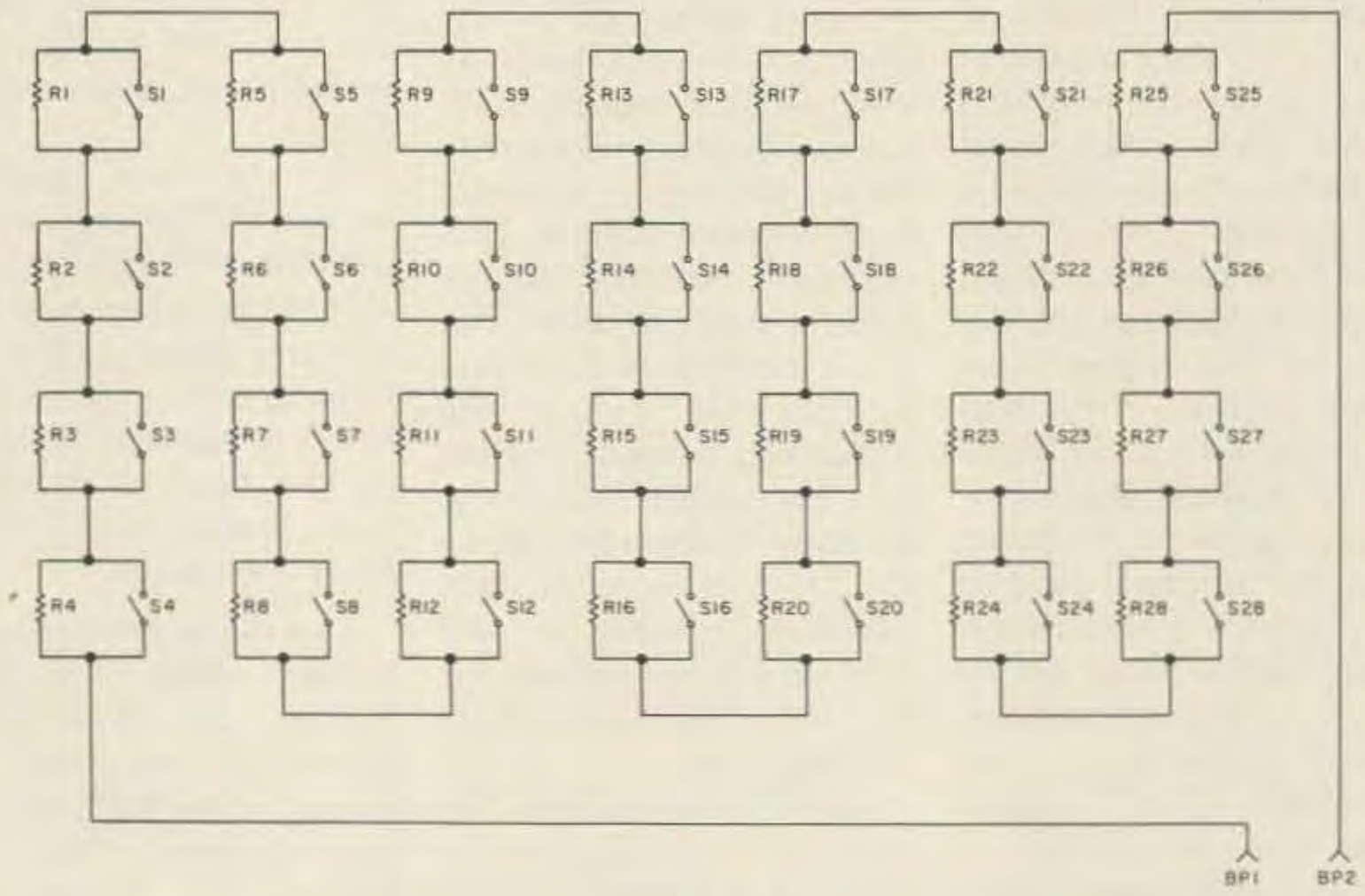

Fig. 1. Schematic for resistor substitution box.

The rectangular openings were cut out with a nibbling tool and the switches were mounted to the box panel with pop rivets.

With the use of 1% resistors, there is a possible error of ±100k (that's with all resistors in circuit for a total of 9,999,999 Ohms).

With this circuit, there is a possible monetary advantage over conventional resistance substitution boxes which usually require sixty-three resistors and seven ten-position switches to cover the same range.

A Capacitor Substitution Box

A ham shack without a capacitor substitution box?

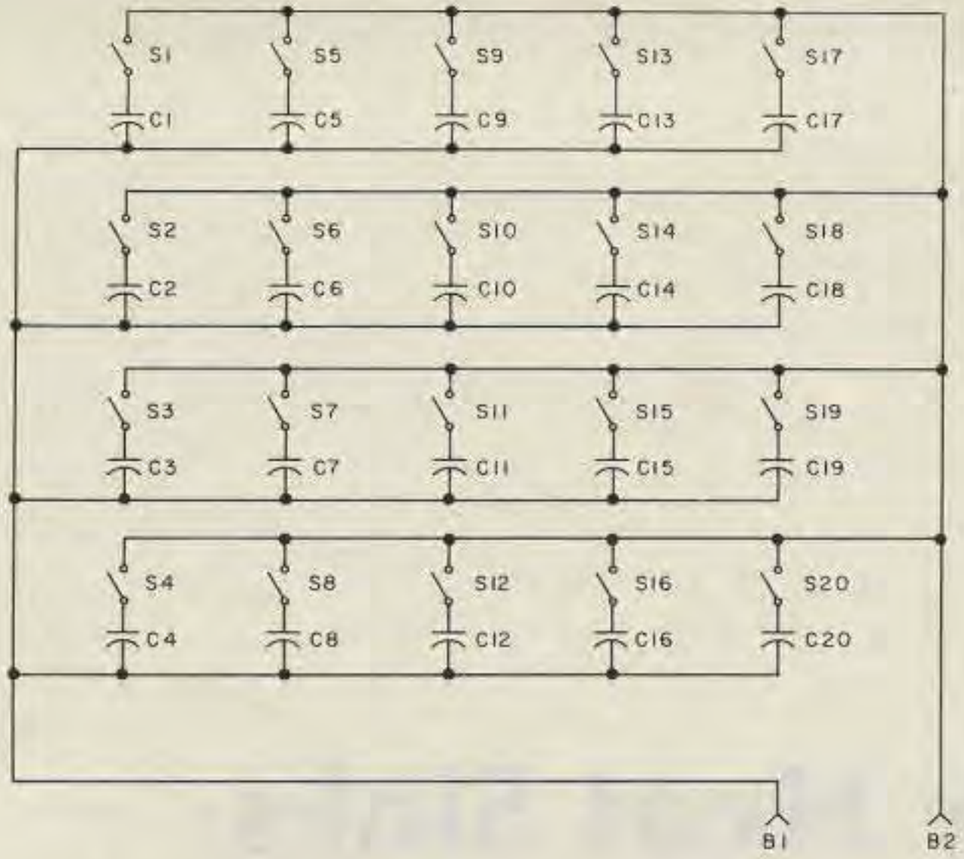

Fig. 2. Schematic for capacitor substitution box.

Resistor Substitution Box Parts List

R1	1 Ohm
R2	2 Ohm
R3-R4	3 Ohm
R5	10 Ohm
R6	20 Ohm
R7-R8	30 Ohm
R9	100 Ohm
R10	200 Ohm
R11-R12	300 Ohm
R13	1k Ohm
R14	2k Ohm
R15-R16	3k Ohm
R17	10k Ohm
R18	20k Ohm
R19-R20	30k Ohm
R21	100k Ohm
R22	200k Ohm
R23-R24	300k Ohm
R25	1 Megohm
R26	2 megohm
R27-R28	3 megohm

S1 through S28—SPST slide or toggle switches
BPI, BP2—5-way binding posts
Misc.—wire, cabinet, rub-on letters and numbers

Capacitor Substitution Box Parts List

C1	10 pF
C2	20 pF
C3	30 pF
C4	30 pF
C5	100 pF
C6	200 pF
C7	300 pF
C8	300 pF
C9	0.001 uF
C10	0.002 uF
C11	0.003 uF
C12	0.003 uF
C13	0.01 uF
C14	0.02 uF
C15	0.03 uF
C16	0.03 uF
C17	0.1 uF
C18	0.2 uF
C19	0.3 uF
C20	0.3 uF

S1 through S20—SPST switches (slide or toggle type)
B1, B2—5-way binding posts
Misc.—wire, cabinet, rub-on letters and numbers

I don't believe it. Well, I've been wrong before, so, if yours happens to be without one, build this one.

This capacitor substitution box has a range of from 10 pF to within 10 pF of 1 uF, in 10-pF steps. That amounts to 99,999 possible values. This is done with only twenty capacitors and switches. Construction of this unit is simple and straightforward. The capacitors are connected between a common line (B1) and one terminal on each switch. The other terminals on the switches are wired to B2. The switches are arranged in rows of four down and five across (Fig. 2). I used mica (5%) and polystyrene (2%) capacitors in my unit.

Of course, the tighter the tolerance on the capacitors, the more accurate the unit. ■