

# Unihedron CapSelector

## Purpose

The Unihedron CapSelector provides an inexpensive way to tune a VLF loop over a wide range (120 - 5510 pF) of capacitances. It replaces expensive and bulky high-value variable capacitors or decade capacitor banks. It is a passive device and therefore requires no power.

## Theory

The total capacitance of N capacitors in parallel is  $C_{total} = C_1 + C_2 + \dots + C_N$ . By using an inexpensive DIP switch to connect (or remove) each of six capacitors to the circuit, 63 distinct (non-zero) values of capacitance can be selected. Once the desired tuning is achieved, the DIP switches are left in that state.

## Connections

Two-wire connector strips are located on opposite sides of the PCB. One pair is used to connect the ends of the wire of the loop antenna and the other pair is used to connect the board to the amplification circuit.

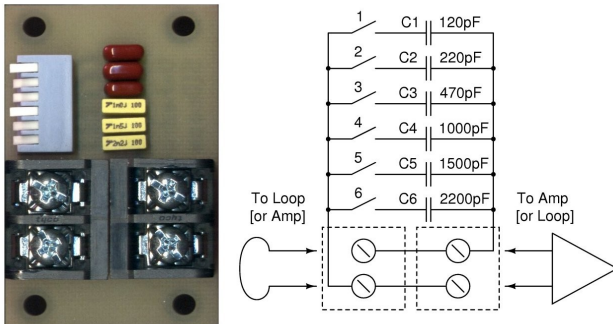


Illustration 1: Top view and schematic

## Selecting capacitance values

The users selects capacitance values by placing the six DIP switch "keys" in appropriate states ("On" or "Off"). The positions of the "keys" for a desired capacitance value are found from consulting Table 1.

Below are a some examples and their corresponding values as found in Table 1:

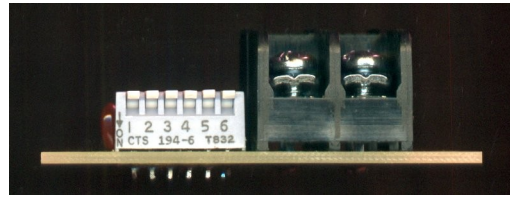


Illustration 2: All off, 0pF selected (~3pF)

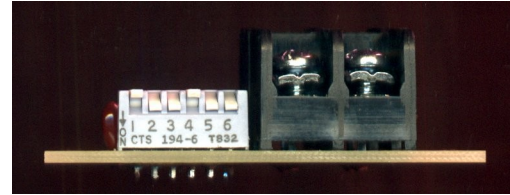


Illustration 3: 1,4 on, 1120pF selected (~1072pF)



Illustration 4: All on, 5510pF selected (~5358pF)

## Precision

The capacitors used in the Unihedron CapSelector are polyester film types with +/-5% tolerances. In this section, we provide an estimate of the variance of the actual total capacitance from that estimated by the specified capacitance.

## Tuning a loop antenna

Tuning a loop to a known transmitting frequency in the VLF range is achieved by turning the switches on/off to obtain the maximum output signal amplitude. Switch 6 provides the coarsest control.

## Reasons for re-tuning a loop antenna

The attachment of different lengths of coaxial cable to a loop antenna will result in the total capacitance changing since every foot of coaxial cable adds about 30 pF.

## Table of Settings

To the right is a table of ordered capacitance values achieved by setting the DIP switch "keys" in the listed fashion. Note that since the available catalog values for capacitors are not factors of powers of two greater than the minimum non-zero capacitance, the combinations are not ordered in a binary progression.

Face Value (pF)	Binary	SW1	SW2	SW3	SW4	SW5	SW6	Measured (pF)
0	000000	Off	Off	Off	Off	Off	Off	3
120	100000	On	Off	Off	Off	Off	Off	119
220	010000	Off	On	Off	Off	Off	Off	212
340	110000	On	On	Off	Off	Off	Off	328
470	001000	Off	Off	On	Off	Off	Off	472
590	101000	On	Off	On	Off	Off	Off	589
690	011000	Off	On	On	Off	Off	Off	683
810	111000	On	On	On	Off	Off	Off	799
1000	000100	Off	Off	Off	On	Off	Off	967
1120	100100	On	Off	Off	On	Off	Off	1072
1220	010100	Off	On	Off	On	Off	Off	1166
1340	110100	On	On	Off	On	Off	Off	1283
1470	001100	Off	Off	On	On	Off	Off	1427
1500	000010	Off	Off	Off	Off	On	Off	1431
1590	101100	On	Off	On	On	Off	Off	1546
1620	100010	On	Off	Off	Off	On	Off	1548
1690	011100	Off	On	On	On	Off	Off	1639
1720	010010	Off	On	Off	Off	On	Off	1644
1810	111100	On	On	On	On	Off	Off	1756
1840	110010	On	On	Off	Off	On	Off	1762
1970	001010	Off	Off	On	Off	On	Off	1904
2090	101010	On	Off	On	Off	On	Off	2023
2190	011010	Off	On	On	Off	On	Off	2118
2200	000001	Off	Off	Off	Off	Off	On	2117
2310	111010	On	On	On	Off	On	Off	2225
2320	100001	On	Off	Off	Off	Off	On	2223
2420	010001	Off	On	Off	Off	Off	On	2317
2500	000110	Off	Off	Off	On	On	Off	2391
2540	110001	On	On	Off	Off	Off	On	2433
2620	100110	On	Off	Off	On	On	Off	2509
2670	001001	Off	Off	On	Off	Off	On	2580
2720	010110	Off	On	Off	On	On	Off	2606
2790	101001	On	Off	On	Off	Off	On	2702
2840	110110	On	On	Off	On	On	Off	2725
2890	011001	Off	On	On	Off	Off	On	2796
2970	001110	Off	Off	On	On	On	Off	2870
3010	111001	On	On	On	Off	Off	On	2914
3090	101110	On	Off	On	On	On	Off	2988
3190	011110	Off	On	On	On	On	Off	3083
3200	000101	Off	Off	Off	On	Off	On	3083
3310	111110	On	On	On	On	On	Off	3201
3320	100101	On	Off	Off	On	Off	On	3205
3420	010101	Off	On	Off	On	Off	On	3299
3540	110101	On	On	Off	On	Off	On	3418
3670	001101	Off	Off	On	On	Off	On	3564
3700	000011	Off	Off	Off	Off	On	On	3565
3790	101101	On	Off	On	On	Off	On	3682
3820	100011	On	Off	Off	Off	On	On	3684
3890	011101	Off	On	On	On	Off	On	3779
3920	010011	Off	On	Off	Off	On	On	3783
4010	111101	On	On	On	On	Off	On	3892
4040	110011	On	On	Off	Off	On	On	3900
4170	001011	Off	Off	On	Off	On	On	4048
4290	101011	On	Off	On	Off	On	On	4166
4390	011011	Off	On	On	Off	On	On	4262
4510	111011	On	On	On	Off	On	On	4380
4700	000111	Off	Off	Off	On	On	On	4552
4820	100111	On	Off	Off	On	On	On	4670
4920	010111	Off	On	Off	On	On	On	4765
5040	110111	On	On	Off	On	On	On	4881
5170	001111	Off	Off	On	On	On	On	5027
5290	101111	On	Off	On	On	On	On	5148
5390	011111	Off	On	On	On	On	On	5242
5510	111111	On	On	On	On	On	On	5358

Table 1: Switch settings vs capacitance value