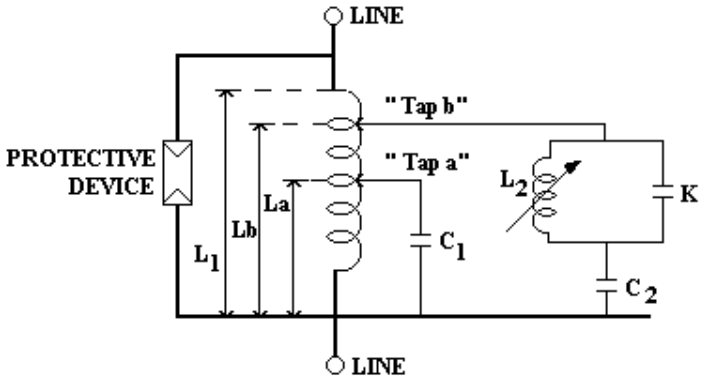
## 1.0 - DESCRIPTION OF CIRCUIT




In the two frequency trap ( shown above ) there are two parallel resonant circuits: La - $C_1$ and $L_2$ - $C_2$. There are both resonant at the upper frequency $f_1$. The La - $C_1$ circuit consists of a capacitance which can be varied in steps and an inductance which can be varied continuously by changing the winding of the main coil.

The high impedance of La - K circuit prevents $C_2$ from shunting the La - $C_1$ circuit at $f_1$.

At the lower, frequency $f_2$, the entire lower branch, K in series with $L_2$ - K, that $C_1$ tunes the trap to the lower frequency, $f_2$, inductance Lb ( shown above ) is that amount of the main coil $L_1$ actually inclosed in the $f_2$ circuit Lb is continuously variable in the same manner as La, in the $f_1$ circuit.

## 2.0 - ADJUSTMENT

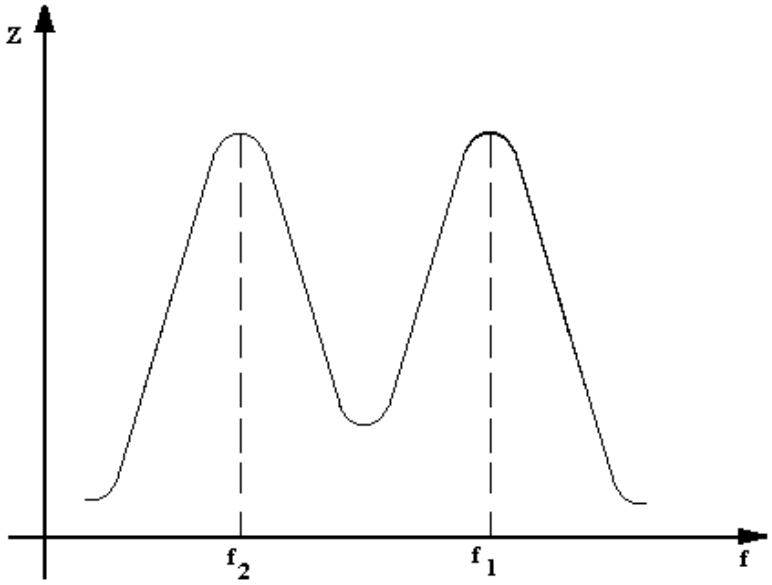
**2.1 -** The tuning charts on pages 9 to 11 provide nominal capacitance values and approximate $L_2$ tap settings. No calculations are required. A particular tuning area is located by the point where the capacitance values and tap settings are then read from a table.

It should be noted, however, that the capacitance tolerances will affect the tuning, for this reason, it is sometimes necessary to go a neighboring tuning area from the one where the frequencies intersect. this is described in more detail later

**2.2 -** 30 - 90 kHz TUNING CHARTS

Figure on page 8 provides tuning informations in the 30 - 90 kHz frequency range. The horizontal line at 90 kHz on the $f_1$ scale shows the nominal upper frequency limit for $f_1$. The vertical dotted line at 30 kHz shown the nominal lower frequency limit for $f_2$. The diagonal dotted line represents the nominal lower frequency limit of $f_1$ for each value of $f_2$, or the nominal upper frequency of $f_2$ for each value of $f_1$. The area enclosed by these three lines is the nominal tuning area of the traps. the regions outside the triangular area can be used with certain limitations. In the regions directly below the triangle, the frequency spacing is less than the recommended minimum, tuning may be more difficult, and the trap bandwidth might be reduced. The rest of the region outside the triangle represents the range in which capacitors tolerance could make it impossible to tune the trap to the desire frequency.

**2.3 – The f**igure below shows atypical curve for a two-frequency traps.




**2.4 -** In general, the total bandwidth of the two peaks approaches that of the bandwidth of one peak of a single-frequency trap tuned to the geometric mean of the two frequencies, that is ± 5% from $\sqrt{f_1 \times f_2}$ considering a 400 Ω impedance. If the adjustment charts in this book are followed, the two peaks are usually of approximately equal bandwidth . Occasionally, unfavorable tolerance of the tuning capacitors result in undesirable unequal peaks. Or, the are equal, but unequal peaks are desired in order to favor a wide band carrier channel at expense of a narrow band channel. The re-adjustment procedure included in either of the next two sections may then be tried to obtain area distributions more suitable for the application. This procedure has the objective of transferring area from one curve to the other. It present a choice of three methods, each of which must be tried to determine if tuning at the desired frequencies cam be obtained with the method, and which method gives best results.

**2.5 -** To Transfer Bandwidth from $f_1$ to $f_2$

**2.5.1 -** Mark the position of the $C_1$ tap on $L_1$ for future reference. Choose the next larger value of $C_1$ and re-tune $C_1$-$L_1$ to $f_1$ by tapping $C_1$ further down on L1. Mark the tap location for future reference.

**2.5.2 -** Starting with the original adjustments, choose the next smaller value of $C_2$. Re-tune to $f_2$ by tapping $C_2$ higher up on $L_1$. Mark the tap location for future reference.

**2.5.3 -** Starting with the original adjustments choose the next larger value of K. Re-tune $L_2$ obtain the $f_1$ dip. Adjust the $C_2$ tap higher on $L_1$ to obtain the $f_2$ dip. If the larger value of $C_2$ and again adjust $C_2$ tap.

**2.6 -** To transfer bandwidth from $f_2$ to $f_1$

**2.6.1 -** Mark the position of the $C_1$ tap on $L_1$ for future reference. choose the next smaller value of $C_1$ and re-tune $C_1$-$L_1$ to $f_1$ by tapping higher on $L_1$.

**2.6.2 -** Starting with the original adjustments, choose the next larger value of $C_2$. Tap $C_2$ further down on $L_1$ to obtain the $f_2$ dip. Mark the tap location for future reference.

**2.6.3 -** Starting with the original adjustments, choose the next smaller value of K. Re-tune $L_2$ to obtain the $f_1$ dip. Adjust the $C_2$ tap lower on $L_1$ to obtain the $f_2$ dip. If the dip cannot be reached use the next smaller value of $C_2$ and again adjust $C_2$ tap.

**2.7 -** Minimum spacing between $f_1$ and $f_2$

**2.7.1 -**It is generally desirable that each impedance peak be symmetrical. As the spacing is reduced, dissymetry is introduced. This is quite evident in case of extremely close spacing in figure on page 3. This effect is aggravated by having the $C_1$ and $C_2$ taps too far down on $L_1$ due to careless adjustment.

**2.8 -** Adjustment

**2.8.1 -** Locate the upper frequency, $f_1$, on the vertical axis of the chart, and draw a horizontal line through the point.

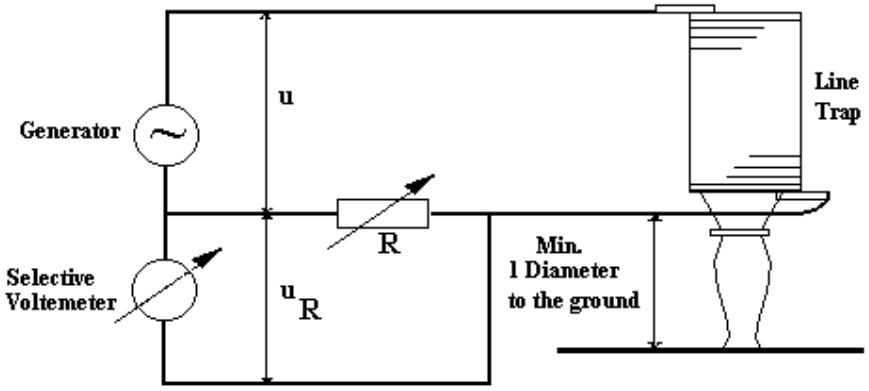
**2.8.2 -** Locate the lower frequency, $f_2$, on the horizontal axis of the chart, and draw a vertical line through the point.

**2.8.3 -** Note the lettered area in which the two intersect.

**2.8.4 -** Locate the letter in the case table, and make the specific connections for $C_1$, K, $C_2$ and $L_2$.

**2.8.5 -** Disconnect the Lb tap so that the circuit consist of only La and $C_1$ ( See figure on page 2 ) .

**2.8.6 -** Make test connections as recommended by the ANSI C93-3 Standards for single-frequency trap adjustment. ( See figure below ).




**2.8.7 -** With the coil tap La on any convenient point, locate the actual resonant frequency by varying the signal generator frequency so that a minimum voltmeter reading is obtained.
If the actual frequency is highers than, the required frequency, move the tap in direction of more windings turns.

**2.8.8 -** If the actual frequency is lower than the required frequency, move the tap in direction of decreased number of winding turns.

**2.8.9 -** If a case should arise ( due to capacitance tolerance ) where the full coil is in the circuit and the frequency is still too high, select the next high nominal value of $C_1$ and readjust the coil tap.

**2.8.10 -** It is desirable to have as much of the main coil inductance in the circuit as possible. Thus, is the tuning tap is set very far away from the tuning pack end of the trap, a smaller value of $C_1$ should be chosen and the tap re-adjusted to determine whether the trap can be tuned for the lower value of $C_1$. Due to capacitor tolerances and the limited number of capacitance steps available, it may necessary to lose considerable inductance by tapping down on coil. However, as long as the specified 400 Ω impedance is obtained over the bandwidth, the trap is operating satisfactorily.
In this case of adjustable tuning from 30 to 90 kHz the bandwidth should be at least ± 5% of the geometric mean frequency of adjusted band.

**2.8.11 -** Connect the " tap b " to any convenient point the main coil.

**2.8.12 -**Without changing the signal generator setting adjust the core of the coil $L_2$ until a minimum voltage Ur is obtained. This tunes the $L_2$-K circuit to frequency $f_1$.

**2.8.13 -** Vary the signal frequency until another resonant dip is located on a lower frequency $f_2$.

**2.8.14 -** If this dip is below the desired $f_2$ frequency, move the Lb tap in the direction of decreased inductance and repeat step 2.8.l3.

**2.8.l5 -** If the dip of step 2.8.l3 is above the desired $f_2$ frequency, move the Lb tap in the direction of increased inductance and repeat step 2.8.l3.

**2.8.l6 -** Repeat steps 2.8.l3. through 2.8.l5. until $f_2$ frequency is obtained.

**2.8.l7 -** If a case should arise (due to capacity tolerances) where the full coil is in the circuit, and the actual frequency is still too high, refer to the adjacent area to the left of the original area on the tuning chart.

**2.8.l8 -** Make the connections this area specifies for K, $C_2$ and $L_2$. (In many cases, only $C_2$ will need to be changed ).

**2.8.l9 -** If necessary, re-tune the $L_2$-K circuit to the upper frequency, $f_1$.

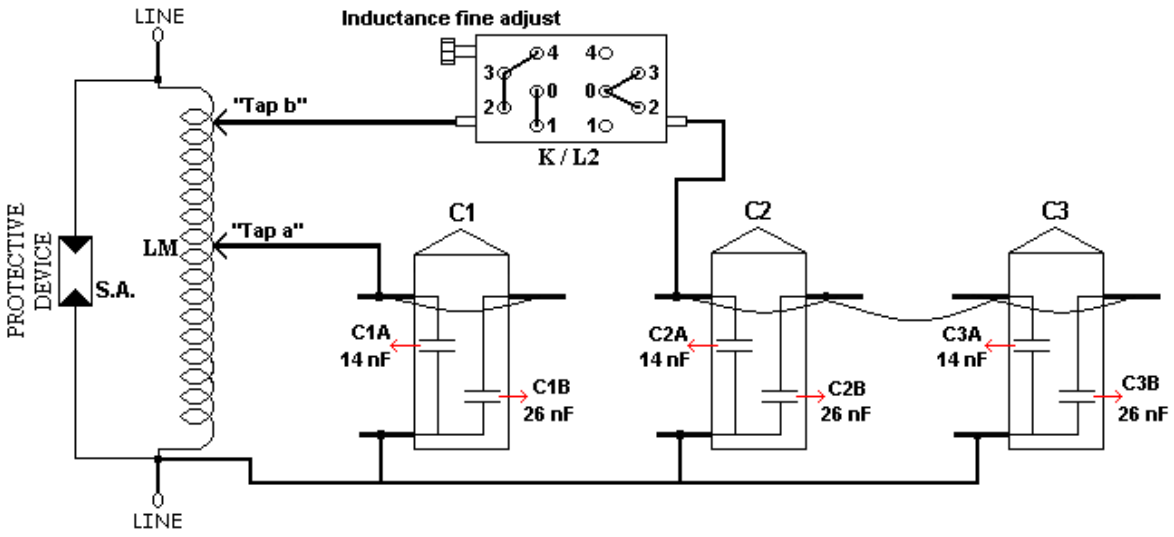
**2.8.20 -** Tune the trap to the lower frequency, $f_2$, using steps 2.8.l3 through 2.8.l6.

**2.8.2l** - If the final setting of the Lb tap occurs at a point which is far below 100 percent of the full coil turns, refer to the adjacent area to the right of the original area.

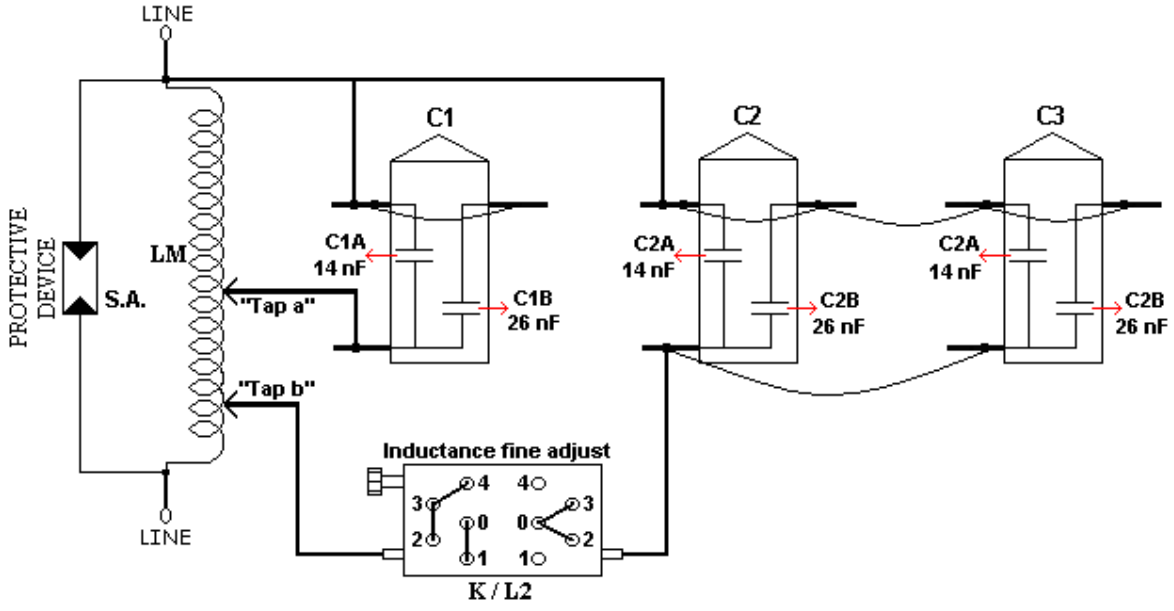
**2.8.22 -** Proceed as in steps 2.8.l8 through 2.8.20.

**2.8.23 -**If it is not possible with this set-up to tune the desired $f_2$ frequency even with the Lb tap in the maximum position, then return to the original chart area and reconnect the circuits K, $C_2$ and $L_2$, adjusted to the original settings.

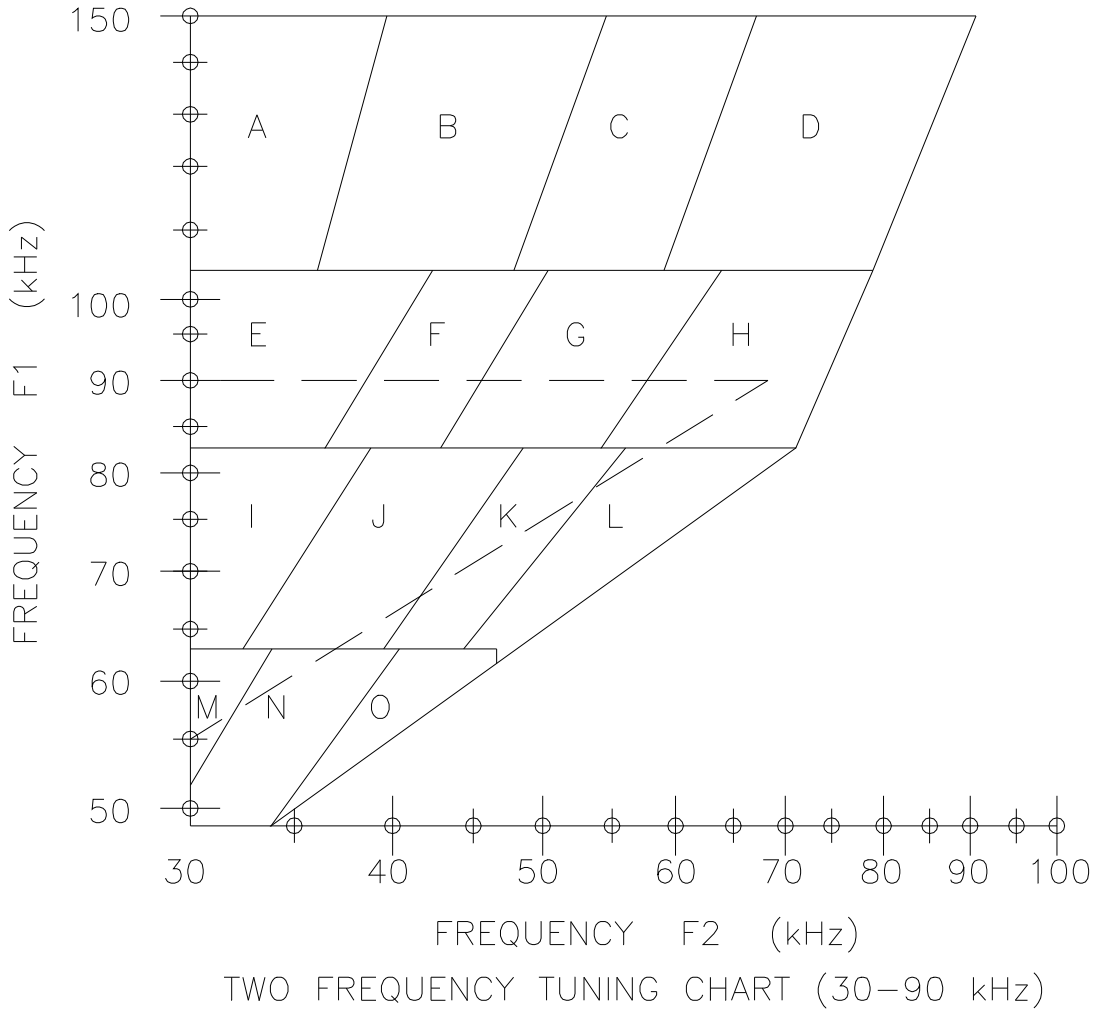
## CIRCUIT A




## CIRCUIT B




The tuning devices can be connected to circuit A or circuit B.




TWO FREQUENCY TUNING CHART (30–90 kHz)

| Diagram's Camp | C1 | | C2 + C3 | | K | L2 |
|---|---|---|---|---|---|---|
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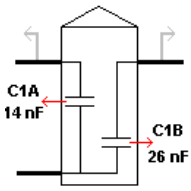
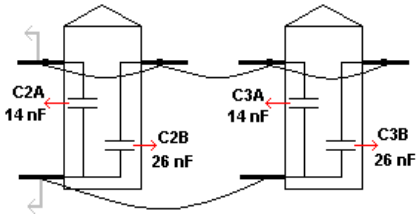
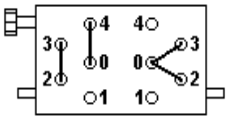
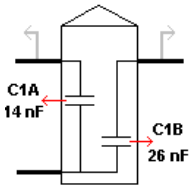
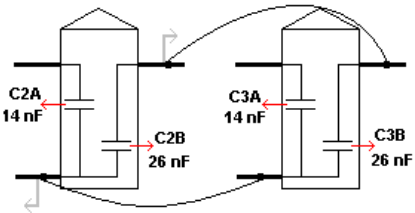
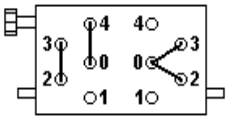
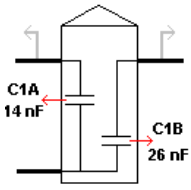
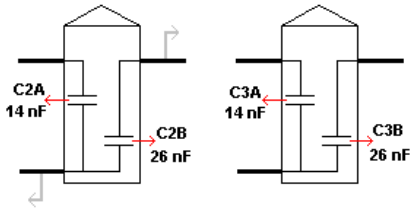
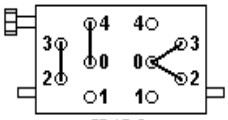
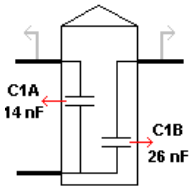
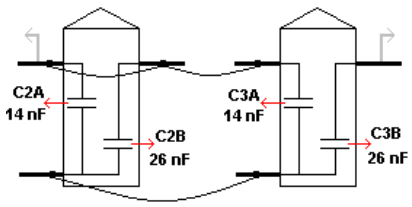
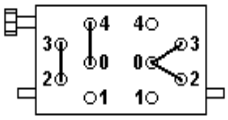
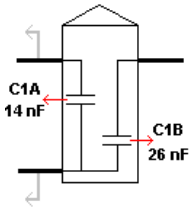
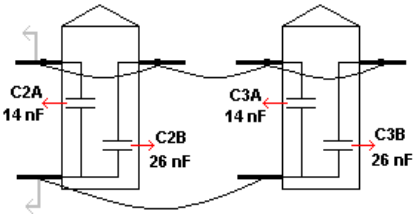
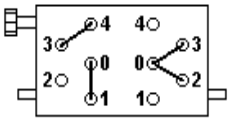
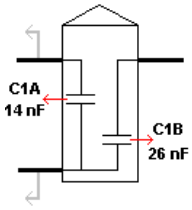
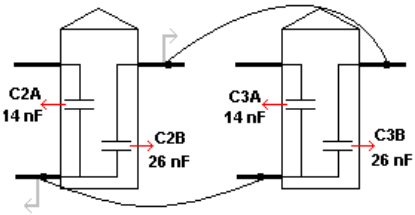
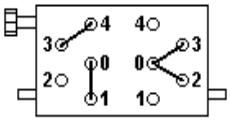
| A | 9.1 |  | 78 |  | 18 |  |
| B | 9.1 |  | 52 |  | 18 |  |
| C | 9.1 |  | 26 |  | 18 |  |
| D | 9.1 |  | 17 |  | 18 |  |
| E | 14 |  | 78 |  | 30 |  |
| F | 14 |  | 52 |  | 30 |  |

| Diagram's Camp | C1 | | C2 + C3 | | K | L2 |
|---|---|---|---|---|---|---|
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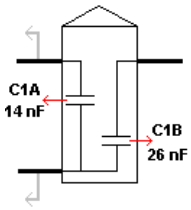
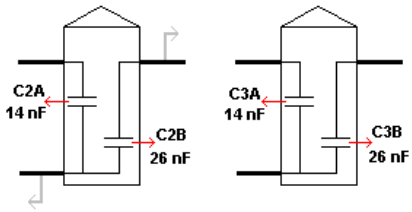
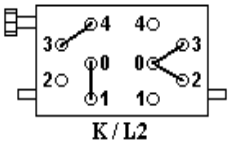
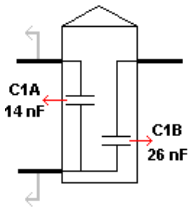
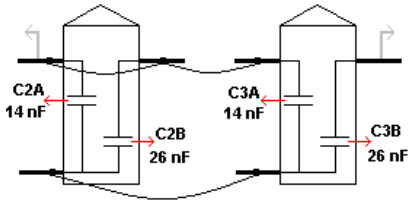
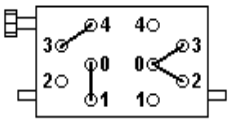
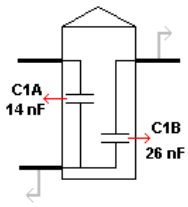
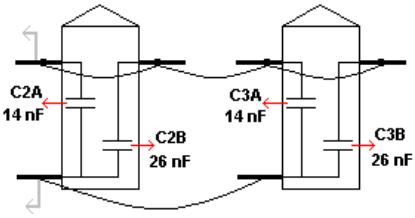
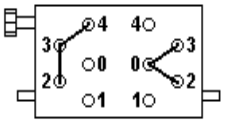
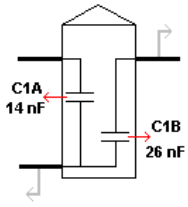
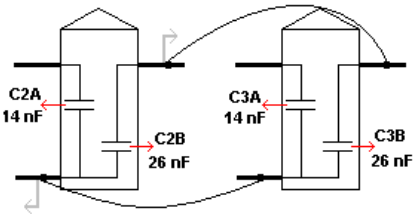
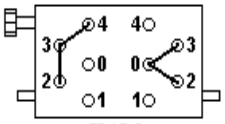
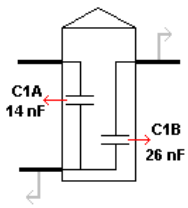
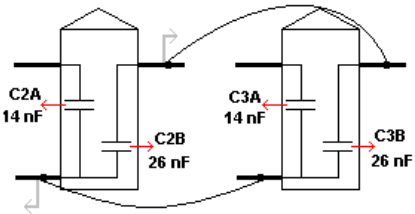
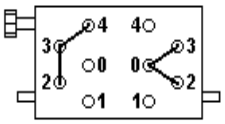
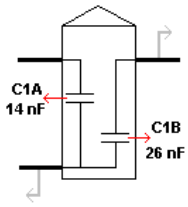
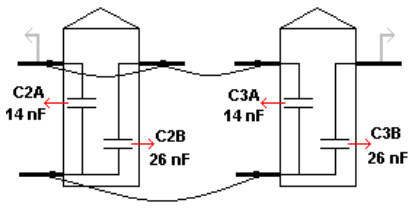
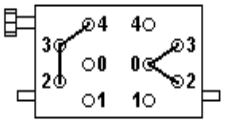
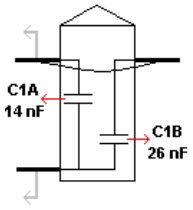
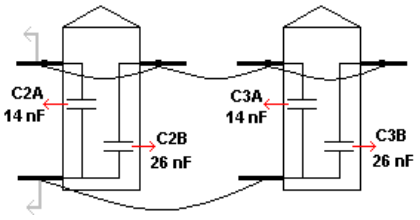
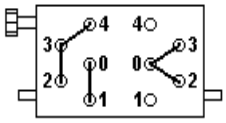
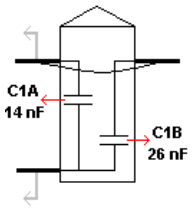
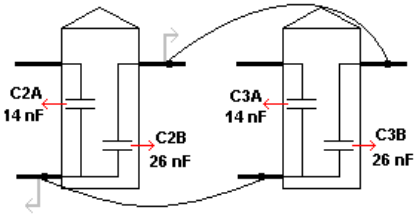
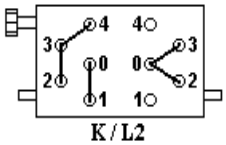
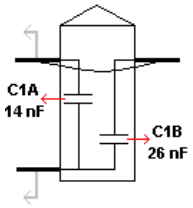
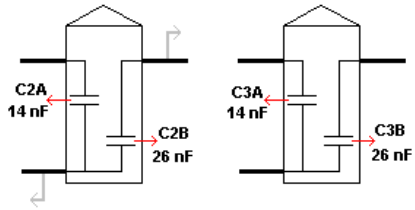
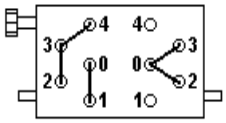
| G | 14 |  | 26 |  | 30 |  |
| H | 14 |  | 17 |  | 30 |  |
| I | 26 |  | 78 |  | 45 |  |
| J | 26 |  | 52 |  | 45 |  |
| K | 26 |  | 26 |  | 45 |  |
| L | 26 |  | 17 |  | 45 |  |

| Diagram's Camp | C1 | | C2 + C3 | | K | L2 |
|---|---|---|---|---|---|---|
| | nF | Connection | nF | Connection | nF | Connection |
| **M** | **40** |  | 78 |  | 75 |  L2= 2 or 3 |
| **N** | **40** |  | **52** |  | **75** |  L2= 2 or 3 |
| **O** | **40** |  | **26** |  | **75** |  L2= 2 or 3 |