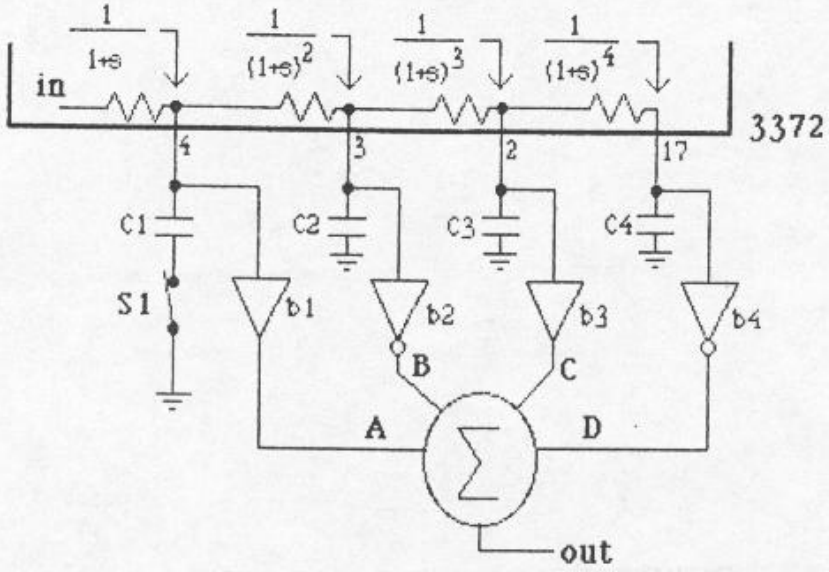
MULTI FUNCTION VCF:

Although the VCF implemented in the 3372 is a standard 4-pole low pass, the additional circuitry made of UX14, UX13, UX15, UX17, and the one percent resistor array on the left of UX17 allows 15 different filter modes including high pass, band pass, notch and all pass.

Understanding how this magic trick happens requires a little theory.

The figure below shows a simplified representation of the circuitry.



The complex representation of the transfer function of a 1-pole low pass filter is:= $\frac{1}{1+s}$ Therefore, the transfer function of the network will be:

$$\frac{out}{in} = \frac{A}{1+s} - \frac{B}{(1+s)^2} + \frac{C}{(1+s)^3} - \frac{D}{(1+s)^4} = \frac{As^3 + (3A-B)s^2 + (3A-2B+C)s + A-B+C-D}{(1+s)^4}$$

Selecting specific values for A, B, C and D allows differente transfer functions. For exemple, selecting A=1, B=1, C=0 and D=0 transforms the above equation into:

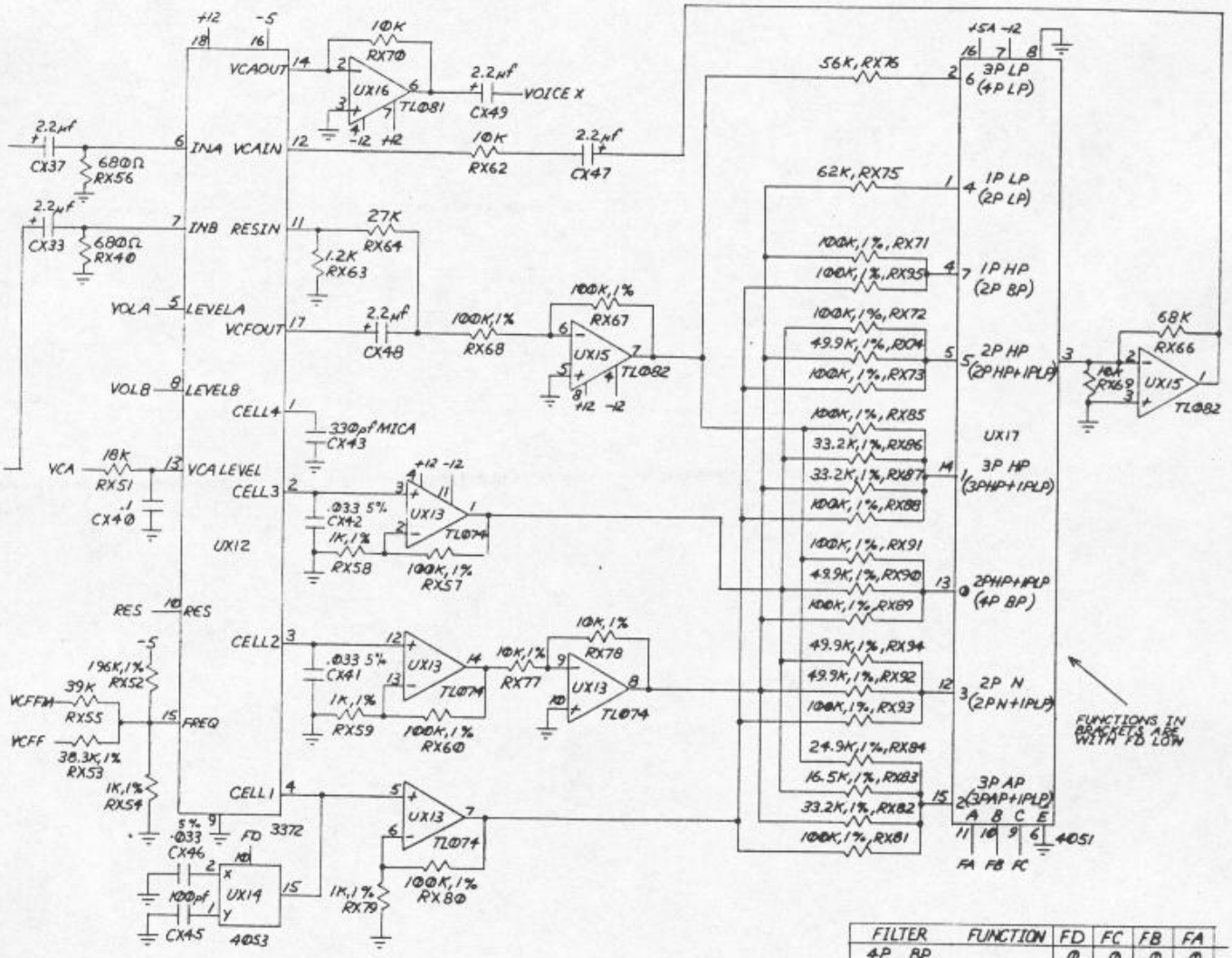
$$\frac{s}{(1+s)^2}$$

which is the transfer function of a 2 pole band pass filter.

Getting different responses from this network will be just a matter of adjusting the coefficients A, B, C and D in order to transform the transfer function into the desired one.

For the high pass and all pass filter modes, it is necessary to cancel the first cell of the filter. This is accomplished by opening the switch S1.

In practice, S1 is implemented by one cell of the analog switch UX15, the buffers b1, b2 and b3 are the four op amps of UX13, b4 is the op amp UX15 (output pin 7) and the summation is performed by the second cell of UX15 (output on pin 1). The coefficients A, B, C and D are set by the value of the summing resistors. The analog multiplexer UX17 allows to select from eight different resistor combinations providing eight different filter modes. Seven additional modes are obtained by selecting the previous modes and opening S1.



FILTER FUNCTION	FD	FC	FB	FA
4P BP	0	0	0	0
3P HP + IPLP	0	0	0	1
3P AP + IPLP	0	0	1	0
2P N + IPLP	0	0	1	1
2P LP	0	1	0	0
2P HP + IPLP	0	1	0	1
4P LP	0	1	1	0
2P BP	0	1	1	1
2P HP + IPLP	1	0	0	0
3P HP	1	0	0	1
3P AP	1	0	1	0
2P N	1	0	1	1
1P LP	1	1	0	0
2P HP	1	1	0	1
3P LP	1	1	1	0
1P HP	1	1	1	1