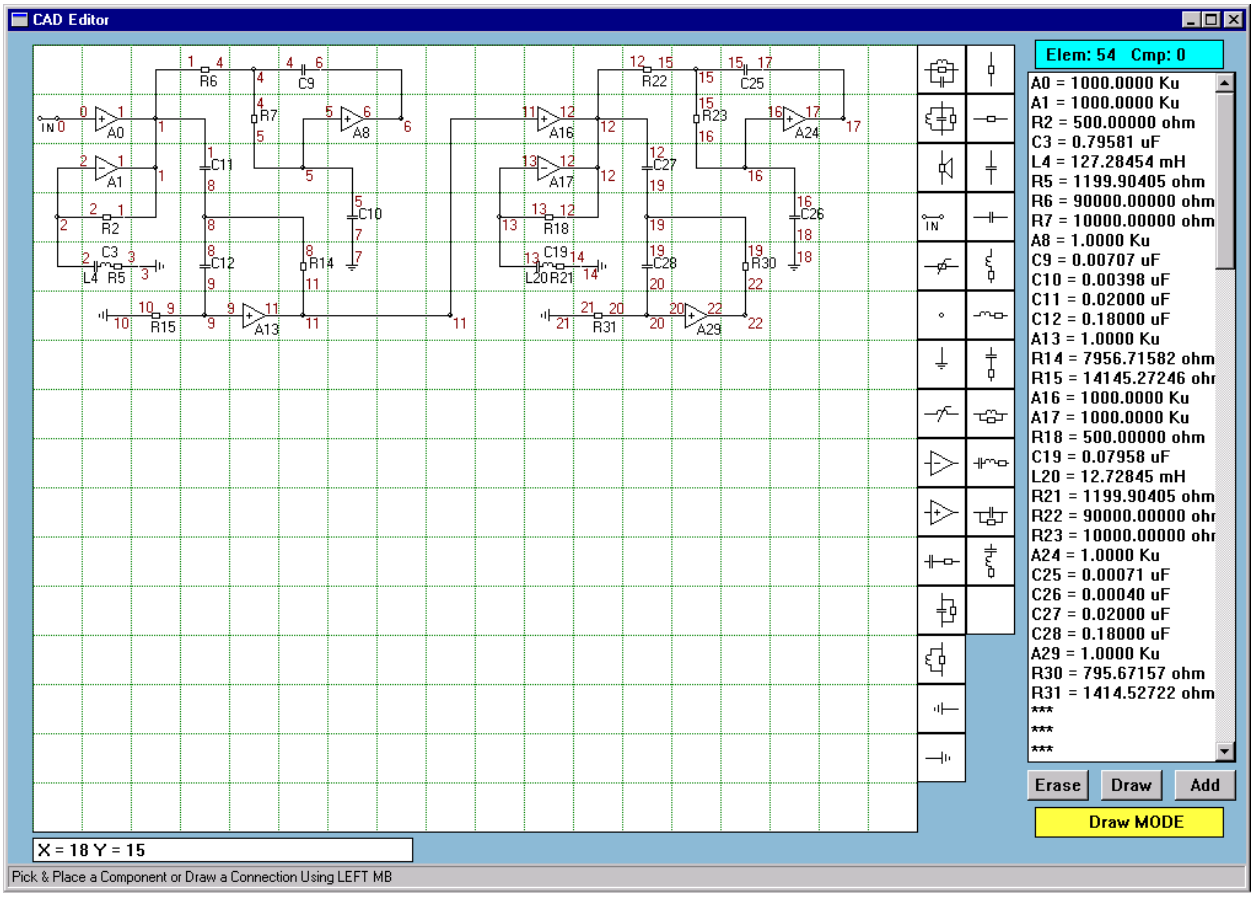
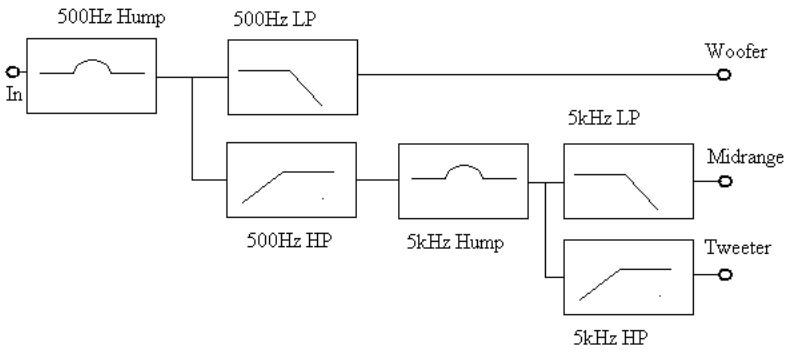
Multi-way Transient Perfect (TP) Crossovers

Woofer:	**Low-Pass,**	**Fc=500Hz,**	**Node 6**
Midrange:	**Band-Pass,**	**500-5000Hz,**	**Node 17**
Tweeter:	**High-Pass,**	**Fc=5000Hz,**	**Node 22**

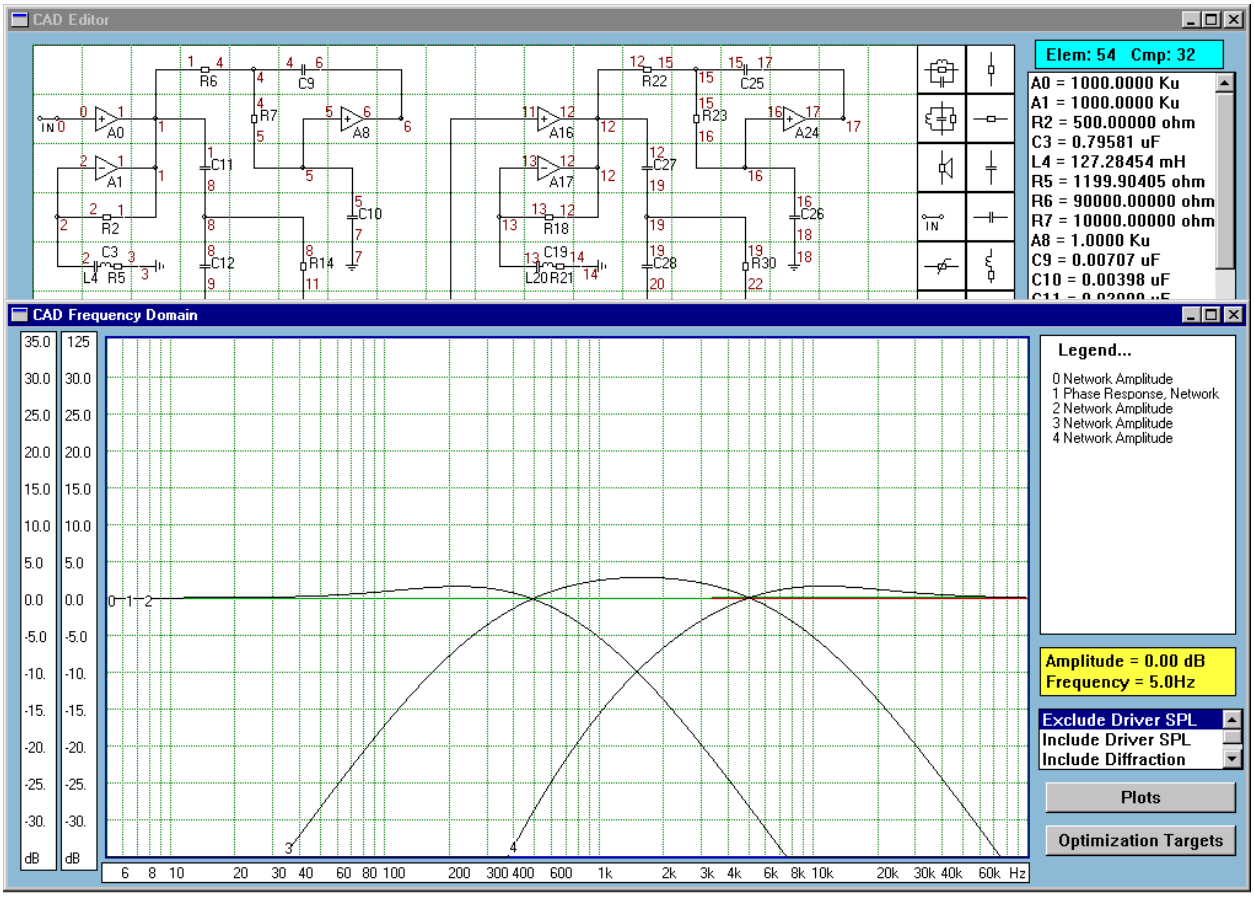
Note: A0+A1 = differential amplifier. A16+A17 = differential amplifier.



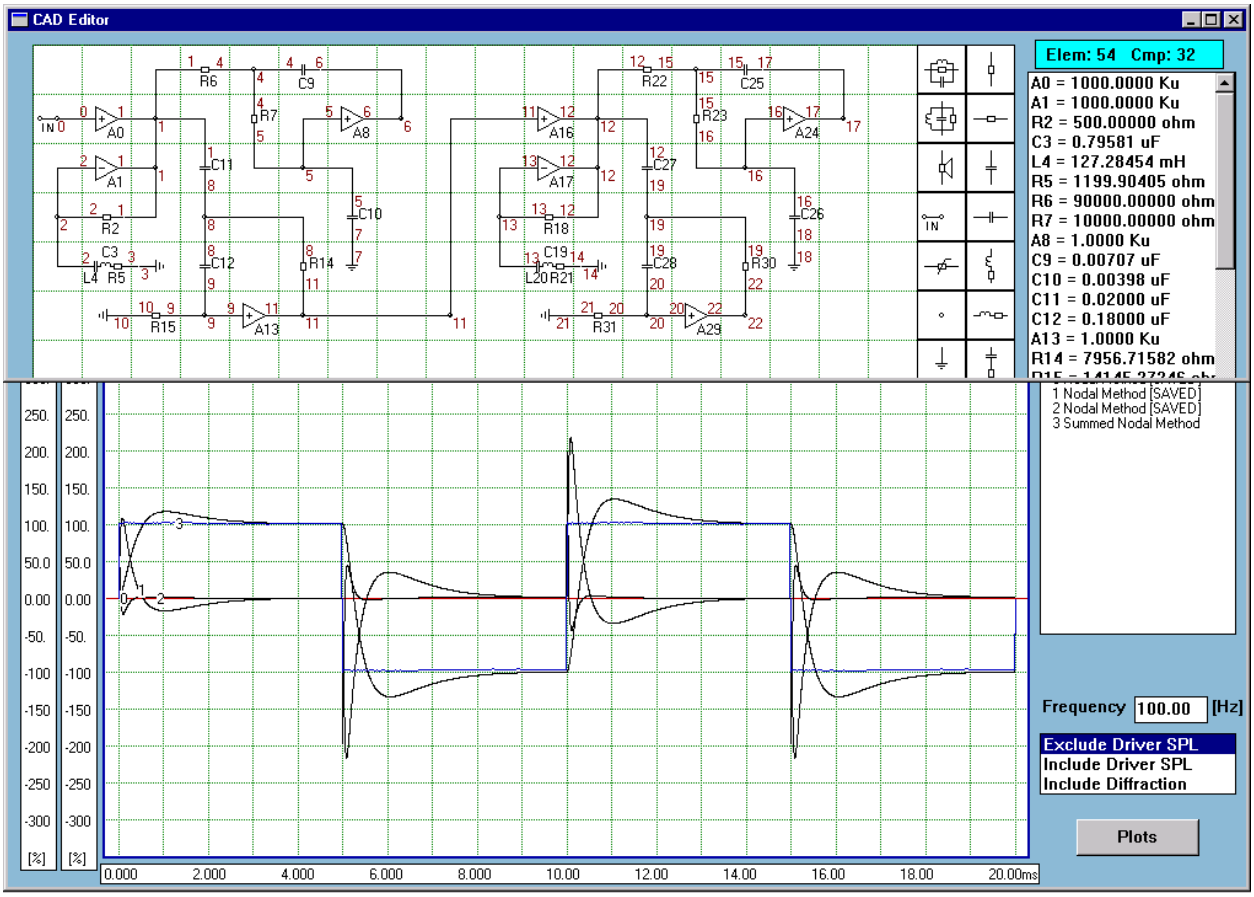
3-Way TP Crossover showing all component values



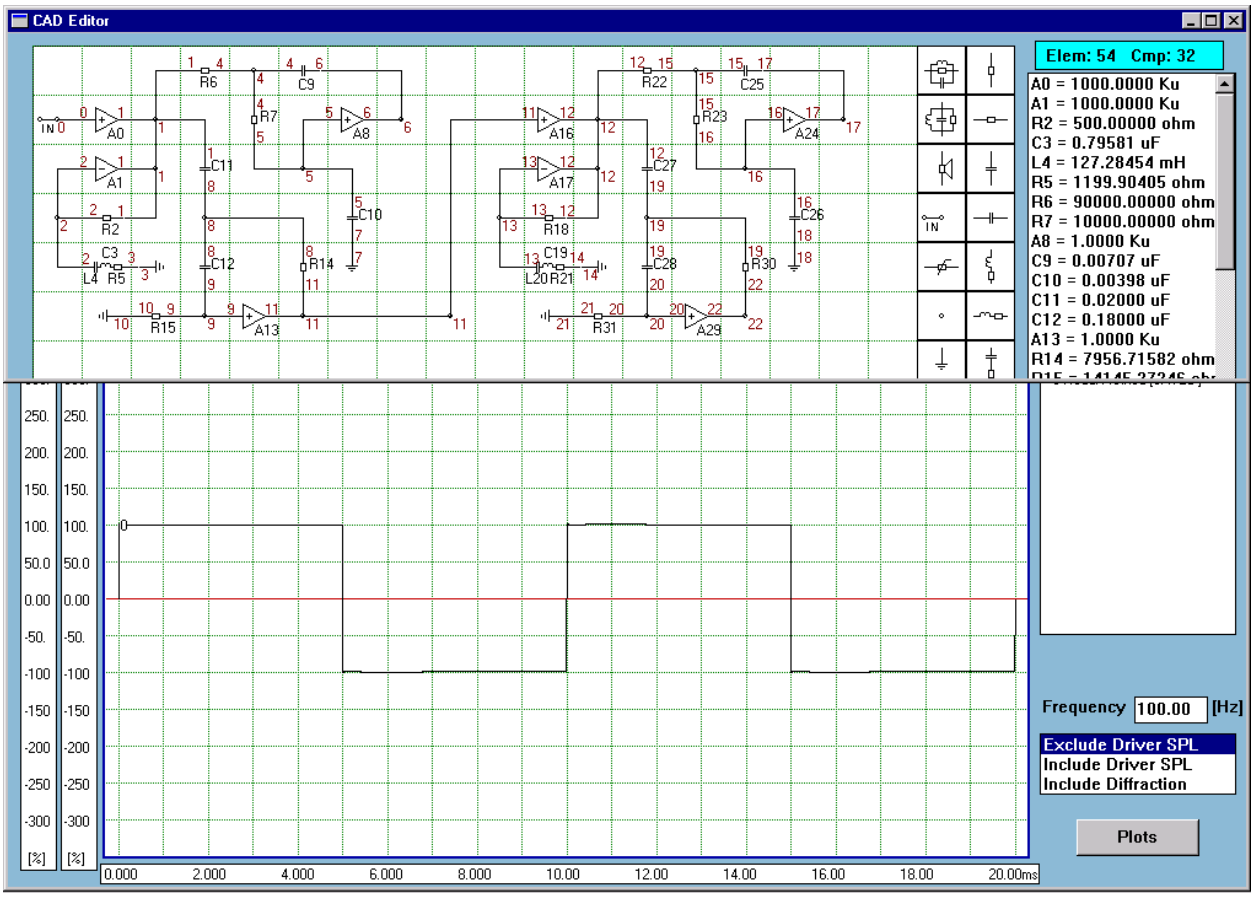
Principle of creating multi-way TP networks: cascade another 2-way TP network (Hump+LP+HP) from tweeter port. Therefore, 4-way 5-way… crossovers can be assembled the same way.



Red – SPL(flat), Green – Phase(flat), Black – individual channels



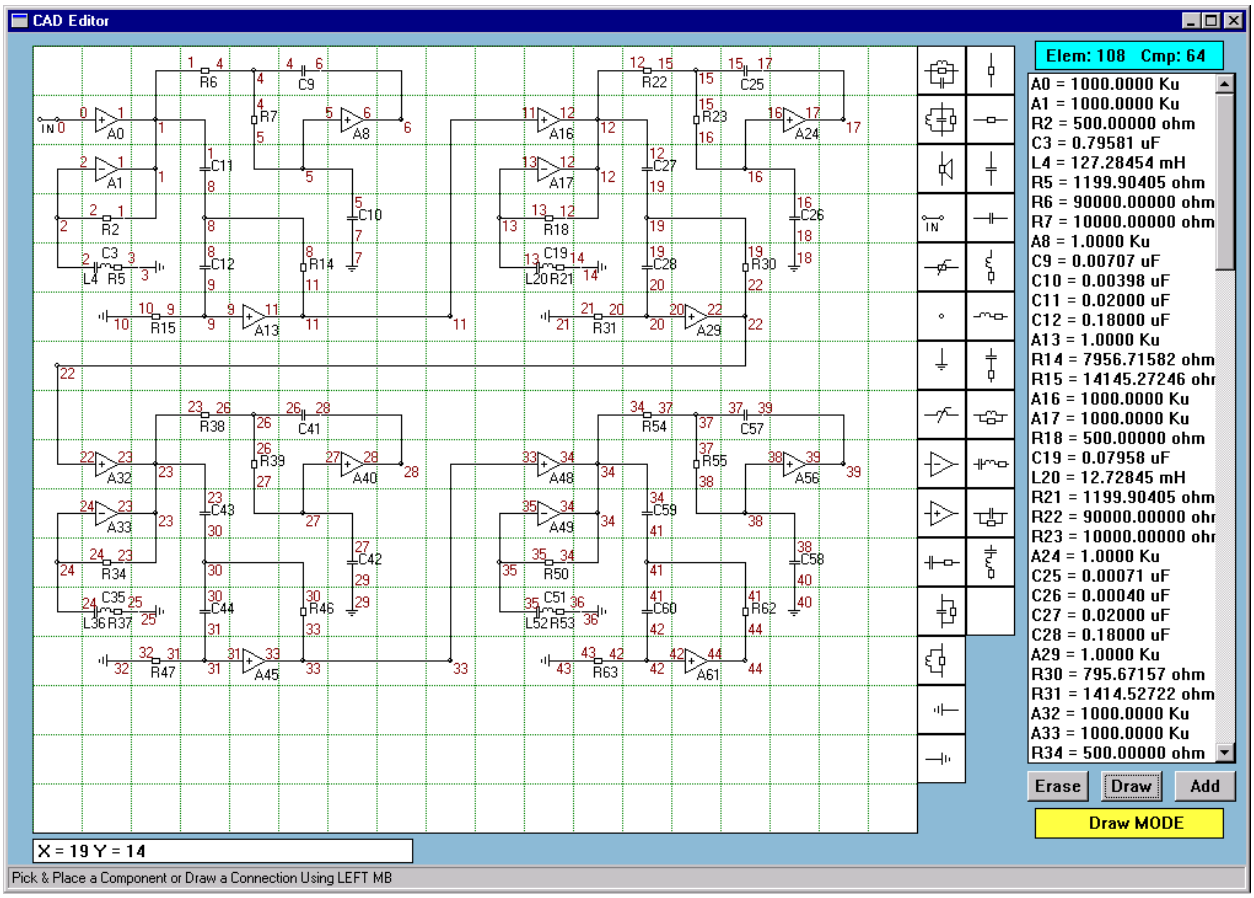
Blue colour is the summed time response of three channels – perfect square wave



Modified Nodal Method used to display time response of all three nodes 6+17+22

Additional requirements:

1. **The active implementation of the 3-way TP network requires three (3) power amplifiers to be connected to each of the crossover outputs. Obviously, 4-way TP network requires 4 amplifiers and so on….**
2. **Gain of the each channel (power amplifier + speaker's SPL) MUST be set <u>exactly the same.</u>**
3. **2-way TP HP/LP filters can be implemented as passive networks, therefore you can get away with single power amplifier.**



5-way, 2-nd order, TP crossover

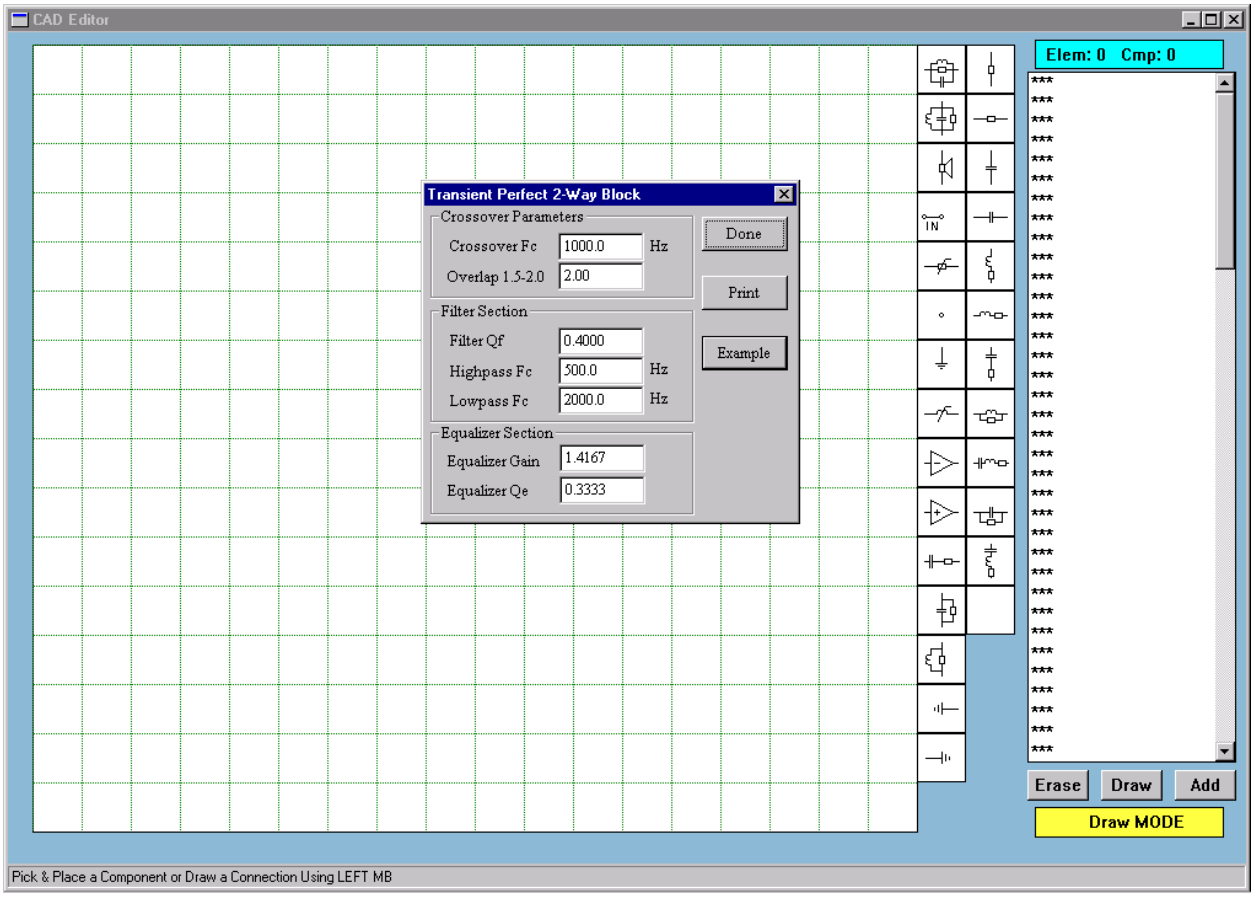
Woofer –	**Node 6**
Upper Bass –	**Node 17**
Midrange –	**Node 28**
Tweeter –	**Node 39**
Super Tweeter –	**Node 44**

SoundEasy 2-nd order TP Calculator is shown below. The 2-way, 2-nd order active crossover with EQ correction is your building block. All you need to enter is crossover frequency and overlap parameters. Filter Section parameters and Equalizer Section parameters are calculated automatically from the two mentioned above. However, you can still edit Filter and Equalizer parameters to force the program into "what-if" analysis.

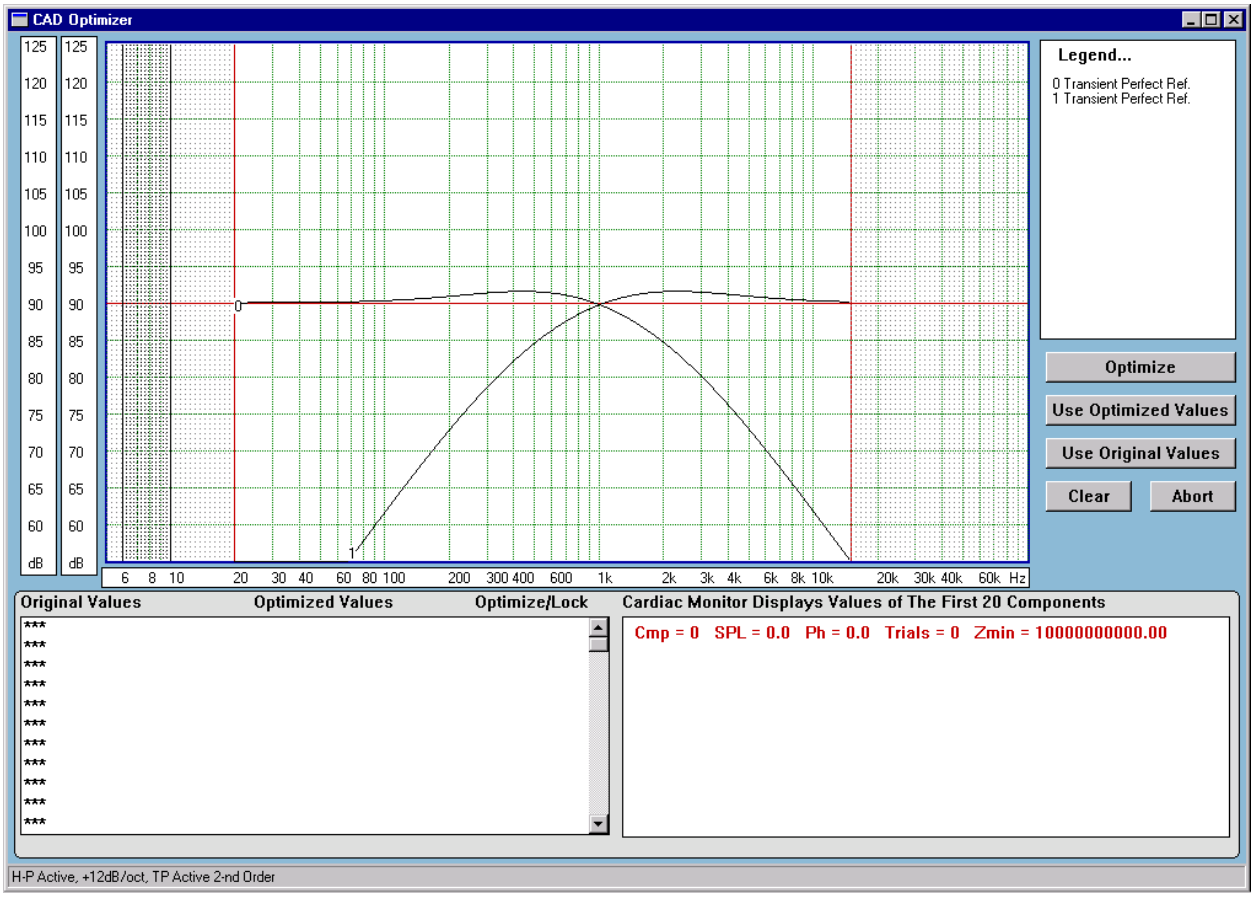
Targets for HP and LP sections of the TP crossover are also built-in for optimizations of the full acoustic response of the crossover – see figure below.

Acknowledgement:
The 2-way TP Crossover and Calculator concepts are due to the excellent papers from John Kreskovsky.

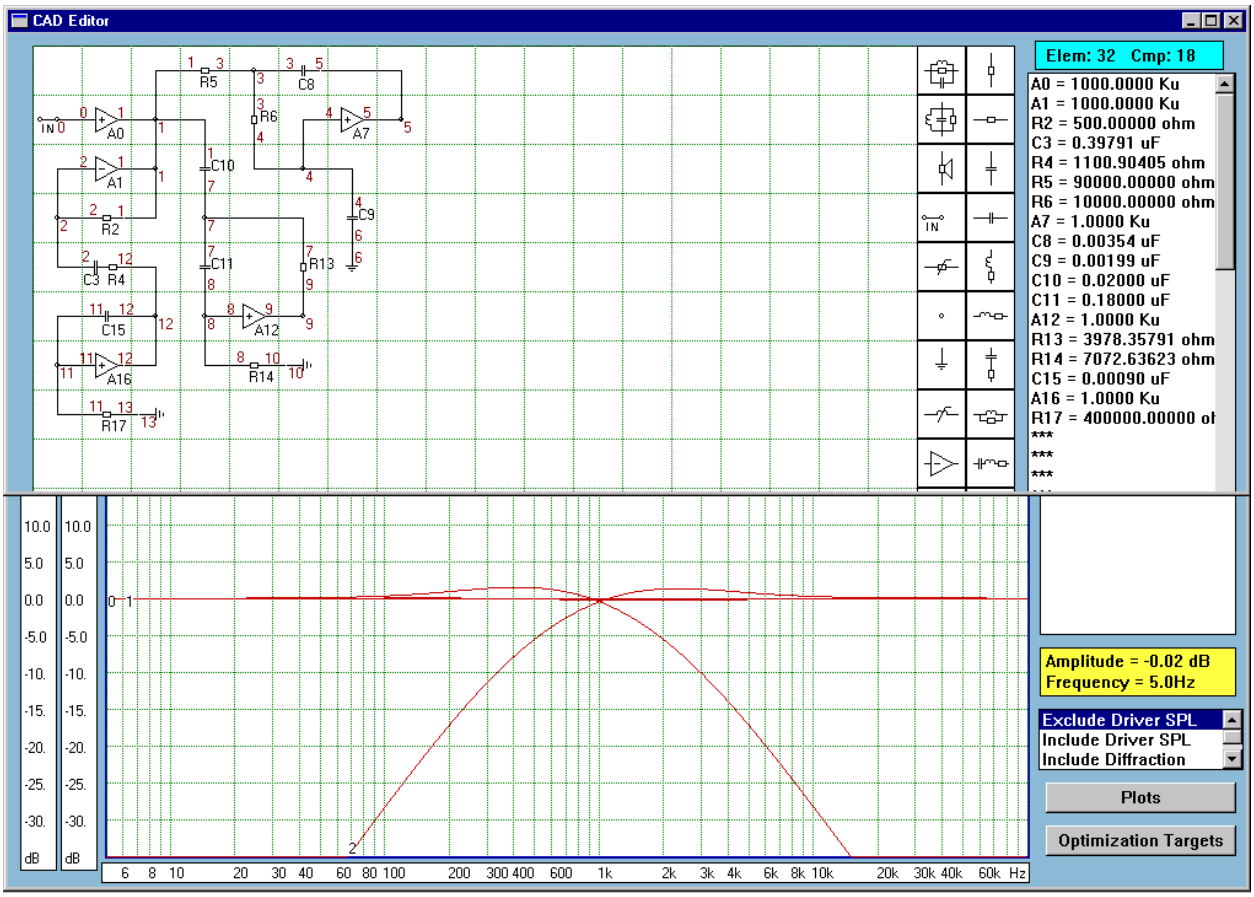
1. "Transient Perfect Second Order Crossover" - May 2001, *AudioXpress.*
2. "Design Rules for Active Implementation of Transient Perfect 2nd Order Crossovers". - In preparation.
3. www.geocities.com/kreskovsky/John1/html



2-nd order TP Calculator – your "building block"



HP and LP Optimizer templates for TP, 2-nd order crossover



TP 2-nd order crossover version with GYRATOR replacing inductor in the EQ circuit.

Note: A16 output impedance is the used as one of the GYRATOR's components. Outputs are Node 5 (LP) and Node 9 (HP).

Approximated value of the inductor, L, created with the gyrator:

L = (R17 – Rout)*Rout*C15
Rout = 200 ohm, output impedance of the A16. Rout should be selected from 200-470 ohm.
R17 = 400 kohm
C15 = 0.009 uF
Hence: L = 70mH

Approximated value of the inductor's, Q, created with the gyrator:

Q = XL/(Rout+R4)
Rout = 200 ohm
R4 = 1100 ohm
L = 0.070 H
Hence: Q = 0.33

Approximated value of the gain, G, created with the gyrator:

G = 1 + R2/(Rout+R4)
Rout = 200 ohm
R4 = 1100 ohm
R2 = 500 ohm
Hence: G = 0.385