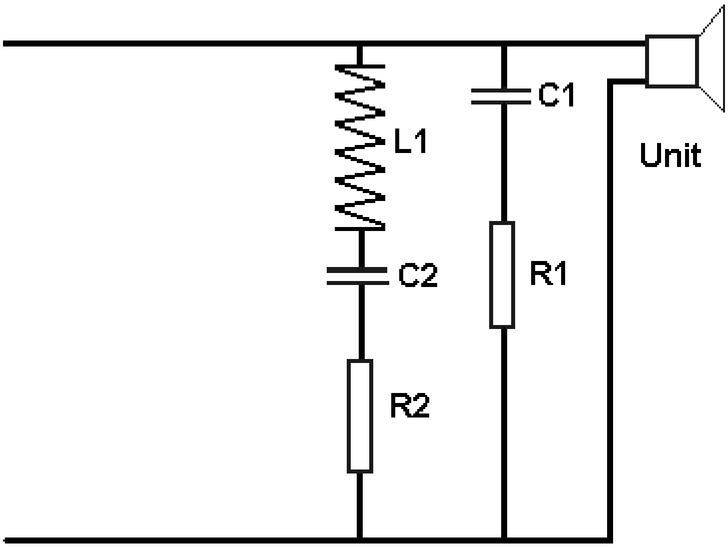
Loudspeaker impedance correction.
When you work with a dividing network, it is a must that the impedance of the loudspeaker has to be corrected to DC-resistance, not just linear as normally seen.
From measurement taken you must determine following.

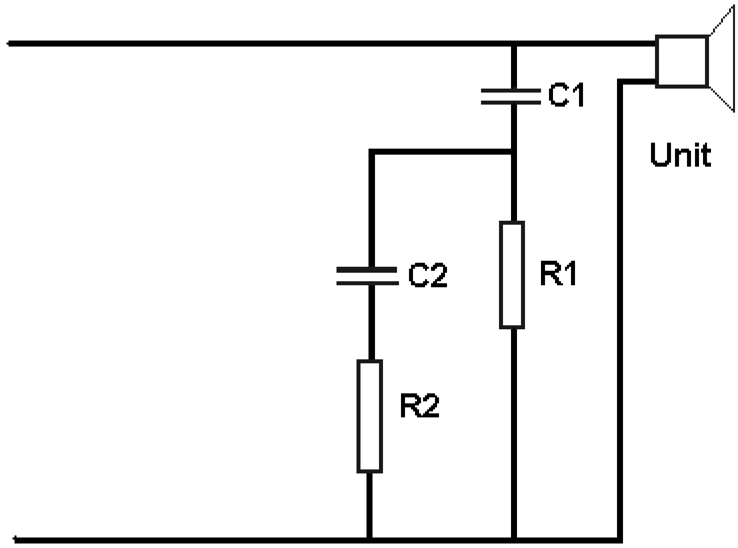
- DC-resistance =R
- Resonance frequency =Fr
- Resonance impedance =Zr
- Frequency for 2*R (voice coil inductance) =F2

From these you can calculate the impedance, for which you shall find the frequency just under and over the resonance frequency.
Look for $(\text{sqrt}(R^2+Zr^2))/2$ and find Fl(ow) and Fh(igh)
To control your reading sqrt (Fh*Fl) should be equal to Fr
You can now calculate values for the components in following circuit.
To calculate C1:
$p=\text{sqrt}(3*R^2) / (2*\pi*F2)$ and $q=R / (2*\pi*p)$ then
$C1=1000000 / (2*\pi*q*R)$ uF
To calculate L2, C2 and R2
$L2=1000*R^2 / ((Zr - R)*2*\pi*(Fh - Fl))$ mH
$C2=1000000000 / (L2*(2*\omega*Fr)^2)$ uF
$R2=R*Zr / (Zr - R)$

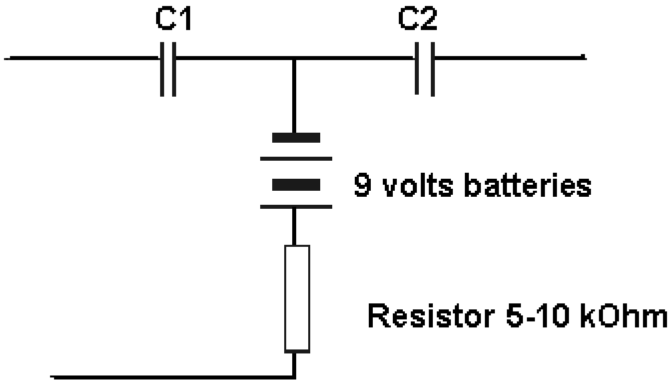


If all was perfect, these values should work, but it isn't. The voicecoil is placed into the magnetic field, surrounded by iron and perhaps copper.
You will therefore probably face mismatches with some or all calculated values, but you will know about where the values are.
It is advisable first to regulate the voice coil inductance, as this network influences the readings on resonance impedance. With copper around the voicecoil you must experiment, as this copper complicates this process.
The C1 works in the lower end and R in the higher end of the rise of impedance caused by the inductance in the voicecoil. You shouldn't be surprised if you have to change the calculated value on C1 and even

double the R-value. This leads to a further rise of impedance to be compensated again to look:



The values depend on the unit used, so you have to experiment.
To my experience great care should be taken to achieve exactly DC resistance. If not - you will have hidden reactance to react with your filter components, sometimes leading to rise of level, more than that received from the unit without any components attached. This extra energy is created by the components within the unit together with the network, and should obviously be avoided. It is a resonance.
Another strange parameter is the need of quality for the components used for this part. Despite they're coupled in series with a resistor, they must be of very high quality.
When this is fixed, you should measure again, to get the value needed for correction of rise of impedance on resonance frequency. Here copper again can interfere, so if that is present the inductance must be raised by a factor 1.4 and capacitance lowered by a divisor 1.4. (This value can vary dependant on factory)
You probably can't avoid use of electrolytic capacitors of the bipolar type. If you need high values you can connect two polar capacitors in series negative to negative or positive to positive (dependant of can connection) to reach that property, beware of voltage - that doesn't double and should be chosen high. (100 v or more)
The calculated value using C1 and C2 should be C1*C2/(C1+C2) and remember to take off their plastic cover.
You can improve the performance of this coupling by adding negative/positive voltage (dependant on polarity chosen) to their connection. See fig.



C1 and C2 will, if the battery voltage is chosen high enough, never reach zero voltage, where the memory effect comes forward. It is a cheap trick for you to try.
The coil could be a toroid coil with airgap in the iron, and able to handle high current, or the former described air-toroid dependent on frequency - iron for low and air for high frequencies. (Over 400 Hz).
The resistor must be able to handle high effect and its calculated value has to be lowered with that DC-resistance present in the correctional coil. Some like to place all impedance inside the coil, but then beware the warmth generated.
But you are not finished yet. You should test how it all behaves under dynamic conditions. For that you should play some music, at a sound level you normally prefer, for an hour or two. Then measure again and look for changes due to rise of temperature in the parts, and correct if necessary.
On could believe this part of the work to end here, but it isn't, you'll probably have to return to this circuit to make slight modifications, to optimise the roll off of the unit, when the filter components is attached. It all is heavily connected, as the output from the unit still is dependent of its Qt, even if it is electrically corrected. If it comes through you can lower the impedance in the correctional circuit.
It is a most tiresome work to get it all right, but there are no ways around these adjustments to get it all in order.