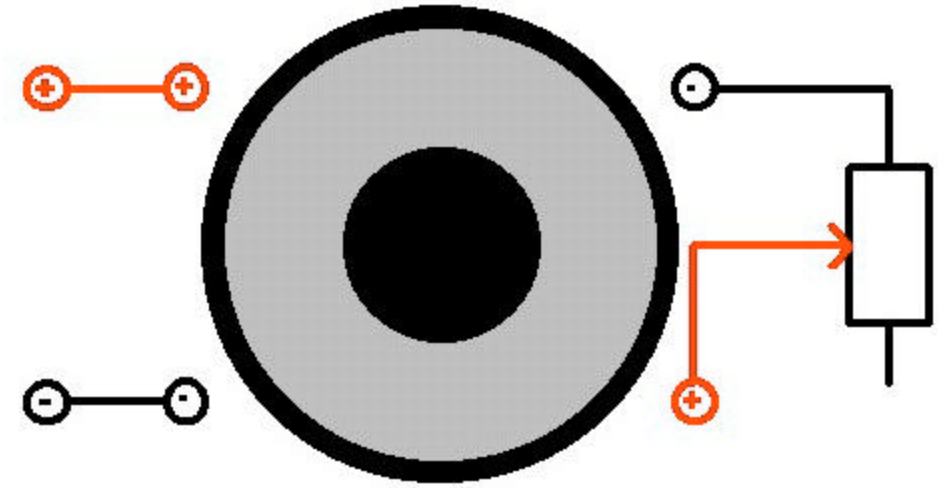
RESISTIVELY DAMPED OPERATION

RDO is a method that can be used with dual voice coil drivers. It allows you to vary the Qts of the driver over a range of nearly 2 to 1, from the "nominal" Qts up to nearly double that value. Since you can't decrease the Qts of the driver with this approach, it is typically only useful with very-low Qts drivers, or in sealed or infinite baffle installations.

RDO consists of placing a variable resistance across the second voice coil of a dual voice coil driver. The amplifier is connected to the first voice coil as normal; the second voice coil is terminated with a potentiometer (variable resistance). One end of the potentiometer is connected to the negative terminal of the second voice coil, while the wiper of the potentiometer is connected to the positive terminal of the second voice coil. The other end of the potentiometer is left open:



Adjusting the potentiometer to move the wiper towards the open end will increase the resistance seen by the second voice coil; adjusting the potentiometer the other way will decrease the resistance.

The math behind RDO is fairly simple; the best explanation/set of equations we've seen comes from Ron Ennega, and was posted at Brian Steele's DIYSubwoofer site:

> First you need the original Rms:
> Rms = 2 * pi * Fs * Mt / Qms
>
> Next calculate:
> Rms'=Bl^2 /(Re + R) where R is the shorting resistor
>
> Rmt = Rms + Rms'
>
> The new Qms is:
> Qms' = 2 * pi * Fs * Mt / Rmt
>
> Qes does not change:
> Qts = 1/(1/Qes+1/Qms)

We've condensed the equations into a single Excel 95 spreadsheet which you can download by clicking on this link.

Because of the rate of change once resistance reaches approximately 200 ohms, we recommend a simple 5W, 250 ohm resistor (we recommend the CT2155-ND, available from Digikey). A 5W value is plenty of power handling, as the transferred power to the second coil is quite small.

There are a few downsides of this connection:

1. Lower efficiency. Because the Qes is doubled, efficiency is lowered by 3 dB. If the driver already has a low efficiency (85 dB or lower), it may be lowered beyond a useable level.

2. Reduced power handling. Because the second voice coil is undriven, it acts somewhat as an "insulator" on the driven voice coil. As such, power handling is slightly reduced. It is best to " derate" the power handling of the driver by approximately 25%.

Overall, RDO has some definite potential in specific installations. A driver with a variable Qts can be a significant boon in many situations. One can build a large sealed box that has a low "musical" Q when a low resistance is dialed in, and a higher "thicker" Q when a higher resistance is dialed in.