



Soup Ceramique Mk-II

Soup Ceramique – Taste's change

Loudspeaker designing is like cooking. The art is in choosing the correct ingredients and blending them together in a way that you find pleasing. Like food, one's taste in sound can also change over the years. The article describes my latest and final version of the Soup Ceramique and how it has evolved since the first pair were built way back in 2004. It still uses the same drivers in the same cabinet but now the port has moved to the rear and the crossover has been completely re-designed from scratch.



The tweeter

The [Accuton C25-6-12](#) is a 1 inch tweeter with an ultra hard ceramic dome in a 82 mm front-plate. Anti-resonant cut-out fills in the concave ceramic dome provide for damping of the dome resonance. An overhung motor design with vented aluminium voice coil former guarantees low energy storage and excellent heat transfer. The soft fabric surround and ferro-fluid with high viscosity centre the moving parts with distinctive linearity. Accuton recommends an application above 2500 Hz. When I first used this tweeter, they recommended a first-order crossover from as low as 2000Hz - I guess they have also learnt from practice like I have. More about that further down the page.



The mid-woofer

The [Accuton C90-6-089](#) is a 5 inch midrange driver with an ultra hard concave ceramic dome. An FEA optimized overhung motor

design with 38 mm titanium voice coil former guarantees very low energy storage and good heat transfer. The low loss rubber surround and a thin fabric spider centre the moving parts with high linearity. Accuton recommends a bass - midrange application from up to 3000 Hz.



The woofer

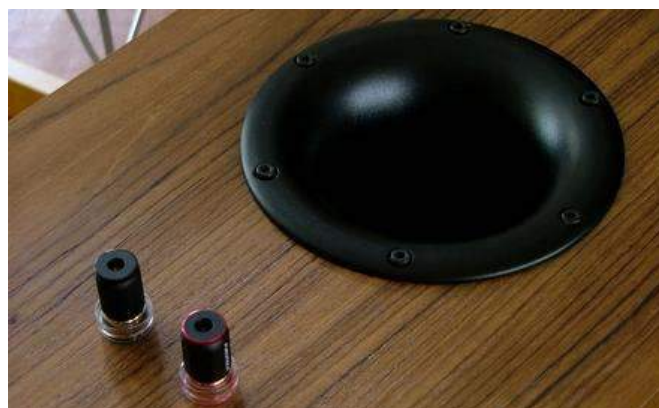
The [Accuton C220-6-221](#) is an eight inch bass driver with an ultra hard inverse ceramic dome. An FEA optimized overhung motor design with 38 mm titanium voice coil former guarantees low energy storage and excellent heat transfer. The low loss rubber surround and a thin fabric spider centre the moving parts with high linearity. As a typical home stereo bass driver, Accuton recommends the C220-6-221 for an application from 32 Hz - 2000 Hz.



The cabinet inside and out

The raw cabinets are made of thick 30mm mdf; the front baffle is double layer with 60mm total thickness. To create the angled baffle the four corners were machined to fit separate panels, if you don't have the possibility to do this, the same visual effect can be done by making the four corners even thicker on the inside and then cut the angles away as can be seen during my factory tour. The outside of the cabinets are the veneered and finished with a few layers of clear water based, polyurethane reinforced varnish. Internally there are several bracings to give extra stability to the cabinet, the separate midrange enclosure also adds to this extra strength. All internal walls (including the midrange enclosure) are covered with a double layer of bitumen (2x4mm) to add extra mass and control panel vibrations. A layer of wedge-moulded foam covers the inside of the woofer compartment to minimize internal reflections. The midrange enclosure is filled completely with sheep's wool. The bass volume is tuned to taste with bonded acetate fibre (BAF) filling the top section behind the midrange enclosure and a little directly behind the woofer. The area around the reflex port is left clear. The cabinet measures 1025x260x405mm with an internal volume of 50 litres for the woofer tuned to about 28Hz it gives a -3dB point around 30Hz. The closed mid-woofer compartment is about 4 litres in volume.

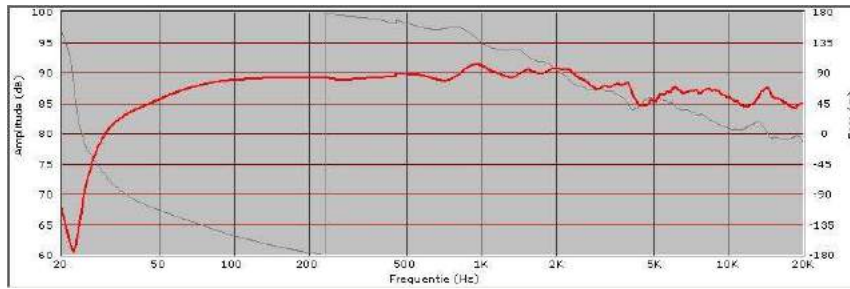
The 30mm thick black painted base-plate acts as a visual plinth to give the speaker a more graceful appearance. The first difference with the original Soup Ceramique is that the reflex port is now mounted on the rear to make room placement less critical. It doesn't matter any more if you have a soft carpeted floor or hard tiles. A single pair of high-grade Furutech FP800(G) input terminals is provided just below the Intertechnik JetSet-70 port on the enclosure rear. Three Soundcare cones - two for the rear and one for the front of each loudspeaker provide optimum stability on all floors. The loudspeakers sound their best with their contoured grilles off and also the cabinet's swept-back profile better time-aligns the drivers, and makes the speaker more stable by shifting the massive front baffle's centre of gravity rearward. All internal wiring is very pure Furutech Alpha S-14 copper wire.



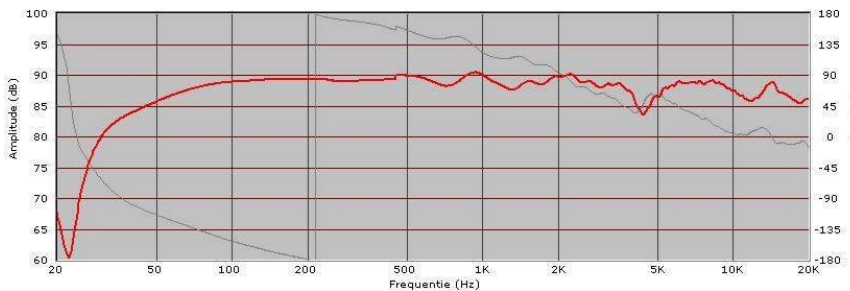
The evolution of a crossover

Before I discuss the latest crossover in detail, I would like to compare the three crossovers the Soup Ceramique has had. Below you can see the frequency curves of the three different crossovers all created with the real-life measurements of the latest Soup. The original crossover was designed in 2004, here you can see that the treble is down about 3dB's from the rest of the spectrum. This

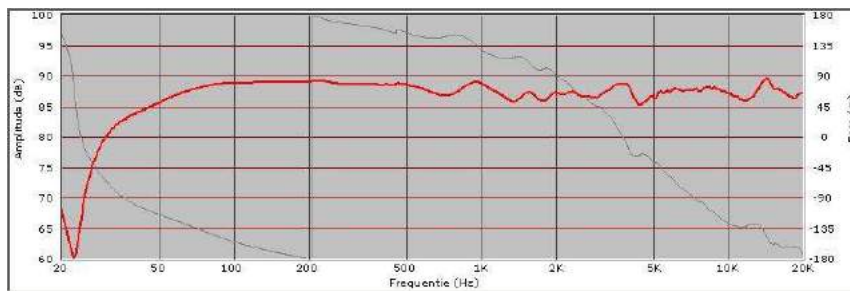
gave a very easy listen to speaker that worked great with those so called audiophile recordings of jazz-trio's etc. but when fed normal music they lacked transparency and were too midrange forward blocking out image depth. The second curve is of the 2007 crossover. Here you can see the treble has been lifted about 2dB's and the midrange reduced about 1dB. Much better overall balance but in practice they still missed bass-weight and drive. They sounded a bit on the polite side. Finally the bottom curve is of this new 2011 crossover. The whole midrange has been lowered about 2 to 3dB's and the treble adjusted to match. This creates a much more powerful sounding loudspeaker seeing as the bass level has not been changed. By the way these curves don't take into account the output from the port, so in real life the in-room bass response goes much deeper.



2004

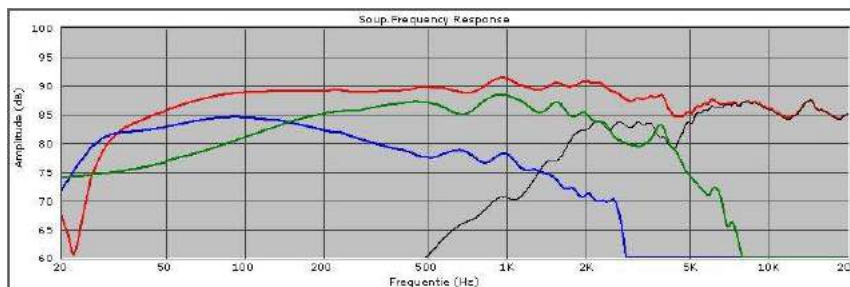


2007

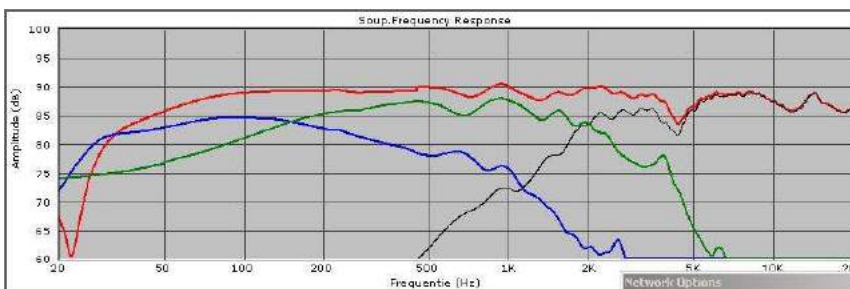


2011

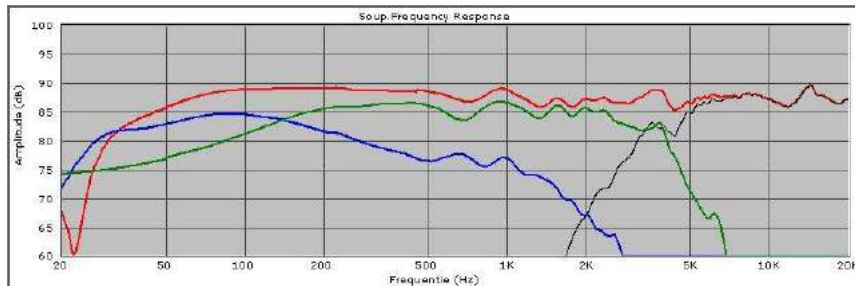
So far the overall response but there is more to it. As mentioned at the beginning of this article, Accuton originally stated that the tweeter could be used with 1st-order crossovers even as low as 2kHz. The 2004 and 2007 versions had a 1st-order series crossover (9dB per octave) with a crossover-point of about 2kHz. This was perceived as very detailed but in turned out that the tweeter was being pushed to (and over) it's limits. At higher SPL's or with certain types of music the sound could become a little "stressed". So the new crossover design not only had to change the tonal balance, it also had to give the tweeter much more protection. Now this is where it got tricky: first of all the cabinets cause baffle edge diffraction. This can be seen as the 5dB dip in the tweeters output at 4400Hz. Furthermore the mid-woofer has a peak at 3800Hz. Fortunately it's only a mild peak and its decay time is a short as the rest but it does need attention when designing the crossover.



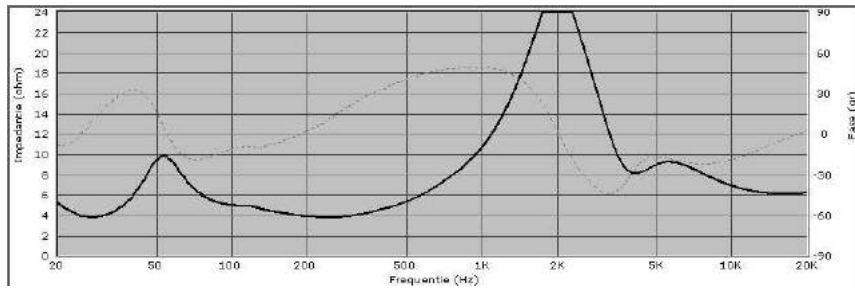
2004



2007



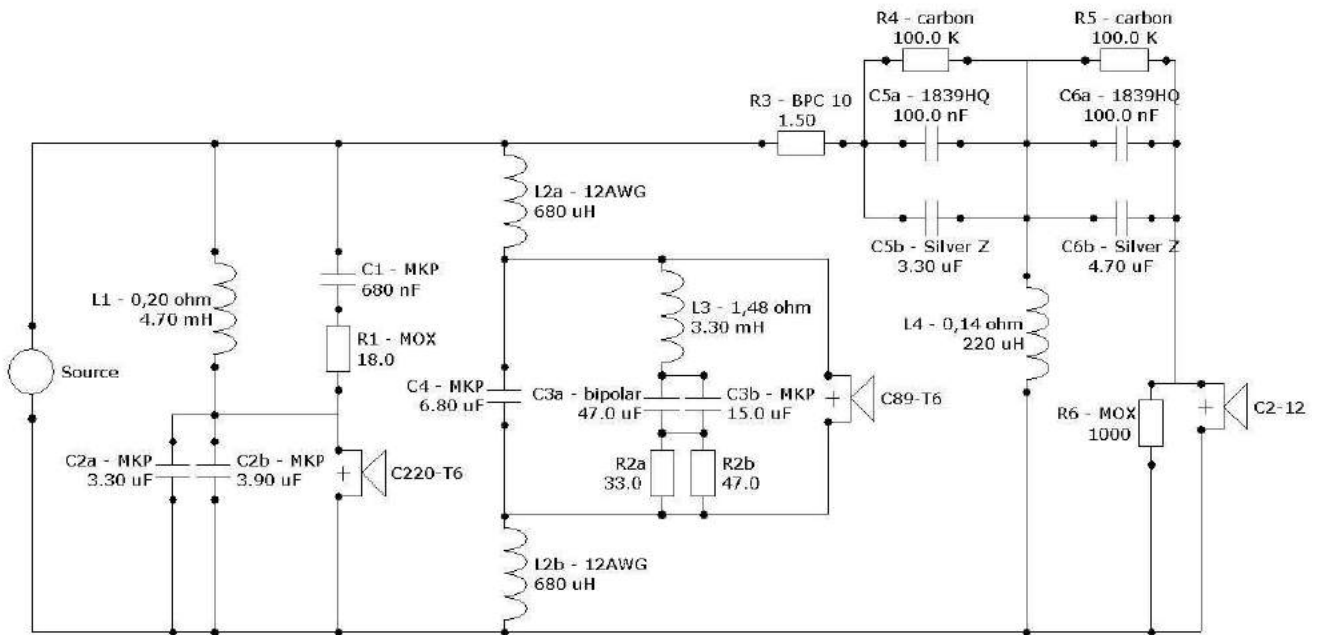
2011



2011

The measurements of the final 2011 version show a crossover point between the mid-woofer and tweeter at about 3500Hz with much steeper curves. The tweeter now can really shine without getting hot. The impedance plot shows a 4 ohm load in the bass and lower midrange with a minimum of 3,8 ohms at 250Hz. The impedance further up the scale is higher. Together with the 88dB overall efficiency this should be an easy load for most amplifiers except maybe for some light-weight single ended triodes.

Crossover components



L1 = 4,7mH / 0,20 ohms Intertechnik Torobar

L2a = 0,68mH / 0,15 ohms 12 AWG copper-foil inductor

L2b = 0,68mH / 0,15 ohms 12 AWG copper-foil inductor

L3 = 3,3mH / 1,48 ohms baked air-core inductor 0,80mm wire

L4 = 0,22mH / 0,14 ohms baked air-core inductor 1,40mm wire

R1 = 18 ohms / 10 watts MOX

R2a = 33 ohms / 10 watts MOX

R2b = 47 ohms / 10 watts MOX

R3 = 1,5 ohms BI-Technologies BPC-10

C1 = 0,68uF standard quality MKP

C2a = 3,3uF standard quality MKP

C2b = 3,9uF standard quality MKP

C3a = 47uF Mundorf E-Cap glatt / plain

C3b = 15uF standard quality MKP

C4 = 6,8uF standard quality MKP

C5a = 0,10uF Vishay MKP1839HQ

C5b = 3,3uF Jantzen Audio Silver Z-Cap

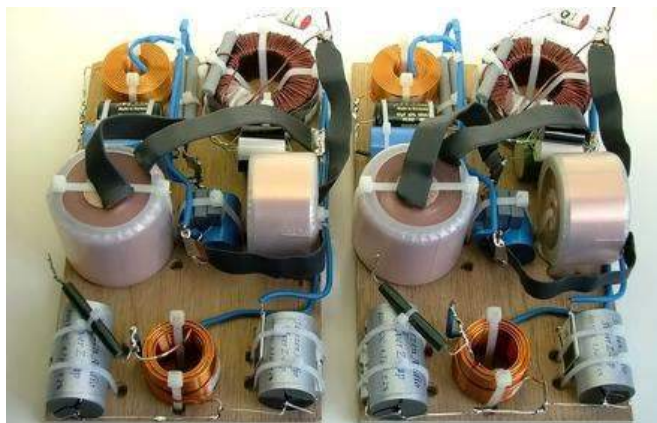
C6a = 0,10uF Vishay MKP1839HQ

R4 = 100 Kilo-ohms / 0,25 watts carbon-film bypass resistor

C6b = 4,7uF Jantzen Audio Silver Z-Cap

R5 = 100 Kilo-ohms / 0,25 watts carbon-film bypass resistor

R6 = 1000 ohms / 24 watts Welwyn W24



Listening impressions

What I like about this "new" loudspeaker is a pleasant balance between detail and warmth. These ceramic drivers let you hear every detail in the recording and all the characters of your Hi-Fi-system but never become tiring or over etched due to the solid and warm bass that underlines everything. The bass goes subjectively deeper than the earlier versions and has more weight, drive and power. The midrange and treble fit seamlessly to this bass and are very coherent, they just sound as one, you can't hear the individual drivers at all. So even though this loudspeaker uses the same drivers in the same cabinet, their overall sound and character is totally different. Just goes to show that the crossover is by far the most important part of any loudspeaker, far more important than the drivers used. The drivers and cabinet must also be of good quality but it's the crossover itself that can make or break any loudspeaker.



Tony Gee, The Netherlands, February 2011

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