DUO omega

The DUO combines all of Avantgarde Acoustic™ ´s technological and creative potential, resulting in a most sophisticated two way horn system.

With its enlarged 670 mm midrange horn, a driver system of exclusive quality and precise integration of all components, this system offers unrivaled performance across the sound spectrum. The DUO with 8 ohm is already a "classic" among 2-way horn systems.

Now the DUO takes the next step introducing the DUO OMEGA system. The DUO OMEGA uses the same drivers developed for our flagship META PRIMO model. Furthermore they incorporate as well the new CPC crossover technology. The technology is retrofitable, so customers can easily upgrade their existing 8 ohm DUO systems.

„The OMEGA drivers are fantastic. I did not expect such an improvement to my 8 ohm DUO! They are much more detailed, but yet even more involving musically. The entire speaker seems much more alive and dynamic" Jim Smith, USA.

The DUO OMEGA is a 2-way spherical hornspeaker system, equipped with the SUB225 subwoofer for the bass range below 170 hz. Its hybrid concept with self-powered bass and the very high sensitivity (108 dB/W/m) makes it easy to drive with any amplifier and delivers outstanding dynamics and resolution.

THE MIDRANGE DRIVER

"*Mostly people focus on treble and bass and completely forget about the mids. But when we design a new speaker we always start with the midrange. The midrange is the core of any system. If you get this right you have practically done most of the job*" explains Matthias Ruff, technical designer of Avantgarde Acoustic™.

The DUO OMEGA offers the same technology as Avantgarde´s flagship model TRIO. It features a sophisticated M2 omega driver with high impedance technology loading a 670 mm spherical midrange. "*First we had to get the performance of the smaller horn to the TRIO level. We experimented with very high impedance voice coils. But the sensitivity was too low*".

During the design process of the M2 omega midrange driver the copper in the pole-piece got eliminated by the designers. "*We managed to increase the effective magnetic flow in the air-gap of the driver by eliminating the usual copper inlay of the pole-piece. The roll-off at higher frequencies caused by the higher inductivity of the voice coil and a specially designed cellulose dome was than set to the exact crossover point of the tweeter.*"

M2 OMEGA MIDRANGE DRIVER

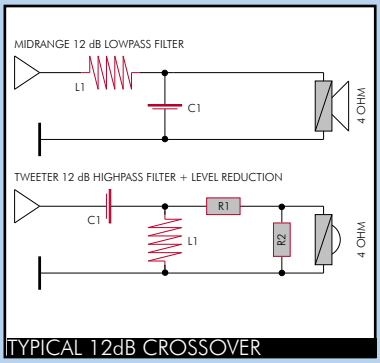
M2 OMEGA MIDRANGE DRIVER

Furthermore Avantgarde Acoustic™ added a powerful ALNICO magnet to this new M2 omega development. This precious magnet material generates a powerful magnetic field which homogeneously controls the movement of the voice coil.

"*I am very proud that we achieved the ambitious task of getting the midrange driver close to the TRIO performance. We got the sensitivity just perfect. But when we incorporated our new cone with VDE technology I was simply blown away. Smooth, revealing with no artefacts*" raves the designer.

The midrange cone of the DUO OMEGA is coated with trillions of tiny microfibres generating a "VELOURS DAMPING EFFECT". According to the manufacturer, this incrementally small fur of the VDE technology cone effectively works in two ways. First it reduces partial resonances of the cone. "*It is similar to a waterbed with only one chamber. Once you move it takes years*

THE OMEGA TECHNOLOGY



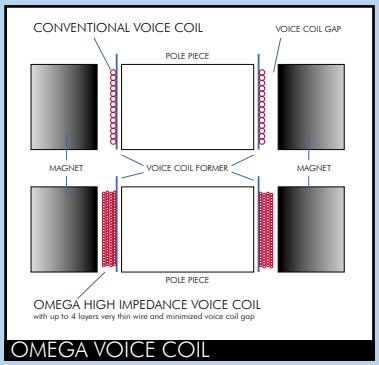
TYPICAL 12dB CROSSOVER

To significantly improve the sound quality Avantgarde Acoustic™´s OMEGA approach is based on two major concepts: simplification of the passive crossover design and high impedance voice coils.

Different to conventional passive crossovers with six components (see graphic) the META PRIMO crossover has only two components for the tweeter and no component for the midrange. Using no crossover in the midrange is usually not easy due to the large overlapping of the frequency response. Using their "Controlled Dispersion Characteristic" of the driver/horn configuration, Avantgarde Acoustic™ effectively controls the output. This is how CDC works: The lower cut-off frequency of a horn loudspeaker is determined by the size of the horn. The larger the horn, the lower the response. Below the cut-off frequency of the horn, the response falls off steeply at 18 dB/octave. Avantgarde speakers thus operate only down to their cut-off frequency limit and require no high pass filters. The upper frequency response is determined by the driver. However, it can as well be influenced acoustically by the horn. For this purpose, Avantgarde places a small chamber between the driver's membrane and the horn throat. The driver does not emit directly but via a small air chamber into the horn throat opening. This air volume operates as a kind of band-pass filter and automatically filters frequencies above the resonance volume of the chamber (at 6 dB/oct.). By choosing an adequate driver with a natural roll-off at 6 dB in this frequency range, the manufactuerer obtains an acoustic attenuation of the frequency response of 12 dB without any passive frequency crossover. No further low pass filters are necessary! The CDC system thus causes the midrange to only operate within their operational band and steeply fall off at the transition points.

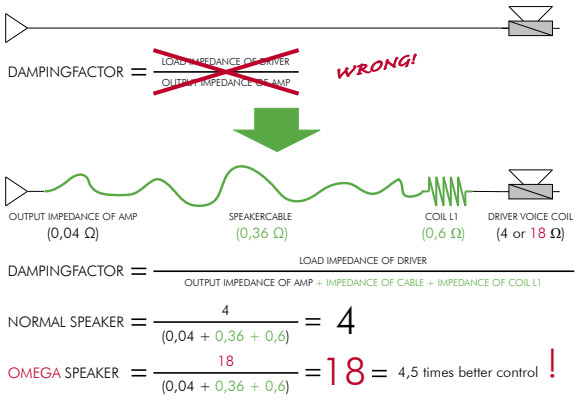
The attached graphics show the difference of conventional and the new OMEGA voice coils. To achieve very high resistance the voice coils of the OMEGA drivers are made with very long but very thin wires. Up to four windings are placed on the voice coil former. Elaborate production technology is required as the wire is so thin and easily breaks and the voice coil gap is so narrow. Now, why is the horn manufacturer taking so much energy and effort to simplify the passive crossovers and enhancing the impedance of their voice coils?.

The key point is the damping factor. Damping factor is the technical term for the ability of an amplifier to control the movement of the membrane. E.g. simply speaking the force the amplifier applies to the voice coil to follow exactly the musical signal. According to common knowledge the damping factor is determined by the quotient of load impedance (driver) and output impedance of the amplifier. An amplifier with an output impedance of 0,04 ohm will thus theoretically have a damping factor of 100 when connected to an 4 ohm speaker. But this is a purely theoretical figure! In real life the signal has to pass a speaker cable and the passive crossover components till it reaches the voice coil. Using a typical 5m long speaker cable with an W-resistance of 0,36 ohm and a resistance of the crossover coil of 0,6 ohm, the effective real damping factor will decrease to a value of only 4! Connecting the same amplifier/cable configuration to the META PRIMO will result in a real damping factor of 18, which gives 4,5 times more control and presicion! E.g. the control of the amp will increase by 450% and at the same time will reduce the negative effects of long speaker cables by 80%. As a result the OMEGA drivers have more authority, less distortions and an excellent detailled response characteristics.



OMEGA VOICE COIL

The high impedance of the voice coil in OMEGA drivers can be best compared with the car tires. Big tires cause a higher rolling resistance but at the same time have a much better traction. Using low impedance drivers is thus like using thin tires. Adding resistance with cables and coils in the passive crossover, is in this case like using thin tires with pulled handbrake!.



DAMPING FACTOR COMPARISON

till the movement of the water comes to a halt. Using multiple chambers in waterbeds will immediately calm any motion" explains Matthias. "*Same with our VDE drivers. Any movement of the cone itself is dampened by these microscopic fibres*". The second benefit of the VDE technology is that it effectively absorbs high frequency distortions. "*If your listening room sounds hard you will probably use a carpet or hang up a curtain. That´s how simple VDE works. The irregular surface of the cone just eats up unwanted harmonic distortions.*"

The generously dimensioned ALNICO magnetic structure of the 170 mm (7 in) cone, provides an extended efficiency as well as offering very high power handling at long excursions. This way the M2 omega has a very low cut-off frequency of 170 hz which allows for an integration with the subwoofer without any passive crossovers. The design of the dome ensures the sound waves entering the midrange horn SH6704 are in phase and cover the required extended bandwidth.

The CDC system features a controlled roll-off at 2,000 Hz and consequently allows the operation of the M2 omega in full range mode, without any degrading filter components in the signal path.

"*When you connect your Avantgarde speaker the voice coil of the midrange driver is directly linked to your amp. No phase shifting components in between, only the speaker cable! You can´t get an any bet-*

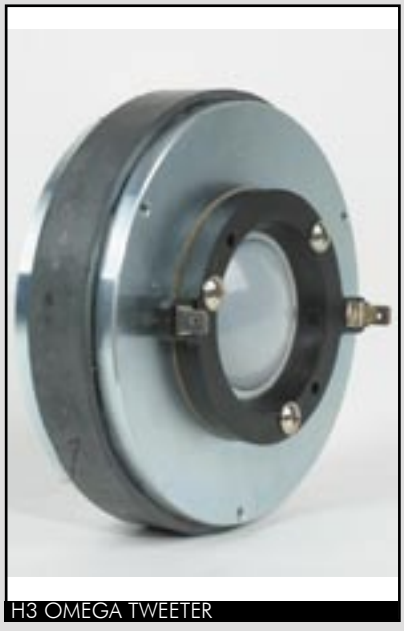
ter direct connection."
The M2 omega offers a neutral, silky and contoured sound reproduction across its entire frequency range. Vocals, instruments and complex signals are reproduced with speed and ease that will let you forget that you are listening to a recording.

THE TWEETER

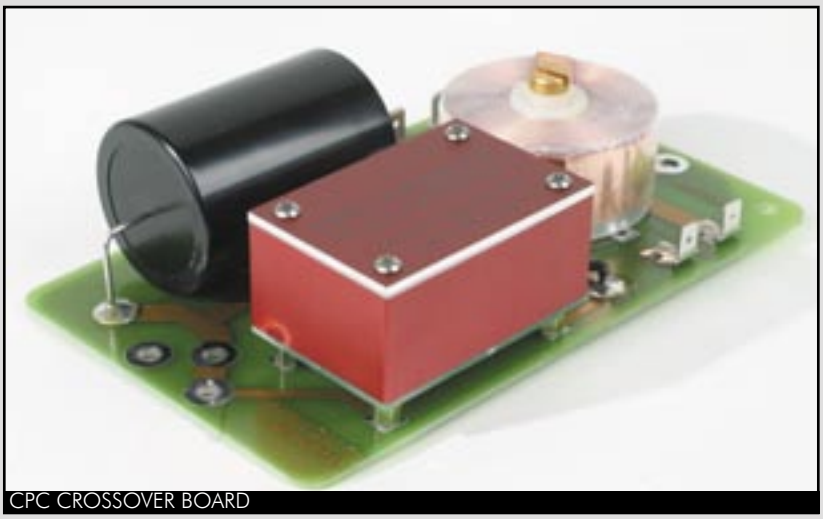
As the performance of the M2 omega midrange driver achieved TRIO levels, Avantgarde Acoustic™ was able to use their flagship tweeter H3 omega for the new DUO OMEGA system. "*Never change a winning team! If I cannot find any mistakes and something works with no flaws, I simply don´t want to change it. So I am very happy that we could use the best tweeter I ever designed in this new product*" resumes Matthias.

This exceptional driver combines the smoothness of an electrostatic driver and the power of a strong 1 inch horn driver. The H3 omega features a voice coil former made of Kapton with a minimised air gap, a special geometrical shape of the 17 ohm voice coil and an ultra light diaphragm. The mere force of the 3 kg (6.5 lb) magnet on the voice coil guarantees 100% detail and precision even at low volume levels, and provides the DUO OMEGA with compression-free sound reproduction at extreme sound pressure levels.

With the spherical horn SH1801 the H3 omega offers an ultra wide



H3 OMEGA TWEETER



CPC CROSSOVER BOARD

bandwidth down to 900 Hz. Due to the passive crossover point being at 2,000 Hz Avantgarde Acoustic™ achieves a seamingless smooth sound with incredible dynamic headroom.

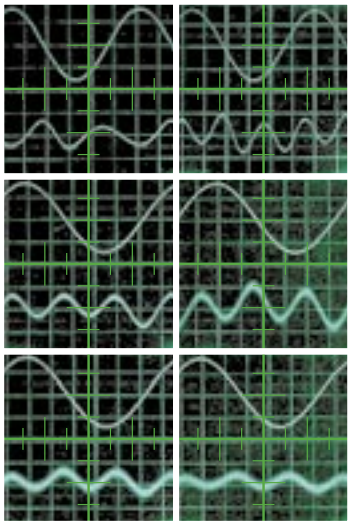
THE CPC CROSSOVER

Although the M2 omega midrange driver is running full range without any crossover, the H3 omega requires a passive filter for thermal protection. "*I would have loved to completely eliminate the crossover for the tweeter, but its physically not possible. The voice coil of the tweeter would simply melt having to cope with unfiltered bass signals*" resumes the designer. So the manufacturer was forced to research on components for passive crossovers. As with all their products Avantgarde Acoustic™ was taking a very puristic approach. Less is more is the design philosophy. "*The spherical horns are so revealing that we had to restrict the number of parts to the absolute minimum and use only highest grade components*".

A potential limitation of any passive crossover is the capacitor required to filter low frequencies. A capacitor consists of two plates or conductors. As both plates are separated by a dielectric or insulator, the conductors have no direct contact but the signal is passed through a dielectric field. Every time the music signal is changing from the positive to the negative half-wave and vice versa the dielectric field gets inverted. This permanent change of direction of the field in a capacitor - a phenomen called "dielectric memory effect"- causes distortions which get worse the closer the signal passes through the zero point and are at a max just when the electric field changes its direction.

A solution according to Avantgarde Acoustic™ is to apply a strong force which holds the electric field in one specified direction no matter what the music signal is doing. Matthias Ruff tells about when he first got the idea of the so called "Capacitor Polarisation Circuit" to solve the problem: "*2004 in Athens I observed an Olympic flag. As it was only fixed on one side it was flattering in the wind. I could see the Olympic rings but they were distorted by the wave motion of the flag. If the cloth would have been stretched on both ends the rings would have been better visible. The more the flag is stretched the lesser the wind can distort the picture. You only have to make sure that the cloth is not torn apart*".

The solution was to find a way to



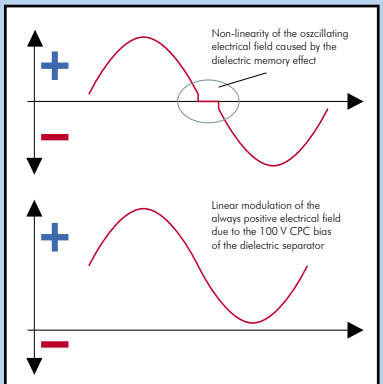
Filter output vs distortions photos of capacitors in a high pass filter at various frequencies

CAPACITOR DISTORTIONS

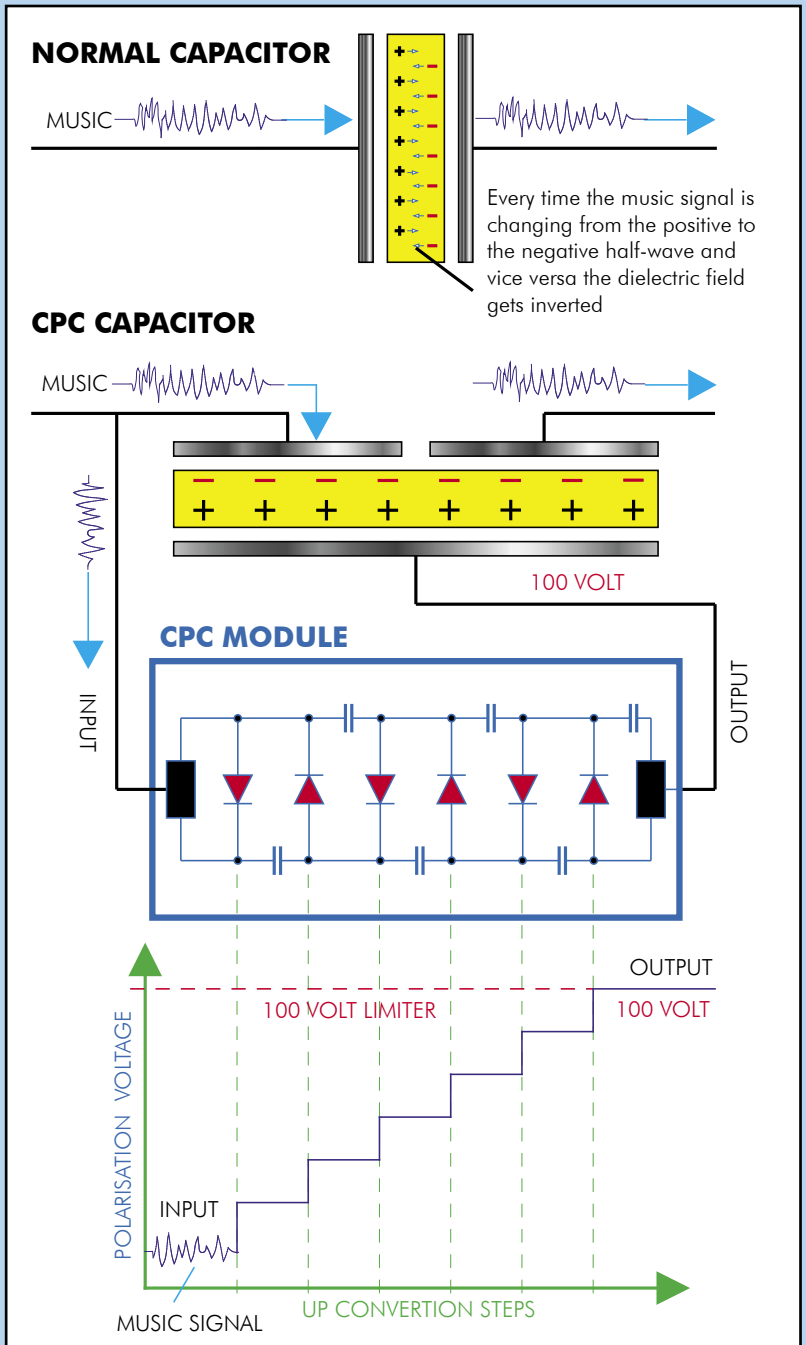
THE CPC TECHNOLOGY

The permanent change of direction of the field in a capacitor - a phenomen called "dielectric memory effect"- causes distortions which get worse the closer the signal passes through the zero point and are at a max just when the electric field changes its direction. The attached pictures show these distortions of capacitors at different frequencies.

To avoid these distortions Avantgarde Acoustic™ uses with the "Capacitor Polarisation Circuit" an elaborate approach. Different to conventional capacitors the CPC–capacitor has multiple conductor–foils connected with a special electric layout shown in the attached graphics. The CPC module up-converts the income music signal to the required voltage to bias the conductors. Only the inner conductor is biased with DC. In the CPC module a voltage cascade through a network of diodes increases the voltage of the music signal to a multiple. This high direct current is than fed into the inner conductor. Furthermore is the diode circuit electrically decoupled through a very high impedance transformer to avoid any backlash to the music signal. Already a view moments after turning on the music the CPC module has generated the required direct current to bias the capacitor. As the CPC diode cascade can build-up voltages by far beyond allowable levels, Avantgarde Acoustic™ has included a protective circuit to avoid overloading the capacitor.



BIASED ELECTRICAL FIELD



CPC UPCONVERTION OF MUSIC SIGNAL

prevent the electric field through the insulator to reverse its direction. By developing a new type of capacitor with an active polarisation circuit Avantgarde Acoustic™ claims to have solved the problem. "*We developed an unconventional type of capacitor with multiple conductors connected with a special electric layout. These where than used to induct a high voltage to polarize the capacitor*" explains the designer. The function of the concept is fairly simple. The field in the dielectric is biased with a direct current so it has a strong electric field strength in one direction. This force is far above the zero crossing point and much higher than the actual peak signal of the music. The electric field now remains in its orientation and cannot be modulated any more by the signal.

To get this theoretical principle to work, Avantgarde Acoustic™ had to overcome two problem areas. At first the designers had to make sure that the induced direct current does not reach the speaker. DC would heat up and likely destroy the voice coil.

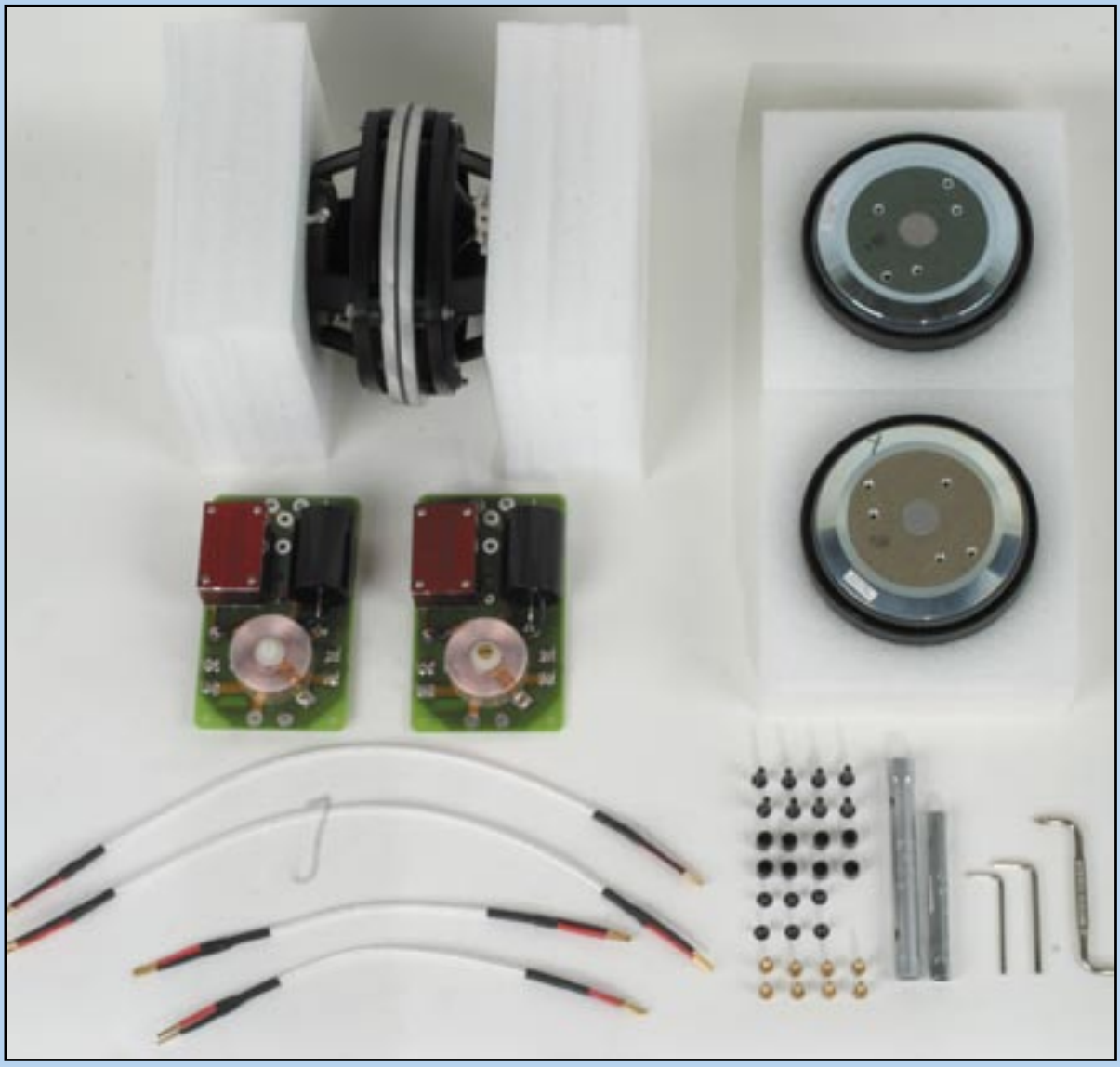
"*Our capacitor is constructed in a special way. Instead of only two plates we use multiple conductor foils. Only the inner conductor is biased with DC. This way no current can leak*". Having executed numerous test and listening sessions Avantgarde Acoustic™ verified that whenever the polarisation current was duplicated the distortions decreased and an audible improvement could be heard. This means that ideally the polarisation current should be as high as possible and is only limited by the load capacity of the capacitor.

Now the task of the designers was to find a simple way of providing the required direct current. Using an external power supply would not have been practical and batteries were excluded as they did not provide a high enough voltage. Instead

Avantgarde Acoustic™ uses its passive CPC board (Capacitor Polarisation Circuit; patent pend.). As the music signal is providing the required electrical energy to drive the CPC module no additional power supply is needed. The CPC module now automatically up-converts the income signal to the required voltage to bias the conductors.

A CPC biased capacitor has less distortions and can more precisely handle incremental signal variations. "*The effect of CPC is amazing. When executing our AB comparisons, we could immediately hear the difference. There is much more detail and I thought the treble level has been increased. But at the same time the sound got much sweeter. Subtle nuances are totally detached to project lifelike aura of spaces and instruments*" raves Armin Krauss, customer support manager of Avantgarde Acoustic™.

THE DUO OMEGA UPGRADE KIT



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