



FORZA ULTRA TECHNICAL NOTES



1. DESIGN PHILOSOPHY

All Estelon products are produced in a similar fashion using the same general design and construction principles. In the design and construction process, it is crucial to consider room and environmental acoustics. All listening rooms have walls, floors, ceilings, furniture, and various décor and treatments which affect the listening experience. Together with the loudspeaker, they participate in acoustical sound reproduction. The goal of the loudspeaker, and the associated system electronics, is to create a life-like (live) and engaging musical experience.

Through Estelon's advanced and innovative engineering concepts, the loudspeakers form a synergy with the room and its acoustics to re-create an emotionally involving listening experience that exposes the soundstage and musical details of the recording, as it was meant to be heard.

Sound waves below 100 Hz

Room dimensions and characteristics have a significant effect on the listening experience. In typical room dimensions, the longest distance between reflective surfaces is smaller than the length of the low bass sound waves up to 100 Hz. The pressure at these frequencies changes equally in every position, similar to pressing on a balloon. In these conditions, it is impossible to localise the exact position of the bass drivers. This situation allows the placement of the low-frequency drivers to be separate from other drivers. The Estelon Forza Ultra's woofers are positioned close to the floor so that the woofers couple acoustically with the surface of the floor maximising their efficiency and output. The placement of woofers close to the floor assists in bass coherency and more even distribution of room standing waves. This makes it easier to find a suitable listening position in the room, with fewer compromises in bass accuracy.

Sound waves over 100 Hz

In frequencies over 100 Hz, there are numerous sound reflections created between the loudspeakers and the walls, ceiling, floor, and furniture/décor. In these higher than low bass frequencies where the wavelength of the sound is short enough for human hearing to be able to detect where the sound originates and to produce localised peaks and valleys in the room due to standing waves, the placement of the driver in relation to other drives becomes significant. The drivers that reproduce sounds over 100 Hz (mid-woofer and tweeter) are grouped together and physically placed higher in the cabinets. In this configuration, the reflections from adjacent surfaces are minimised. Furthermore, a high degree of coherency can be achieved with a stable stereo image from high bass notes up to the highest harmonics. To further minimise high bass to low midrange colouration, it is beneficial to have the mid-woofer driver positioned higher. Thus, in all Estelon speakers, the midrange/mid-woofer driver is positioned above the tweeter.

2. CABINET & TECHNOLOGY

The unique shape of the cabinet is highly complicated and differs greatly from a classical box design. In fact, it's not a box at all

Proprietary marble-based composite material and moulding technology

Estelon engineering took many years of research and testing to find the right material that would allow the highest quality of cabinet and construction for the loudspeaker's acoustically engineered complex shape. We developed a proprietary marble-based composite material and special moulding technology to be able to make cabinets with such advanced surface geometry, inside and out. The combination of the high-density, solid mass of the moulded marble-based composite and the purposeful shapes, and various internal chambers, results in characteristics that allow for close to perfect acoustical properties. The cabinet is extremely rigid, highly dense, resonant-free, and with exceptional internal damping and acoustical control.

Curved surfaces and a system of interior chambers

The unique shape of the cabinet is highly complicated and differs greatly from a classical box design. In fact, it's not a box at all! There are no parallel walls, almost every surface inside is curved. The combination of curved cabinet walls and a complex system of interior chambers make the cabinet completely "dead" and non-resonant. Furthermore, the enclosure of each driver system has optimised enclosure geometry to suit specifically for the driver to perform its best. Such a highly advanced and complex cabinet design and construction allows only pure and uninfluenced sound to emanate from the various high-performance driver elements. The 150 kg (330 lbs) weight of each speaker gives it static and dynamic stability. This provides a solid foundation for the explosive acceleration of the driver membranes. There is no compression effect in macro dynamics and no confusion or uncertainty in subtle micro-dynamics of the sound.

Advanced internal damping

In order to assist the loudspeaker to unveil its purest musicality, advanced internal damping has been implemented. The damping was designed through a long testing process to have the best effect and overall balance throughout the musical spectrum. We have chosen different natural and synthetic damping materials. The damping materials type, placement and amount have been chosen through calculations, measuring and rigorous listening test.

3. A COMBINATION OF THE BEST DRIVERS

To achieve uncompromised acoustic perfection across the full frequency spectrum, the Forza Ultra utilises a meticulously curated four-way driver configuration. Engineered in collaboration with the renowned German manufacturer Thiel & Partner GmbH (under the **Accuton** brand), these bespoke drivers represent the absolute pinnacle of audio engineering.

Woofers - Aluminium dome

Dual 250 mm (10-inch) custom-designed, long-stroke woofers feature an advanced Neodymium motor system for exceptionally linear excursion dynamics. Developed with direct input from Estelon engineers, they represent the next era of woofer technology.

Mid-woofer - Crystalid

A 190 mm (8-inch) custom dome mid-woofer utilises Crystalid, the next generation of membrane material. Crystalid surpasses the exceptional tonal purity of ceramic membranes, while offering even greater rigidity and significantly lower moving mass. This unique combination preserves the purity and low distortion associated with the finest ceramic membranes, while approaching the speed and transient response of the lightest membrane materials.

Paired with an advanced Neodymium motor, it delivers an unprecedented transition from high-bass to low-midrange, completely free of tonal artefacts or loss of resolution.

Midrange – Crystalid

The 90 mm (3.5-inch) midrange driver leverages the same ultra-fast, highly accurate Crystalid membrane material as the mid-woofer. In the midrange, where even the finest nuances and harmonic structures are critical to a natural and lifelike presentation, the benefits of Crystalid become arguably even more significant. Its exceptional speed, rigidity and low distortion allow voices, particularly the delicate harmonics of the female voice, to be reproduced with remarkable effortlessness, purity and resolution.

This enables the Forza Ultra to reproduce the most critical midrange and low-treble frequencies with uncompromised dynamics, exceptional transparency and stunning clarity.

Tweeter - Next-Generation Diamond

A 25 mm (1-inch) next-generation, chemical vapour-deposited diamond membrane tweeter by Accuton. Diamond offers the highest speed of sound of any known material. Accuton's complex multi-cavity back chamber and updated custom surround eliminate the need for brute-force damping, ensuring all acoustic energy is emitted intact. Operating flawlessly up to 60 kHz, the result is a tweeter that seemingly disappears, leaving only pure music.

4. SPECIAL CHAMBERS IN THE LOUDSPEAKERS CABINET

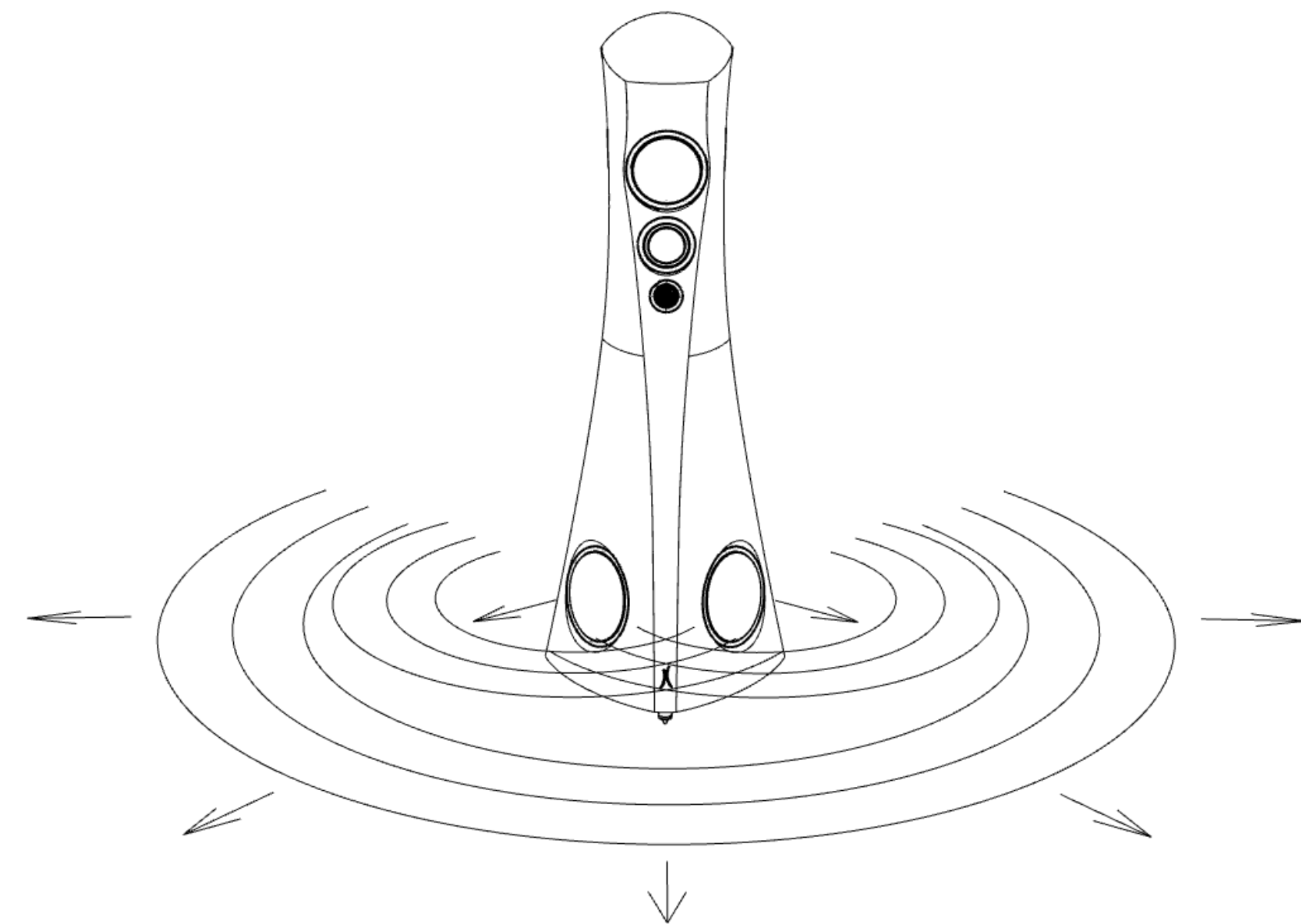
Woofers and mid-woofer have
anti-resonance chambers

The two woofers coexist in one optimised sealed chamber. The chamber configuration has no parallel walls, most of the walls are curved. As a result, standing waves in the cabinet are spread out and minimised. Also, the curved shapes assist in rigidity. The combination of the heavy and rigid marble-based material, curved shapes and internal bracing suppresses the cabinets inherent resonances to almost non-existent levels. The drivers have everything to support them to perform their absolute best.

The mid-woofer has its own isolated chamber, constructed with the same principles as the woofer chamber.

Symmetric Driver Loading (SDL) technology provides extraordinarily precise bass

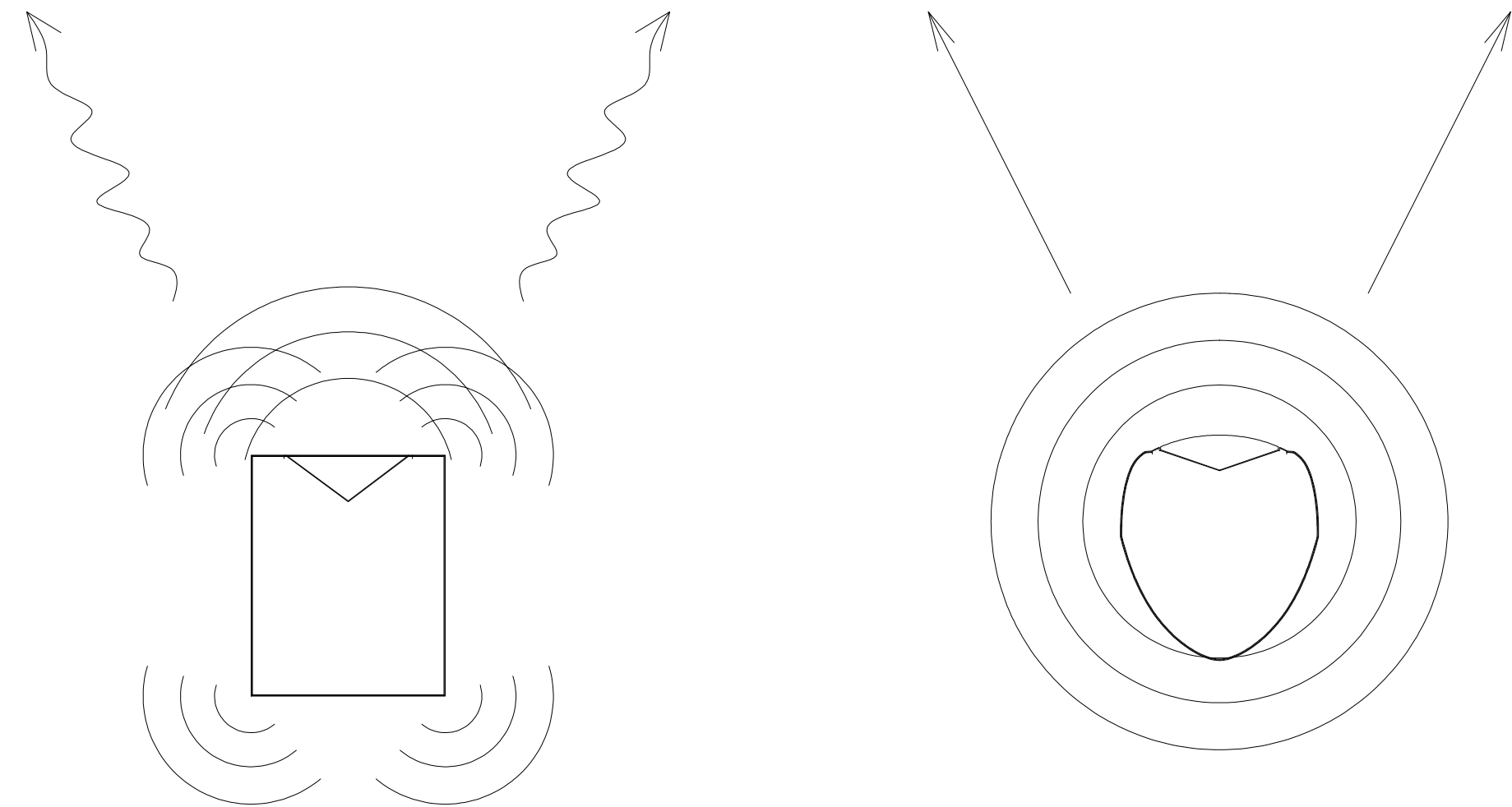
Symmetrical driver positioning - both woofers have exactly the same acoustic load outside the loudspeaker as inside. Due to such configuration, both woofers move identically and without competing with each other (Graph 1). We call this Symmetric Driver Loading (SDL) technology. With the aid of this technology, the Forza Ultra loudspeaker produces extraordinarily precise bass with power, authority, and speed.



Graph 1. Front view of Estelon Forza Ultra loudspeaker

The cabinet around the midrange is curved to eliminate diffraction

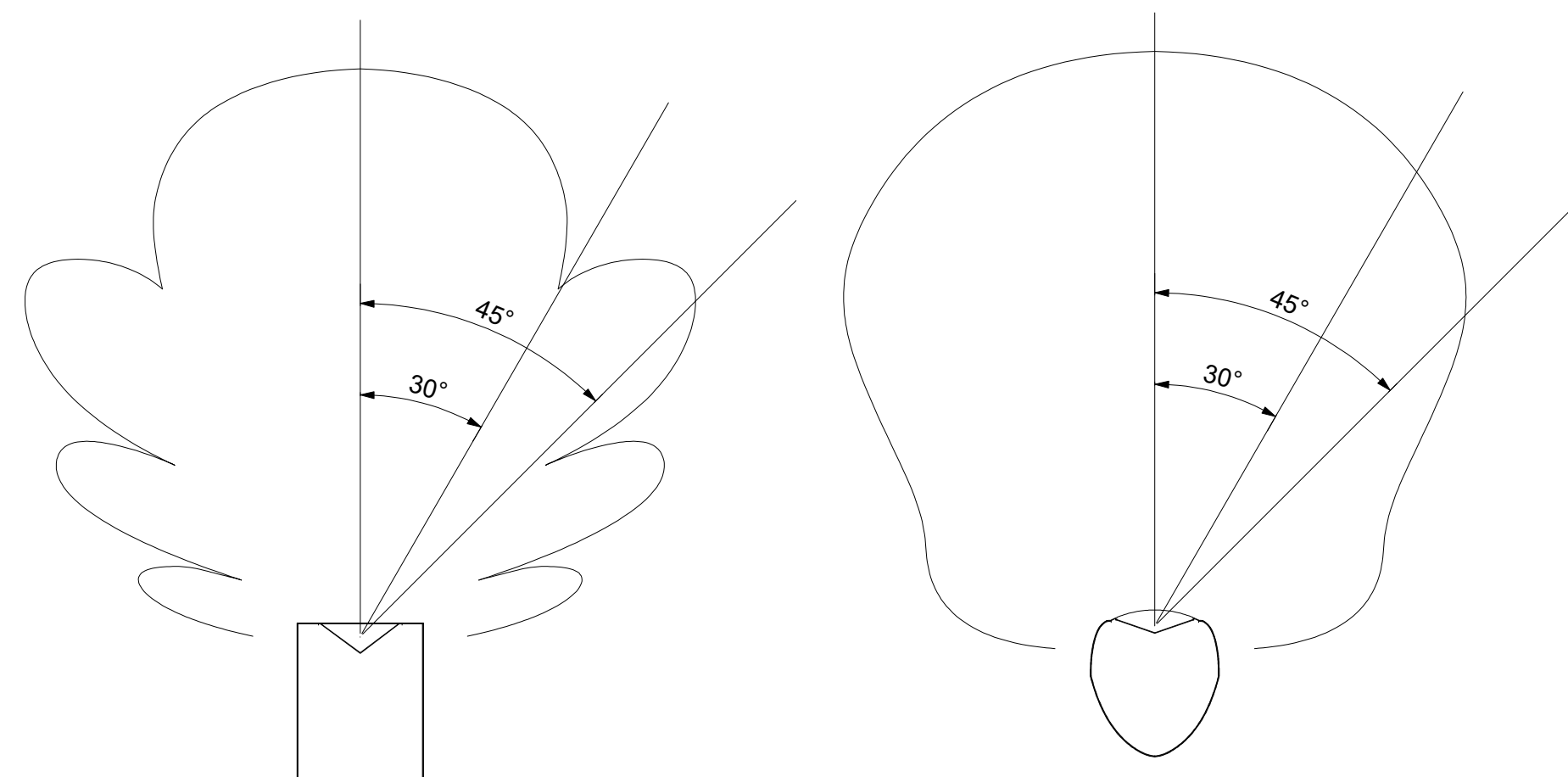
The entire Forza Ultra cabinet has been designed in a way that there are no sharp edges (Graph 2). The soft curves of the cabinet eliminate the effects of reflective diffraction from the drivers' output, thus the directivity of the speaker is homogenous and wide. The frequency response and timing change very little from the centre to sides, retaining smooth tonal characteristics and time alignment of drivers. This widens the ideal listening position.



Graph 2. Top view. A traditional box shaped speaker on the left, Estelon Forza Ultra Mk II on the right.

The separated chamber together with the surrounding cabinet surface create dispersion control

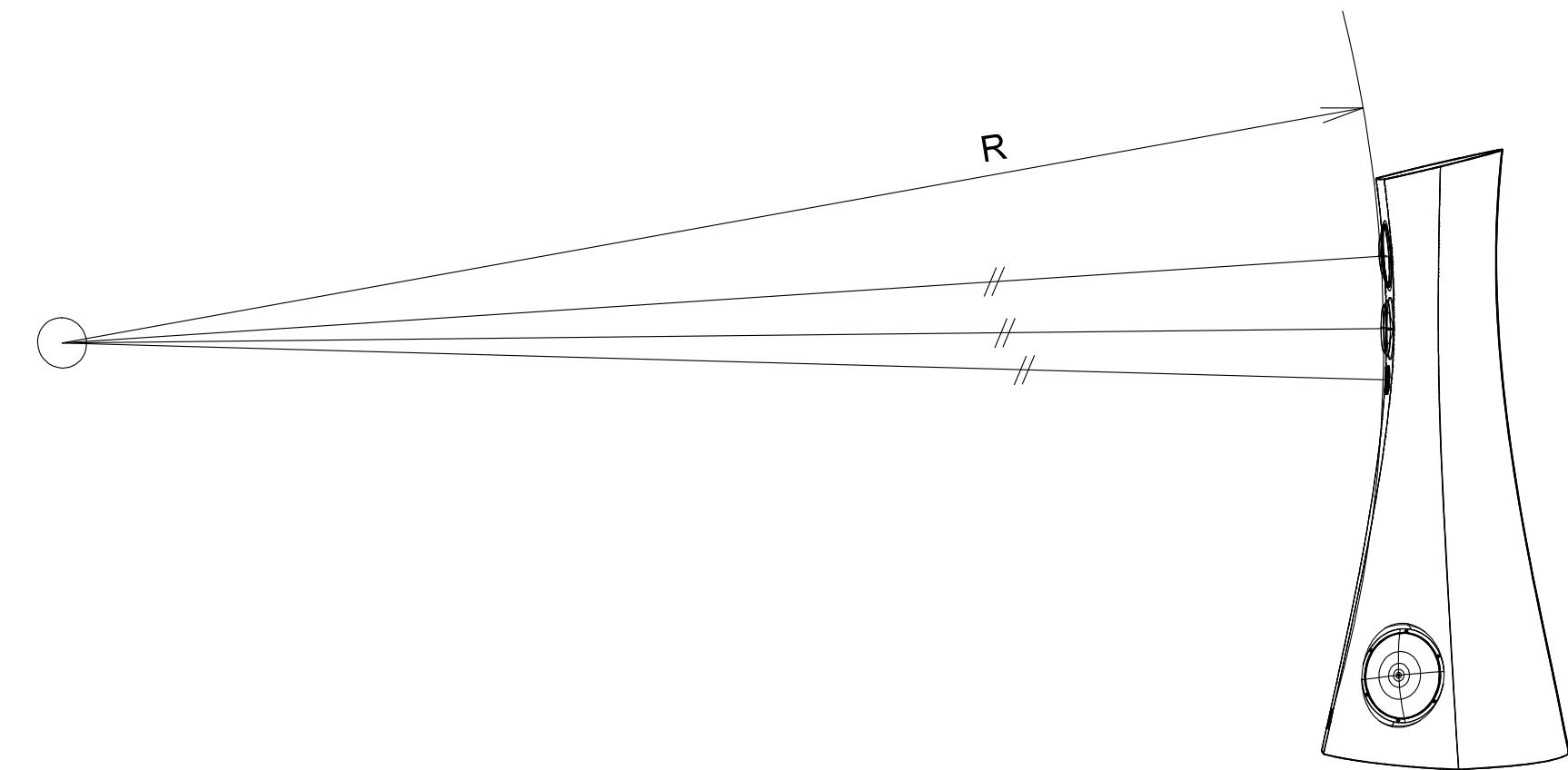
The tweeter chamber is separated to reduce the transmitted vibrations from the surrounding internal cabinet pressure waves. The surrounding external cabinet surface is extremely important for the performance of the high frequency's driver. Around the tweeter, the cabinet surface is narrowing with smooth curves (at a calculated radius) to help control dispersion. The tweeter surroundings shape helps to create a linear and even directional dispersion (Graph 3), allowing the high frequencies to be clearly heard at different listening locations while also improving imaging.



Graph 3. Top view. A traditional box shaped speaker on the left, Estelon Forza Ultra on the right.

Drivers are positioned on the intentionally curved front panel for increased coherency

The three upper drivers are positioned on the curved front panel in a way that from the listening position these are approximately at the same distance from the listener. This, combined with the meticulously fine-tuned cross-over filters, means that the sound from each driver reaches the listening position at the same time, resulting in a coherent, precise sound signal (Graph 4) with uncompressed dynamics, perfect tonal balance, very precise imaging and lifelike sound-staging.



Graph 4. Side view depicting the curved front panel of Estelon Forza Ultra

5. CROSSOVERS

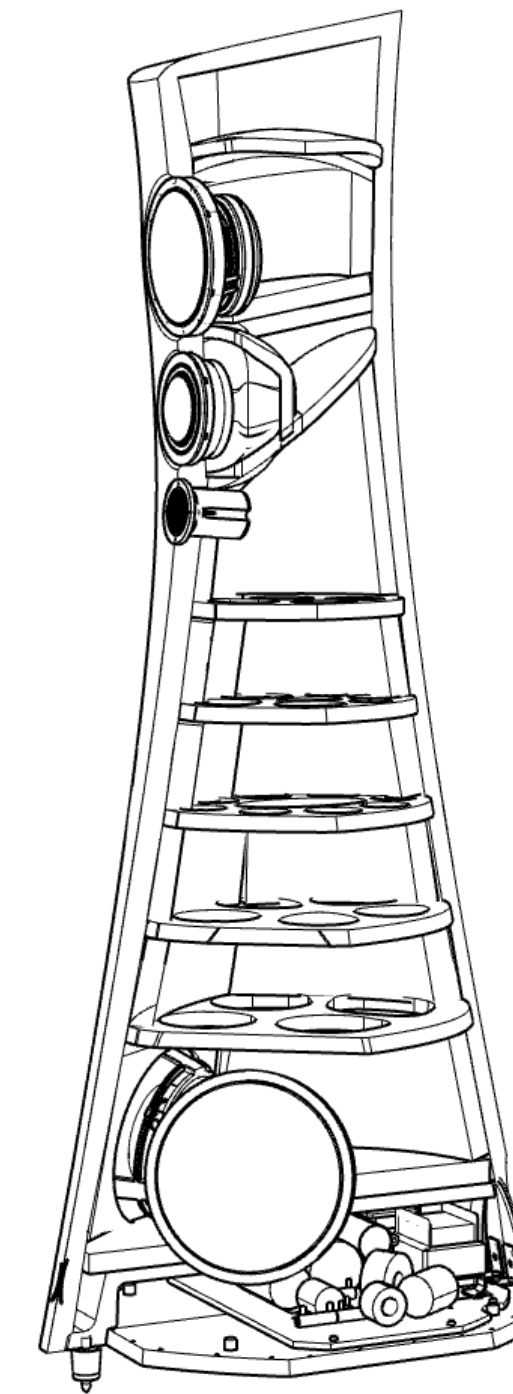
We use specifically engineered and highly precise third-order crossovers for the woofers and second-order networks for the mid-woofer, midrange and tweeter.

Every aspect of the crossover construction is carefully supervised by our engineers and designers, with each component undergoing rigorous testing to guarantee flawless performance. Additionally, our highly experienced team conducts extensive critical listening evaluations to fine-tune the sound.

Housed in acoustically isolated chambers to mitigate microphonics and vibration, the Forza Ultra utilizes second-order crossover networks (at 90 Hz, 800 Hz, and 2.5 kHz). These networks are meticulously engineered and extensively play-tested to ensure flawless time alignment, frequency response, and timbral accuracy.

- **Flat Foil Direct Coupling:** An in-house developed technique where all components are connected in a star configuration, feeding the signal directly to the speaker connectors for maximum signal integrity.
- **Custom Mounting:** Components are mounted on a specialized, custom-designed plate that mimics a high-end PCB but eliminates the sonic degradation associated with conventional PCB materials.
- **Purest Signal Path:** Each crossover is hand-soldered using premium materials. Cable lengths between the drivers, crossovers, and connectors are kept to an absolute minimum.

Each crossover is hand-soldered with high-quality solder, and we minimise cable lengths between the drivers, crossover, and speaker connectors, ensuring the cleanest, most direct signal path possible.

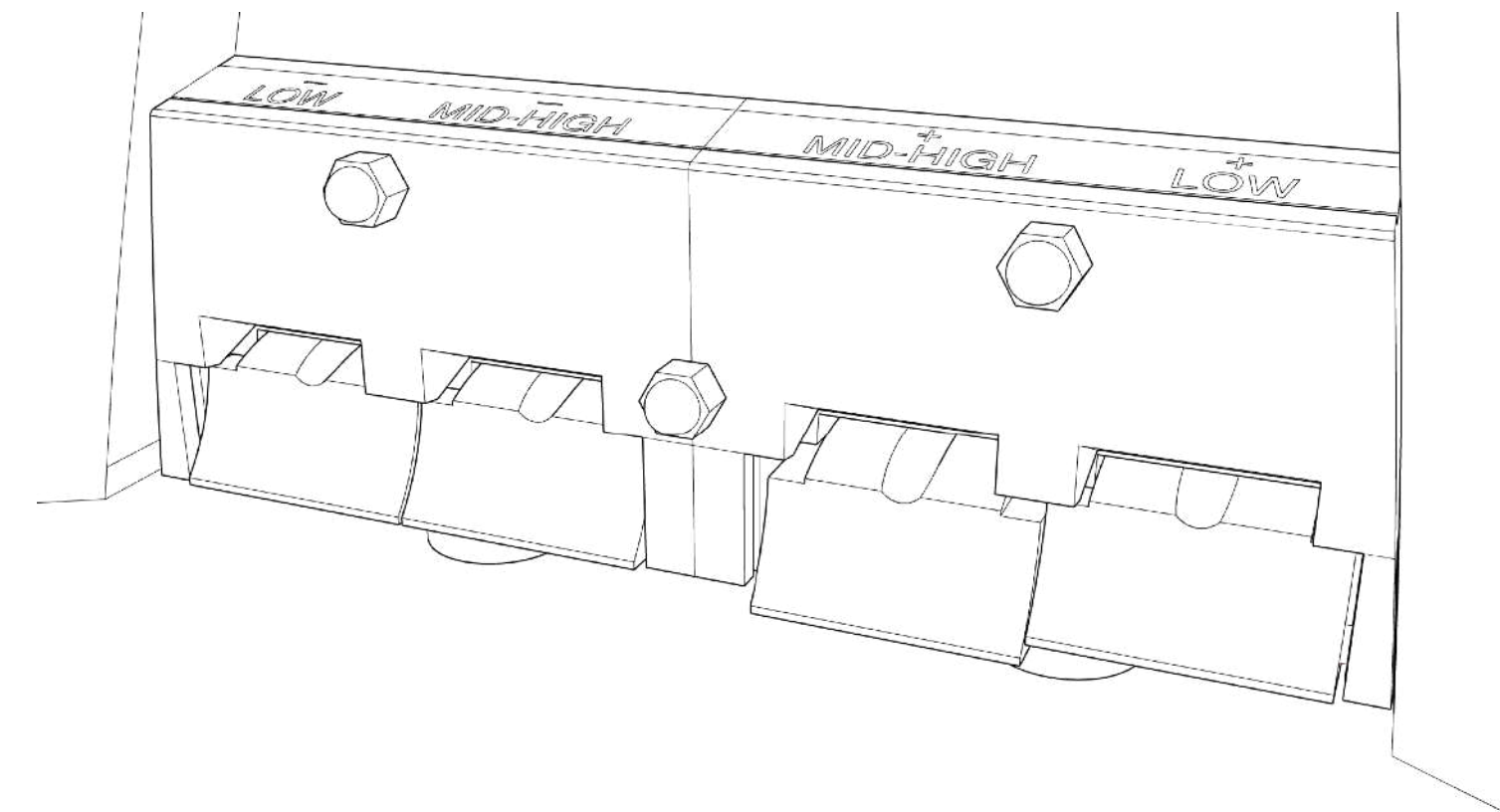


Graph 5. Internal cabinet construction showing cross-bracing and the individual chambers for the woofers, mid-woofer, midrange, and crossovers

6. CONNECTORS

First implemented in the Extreme Mk II, the Forza Ultra abandons traditional screw-style binding posts for an innovative, proprietary clamping system built directly into the base of the loudspeaker.

- **"Piano Key" Construction:** Spring-loaded clamps securely hold the speaker cables in place.
- **Direct Ribbon Routing:** Beneath the key, a high-grade copper foil ribbon routes directly to the crossover above, eliminating unnecessary metal-to-metal transitions and bulky conductors that cause circulating currents.
- **Dielectric Optimisation:** The assembly is free of standard metal parts and smearing dielectrics, relying only on specific dissipative dielectrics and pressed particle board. This results in purer, more articulated sound with radically improved micro-dynamics.



Graph 6. Our proprietary connectors accept banana, fork or bare wire termination.

7. ISOLATION: STILLPOINTS ULTRA SS V2

The Forza Ultra sits on **Stillpoints Ultra SS V2** isolators. These premium, stainless steel footers utilise a proprietary internal ceramic ball-bearing system to dissipate vibrational energy. By effectively decoupling the massive speaker from the floor, they eliminate acoustic feedback and micro-vibrations, resulting in a dramatically lowered noise floor, tighter bass transients, and enhanced spatial imaging.



8. CUSTOM FINISHING

Because of the highly sophisticated cabinet shape, all the processes in the finishing stage are hand-made with extreme care by highly experienced specialists using the best technology and procedures.

We offer a wide range of colour options in gloss and matte, with custom finishes upon request. Each cabinet is professionally painted and wet-sanded between each of the coats (up to 12) of the highest grade of paint, and then carefully hand-polished to perfection. It is a time-consuming process to finish each cabinet and takes several weeks to complete this intense artisan procedure. This is the only way to achieve results of such caliber.



9. PACKAGING

The packaging is precisely thought-through so despite the weight of 150 kg (330 lbs.) of each speaker, they can be quickly and safely transported to their final position in the room.

The transport cases (industrial grade custom flight-cases) and the speakers themselves are equipped with wheels to ease the transportation and setup. The speaker wheels can be easily replaced by the designated special floor spikes or flat bases (supplied) once the ideal placement and positioning has been determined. We would like to also remind that leaving the speakers on wheels will negatively impact the sound, so please use the supplied spikes.

10. EASY SETUP

Considering the mentioned special characteristics, the Forza Ultra loudspeaker is easy to set-up and achieves a natural tonal balance with realistic 3D image. To decrease the vibrating effect from the floor, we offer special stainless-steel stand options – with a flat bottom surface for hard floors and with spiked cones for carpeted floors. Both types are included with the loudspeakers.

It is important to note that setting up these speakers will require at least two or three able-bodied individuals.

11. TECHNICAL SPECIFICATIONS

Type:	4-way passive loudspeaker, sealed box
Frequency response:	27 - 60 000* Hz
Power rating:	400 Watts
Nominal impedance:	3 Ω (min 2.3 Ω at 51 Hz)
Sensitivity:	89 dB/2.83 V
Min amplifier power:	20 Watts
Internal cabling:	Kubala-Sosna
Cabinet material:	Marble-based composite

*Linear up to 33 000 Hz

Drivers:

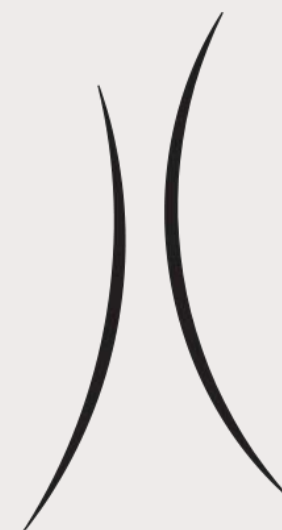
Woofer:	2 x 250 mm (11") Aluminium dome from Accuton (custom design)
Mid-woofer:	190 mm (8") Crystalid from Accuton (custom design)
Midrange:	90 mm (5") Crystalid from Accuton (custom design)
Tweeter:	25 mm (1") Next generation diamond from Accuton

12. DIMENSIONS

Height: 1675 mm (66")
Width: 617 mm (24")
Depth: 682 mm (27")

Net weight: 150 kg (330 lbs) per piece

Recommended room size: 40 - 125 m² (430 - 1345 ft²)



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