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ACOUSTIC





ZERO iTRON

THE ACTIVE REBEL.



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The Avantgarde Acoustic-Team

Foreword.

Music touches us like nothing else. For more than 30 years, our factory in the Odenwald region of Germany has been passionately and meticulously producing horn loudspeakers that let you experience music in its purest form - as intensely and vividly as if you were there.

Behind every Avantgarde Acoustic loudspeaker is an exceptional team. Engineers, designers, craftsmen and music lovers work side by side to perfect every detail. We are driven not only by technology, but above all by a love of music and the conviction to create something truly unique. Everyone contributes their expertise and passion so that we can offer you an unrivalled sound experience.

Together, we have set a new standard with the G3 series. It is the result of more than 30 years of experience, teamwork and innovation. From the optimisation of the driver systems to the introduction of our iTRON technology - everything has been developed with the utmost care and dedication. The G3 Series stands for perfection, musicality and a clear goal: to bring music to life as it should be experienced.

Trust your ears - and experience the difference. Welcome to the world of dynamic sound.



Vision.

Our vision is to create the perfect loudspeaker, modern yet timeless,
a statement that will last for decades.

Our aim is to give listeners goosebumps, flood them with unforgettable musical experiences
that transcend the possibilities of mere audio.

Our goal is to reproduce music as perfectly, thrillingly, and realistically as possible – and to do so with products
that are as beautifully designed and timeless as they are remarkable.

Values.

PASSION	INNOVATION	PERFECTION	QUALITY	CUSTOMER SATISFACTION
We love what we do - and want to inspire others to love it too.	We develop and use the most advanced technologies – our products consistently break new ground.	We are not easily satisfied – close enough is never good enough.	We don't just build speakers to perform – we build them to last for decades!	We are our customers – if our products make us smile, we know you will too

Awards.

We have received numerous awards for our unique purist designs as well as the consistency of our brand values and identity, including the German Brand Award and the IF Design Award.

Our products regularly redefine the benchmark for measured performance, achieve “Best in Test” and receive glowing reviews from the most respected, experienced, and influential audiophile reviewers and magazines.

But most important of all, is the constant affirmation and positive feedback we receive from our customers, proof positive of the uniquely musical performance and unparalleled communicative capabilities of our loudspeakers.



Member of **Rat für Formgebung**
German Design Council



Highlights.

- New generation Evolution^{AA} drivers for increased dynamics, lower distortion and even purer sound.
- Innovative XT2 tweeter with record-breaking low distortion values.
- Patented and fully active iTRON^{AA} Current Drive, for perfect control of the driver output and the ultimate sound.
- Clear, striking design language with a unique look due to the recessed spherical wave horns.
- Two elegant colour options with a high-quality softtouch finish to suit any room.
- Adjustable spikes for perfect speaker inclination.



ACTIVE HORNSYSTEM

18 ohm Omega midrange driver
400 mm recessed spherical midrange horn
130 mm recessed spherical tweeter horn
Handmade, sieved paper membrane
2 x 10 Watts iTRON amplification
1 x 12 inch bass driver
400 Watt subwoofer amplifier
Digital sound processor with EQ

ZERO iTRON Concept.

THE ACTIVE REBEL.

More integrated, more compact, simpler - and yet a true horn loudspeaker. The ZERO iTRON realises a dream that we have shared with many friends of our horn loudspeaker manufacturer for over twenty years. For as much as we are fascinated, moved and overwhelmed by our larger transducers, there has always been a desire for a more compact horn loudspeaker that would make the unrivalled Avantgarde Acoustic experience accessible to a wider group of sound enthusiasts. The ZERO series opens up this new path with its revolutionary design, minimalist style, effortless installation and fully integrated amplifier and processor technology.

The ZERO iTRON is a 3-way active loudspeaker in a 2 x 10 watt iTRON current amplifier and 1 x 400 watt Class D power amplifier configuration. The strict division into 3 ranges prevents bass signals from affecting midrange and treble reproduction and vice-versa.

The Evolution^{AA} XM1 is a 127 mm midrange horn driver optimized for large, linear excursion. Its new "SoftMesh–Compound" membrane uses a stable grid carcass as its structural foundation. The microscopic apertures of the grid are sealed with a proprietary synthetic elastomer coating. Combining a stable grid structure with a flexible lining effectively reduces partial resonances of the dome itself and absorbs distortions.

The tweeter of the ZERO iTRON features an annular diaphragm which extends its frequency range up to 22,000 Hz with 107 dB sensitivity, ensuring greater clarity, focus, and harmonic resolution, a fuller and more natural sound.

The ZERO iTRON is combined with a powerful subwoofer module, utilizing a redesigned powerful 12"-driver in a bass reflex configuration.

The bass amplifier of the ZERO iTRON has 400 watts and is equipped with an advanced digital sound processor. The new user interface allows for a simple adjustment of the sound to individual preferences and seamless system integration in different rooms.

ZERO iTRON

THE ACTIVE REBEL

Clear and minimalist in its design, compact in size yet full of self-confidence, the ZERO iTRON integrates seamlessly into its owner's living space. Its recessed spherical horn is a prime example of no-frills functionalism.



G3 FREQUENCY CROSSOVER
- SphericLowCut[AA] Technology
- AirGate[AA] frequency filtration chamber

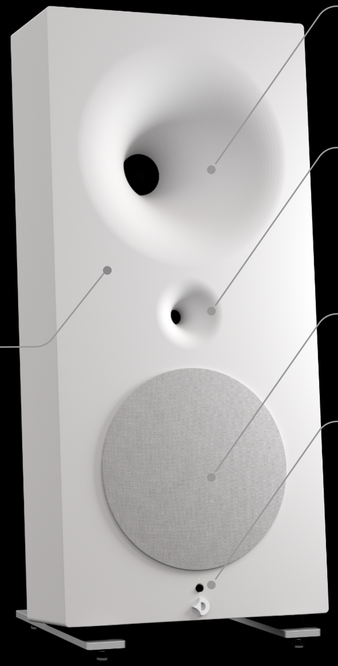
BASS AMPLIFIER
- 400-Watt power output
- Processor-controlled active filters
- New G3 user interface for programming

CONNECTIVITY
- XLR input
- 12 VDC trigger input
- XLR daisy-chain ouput

SIGNAL SENSING
- Signal-controlled auto power-on
- 20-minute auto power-off/standby

iTRON[AA] ACTIVE POWER MODULE
- Patented current drive technology
- Symmetrical, single-ended circuit without any negative feedback
- Direct control of the membrane acceleration

SPIKES
- Variable inclination adjustment through the rear spikes
- Die-cast aluminium vibration damper
- Precision spike made of CNC-milled solid material



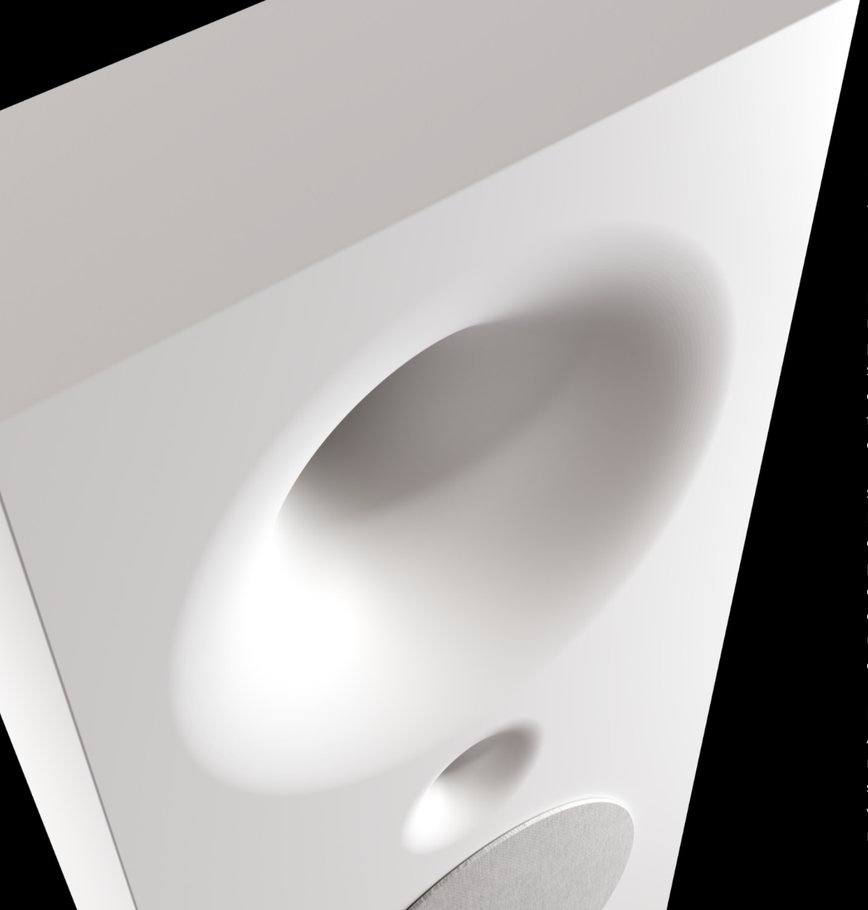
ELEGANT FINISH
- White softtouch finish
- Black softtouch finish

XM1 MIDRANGE UNIT
- New improved XM1 Evolution[AA] driver
- 107dB efficiency with 18 Ohm Omega technology
- 400mm recessed spherical midrange horn

XT2 SUPER TWEETER UNIT
- New 130mm recessed tweeter horn
- XT2 Evolution[AA] driver
- Annular diaphragm with duplex suspension
- Extended frequency range up to 22,000 Hz

Z12 BASS DRIVER
- Redesigned 12"-driver
- 3" voice coil
- Handmade, sieved paper membrane
- Removable cloth cover

ON/OFF SWITCH & LED



Spherical horns.

THE ROYAL ROAD TO SUPERIOR SOUND –
PERFECTED BY AVANTGARDE.

More than 30 years ago, we transformed a fundamental natural principle into a unique product portfolio, using precise mathematical algorithms. Superior horn technology using the most precisely calculated spherical wave horns ever made. Form follows function. Natural efficiency generates engineering and artistic elegance.

SETTING LIMITS TO OVERCOME LIMITATIONS.
Instead of uncontrolled radiation in all directions, our spherical horns emit sound waves with perfectly controlled directivity. This acts to both concentrate the sound – improving perceived efficiency, presence, and energy – and reduce unwanted sidewall reflections that muddle and distort the music.

LESS LOSS, MORE MUSIC.
A horn mounted on the front of the speaker is the most effective way to increase the efficiency of the system. The moving parts of the loudspeaker – voice coil and diaphragm – can be made much more compact. Smaller moving parts mean less weight and greater mechanical control.

This reduced size and weight of the moving parts results in a significant reduction in moment of inertia, increasing the sensitivity and responsiveness of the system. The diaphragm in a horn loudspeaker not only accelerates much faster, but also comes to rest more quickly, if and when the audio signal demands it.

The reduction in diaphragm area also increases the mechanical stability of the assembly. The improved mechanical behavior of the diaphragm combined with its smaller excursion significantly reduces distortion.

‘SURGICAL’-QUALITY HORNS.
The driver is one-half of the equation. The spherical horn is the other. Its profile must be calculated with micro-millimetre accuracy so that the sound waves do not ripple or refract within the horn, causing reflections and thus interference and distortion.

Avantgarde’s spherical horns are not just incredibly complex in design and development, their manufacturing requires incredible accuracy and consistency, involving massive aluminium tooling and the sort of clean surfaces normally only found in operating theatres.

SQUARING THE CIRCLE.
Have you ever seen a trumpet with a square mouth? To take full advantage of the natural laws that govern horn performance, the horn itself must be circular.

The sound waves thus propagate linearly from the circular diaphragm of the driver through the horn and out into the room, completely free of diffraction or interference.

SCIENTIFICALLY PROVEN.
We have subjected our horn speakers to the most exacting, independent scientific testing. The results from university laboratory tests even impressed the researchers!

- 8 x greater dynamic range
- 90% less distortion
- 10 x more resolution

What do those results mean in musical terms? This range from the softest sound to the loudest is 8 x greater with an Avantgarde Acoustic speaker.

At the same time, due to the much lower distortion and higher resolution, our horn systems can clearly and accurately reproduce musical sounds and textures, the tiny details that bring recordings to life, that are finer by a factor of ten than with conventional loudspeakers in a box design.

A full-fledged spherical wave horn system, the ZERO iTRON has all of the tonal advantages provided by the horn technology

Drivers.

A PERFECT HORN NEEDS A PERFECT DRIVER.

Behind every beautiful horn, there should be a beautiful driver. At Avantgarde Acoustic, every drive unit is developed specifically and alongside its corresponding horn element. Since spherical wave horns place special technological demands on the driver and, at the same time magnify inaccuracies by a factor of ten – just like an acoustic magnifying glass – we must take extreme care in our driver development. Horn and driver have been perfectly matched and merged to form a single, coherent unit of outstanding quality and performance.

THE IDEAL FREQUENCY RESPONSE FOR THE PERFECT SOUND.
A horn amplifies more efficiently the lower the frequency. For a perfectly balanced sound, our drivers must thus reproduce higher tones at a correspondingly louder level. That's why conventional drivers simply won't work in a horn speaker, meaning that not only do we design every driver ourselves, but each Evolution^{AA} driver is painstakingly designed for and matched to a single, specific purpose.

LIMITLESS POWER.
The column of air in the horn imposes a greater resistance and is more closely coupled to the movement of the driver than in speakers without a horn. To overcome this initial mechanical impedance, our drivers have to be equipped with much more powerful magnet assemblies and motors.

Compare our Evolution^{AA} horn drivers to conventional drive units of similar size and you'll discover that they generate vastly greater power. To achieve this we must use the most sophisticated design, technology, and construction.

PRECISION IS THE PRODUCT OF ATTENTION TO DETAIL.
Because horns amplify sound with such extraordinary efficiency, any distortion or non–linearities in the driver are also amplified accordingly. For this reason, our Evolution^{AA} Series drivers have to meet performance, consistency, and quality control standards that are ten times higher than conventional design and manufacturing processes.

SPHERICDOME^{AA} MEMBRANE.
The spherical-dome geometry used for the diaphragms in our Evolution^{AA} drivers is precisely matched to the corresponding horn element to ensure a phase-coherent sound pressure curve within the horn. The perfect radiation of the sound waves is crucial for the final performance.

AIRGATE^{AA} TECHNOLOGY.
By precisely controlling the chamber that couples the driver diaphragm to the horn mouth we can filter high-frequency distortions, reducing them by a factor of four, a natural phenomenon that sees distortion literally vanish into thin air.

MORE RESISTANCE FOR MORE CONTROL.
Our Omega voice-coil technology used in the G3 Series Evolution^{AA} drivers, gives them extremely high electrical impedance, making them very easy to drive. That effortless drive characteristic allows amplifiers to perform at their best. The speaker has more authority, less distortion, and more control, for a more precise response.

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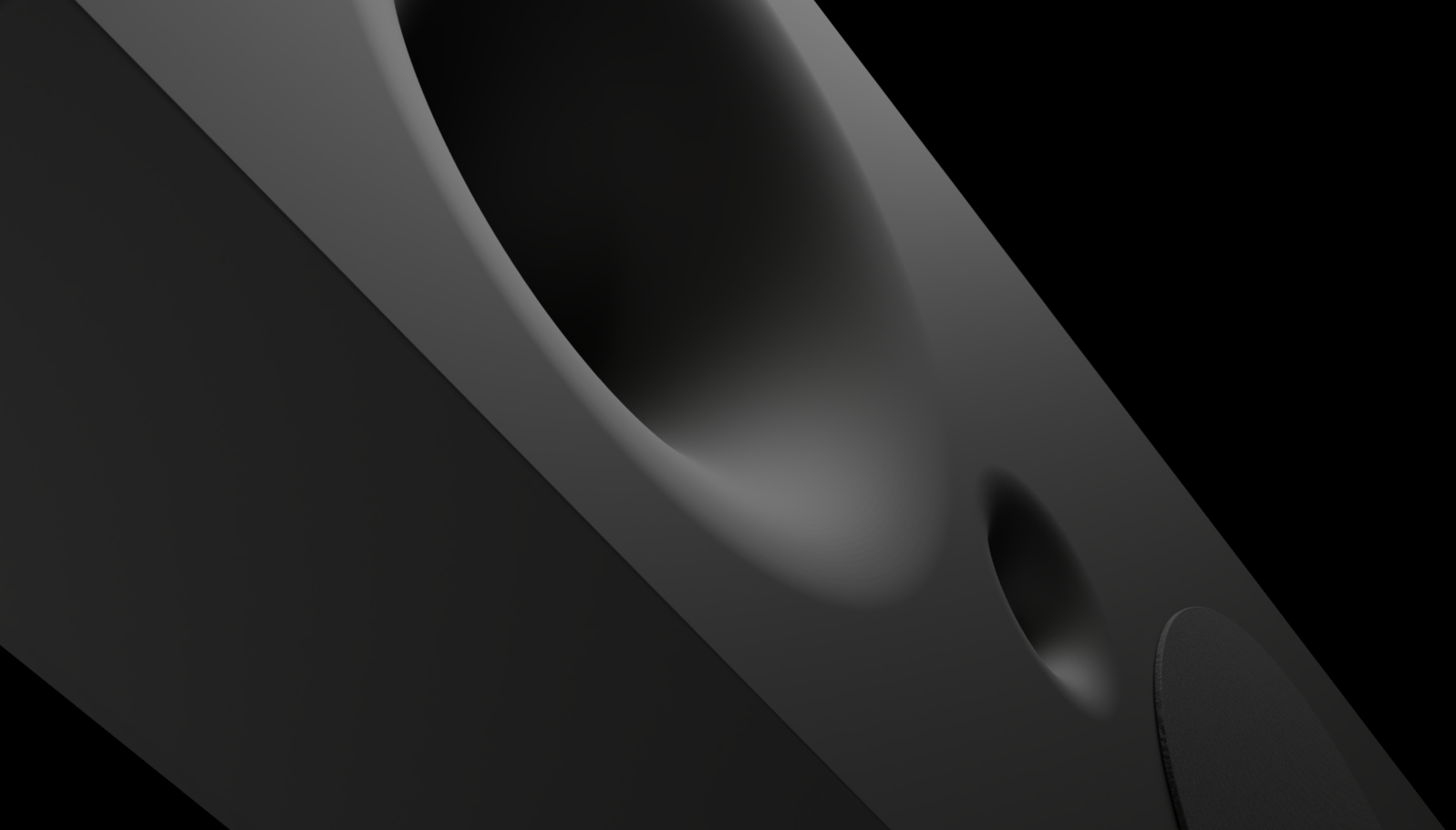


Drivers.

A PERFECT HORN NEEDS A PERFECT DRIVER.

SINGLEFRAME[AA] MIDRANGE DRIVER.
The midrange driver of the ZERO iTRON employs robust, cast baskets that also enclose the motor elements, creating a stable mechanical foundation for the moving components of the Evolution[AA] drivers.

LINEAR FORCE SUSPENSION.
Conventional drivers are designed for multiple applications in a wide range of different designs. Normally, the stiffness of such a driver's suspension increases as it approaches the limits of its travel. In an Avantgarde Acoustic system, because we can precisely define the operating range and physical characteristics of each driver, we can also develop special suspension elements with linear stiffness throughout their travel, avoiding compression and limited dynamic response.

INPHASE RESPONSE.
In redesigning the Evolution[AA] drivers, we have succeeded in significantly improving the phase response of the drivers over their respective frequency ranges. With phase-coherent output, all frequencies are emitted at the same time, avoiding frequency-related steps or jumps in volume and preserving the spatial relationships within the recording.

XT2 – the tweeter.

THE PERFECT COMBINATION.

Although the sensitivity of human hearing decreases above 5,000 Hertz, musical overtones and harmonics are crucial to individual instrumental timbre. Accurately reproduced upper registers are vital for identifying specific voices or instruments, creating an airy, open sound stage and precisely locating individual sounds in space.

ANNULAR DIAPHRAGM & DUPLEX SUSPENSION.
In contrast to dome shaped tweeters, the new Evolution^{AA} XT2 tweeter uses a completely different geometry. Its annular diaphragm, with duplex guides on the inner and outer rims, is lighter and at the same time mechanically more stable, ideally suited to withstand the higher back pressure of the 130mm horn.

RECORD LOW DISTORTION VALUES.
With the Evolution^{AA} XT2 high-frequency driver, THD values are 50dB lower than the actual music signal.

HIGHER EFFICIENCY. PURE SOUND.
With the incorporated recessed tweeter horn, we have managed to squeeze even more sound pressure out of a smaller and lighter diaphragm. Combined with a higher frequency for the high pass filter this improves the power handling and headroom of the Evolution^{AA} XT2.

PERFECT TIMING AND NO PHASE SHIFTS.
The new Evolution^{AA} XT2 high-frequency driver achieves reference values when it comes to the measurements of temporal offset across the frequency range. With a linear phase progression of less than 50 degrees (4,000 – 20,000 Hz), this exceptional driver is in a league of its own, capable of reproducing even the highest frequencies without timing errors.

22,000 CYCLES PER SECOND.
The Evolution^{AA} XT2 tweeter's lighter, annular diaphragm can vibrate extremely fast and accurately. The frequency range covers up to 22,000 Hz, ensuring greater clarity, focus, and harmonic resolution, a fuller and more natural sound.



Tweeter driver.



XM1 – the midrange unit.

AVANTGARDE MIDRANGE PERFORMANCE.

When people talk about high-end sound, they talk a lot about treble and even more about bass. But nobody talks about the upper bass (or fundamental range) and midrange. Yet 250 – 4.000 Hz is not just the area where our ear is most sensitive, it's the range in which you find both the human voice and most instruments. More than 80% of our auditory perception (and musical appreciation) happens in this area.

Therefore, for us – no matter how high the treble or how low the bass – it is the quality of the low-midrange that defines the quality of any high-end audio system. That midrange carries the essence, the very "soul" of the music.

It is very difficult to realize a lightning-fast reproduction in this range with horns, which is why this is where the high-end wheat is separated from the audio chaff. Here the sound transforms from good to "out-of-this-world". Get this range right and the sound is transformed, perceived as warmer and fuller. At the same time, the dynamics of the bass harmonics give the music an undreamt-of energy, precision and presence from from low frequencies right up through the upper-midrange.

400–190–75. DREAMY VITAL STATISTICS!
The spherical wave horn of the XM1 midrange unit has a diameter of 400mm, a length of 190mm and a horn throat opening of 75mm. That's not just pretty big, but also pretty unique and, let's face it – just downright pretty. And because it is so big, it will easily cover the frequency range from 250 Hz up to 4,000 Hz at a mind blowing passive sensitivity of 107dB.

AN EXTRAORDINARY ENGINE.
To achieve low–frequency performance levels that push the limits of what's technically possible, you need one thing above all: power. That's why we have equipped the midrange horn driver with powerful double magnets. For an even stronger magnetic field, we have also added InnerCore^{AA} magnets to the space inside the voice coil former. Pure power for pure, explosive sounds.

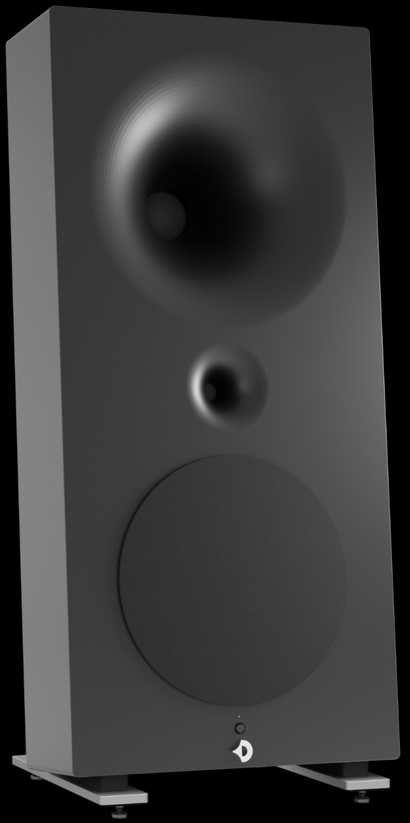
LEAVE NO STONE UNTURNED – REGARDLESS OF COST.
In designing the Evolution^{AA} XM1 midrange horn driver, we've used our unique technologies and materials: AirGate^{AA} filter, SphericDome^{AA} architecture etc. etc. Superior technologies based on over 30–years of experience, combined with a manufacturing precision that is second to none.

Our Evolution^{AA} XM1 midrange unit – extending the unmistakable, phenomenal sound that has made Avantgarde Acoustic systems so famous. The midrange unit projects musical energy, generating 107dB sound pressure levels from just one, tiny watt. There is no competition.

The XM1 simply delivers an outstanding midrange – bar none.

Midrange driver. 26–27





Filter.

THE CROSSOVER.

The purpose of a crossover in any multi-way loudspeaker is to prevent the same frequencies from being produced by different drivers simultaneously. If that happens, the tones can overlap, resonate, or cancel each other out. This interference must be avoided at all costs for credible, high-quality musical reproduction – reproduced music that sounds like life.

The ZERO iTRON uses the most effective method of frequency division using active filtering technology, dividing the frequency spectrum before the built-in amplifiers.

SPHERICLOWCUT[AA] TECHNOLOGY.
Each of our spherical horns can only reproduce low tones down to a certain, clearly defined frequency. If the wavelength of the notes becomes larger than the dimensions of the horn, those notes cannot properly propagate and are automatically filtered. Through careful calculation and without any additional componentry, Avant-garde Acoustic horn drivers use SphericLowCut[AA] technology to achieve perfect, perfectly natural low-frequency roll-off, the most efficient possible filter, based entirely on physical laws and devoid of any artificial artefacts.

AIRGATE[AA] TECHNOLOGY.
With AirGate[AA] used for the midrange, we have developed an innovative passive technology that filters high frequencies without placing a single component in the signal path. Unique, innovative, and without the typical, negative side effects.

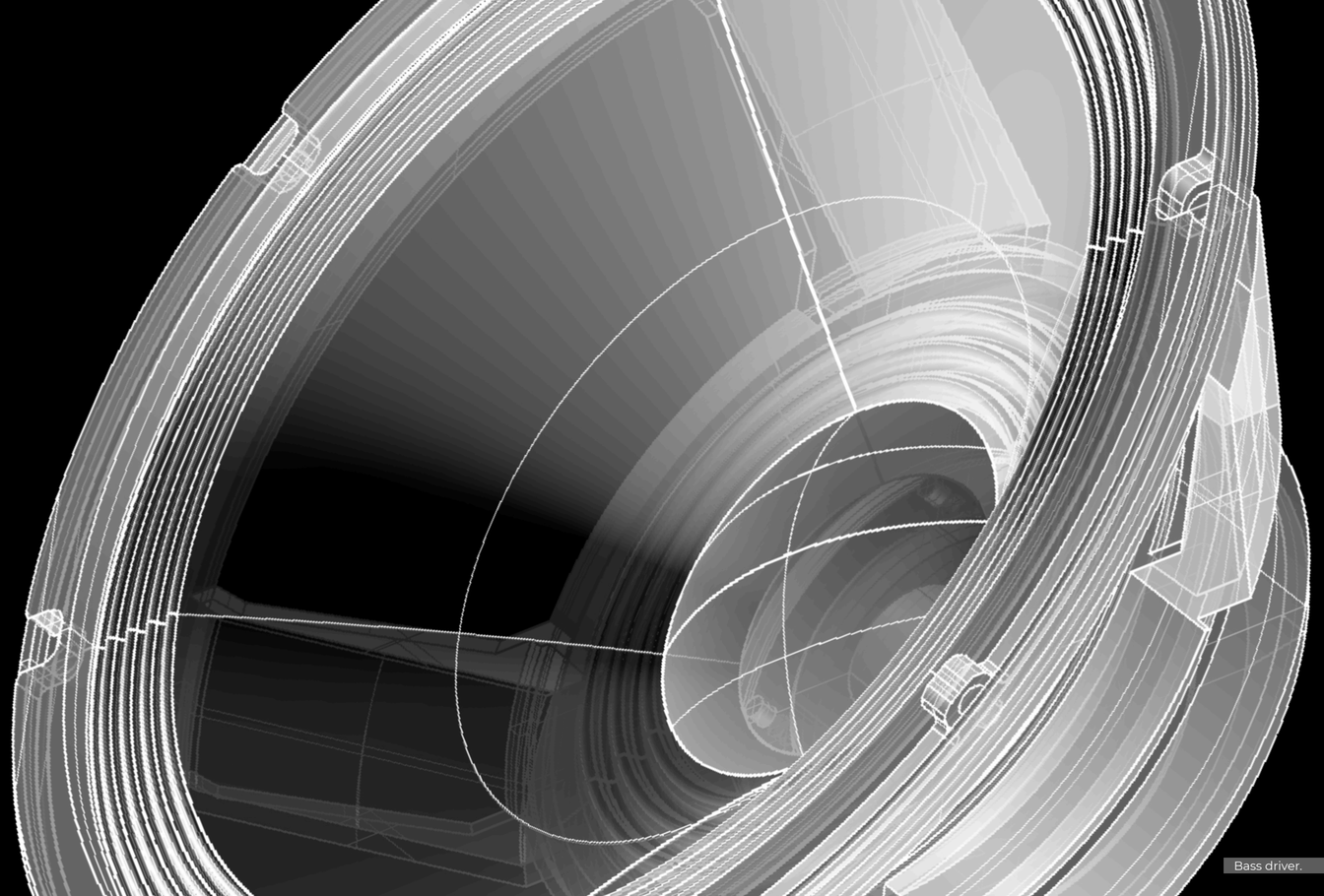
Z12 – the bass driver

POWER & CONTROL

We are using a redesigned 12”-driver for the ZERO iTRON. By featuring a 3” voice coil and a double-wave suspension system, we achieve high-power handling and very low distortion values.

The diaphragm is a handmade and sieved paper membrane with excellent surpression of partial oscillation of the cone.

The cone is proteced by an elegantly-shaped, removable cloth cover.



Bass driver.



Bass amplifier.

POWER TO ROCK & ROLL.

The active subwoofer of the ZERO iTRON is driven by an integrated amplifier consists of a 400 watt amplifier, providing for ample headroom even in complex EQ settings.

A 12 Volt switching voltage input allows the ZERO iTRON to be powered on remotely.

The signal take-off is not only at high impedance but is also balanced and transformer-coupled. This floats the circuit ground, avoiding hum loops.

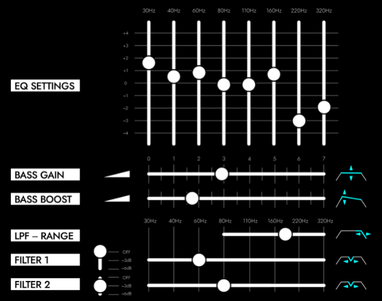
Digital crossover.

EVERYTHING UNDER CONTROL.

The bass power amplifier is equipped with an advanced digital sound processor.

With precision and accuracy that cannot be achieved with analog technology, the digital crossover eliminates all passive filter elements in the signal path.

The subwoofer volume is adjusted via two buttons beside the DSP display.



Numerous additional settings (e.g. high and low pass filters, equalizers, etc.) can be programmed with the Avantgarde Control software. For this purpose, the DSP has two LAN sockets, which allow daisy-chaining and thus programming of several subwoofers simultaneously. A USB port is provided for servicing.

The user interface has been completely revised and now allows a very simple intuitive use by the customer. Thus, all parameters can be easily adjusted to the room acoustics or listening habits.

The BASS-BOOST fader can be used to boost the low-frequency response below 45 Hz and thus adjust the bass response from "linear" to "fat".

For individual frequency adjustments, the DSP has an 8-band equalizer. Each of the eight bands can be boosted or cut by up to 4 dB. This way the bass response can be adjusted to specific sounds (linear, techno, disco, pop, etc.) or some broad-band room resonances can be reduced.

The LPF-RANGE slider adjusts the upper crossover frequency of the subwoofer and thus the "tonal balance" of the system.

With higher frequency, the subwoofer partly overlaps with the frequency response of the midrange horn. This makes the sound character of voices/instruments "warmer" and "fuller".

When the crossover frequency is set to a lower frequency, the subwoofer and midrange frequency response have a small gap. The tonal balance of the system shifts towards a more "dynamic & punchy" sound.

FILTER 1 & 2 are narrow band "notch" filters with a level cut of –3dB or –6dB. These filters can be used to eliminate/reduce unwanted narrowband resonant frequencies in the room.

Innovation that revolutionizes sound.
The amplifier that is not an amplifier.

iTRON

OHM'S LAW

$$I = U/R$$

Current Voltage Resistance

iTRON.

CURRENT DRIVE – DELIVERING PERFECT CONTROL.

iTRON^{AA} is a revolutionary electronic circuit from Avantgarde that, for the first time ever, allows perfect control of the driver's diaphragm, achieving an incredibly detailed, pristine, and crystal-clear sound. The difference to conventional amplifiers is so great that we call it our game-changer technology.

iTRON^{AA} is based on the current converter circuit principle. Our patented development is based on the concept of an ideal voltage-current converter being the perfect driver for a dynamic loudspeaker. Innovative, stringent and, above all, electro-physically correct. iTRON^{AA} is not an amplifier, but "the most sophisticated driver engine in the world". In order to better understand this logic, we would like to take you on a short excursion into the basics of electro-physics.

HOW A LOUDSPEAKER WORKS.
A loudspeaker converts electrical energy into acoustic signals (sound). The functional principle is based on current flowing through a coil suspended in a magnetic field. It is important to understand that the acceleration of the diaphragm is caused by the magnitude of the current flow – and not by the magnitude of the electrical voltage.

HOW AMPLIFIERS WORK.
Paradoxically, however, practically all commercially available audio amplifiers work on the principle of voltage amplification. This means that an amplified voltage, which varies with and tracks the music signal, is fed to the loudspeakers. Strictly speaking, the voice coil is supplied with the wrong signal – a current flow is needed to generate sound, not a voltage. The fact that this sub-optimal system nevertheless works is due to the electro-physical relationships between voltage, current and resistance.

OHM'S LAW.
Ohm's law states: The strength of the electric current flowing through an object is proportional to the electric voltage at constant resistance. This means that if the voltage increases at a loudspeaker voice coil with constant impedance (e.g. 8 Ohms), the current flow increases proportionally and the diaphragm is accelerated in a linear fashion, tracking the input signal.

Conversely, Ohm's law also states that for the same voltage, the current flow depends on the resistance. The greater the resistance, the smaller the current flow and vice versa. The diagram below with the water containers illustrates these relationships.

In the case of a real-world loudspeaker, with constantly changing impedance, this means that the diaphragm's acceleration is no longer linear compared to the input signal, introducing significant distortion.

It is therefore crucial to understand the actual impedance characteristics of any loudspeaker.

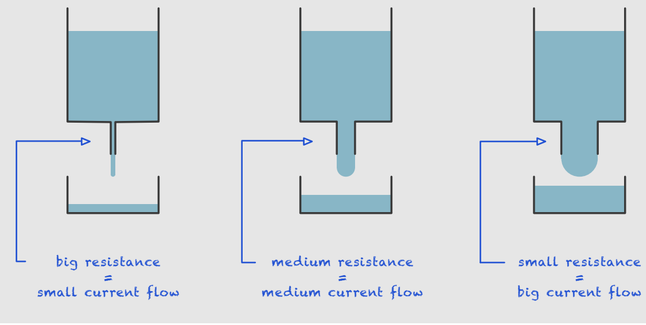


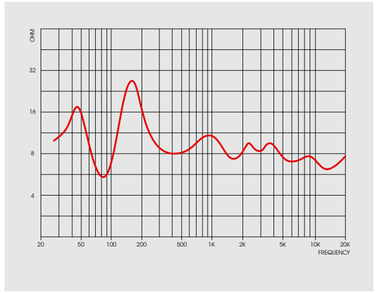
Fig. 3 Water tank with identical water level or pressure (= voltage).

Loudspeaker impedance.

THE ORIGIN OF THE SINGLE BIGGEST ERROR IN AMPLIFIER DESIGN.

A dynamic loudspeaker is a complex electro-physical system whose resistance, i.e. impedance, is influenced by a multitude of factors. Difficult to control, these factors constantly change during operation.

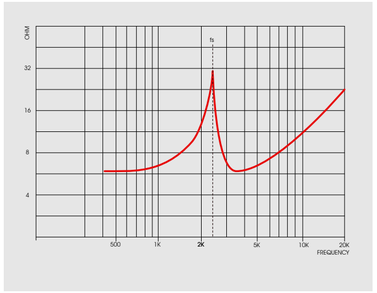
FREQUENCY-DEPENDENT IMPEDANCE CURVE.
The impedance curve of any drive unit varies but is highest in the range of its resonant frequency. A voltage amplifier reacts to this changing impedance, reproducing certain frequency ranges too loudly or too softly, distorting the music signal.



Impedance curve of a multi–way loudspeaker

INDUCTIVE REACTANCE OF THE VOICE COIL.
The inductive reactance of the voice coil causes increasing impedance at high frequencies. With a voltage amplifier, this causes a drop in level at higher frequencies, especially with tweeters.

POSITION-DEPENDENT INDUCTANCE.
The inductance of a voice coil depends on its distance from the pole core. When oscillating in and out, this distance changes and thus automatically changes the electrical inductance. Operated with a voltage amplifier, a driver thus produces



Impedance curve of a tweeter

continuous distortion that can be up to 20%, depending on the driver's stroke. Dynamic music impulses are thus distorted.

BACK EMF.
A voice coil with current flowing through it generates a negative voltage when it swings out, which is fed back into the loudspeaker cable. This so-called counter-electromotive force (back EMF) reduces the incoming voltage, the voltage that is actually required for a voltage amplifier to track the music signal. Music impulses are reproduced too softly and dynamics are compressed.

THERMAL COMPRESSION.
During operation, a voice coil carrying current heats up, sometimes considerably. Heat increases its internal resistance and under full load the impedance of the driver can increase by up to 40%. Musical impulses are strongly compressed and there is a considerable reduction in dynamics.

THE INERTIA OF AN ACCELERATED MASS.
In physics, inertia is the tendency of moving bodies to remain in their state of motion. In terms of the loudspeaker, Newton's 1st law means that the accelerated diaphragm tries to maintain its direction of movement, independent of the music signal. The magnitude of this force, which directly counteracts the music signal, depends on the moving mass of the driver and the speed of the diaphragm's movement. In practice, this means that loudspeakers with a high moving mass cause considerable non-linearities at high volumes.



Fig. Resistor

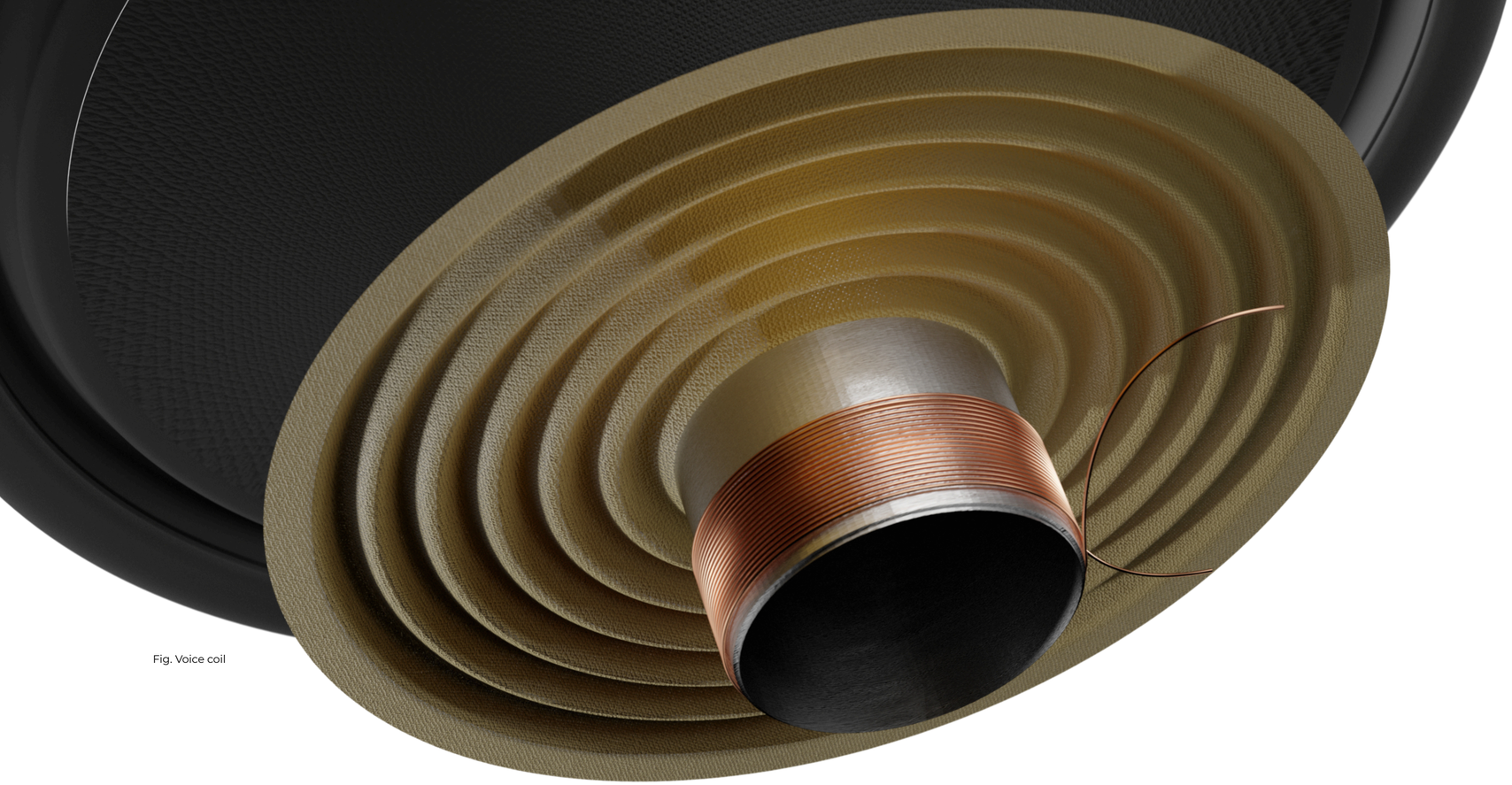


Fig. Voice coil

The challenges facing current amplification.

OR, WHY CURRENT DRIVE IS NOT COMPATIBLE WITH EVERY LOUDSPEAKER.

As explained in detail, a loudspeaker is an extremely complex load and impossible to operate without distortion, at least with a voltage amplifier. Nevertheless, virtually all, audio amplifiers are based on this principle. Why voltage amplifiers? Why are there practically no current amplifiers on the market? The reasons lie in a basic incompatibility between current drive and conventional passive loudspeaker cabinets and in the enormous complexity of current amplifier technology.

CURRENT DRIVE RESTRICTIONS.
A current amplifier cannot control a drive unit in the range of its resonant frequency. This is the range at which any loudspeaker is loudest and at the same time has its impedance maximum. The iTRON^{AA} circuit would try to compensate for the peak and "pump" ever more energy into this range. The electronics would be overloaded and the loudspeaker would therefore inevitably boom at this frequency.

To further complicate matters, the principle of the current amplifier does not work with passive cross–overs. Instead of precisely controlling the current flow in the voice coil, parts of the current would flow unhindered through and flood the passive crossover.

So, current drive technology cannot be used in the drivers' resonant frequency range and cannot be used on a passive speaker.

Since practically all loudspeakers are based on these principles, only voltage amplifiers can be used in these applications.

THE AVANTGARDE WAY.
But we are so convinced of the clear superiority of our iTRON^{AA} current drive technology, that we developed a system topology just to exploit it. By moving to a fully active system, in which each individual drive unit has its own iTRON^{AA} electronics, we can ensure that each driver is operated outside its resonant frequency range and that there are no passive crossover components in the signal path.

iTRON- the greatest technological challenge.

THE PUREST VOLTAGE-CURRENT CONVERTER EVER.

iTRON^{AA} is the greatest technological test we have ever faced. Theoretical knowledge is one thing, but its implementation is the real challenge. As with any fundamental innovation, it demanded extensive basic research.

We developed the most diverse circuit concepts and extensively tested them on the widest range of drivers, with technical measurement and comparative listening, the entire development programme taking over five years. The result: a patented circuit that outclasses every voltage amplifier known to us and puts all previous current amplifier concepts in the shade.

Established current amplifier circuits work either as a voltage amplifier with current feedback or as a current amplifier with feedback. In both variants, the negative feedback turned out to be too sluggish for the requirements of a high-end audio amplifier.

The iTRON^{AA} circuit, which we have submitted for a patent, is a symmetrical, single-ended circuit without any negative feedback. The output is a perfectly controlled current that exactly follows the voltage at the input. Strictly speaking, therefore, the iTRON^{AA} circuit is not really an amplifier at all, but a sophisticated voltage/current converter, an engine that directly controls the movement of the driver diaphragm.

LABORATORY TESTS.
To demonstrate the dramatic advantages of the iTRON^{AA} circuit, we can simulate its behavior compared to a voltage amplifier using laboratory modeling techniques. The two graphs show a simulation of both concepts using a 2-way box loudspeaker. The curves for input voltage (blue), output voltage (green), and output current (red) are slightly shifted relative to each other for greater clarity.

With the voltage amplifier (Fig. 1), the input voltage is amplified perfectly to the output voltage. In this circuit, the current (red curve), which actually accelerates the diaphragm, builds up only slowly due to the inductance of the voice coil and runs sluggishly behind the input voltage. Pulses of musical energy are inevitably slowed down and reproduced with a time delay.
The simulation of the iTRON^{AA} current amplifier (Fig. 2) shows the completely different way in which this circuit functions: the output voltage (green curve) does not follow the input voltage, but peaks dramatically (approx. 20V) at the beginning of the input pulse. The current amplifier circuit thus generates a short max. voltage so that the inductance of the voice coil is overcome and the current starts to flow immediately. In this case, the output voltage peak runs ahead of the output current, but the output current is a time-correct, practically perfect 1:1 copy of the input voltage.

SUMMARY.
In terms of both operational principle and measured performance, the iTRON^{AA} current drive circuit is superior to any voltage amplifier on a compatible loudspeaker. No other amplifier concept can drive and control the voice coil so perfectly: innovative, stringent and, above all, electro-physically correct.

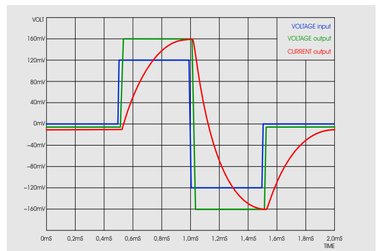


Fig. 1: Voltage amplifier simulation

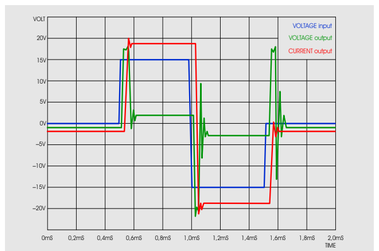


Fig.. 2: iTRON^{AA} current amplifier simulation





The iTRON Module.

THE BEST AUDIO CURRENT AMPLIFIER OF ALL TIME.

The iTRON[AA] circuit (patented) combines the innovative direct voice coil drive technology of the current amplifier principle with a state-of-the-art circuit topology of uncompromising high-end technology.

The iTRON[AA] module of the ZERO iTRON includes two analog crossovers and two completely autonomous current amplifier circuits.

The active crossovers limit the operating range of the amplifiers to the exact frequency range of the respective driver. This ensures that the current amplifier does not operate within the resonant frequency of the drivers. In the signal path of the circuit, we use the superior-sounding NatureCap[AA] components. Extremely intricately designed capacitors, handmade in Germany.

The iTRON[AA] circuitry is fully balanced. The circuits operate exactly differentially and any interference that may occur thus neutralizes each other.
The current amplifier is designed as a single-ended amplifier. With this circuit design, the operating current is always larger than the actual music signal and thus has by far the lowest distortion and the purest sound.

The limited slew rate of multiple amplifier stages results in a certain delay time between the input and output signal when using negative feedback. This accumulates over several amplifier elements and leads to audible sonic degradation. iTRON[AA] is consequently a pure zero-feedback circuit that operates without any negative feedback in the signal path.

The generously dimensioned power is provided by modern power supply technology of the latest generation.

The iTRON[AA] active module is connected via a balanced XLR input. For the balanced connection of additional subwoofers, an XLR daisy-chain output is available.

With the power mode switch four different power on/off modes can be selected. A 12V trigger input is available for automatic remote switch-on.

A brand new feature of the ZERO iTRON is the signal sense power-on and 20-minute auto standby circuitry.

The volume of the two ZERO iTRON horns can be adjusted in adjusted in +/– 1.5dB steps. The settings can be made according to personal taste, to match the sonic "tonality" of the connected source devices or to slightly correct room acoustic influences.

The place where paradise caresses music.

HORN TECHNOLOGY AND CURRENT DRIVE – THE PERFECT PARTNERSHIP.

The speed and dynamics of our horns combined with the control and resolution of the iTRON^{AA} circuitry is an audiophile marriage made in heaven – a perfect combination – a seamless junction between the world of acoustics and the world of electronics. It is the place where paradise caresses music.

What does iTRON^{AA} sound like? Fantastic, phenomenal, audibly invisible, unforgettable, beyond our wildest dreams or simply super awesome? We are happy to leave the struggle for an adequate description to you: music – live music – means different things to different people. But we would like to point out a few attributes that distinguish the performance of our iTRON^{AA} current drive from that of the very best and most highly regarded voltage amplifiers.

SUBSTANTIALLY BETTER DYNAMICS.
iTRON^{AA} delivers much wider and more natural dynamics because the impedance fluctuations in the loudspeaker are effectively eliminated, the current output (and thus the acceleration of the diaphragm) perfectly tracking the input signal. The power in the musical performance is unleashed. Live-like. Like an audio system on steroids.

ETHEREAL RESOLUTION AT LOW VOLUMES.
The iTRON^{AA} circuitry can compensate perfectly for inductance effects, especially at very low volumes and with the most delicate electrical signals. Even the quietest sounds have a presence and intimacy, delicate texture and attack, dimensionality, tonal shading and luminous harmonics. Even the quietest passages come to life...

UNRESTRAINED HIGH FREQUENCIES.
iTRON^{AA} has tremendous high-frequency resolution because it compensates perfectly for the increasing inductance in the tweeter. Combined with the extended frequency response of the new G3 super tweeters, this means fabulously delicate reproduction right up to the highest frequencies, without the level drop otherwise inherent in other systems.

THE MOST PRECISE TIMING THERE IS.
With the iTRON^{AA} circuit, the output current does not lag behind the input signal as it does with a voltage amplifier. Leading edges start at precisely the right moment and rise to exactly the right level. The diaphragm starts to accelerate at the correct time and moves just the right distance. With iTRON^{AA} every detail, every facet of the sound happens in the moment – the right moment. Temporal accuracy to within one-thousandth of a second – separate sounds (so, separate instruments) in perfect harmony.

EXTRAORDINARY DIMENSIONALITY.
iTRON^{AA} delivers outstanding impulse response from loudspeakers (see Fig. 2). Even the smallest time differences in music are reproduced with crystal clarity, recreating the three-dimensional space in which the recording was made, sitting you in the middle of the front row at the live event.

NO DISTORTION FOR EVEN PURER SOUND.
Let's cut to the chase: No amplifier sounds anywhere near as natural as iTRON^{AA}. The artificial artefacts that bedevil voltage amplification, overlaying, smearing, and distorting the musical signal are entirely eliminated. This technology disappears. The sound detaches itself from the loudspeakers, simply existing in your space. The music has a natural clarity and purity – and because of that it has the power to touch our heart.

CONCLUSIONS.
As you can see, we are pretty excited. We see iTRON^{AA} as a technological step-change, a game-changer that establishes a completely new level of audio and musical performance. Sound that simply sounds like music. Its superiority to conventional technology is so marked that once experienced, you'd rather listen to iTRON^{AA} in mono than stereo with a voltage amplifier. Suddenly, eliminating losses in the amplifier/speaker chain means that even an MP3 music file can sound more impressive than the best high-res playback on a conventional system!

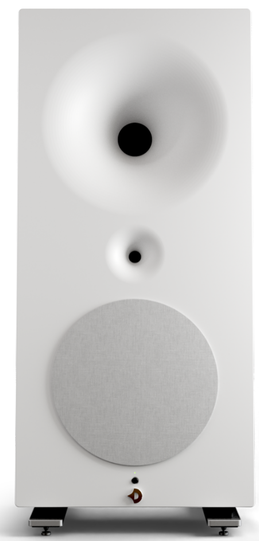
You probably think that we are exaggerating. Go to your dealer and find out for yourself. Listen to our iTRON^{AA} current drive technology and compare it with the best voltage amplifiers in the market.

Our customers have always been the final judges, our most demanding audience. We have never awaited that judgment with greater confidence.



COLOUR VERSIONS.







Specifications.

SYSTEM DATA		
Frequency range		18 – 22,000 Hz
Driver sensitivity (1watt/1m)		> 107 dB
Crossover frequencies		250/2,800 Hz
Recommended room size		> 16 sqm
OmegaDrive[AA]		yes
AirGate[AA]		yes

HORN		
Horn type		spherical Horn
Horn aperture angle		180 degree
Horn diameter	midrange	400 mm
	tweeter	130 mm

HORN DRIVER		
Diameter	midrange	127 mm / 5 inches
	tweeter	25 mm / 1 inch

BASS DRIVER	
Driver size	300 mm / 12 inches
Number of drivers	1
Voice coil diameter	3 inches
Membrane material	Handmade, sieved paper

BASS AMPLIFIER	
Output power (RMS)	1 x 400 Watt
Digital crossover	DSP
Equalizer	8 Band EQ
Digital room adjustment	yes
Inputs (10 kOhm)	1 x XLR
Output (daisy-chain)	1 x XLR

iTRON[AA] ELECTRONICS	
iTRON[AA] voltage/current converter technology	patented
Fully balanced circuit	yes
Class-A/AB circuit	yes
Zero feedback	yes
Output power	2 x 10 Watt

DIMENSIONS/WEIGHT		
Dimensions	width	490 mm
	depth	400 mm
	height (+/– 10 mm)	1.090 mm
Weight		40,5 kg

Illustrations show pre-series models. Design and colour scheme of the final model may differ.
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