Eos HX

New Technologies, Refinements and Breakthroughs

Design Concept by Roy Johnson, Designer

WHEN ORIGINAL EOS AND EOS HD WERE DESIGNED, it was with full respect for a speaker as a system, where each part of its design influences many other aspects. The goal was to obtain state of the art performance from a compact package, with no need for a subwoofer in most rooms.

Eos went on to win Editor's Choice Award and Product of the Year from the UK's oldest audio magazine, by their most experienced reviewer, Keith Howard—unheard of for American speakers!

To truly consider a speaker as a system, we must look also at how long it takes for any electrical signal to emerge as sound pressure. A properly-designed 1st-order crossover circuit prevents any electrical delays. A woofer and tweeter cannot have cone/dome breakups, to avoid the resulting mechanical delays. These issues we mastered more than twenty years ago, yet two delays still remained— the mechanically-induced delays that creep into any woofer and tweeter's lowest ranges. We finally solved that with our **eXtended-bandwidth Time Correction (XTC™) circuit technology.**

Eos HX was introduced in 2012, replacing both Eos and Eos HD (upgrade -kits are available).

hi-fi news EDITOR'S CHOICE

The finest sonic reproduction requires that every aspect of design be explored at the most fundamental levels.

Improvements come from hard-won knowledge, not from 'inspiration' or 'dedication'. It takes talent, education, and the insights gained from long experience.

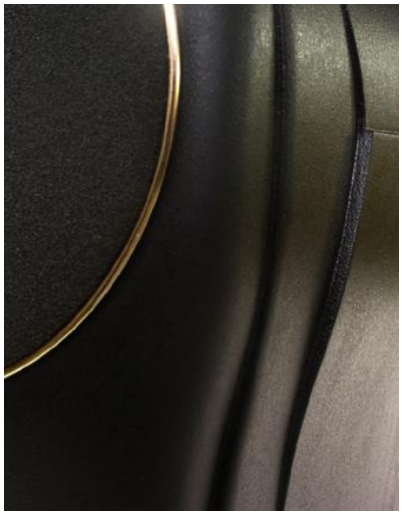
Because it is easy to become a manufacturer, most speaker firms offer little more than the latest parts in a fancy box—with vague details about the engineering details and decisions, and touting the passion of their designer.

We prefer physics.

Designing Eos' Enclosure

With Eos' tweeter in its own module, away from the woofer's cone and the main enclosure, we reduced all its reflections coming off of those surfaces. Eos' tweeter also moves back and forth to attain perfect 'focus' to where you live, whether that's sitting high or low, near or far, or even when standing (quite special for a dinner party, as your stereo can then play at a whisper with far more influence on the mood).

To reduce the voice-range reflections from the woofer off Eos' main enclosure, three years of experiment led to an asymmetric and minimalist shape. Just enough surface remains around the woofer to perfectly support its mid-bass output— with your floor and nearest walls supporting its lowest-bass output (as happens with all speakers).



Specialized soundfield mathematics had also revealed how the shape of the enclosure **reflects the reflections** coming off nearby room surfaces. From the lower-voice range down into the middle-bass, this reflective cycle eventually makes those tones too loud, too 'warm'. The undulating curves of Eos break this reflective cycle, producing a very natural and 'un-boxy' sound. These curves also diffuse upper-voice range reflections, for a very 'wide-open' sound everywhere in the room.

A small speaker is often placed near other objects and the walls of smaller rooms. Certain reflections off those surfaces are annoying; others alter the tone balance. The irritating ones are in the high-voice range and treble. Therefore, a tweeter cannot be allowed to radiate to its left or right, but be made to cut off sharply to its sides.

For this, Eos' tweeter has a **new absorptive material design** around it, which captures all the highs usually sent to its sides, and up and down as well. The channels between the discs present even more surface area for more sound absorption. The non-symmetric placement of the discs results in a more uniform sound absorption. Simple, economic, and completely effective!

When this tweeter's **controlled dispersion** is combined with the 6" woofer's natural dispersion pattern, an Eos 'speaks' far less to nearby surfaces while delivering a uniform tone balance and maximum clarity everywhere out in the room. One hears more deeply into every recording.

We also developed a unique method for casting an Eos enclosure in just two pieces, maximizing its rigidity and internal damping. Eos' enclosure is still heavy, darn it, because of our Q-Stone™ formula's very high density.

Inside Eos' Enclosure

Two critical aspects of the acoustics inside any speaker's enclosure must be addressed:

1. Complete **sound absorption** for all tones higher than the bass-port's tuning frequency
2. Complete **lack of sound absorption** at the bass-port's tuning frequency.

For both purposes, we'd previously discovered how to maximize the internal sound absorption everywhere except in the lowest bass, where our sound absorption literally 'turns off', since nothing should interfere with the pressures transmitted between a woofer and its port.

Those twin bass ports in Eos are quite unusual. Research into air turbulence at both intake and exhaust of ports led to combining two port-exits into one large opening on the inside. This Bi-port™ design increased bass output and port-coupling to the woofer. The resulting harmonic richness, pitch definition and percussive impact were previously not possible from a small woofer. Eos' internal shape also has six-sided asymmetry, to further break up voice-range standing waves. As a result, no other speakers are nearly as quiet inside— not even close. Nor are any as efficiently coupled to their bass ports.

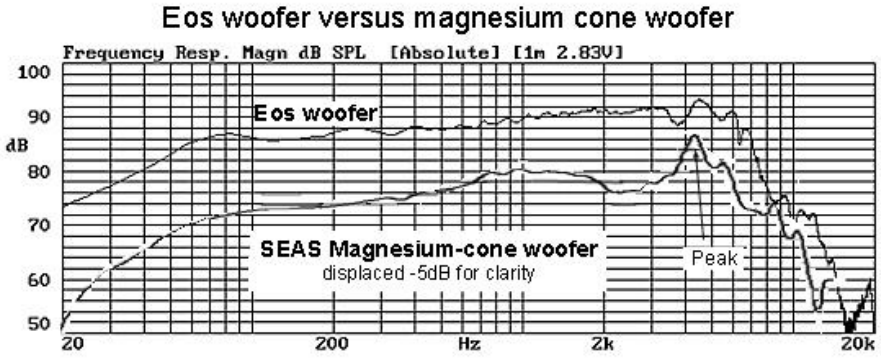
Selecting Eos' Drivers

A woofer and tweeter must perform to **the highest standards** over the widest possible frequency ranges, so we can better blend them into just one source of sound for the ear. We are very proud how Rio's drivers produce full musicality and front-row clarity at the softest volumes— especially important in smaller rooms.

Below we detail the important points about them because too many believe 'the best drivers' come from using the latest high-tech materials. Unfortunately, all of those fall short in one or more important parameters to making good sound.

Eos woofer is in its fifth generation of refinement, and remains unsurpassed in its wide and smooth frequency response and ability to play loudly with clarity and dynamics, and softly with a nuanced flow. Each pair is matched to ultra-tight tolerances for the most stable stereo image at all frequencies.

The woofer's cone is a sophisticated and unique blend of cellulose fibers, carbon fibers and acrylic resin, with a critical amount of damping compound applied right next to the dustcap and suspension. This piston is lighter, more rigid, with better internal damping than any metal cone. Below are the responses of Eos' woofer and 'the best' metal-cone woofer. The metal cone's high-frequency peak is its severe 'ringing', something not prevented by any crossover circuit.



Eos woofer's magnet structure is unique and patented, to provide a completely uniform magnetic field around its voice coil, no matter how far the cone strokes.

The voice coil is wound on high-temperature Nomex former, instead of a metal one that disturbs the magnetic field. This voice coil is immersed completely in its surrounding magnetic field, so there is no bass distortion, as the coil never leaves the control of the magnetic field.

This is a very lightweight magnet structure, because neodymium magnets need be only 1/10th the size of conventional magnets. This woofer supports its magnet structure with a very strong metal frame. Then we reinforce this metal frame with epoxy, which sounds better than an undamped cast frame.

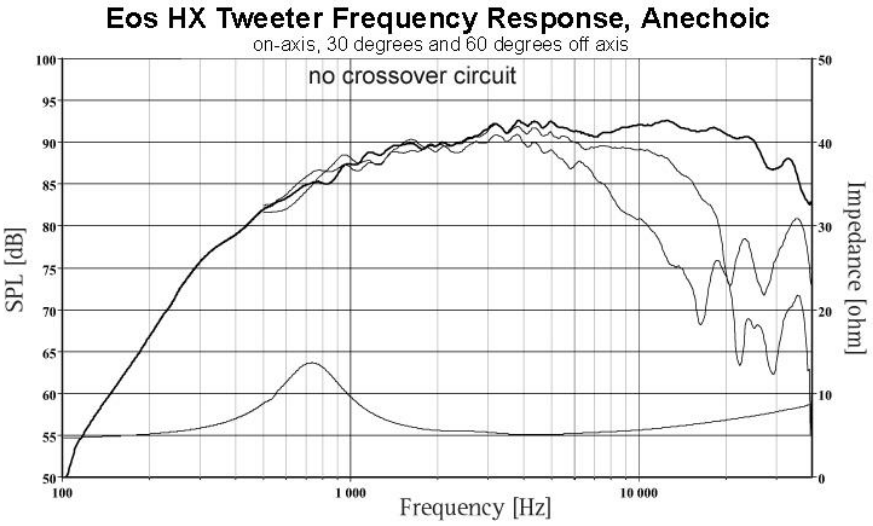
Eos' tweeter is made for us by SEAS, with true state of the art performance. What makes it so special are many things— its dome, suspension, chassis, the advanced magnetic structure, large rear chamber, and highly flexible braided-silver lead-in wires.

This dome's material is a unique fabric developed over several decades, exhibiting near perfect-piston behaviour smoothly past 30kHz. Its frequency response is far smoother than the finest metal dome tweeter (next page).

Its suspension is a very thin and highly flexible polymer, to minimize reflections between dome and suspension, and permit a superior ease of motion for both small signals and large.

The mounting plate of the tweeter is non-magnetic aluminum, with damping material placed between it and its magnet, for rigidity and lack of resonance.

A large rear chamber absorbs all sounds behind the dome, made possible by a compact neodymium ring magnet that physically 'gets out of the way' compared to standard ceramic magnets. This chamber is cast from non-magnetic alloy, providing firm structural support and lack of mechanical resonance. It is further damped by the Q-Stone™ enclosure.



Because Eos' tweeter has such a smooth and uncolored response, with vanishingly low distortion, it preserves the most delicate treble sounds, refusing to become harsh on the most complex music even at tremendous SPLs.

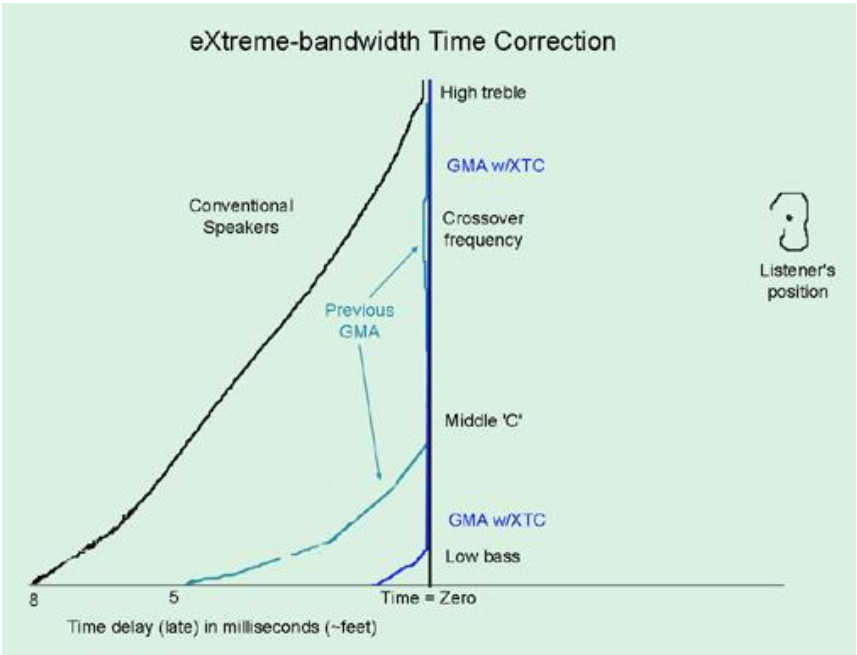
What you will notice is every note is being sung with its own sonic signature, not the signature of this driver.

Crossover Design

These two very linear drivers are connected with our simple, time-coherent 1st-order crossover circuitry. Simple because together these drivers and circuit form **a complete and balanced system** (the circuit having no 'problems' to 'correct').

In Eos HX, the **eXtended-bandwidth Time Correction** or **XTC™** circuit design delivers far more definition, coherence, body, emotion. It's been difficult to describe, but we can everything sounds more real. The flow of the music is physical— tunes swing, rhythms dance, emotions ebb and soar. We easily feel what the performers felt.

Listening has become a right-brain experience. Women have cried and men stopped listening to 'audiophile music'. All while playing at a whisper.



We hear substantial increases in separation between instruments and voices. Every musician is more clear and articulate. There is no listening fatigue, even from poor recordings.

We definitely hear ***how*** each note is being played, interpreted, caressed, accentuated, and no longer think of 'detail' or 'impact'. Those qualities are there, in spades, but it's how the music is played that draws one's attention.

Eos HX is far more efficient on music. At ten feet away, anything more than one Watt peak input makes it too loud to talk.

XTC™ design also made it quite clear, literally, what happened when we then had the entire circuit, including its Marigo Matrix™ Litz wires and pure-copper terminals, treated by **Audio Magic's Nanostream™ process**. We are the only speaker company licensed for this by Audio Magic.

Eos HX is designed to bring a lifetime of listening pleasure to all music, at any loudness.
We hope you enjoy them as much as we do!

Specifications

Room size	Small to medium, 100-500sf (10-50 sq. m).
Power	150 W peak— amplifier's 8-Ohm rating
Polarity	Positive over full bandwidth
Response	In-room, +/- 2dB 50Hz to 20kHz; -3dB at: 47Hz, 27kHz
Dispersion	Omni at 47Hz, smoothly decreasing to cardioid above 10kHz.
Distortion	<0.5% harmonic 100Hz-24kHz, <1% intermodulation, both at 91dB at 1m
Phase shift	< +/- one degree from 80Hz to 15kHz, acoustically. Does not vary with loudness
Rise time	< 10 microseconds, positive or negative input. Does not vary with loudness
Impedance	4.1 to 7.1 Ohms 100Hz to 50kHz. Treat as a 4 Ohm speaker
Sensitivity	91dB for 2.83V at 1m, at sea level. Dynamically linear within 0.5dB to 102dB
Max SPL	108dB peak midband, at 3m from stereo pair, first-arrival (without room gain)
Pair matching	Amplitude +/- 0.25dB; impedance +/- 0.1 Ohms, 80Hz-10kHz; crossover parts +/- 0.15%

Physical details

Cabinet finish Clad in black Texture-Kote™.

Enclosure material Proprietary Q-Stone™ cast marble.

Speaker Conditioning Crossover circuits burned in for 100 hours before installation. Upon request, we condition the speakers' drivers at no charge. Recommended for apartments, townhomes— anywhere the speakers will never be played loudly.

Grilles Speakers designed for foam grilles to be left in place.

Size 15.5"H; 8.2"W; 13.75"D with grilles.

Weight 42 lbs. (19kg) each.

Technical details

Woofer 6" (17cm) single-pressed cellulose/carbon fiber/acrylic cone with ultra-linear suspension, vented under-hung 2-layer 25mm voice coil wound on Kapton former. Mechanically damped chassis, epoxy reinforced. Self shielding, radially-magnetized neodymium-iron-boron magnet structure with black, heat-dissipating coating; 8mm peak to peak linear excursion; 9.85g moving mass.

Enclosure 4th-order Butterworth ported; nearly zero box loss. **Airtight Q-Stone™**.

Bass ports Twin 40mm aerodynamic ports tuned to 54Hz. The **Bi-Port™** intake is located to most efficiently transmit bass pressures from inside the enclosure.

Tweeter 27mm impregnated fabric dome with high-compliance thin polymer suspension, neodymium ring magnet, and large rear chamber. Ferrofluid-cooled aluminum voice coil with highly-flexible braided-silver lead-in wires. 0.31g moving mass. 1mm peak-peak excursion. Surrounded by wool felt to prevent reflections and diffraction, and control dispersion.

Crossover At 3kHz, our Balanced-Phase™ 1st-order circuit with **XTC™** design, treated by Audio Magic's Nanostream process. Marigo Audio Matrix wire™ having 500+ OFC strands separately-insulated with organic fiber insulation. Marigo Fusion™ solder. Solen™ Litz-wire inductor for woofer circuit. Sonicap™ capacitors. Very low T_c non-inductive resistors. Machined pure copper low-mass binding posts directly plated with gold. Anti-resonance shaped plywood circuit board.

Warranty

Happy Ears for Life™— see our website for details.

Green Mountain Audio, Inc.

Manufacturer of the most musical speakers on the planet, designed by physicist Roy Johnson
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