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A Neutral Reference Headphone Amp: Simaudio MOON Neo 430HA

By Tyll Hertsens

If I were in this simply for personal listening pleasure it might be a different story. I might go with the lightning fast HeadAmp GS-X Mk2; or the meaty musicality of the Eddie Current Black Widow; or the tantalizingly clean yet euphonic Apex Teton. But I'm a headphone reviewer, and what I need in a headphone amp is for it to get the hell out of the way and let me hear the headphones at their level best. What I need is an amp that will drive any headphone, balanced and unbalanced, regardless of efficiency. I need a no bullshit, competent headphone amp. What I *need*, as a reviewer, is the Simaudio Moon NEO 430 HA. Let's take a look.

Physical Description

The Simaudio MOON Neo 430HA ($3500; $4300 w/DAC) lives in a very beefy (15 lbs.), full-size (17"x13"x3.5") aluminum enclosure. Operating temperature is mildly warm. Simaudio has a solid reputation as a high-end audio manufacturer, and the 430HA clearly gets its nature as a fully featured headphone amp from these roots—the 430HA would function very nicely as a pre-amp in your main audio system as long as you don't need a built-in phono stage or balanced drive to your power amps.

The 430HA has two sets of control switches to the left and right of center on the front panel. The left side includes: Standby; Gain; Display; ands Xfeed controls. Standby disconnects all power between the power supply and electronics with the exception of the controller and IR remote control receiver circuit. Two gain settings are available, which deliver 14dB (Lo) and 20dB (Hi) of gain respectively at full volume. The Display button toggles between volume control settings (0 to 80dB) and incoming digital bit-rate. A long push will turn on and off the display. Xfeed engages a crossfeed circuit to reduce listening fatigue and improve audio imaging on headphones—more on this later.

The red segmented front panel display will indicate which input is active and either the volume setting or the incoming bit-rate depending on user selection.

The right side controls include: Input; Mute; and MP. The two input select buttons toggle you forward and back though the list of various inputs: Unbalanced analog inputs A1 and A2; balanced analog input B1; and four digital inputs, D1-Toslink, D2 and D3-coaxial digital inputs; and D4-USB input. The Mute button will silence all outputs and will blank the displayed volume setting. You can re-instate output by clicking the mute button a second time, but you can alternatively move the volume control to automatically un-mute the system.

An unusual feature is the "MP" button and "MP in" jack, which gets its initials from Media Player. The intention here is to give you a ready access point to plug in a small personal audio player or smartphone without having to fumble around with the rear panel. Simply take the audio from you player with an appropriate cable terminated in a 3.5mm TRS (tip-ring-sleeve) plugs and plug it into the "MP in" jack. Then push the "MP" button to toggle between that input and the otherwise selected input.

Regular headphones plug into the "Phones" 1/4" jack to the lower left of the volume control. Personally, I would have rather seen the MP jack be a second 3.5mm output headphone jack. Balanced outputs are to be found behind a sliding door to the right of the display. Both 4-pin XLR and dual 3-pin XLR connections are available.

A full complement of analog ins and outs are available on the 430HA rear panel. As you can see in the photo above, it has: two unbalanced analog inputs on RCA connectors, A1 and A2; a pair of balanced XLR inputs, B1; and both fix(ed) and var(iable) (non-volume controlled) unbalanced outputs. No balanced outputs are available.

The center of the rear panel is reserved for digital connections. The top row of connectors are for digital audio input. Toslink, USB, and coax (two) inputs are available. The is no 3-pin XLR AES/EBU digital input available. Toslink and coax inputs can decode PCM signals to 192kHz. The USB input can decode PCM to 384kHz and DSD to 11.28MHz (DSD4).

The connectors beneath the digital input are for remote control and firmware updates. Simaudio fans will recognize the SimLink connections as a way to string together numerous Simaudio MOON products and have a higher degree of interoperability and control. The "IR in" connector allows the use of aftermarket infra-red remote receivers. "12V Trig Out" sends a trigger signal to other compatible gear for turn-on. The RS 232 port is for firmware updates, and complex remote control done by professional custom installers. A remote control is included with purchase.

Highlighted Technologies
Simaudio tout a number of important technologies in the 430HA including:

- Transconductance topology using current signal internally.
- M-eVol2 proprietary volume control.
- Analog crossfeed circuit.
- An oversized power supply with seven separate regulated supplies.
- Proprietary M-LoVo +/-18VDC power supply regulation for analog audio circuits.
- Fully-balanced audio circuits including optional DAC.
- Ultra-rigid chassis construction

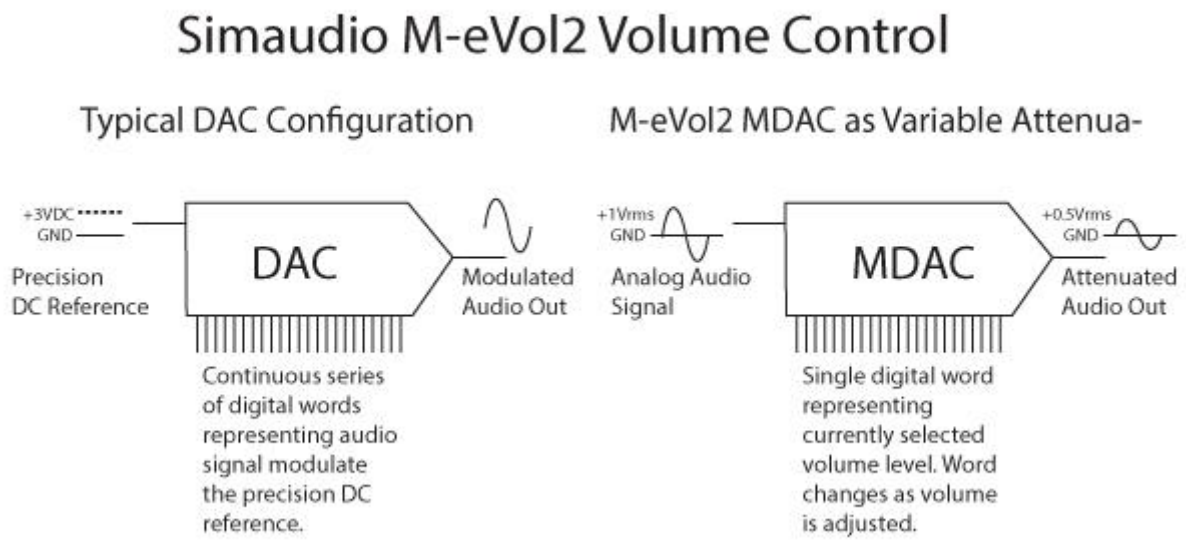
I'm going to highlight the first three specifically.

Transconductance Topology
It seems to me it's becoming more and more common to find high-end headphone amplifiers going the route of using current signals inside the amplifiers. (Questyle, for example, is another.) Don't confuse this with current source amplifiers that output current signals and have high output impedances. (Like the Bakoon or Apogee Groove.)

Theoretically, current topologies allow the audio signal to propagate more quickly through solid state devices. A voltage signal suffers a short time lag as it develops a voltage across the input capacitance of a transistor. These delays can accumulate and cause intermodulation distortion problems when feedback is used to stabilize circuits.

I did have the chance to chat with Dominique Poupart, lead design engineer for the 430HA, who told me a bit more about the output stage. As best I can gather, it's unusual in that the differential curent drive to the output stage forces both positive and negative halves of the complementary output stage to always be passing current, similar to class-A biasing. But unlike most class-A biased topologies, the current draw of the output stage is always proportional to the audio signal, and therefore runs much cooler than typical class-A biased products. He also told me that this type of topology is a superior for isolating audio from the power supply noise.

M-eVol2 Volume Control
The front panel volume control is an optical encoder that can be continuously spun, sending direction and increment information to an embedded control processor within the 430HA. At very low volumes (between 0 and 30 on the display) volume will be stepped in 1dB increments. Above 30 on the volume display, slowly adjusting the volume control will yield 0.1dB steps; and moving the volume control faster will make it jump to 1dB steps. A total of 530 volume steps are available. I found the volume control particularly cool as it allows you to very precisely match volumes when necessary.

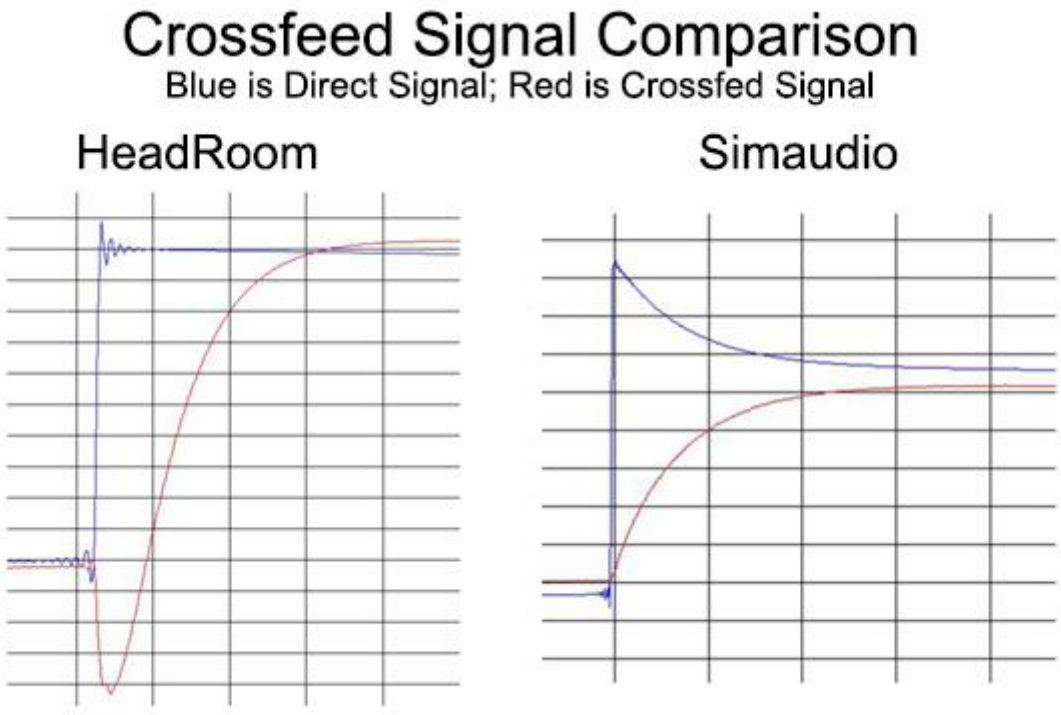


The volume control electronics are quite unusual in that it essentially uses a R2R multiplying digital to analog converter (MDAC) to adjust volume...but *not* in the way you likely expect! A DAC has two inputs: the digital word (8, 16, or 32 bit word of 1's and 0's) and a reference voltage. Normally, the reference voltage is a very precise and noise-free D.C. voltage, which is then attenuated to one of 65536 various different levels by the incoming digital word 44,100 times a second (if we're talking about CD bit rate and depth) to create the desired audio signal. BUT! That incoming reference signal doesn't *have* to be a D.C. reference voltage, and the incoming digital 16-bit words don't *have* to come flying by 44,100 times a second.

In the 430HA, the full-scale audio signal is sent to the reference input of the volume control MDAC. The embedded micro-controller presents a digital word to the digital inputs of the MDACs, which configures the resistor divider values in the DAC to achieve the desired volume level. The beauty of this system is it *allows the audio signal to remain in the analog domain*, and because of the extremely fine control, a look-up table can be stored in the micro-controller's memory to ensure extremely close level matching of the four channels of audio (L+; L-; R+; and R-) through the volume control.

Crossfeed
Having been one of the first people to put an analog crossfeed circuit into a headphone amplifier I was, of course, quite interested in the crossfeed circuit of the 430HA. I did a couple of measurements of the 430HA and a HeadRoom amp I have here for comparison. You'll have to excuse the lack of axis labels as I don't want to spill too much secret sauce here. I will note the space between vertical ticks is 250uSec.

The following plots were created by putting a shorting plug in the right unbalanced analog input and a 500mVrms 30Hz square wave into the left input. In the plots below the crossfeed circuit in the 430HA and HeadRoom amps are turned on, and we see the left output in blue, and the right channel in red—which is the crossfeed signal from the left channel.



In the HeadRoom amp, the blue trace shows an unaltered square wave leading edge (disregard the ringing, it's an artifact of the measurement system) coming out of the left channel. The right channel (red trace) is the crossfed signal from the left input, which shows a phase delayed leading edge of roughly 250uSec. This is to simulate the delay in a regular speaker system of the left speaker audio getting to the right ear slightly after the left ear. The HeadRoom unit uses a rather complex two-stage, all-pass, phase delay filter that attempts to achieve delays on the order of 200-400uSec.

In the Simaudio amp, you can see that the direct channel (left input to left output) has a slight high frequency emphasis, which can be seen in the elevated peak at the leading edge of the blue trace. The crossfed channel (left input to right output) does not have a readily apparent significant phase shift similar to the HeadRoom unit, but does appear to have a slightly rolled-off (treble de-emphasized) response.

One of the problems with analog crossfeed is bass build-up in the low frequencies of the mono component of the signal. Because the mono component, by definition, is the same in both channels, the crossfeed delay can cause a comb filter effect with the mono-component of the audio signal. Because the delay is short (200-400uSec) and the active filter of the crossover only being able to delay a limited phase angle, the comb filter has only one broad, shallow notch roughly in the low treble. This EQ shift will change as you change your music because of varying ratios of mono-component to difference-component in the stereo signal.

That last paragraph is less about the Simaudio crossfeed and more about my experience developing the most pleasing mix of signals possible as we modified the HeadRoom crossfeed circuit over the years. I can tell you it did change over time, and it was always a balancing act of compromises. In the end, most people felt the HeadRoom crossfeed was too warm, and obscured too many details.

From the above data, it looks to me that Simaudio took a somewhat differing approach, relying less on the time delay between the ears, and more on the frequency response difference between them to improve imaging and reduce listening fatigue.

(Listening fatigue comes from excessive difference signals heard on headphones that don't exist with speaker listening. Old hard-panned jazz recordings with a trumpet in one ear only and sax in the other can become quite annoying after a little while.)

At any rate, I evaluated the Simaudio crossfeed while having a HeadRoom unit on hand and listened to a variety of program material on both. I felt the 430HA crossfeed narrowed the image more than the HeadRoom, but it also more successfully retained the original tonality of the music. The HeadRoom crossfeed can smear the signal a bit causing the image and resolution to be a bit blurry, but I also felt it much more convincingly created a better sense of space than the 430HA.

My belief—after 20 years of trying in the analog domain—is that convincing out-of-head virtualization is very difficult, and really effective solutions will come out of the digital domain with complex signal processing algorithms. Given the extreme difficulty, Simaudio's choice to solve the headphone listening fatigue problems with old hard-panned recordings using a rather simple analog crossfeed filter that leaves tonality reasonably intact seems legitimate to me.

Sound Quality

My report on the sound quality of the 430HA is likely to be somewhat anti-climactic. To me, it doesn't have much of a sound—it just seems dead neutral. In direct comparison, it's not as quick and articulate as the HeadAmp GS-X Mk2—but the GS-X can sometimes come off as a little bright. The 430HA isn't as captivatingly musical as the TTVJ's Apex Teton—but the 430HA seems to have a simpler sounding and more naturally articulate detail response. During the Big Sound event, as I listened to all the amps with the various headphones, the Simaudio MOON Neo 430HA just kept drawing me to it as a terrific tool to compare headphones. In a room full of headphone amps, the 430HA felt like the neutral reference for me. As a reviewer, this easy transparency is crucial. I don't want an amp that has any character at all. When I compare headphones, I want to compare the headphones, not the interaction between the headphones and the amp. After checking out the measurements and the sub-1 Ohm output impedance, it's pretty easy to conclude this amp will drive pretty much any headphone without breaking a sweat. Distortion vs. Output Voltage vs. Load Impedance plots (.pdf amp measurement booklet including the 430HA here) show a low-distortion, noise limited plot to 10Vrms output with a 16 Ohm load!!! This thing is a beast. The only problem I had was slightly excessive noise with very efficient balanced armature IEMs. A slight noise background was audible when coming off mute at zero volume; the hiss got louder as the volume was turned up. With music playing, the noise was, for the most part, inaudible. The unit I reviewed does have the Saber DAC option. This too work flawlessly and seemed right down the middle. I did compare this internal DAC against the Antelope Zodiac Platinum DAC with 10M Atomic Clock. Flicking a switch between the two reveals a slightly more open window on the fine detail. This is likely one of those small, but important differences. Extended listening has me fairly easily preferring the $13k external DAC, but in my day-to-day use evaluating headphones I've not felt any need for a better DAC...at all.

Summary

The Simaudio MOON Neo 430HA is both a brute and a ballet dancer. It easily drives even the most stubborn of planar magnetic headphones with Adam's apple wobbling authority. And it's lithe articulation simply and cleanly draws out fine detail, without drawing undue attention to the treble or venturing into undesirable excesses of any kind.

The 430HA has a well fleshed out feature set with full complement of analog and digital inputs, and both single-ended and fully-balanced headphone outputs. It comes with a remote control, and has an optionally available built-in DAC.

The 430HA just wreaks of competence. It's going up on the Wall of Fame as an outstanding all-around, neutral-reference amplifier...and as my current professional headphone reviewer's reference here at InnerFidelity.