

## Nagra HD DAC

by Alan Sircom

**T**here's still a buzz about Nagra. Even those who have racked up a lot of miles on their audio clock get a little worked up over a Nagra product, and when that product is the first of the company's new cost-no-object range, the long-awaited HD DAC, it's hard to keep your feet on the ground.

Let's get the aesthetics bit out of the way first: you have to be some kind of cold-hearted anti-geek not to love Nagra's industrial styling. With the large recessed dials, switches, and that famous 'modulometer' on the front of both DAC and MPS power supply, the HD DAC has the classic look of a product made back when 'built to last' meant something. And yet, it's not simply retro styling for its own sake; everything is there for a purpose. But regardless, it's hard not to be impressed by the look and feel of these solid pieces of audio architecture.

However, it's also important not to let the whole 'it's a Nagra' element swamp the sophistication of what's going on beneath that solid alloy case. This is a 'back to the source' digital project, leveraging years of professional digital audio engineering to basically start again with digital to analogue conversion. The professional audio side becomes apparent at the point of contact for a datastream; all the HD DAC's digital inputs are filtered before being passed to a multiplexer circuit. This means the AES/EBU input on XLR and the S/PDIF inputs on BNC and RCA connectors each has its own individual transformer. This might seem like overkill to most digital companies because a digital datastream is not influenced by the impedance and level of the signal. However, the same does not apply to the electronics that process the datastream, and using the kind of best-in-the-business grade of transformers that Nagra can get for the task means the datastreams from each input are 'presented' to the digital processing section in the best possible condition.

The audiophile intent begins after these balancing operations, however. As suggested previously, the company went right back to first principles. Nagra sees the quantization noise of 16-bit/44.1kHz digital audio, and the methods used to quell that noise, as one of the big problems of the CD age. Crude brickwall filters that block out any noise above 22.1kHz can undermine phase above 10kHz, the company suggests, while conventional oversampling and interpolation methods are a cure that Nagra believes is often worse than the disease.

Nagra instead concentrated on the goals of getting the extraction and converting of data absolutely right, without resorting to 'cheating' (oversampling). Ultimately, this led to Direct Stream Digital, and Nagra (in association with DSD pioneer Andreas Koch) developed its own Sigma-Delta DSD processing, on a custom 72-bit Field Programmable Gate Array. Add to that a custom time-correction algorithm, in place of the usual demands for atomic clocks at this grade, to keep this DAC temporally precise, and the result is the removal of that quantization noise up to so far beyond the audio band, its impact is effectively completely eliminated.

This conversion schema is a very clever one indeed. Normally, DACs process DSD by passing the datastream through a low-pass filter and then to the same PCM converter used for 16-bit or 24-bit digital words; a simple, but effective way of decoding these signals for more real-world audio systems. When you ascend to the high end, typically DSD and PCM are routed through entirely different processors, each suited for the task in hand. This works well, but when one DAC is in use, the other sits there gently propagating self-noise through the system, and steps (typically heavy, expensive steps) have to be taken to manage this. Nagra does it differently, turning PCM into DSD, running at 5.64MHz. That's a rare pathway (in hardware, EMM and Meitner follow the same route, and you can run JRiver that way in software, if you have a hard-as-nails computer up for the task), but that means off-the-shelf digital conversion is simply not available.

Bizarrely, one of the things that is frequently overlooked in DACs is the 'to analogue' part. Perhaps it's not so bizarre; digital engineers think in the digital domain, and can sometimes view the analogue section as something of a 'done deal', but it can mean a very good DAC in the digital domain can have a relatively 'blah' analogue output stage. The Nagra HD DAC is not one of those devices; the thoroughness applied to its digital processing applies just as much to the analogue domain. This is perhaps understandable given Nagra's heritage in professional recording, because the company retains, "a culture of total intransigence when it comes to respecting the integrity of sound."

There are two key points to this intransigence. First up, the analogue section is designed to be 'phase perfect' throughout. This should be a given – we spend an inordinate ►

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▶ amount of time and energy ensuring the digital input from a digital source is 'bit perfect', why shouldn't the same apply to what happens inside the DAC? However, once you include any kind of complex filtering in the input stage, phase integrity is 'difficult' ('difficult' being the polite form of 'damn near impossible'). Moving from a PCM to a DSD-based architecture allows Nagra to eliminate that input stage filtration, and the company instead invested considerable R&D time into group propagation delay. The result is a DAC with the reactions of a ninja cheetah, even under significant dynamic swings.

But then, we return to transformers. Where most DACs rely on voltage gain from active electronics, Nagra uses custom-wound, custom-designed interstage transformers, which took the company months to perfect. Fed by ultra-rapid drivers, these transformers mean a lower impedance signal path, making this the perfect internal environment for the valve output stage. The use of a single JAN 5963 double triode (essentially a 'super' ECC82, with beefed up anodes to give it almost solid-state bandwidth and signal-to-noise ratio) in so sophisticated a device may seem odd, but it was selected because Nagra claims it found no way of making a solid-state output stage with the same degree of harmonic integrity.

As ever with high-end devices, the individual components come in for some special attention. Which is why you'll see coupling capacitors with some very distinctive materials (such as a beeswax dielectric) inside, all selected for their performance in that particular section of the DAC. Also common to high-end devices, close attention has been paid to the power supplies, and the HD DAC features 25 separate power supplies, driven by two separate external power supplies as standard. I suspect most people who have gone as far as the HD DAC, will go the extra mile for the optional battery MPS supply, and that was how the HD DAC was supplied. The comparison in size was interesting here; the MPS is in the standard Nagra small alloy box, and while Nagra has retained similar height and width, it had to make the HD DAC considerably deeper.

Essentially, the way to think about this DAC is Nagra treats digital audio like an obsessive-compulsive equerry might treat the Queen – with great respect, but also with absolutely no conception of 'good enough'. Nothing is 'good enough' on the Nagra HD DAC. Other DACs do

'good enough'. Nagra shows that 'good enough' isn't 'good enough,' after all! Of course, that implies your approach to the digital input the Nagra receives is equally uncompromising, but this is less 'fussiness' on the HD DACs part and more that music (and especially music played through the Nagra) commands respect, and this is the way respect should be shown. That means the right transport, the right computer, the right program, the right music files, even the right cables.

My sample arrived fully run in, from the late 2014/early 2015 show circuit. So the only waiting I had to deal with was the 30-second warm-up/diagnostic cycle the HD DAC takes to power up, and the 15 minutes or so it takes to come on song after that. Then, you had a full evening's magic before the battery pack began to need charging, and the rest of the evening in a state of near-Nirvana. The quality drop from battery to mains power is relatively small, but is like reaching for a Château Lafleur, after drinking a Petrus.

There's a meme floating round the internet that digital audio is the great leveller; that it closes the gap between the best and worst digital devices. Bits is bits, after all. In truth, the meme is not without some justification; the difference between a £100 turntable and a £10,000 turntable is fairly easy to identify, and very easy to justify, but the gap between digital audio devices at the same prices are not quite as significant. The Nagra HD DAC takes that meme apart.

Digital played through this DAC doesn't sound like all the others, and it doesn't sound 'digital'. It has a richer, more harmonically organised, and just 'organic' sound compared to most other digital sources. This makes most digital replay sound as if it were taking the music apart, where this portrays it as a contiguous, flowing 'whole'. That said, it's still deeply analytical, and with the kind of systems a DAC of this calibre is likely to work with, can highlight the structure of the music, the quality of the musicianship, and the sensitivity of the recording engineers. However, it does this analysis in that 'lean forward' manner one gets at a really good concert, rather than a mechanical, 'air crash investigator' approach.

The natural partners for the HD DAC are well-recorded jazz and classical, because the sense of musical 'flow' the Nagra creates is easier to find in these genres. But that doesn't mean it's somehow soft-edged and too legato for anything amplified or electric. I have a suspicion this might be the one ▶

▶ and only time this music is played through this DAC, but it sounds great playing 'Endorphin' by Burial [*Untrue*, Hyperdub], as it plays those crackly electronic sounds, the sampled voices, and the huge bass with a sense of insight and focus that is often skipped over. But where it works truly remarkably is on slower, more contemplative pieces, and especially those slow-build works where it starts *ppp* and ends *fff*, such as 'Mars' from Holst's Planets Suite [Zubin Mehta, LA Phil, Decca] or at the other end of the spectrum, the achingly beautiful 'Lift Your Skinny Fists Like Antennas to Heaven', from the album of the same name by Godspeed You! Black Emperor [Kranky, CD]. If your system and ears can handle it, the Nagra HD DAC has dynamic range enough to spare, and that 'harmonic integrity' the company discussed in making a tube output stage shines through. It's one of those rare devices that demand your full attention; turning the music off or even 'down' becomes an affront to music, and anything that breaks the spell is apt to get shouted at.

As a consequence of this 'holistic' approach to digital music making, the listener is drawn deep into the piece playing, in the manner of good analogue systems. This is more than just soundstage or detail, and is a lot more than the tonal balance or frequency response. For the want of a better term, this is about 'mojo'; the Nagra HD DAC has lots of mojo. Mojo in this respect is the difference between The Beatles and The Bootleg Beatles; no matter how close the alternative gets, you just know when you are listening to the real deal. And the Nagra HD DAC sounds like the real deal.

Walk this back to 'surface' observations. The Nagra HD DAC has excellent coherence from the deep, powerful bass to the unforced, grain-free treble. It has sublime detail and you'll hear things in your music you didn't know were on the recording. Vocal articulation is first rate, drawn out of a wide dynamic range, top-to-toe coherence, and an absence of background noise. The DAC is transparent, melodically, harmonically, and temporally spot on, and has the kind of flat frequency response that makes the Bonneville Salt Flats look like the Rockies. And all of that applies just as much to the powerful, servo-controlled, capacitor-free headphone socket as it does to the rest of the outputs; my HiFiMAN HE-500s, the oBravo HAMT-1, and even the Ultrason Edition 5 have never sounded so right!

We are duty bound to find a downside to any product, but in concluding the review of the Nagra HD DAC, I simply couldn't find one. It represents a leap in digital audio performance that doesn't happen that often. It extracts a lot from existing 16-bit, 44.1kHz files, and even shows to a



## TECHNICAL SPECIFICATIONS

**Digital inputs:** 1× RCA S/PDIF, 1× BNC S/PDIF, 2× XLR AES/EBU, 1× TOSlink Optical,

1× Audio USB (mode 2), 1× I2S (Nagra format)

**Signal handling:** 5.6MHz/6.2MHz, 72 bits

**Analogue outputs:** 1× RCA stereo, 1× XLR stereo (optional balancing transformers)

**Output level:** 1.3 or 2V RMS (for a digital signal at 0dB FS)

**Noise:** -128 dB linear (without filter)

**Distortion:** < 0.02% @ -20 dB FS

**Harmonic Distortion:** < 0.03% @ 192 kHz

**Bandwidth:** 5 to 40 kHz, +0/-1 dB

**Diaphonics:** 99 dB (at 1 kHz)

**Dimensions (WxDxH):** 280×350×76mm

**Weight:** 5 kg (without power supplies)

**Price:** £17,950 (as tested, including MPS)

**Manufactured by:** Audio Technology Switzerland SA

**URL:** [www.nagraaudio.com](http://www.nagraaudio.com)

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high-resolution sceptic what DSD is capable of. OK, if there is a shortcoming, it's that price tag. It's not overpriced – if anything, once you've heard what the HD DAC can do, the price becomes irrelevant – it's just that, for me, that price tag means I have to put it back in its boxes soon. And I'll miss it greatly. Highly Recommended! +