Jitter Ye Not!

MALCOLM STEWARD GETS TO PLAY WITH NAIM'S NEW DAC, AND HASN'T STOPPED MOANING SINCE HE HAD TO GIVE IT BACK

MALCOLM STEWARD

The standalone DAC (Digital-to Analogue Converter) first appeared in the late 1980s, when a number of models like Arcam's *Black Box* appeared. Compared to many of today's DACs, this was a real bare-bones affair. Inside its mundane case was a 16-bit Philips *TDA1541* chip with 4x oversampling, connecting to the outside world through a solitary S/PDIF phono input, designed to mate with the similar socket provided on most complete CD players.

The £550 *Black Box* looked as prosaic as a very prosaic thing, but its performance was decidedly invigorating, and it sold by the truckload. I recently dug my original review sample out from the garage, and was pleasantly surprised to find that the 20-year-old device could still hold its head high in modern company. The comparison demonstrated that there have not been any massive breakthroughs in converter technology: none, at least, that have brought about substantial advances in the portrayal of music, even if some sonic aspects have improved. This notion was reinforced when I heard a friend's venerable, TGI-era Creek DAC. It too sounded none too shabby, given its age and lack of contemporary sophistication.

One British company steadfastly refused to clamber aboard the DAC bandwagon – indeed it didn't even make a CD player until the early 1990s. Naim felt that removing the DAC from the CD player and piping data to it down a length of copper or glass cable was not a clever idea. The internationally agreed two-wire S/PDIF connection used for external domestic and ProAudio transmission combines the musical data with the bit-clock and word-clock timing signals, then unravels the three when they arrive at the DAC. This arrangement is prone to delivering the timing errors – jitter, as it became known – and noise that have been the thorn in the side of this transmission method since the dawn of digital. This is not a problem within the unit itself, where the I^2S interface is often used to move the signal around, and where the three streams of data are kept separate. Regardless, S/PDIF has become a *de facto* standard and one can hardly ignore it.

Twenty years after the launch of the *Black Box*, Naim has found its own way around the S/PDIF dilemma and has finally released its first DAC, called not too surprisingly the Naim *DAC*. And like a number of competitors in recent years, Naim claims to hold jitter to near zero through its S/PDIF connections.

Realistically, the company has recognised the growing importance of DACs as a breed in the hi-fi and entertainment systems of today. More and more devices can exploit a digital connection, as the move toward computerised music gathers momentum. It will surely not be long before this becomes a truly mainstream proposition. I expect Naim would like to see itself established as the high-end leader in the DAC/'digital hub' market before that happens... because the Naim *DAC* has been designed to do much more than simply upgrade the sound of a CD player.

The ten inputs consist of two coaxial BNCs, two coaxial phonos (RCAs), four optical TOSlinks, and two USB ports, meaning that the device can connect to CD players, hard disk players, *Mac*s, PCs, network music streamers, USB sticks, *iPod*s and *iPhone*s. And more. The *DAC* includes an Apple Authentication Chip, which enables it to access digital data from *iPod* and *iPhone* models, possibly making this the world's first Apple-authenticated high-end DAC.

The *iPod* sounds better through the *DAC*, as one would expect, but it still 'ain't no cigar'. To carry on the smoking analogy, it continues to sound to me more like a damp dog end than any Cohiba Esplendido. In commercial terms, official Apple approval will do Naim no harm whatsoever and the *DAC* looks to me like a more likely contender to bring the iGeneration into the high-end fold than, say, Chord Electronic's *Indigo* DAC/pre-amp, whose c£9,000 asking price makes Naim's £1,950 *DAC* look downright bargain basement – even if you add

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an extra £2,850 for the optional *XPS* outboard power supply (which I would strongly advise hardcore users to contemplate).

For me, though, the *DAC* earns whatever money one spends on it simply by revealing the true potential of the *HDX* hard disk player, which is currently my most frequently used source. I have even installed a *NaimUniti* in my office, and use the UPnP serving ability of the *HDX* to listen to it and to networked music through my office system. Given my enthusiasm for the hard disk player (which when reviewed was not entirely shared by colleagues on this title), it might be hard to imagine by what degree the *DAC* could improve its performance, but the specifications alone suggest this new standalone unit is much more advanced than the *HDX*'s internal DAC. (Forget any notions of this evaluation being exclusively Naim source oriented. I'm currently using it with a Micromega CD player, and a pal reports incredible results with a cheap as chips – in audiophile terms – Squeezebox *Duet*.) It's also decidedly revealing of the digital cable used to feed it. The Naim *DAC* seems to prefer Chord Company *Indigo* digital cable over Naim's own *DC-1*, though not by any great margin, so this might well come down to personal preference.

Starting at the beginning, the Naim *DAC* uses a 40-bit *SHARC* DSP (digital signal processor) for the digital filtration, clocking data into and out of the RAM (random access memory) buffer and into the multi-bit Burr-Brown *PCM1704K* DAC chips (the same as used in Naim's CD players). The DAC has to recover timing data from a tri-partite signal containing the audio data, and the word- and bit-clock signals. Unfortunately, that recovered clock signal can be modulated by the other data resulting in jitter. The usual way of minimising the effects of these errors is by using a phase locked loop (PLL) to compare the incoming signal with a regenerated clock, and so reduce these short-term variations. Using sequential PLLs can make these variations even smaller, but this is not the Naim approach, and indeed some suggest that using sequential PLLs can improve detail resolution but at the expense of musical timing.

Naim's buffer approach clocks the audio data into random access memory at the inconsistently timed incoming rate, then clocks it out of that buffer and into the DAC chips using a precise master clock. (A broadly similar approach may be found in some Meridian designs.) DACs frequently use an ASRC (asynchronous sample rate convertor) or alternatively a VCXO (voltage controlled crystal oscillator) to match their clock frequencies to that of the S/PDIF datastream. Neither methodology was deemed appropriate for the Naim *DAC*, although it does default to the integral ASRC in the SHARC DSP digital filter when the incoming data falls outside the S/PDIF specification. Rather, the *DAC* clock offers a choice of 10 different fixed crystal controlled frequencies selected to keep the average clock frequency the same as that of the source. The best match oscillator is chosen by the SHARC DSP, which monitors how fast the RAM buffer is filling up and then selects an appropriate clock rate on a long term basis to prevent any data over- or under-runs.

The SHARC runs on minimalist code developed in-house by Naim. Just five lines of instructions 'drive' the DSP and, according to Naim's R&D engineers, the effect of removing even a single byte can be heard in the audio output. (There might only be five lines of code but they are cycled millions of times every second!) And the Naim *DAC* has genuine hi-res capability – 32-bit/768kHz through its USB input, and up to 192kHz through its S/PDIF connections.

For those who might enquire whether this *DAC* upsamples, the answer is no. Rather it oversamples. It is said that upsampling doesn't sound that hot because the convoluted mathematics involved require rounding type calculations. Oversampling – integer upsampling as it is sometimes known – produces superior results because it significantly eases the load on the processor, increases the mathematical precision by avoiding rounding, and keeps the filter's inherent noise comfortably below that of the actual DAC output chips. The arithmetic noise of the Naim *DAC* needs to be greater than the -144dB of those Burr Brown *PCM1704K*s, and is actually around -156dB, so the filter is operating well inside the 'comfort zone'.

In appearance and design, the Naim *DAC* exudes a healthy pragmatism. For example, some internet forum 'experts' expect to see balanced connections on any high-end DAC. Naim's response is that its *DAC* is designed for use in the home not the studio, and that a balanced interface exacerbates RF noise, so why fit one? Likewise a FireWire connection (another high jitter interface) is omitted, and it's suggested that anyone using a laptop computer (PC or *Mac*) as a source of music should instead employ one of the USB/optical S/PDIF connections, such as that provided by the inexpensive M-Audio *Transit* device, or the optical digital output found on *Mac*s and others.

While accepting that design compromise is inevitable in some respects, Naim's traditionally obsessive approach to detail still ensures that the prime signal sources receive the treatment that they deserve. That much was evident after a mere ten seconds' listening to my *HDX*, the sound of which, it's fair to say, the *DAC* transformed. Adding the *DAC* to the *HDX* renders the latter's internal DAC

and analogue stages redundant and, as these are normally powered in my system by an *XPS* power supply, that was moved over to augment the mains power feed to the *DAC*. That reconfiguration alone provided a noticeable uplift to the performance, so it remained in play once auditioning was complete. (One thing that has bugged me throughout the 25 years I've been using Naim kit: just when you think your system could not sound any better, along comes an upgrade or a new piece of gear that dramatically improves performance. As a music fan that is good news; as a reviewer it is not. As a music-loving reviewer it is a prime example of cognitive dissonance: how to tell the truth with an appropriate degree of enthusiasm and, at the same time, avoid appearing like a rubber-stamping sycophant.)

One curious aspect of the performance of the Naim *DAC* is that although it is intensely satisfying from the musical perspective – as one might expect – it also exhibits stereo characteristics and qualities that one more usually associates with American high-end components: stand by to hear air, space, three-dimensional imaging, instrumental timbre, extreme resolution and transparency when you audition the Naim *DAC*... even through a 100 per cent Naim system.

For example, my jaw plummeted towards the carpet when Jose Carreras and the choir began to perform the *Kyrie* from Ariel Ramirez' *Misa Criolla* in a highly credible three dimensional acoustic environment created by my hard-against-the-back-wall, actively driven Naim *DBL*s. I should have been focusing on Carreras' magnificent singing but instead found myself shocked into listening to the space and the interactions of Carreras' voice and those of the *Sociedad Choral de Bilbao* and the playing of the *Grupo Huancara* with the wonderful acoustic of the *Santuario de la Bien Aparecida, Cantabria*. It definitely resulted in one of those eerie 'I felt as if I was there' moments...

Switching from Carreras to the Los Lobos album *Kiko* swiftly confirmed suspicions that the *DAC/XPS* might well offer quite outstanding low frequency performance too. Furthermore, the *DAC* was equally as explicit and controlled at the other end of the spectrum. Not only did it render the kick drum on *Angels with Dirty Faces* with formidable weight and slam, but it also revealed amazingly delicate detail on the snare, cymbals and other percussion.

The Naim *DAC* captures note shape envelopes with ease, and its ability to track a note from leading edge attack to eventual decay explains, for me at least, why Naim's *DAC* is so musically communicative. It's also quite phenomenal at differentiating the contributions of individual instruments playing simultaneously alongside others in the same register, and this probably helps explain its 'high-end stereo' dexterity.

Whenever a piano was played – a notoriously difficult instrument for hi-fi components – the *DAC* relished the challenge of making it sound truly credible. With songs such as *Almost Rosey* and *Father's Son*, on Tori Amos' *American Doll Posse*, the portrayal convincingly showed that even though the instrument was played gently it had awe-inspiring volume potential. Even at low levels the sound had the resolute stability, solidity and weight that told you that it was ready to catapult you into the stratosphere in the blink of an eye.

This is one aspect of the *DAC* that needs to be heard, because it is damn near impossible to describe in words: somehow this *DAC* seems to promise that there is still more to come, even when you are convinced that it has exhausted all its potential.

The *DAC* still displays all the temporal characteristics and fundamental timing qualities that one has come to expect from a Naim product, its intrinsic rhythmic correctness and urgency ensuring that one simply cannot sit or stand still when listening to insistent tracks such as *Que Onda Guero*, from Beck's *Guero*. Although strikingly detailed in classic high-end finery, the musical persuasiveness of the presentation encouraged my brain to ignore the niceties and simply groove along as well as my motor skills would allow.

The only problem with the Naim DAC is that it might leave some listeners feeling deluged with information. Thankfully, all is cohesive and musically relevant. Even though the amount of data on some recordings can seem overwhelming at first, that is not a bad thing. I'm currently enjoying a splendid but quite low-res recording of Keith Jarrett. To be honest, though, 24-bit/96kHz doesn't sound all that bad...

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UPGRADES: Adding an XPS (or a 555PS) supercharges the performance of the DAC, and makes digital audio appear even more convincingly analogue. With the extra power supply it becomes even more as though digits were never allowed a look-in during the recording process.

Listening to the above recordings with an XPS attached gave an enhanced sense of note envelope definition, which contributes so much to timing accuracy, and an impression that the presentation of all manner of music – not just rhythmically urgent material – had greater immediacy and vitality. An XPS also enhances the DAC's presentation of stereo imagery. So the power supply makes the DAC more flat earth and simultaneously more round earth, which is neat trick.

Finally I added a Chord Company Solstice interconnect (connecting the DAC to my pre-amp) and a Naim Power-Line to feed mains to the DAC. Both provided clearly audible steps forward. Who said that tweaking died with vinyl?

NB: We plan to include a full technical examination of the Naim DAC in the next issue, once a sample is available