

# Chord DAVE

Chord says its new flagship DAC/preamp is not only its most advanced yet, but also sets a standard others cannot match – does its performance live up to expectations?  
Review: **Andrew Everard** Lab: **Paul Miller**

**T**hink 'DAVE' and what springs to mind? 'I'm sorry, Dave. I'm afraid I can't do that'? Famous Dave's Bar-B-Que? Trigger insisting on calling Rodney 'Dave' in *Only Fools And Horses*? Chord Electronics has a new one for you, in the form of its £7950 flagship DAC. After the rather more patrician-sounding Hugo [*HFN* Dec '15], with its overtones of a Cotswold weekender, now we have the DAVE – and you don't get many Daves in the Cotswolds. Oh, hang on...

Actually, though the name may sound rather more down to earth – apologies to readers called Dave (or indeed Hugo) for any sweeping generalisations here – Chord's DAVE is a decidedly more upmarket prospect than either of the Hugos. In fact, it's described by the company as no less than its 'most advanced DAC to date', and behind that name is a spot of yer actual Latin: DAVE stands for 'Digital to Analogue Veritas in Extremis', this only slightly tortured description setting out its stall.

## CHORD'S DIGITAL WHIZZ

What we have here is the latest model from a company best known in the past for its amplification, but of late more identified with products like this. And it's a DAC at which Chord's digital whizz Rob Watts has thrown everything he knows – or at least everything he's prepared to divulge at the moment – fitted into the familiar corporate Choral casework. The extended lozenge shape has a bite taken out to house a high-resolution display in the angle between the top and the front.

It can be used free-standing on its integral rubber feet, or mounted on a single shelf of the company's Choral Ensemble racking system, extending the footprint and adding £1835 to the price [see front cover image and p37]. If you've just winced at that cost, some justification comes in the fact

**RIGHT:** Screened within the milled alloy chassis, Chord's switchmode PSU feeds the FPGA-based WTA filter, discrete 20-element Pulse Array DAC and headphone amp

that the support is machined from a substantial 30mm-thick billet of aircraft grade aluminium and mounted on 50mm diameter solid 'Integra' legs of the same material (also used for the DAVE casework), making it extremely inert.

Multiple Ensemble shelves can house a number of Choral-shaped components in one neat tower, and you can even stack models from the company's Reference and Standard ranges along with Choral models, as the leg-layout is the same.

First announced in early 2015, it's taken almost a year for DAVE to get to the point of this exclusive review – a year in which the company launched what is arguably an even more attention-grabbing product, the cute and rather wonderful-sounding Mojo, which compared to DAVE is almost pocket-money-priced at £399 [*HFN* Jan '16].

Like the Mojo, and indeed the Hugo and Hugo TT, DAVE uses Chord's proprietary Rob Watts-designed digital-to-analogue conversion technology. Rather than the 'off the shelf' chipsets found in most DACs these days, from the humblest right the way through to high-end models, Watts builds his conversion from scratch, in software running on a Field-Programmable Gate Array (or FPGA), an expanse of silicon designed to be configured to its task after it's manufactured – rather like loading software into a home computer – instead of being manufactured for a single task.

It's an approach gaining traction in high-end digital products, with companies such as dCS and EMM Labs taking the same path, but Watts has long been an advocate of this method of working. Why? Such a methodology allows him to bring his (considerable) experience in digital design to bear in imagining a conversion system built to do things right the first time. This is preferable to accommodating the foibles of pre-built DAC chips, which, after all, may be designed for use in anything from a mobile phone or tablet all the way through to a high-end audio component.

## CREATING A UNIFIED WHOLE

The argument is a compelling one, or at least it is if you have the wherewithal to design such devices for yourself. It avoids the need to spend a lot of development and tuning time building circuitry around an off-the-shelf DAC chip in order to get the best from it, and instead allows a designer to create the digital and analogue stages of a DAC, the power supplies and all the other ancillary components in a unified fashion. That way the whole of a product can be designed to work as one, rather than parts of it compensating for the characteristics of other sections.

So does the £7950 DAC here use the same technology as the company's £399 pocket version? Must be some pretty fancy casework to justify a £7550 price hike,





right? After all, even the Mojo has a milled-from-solid case, although admittedly it's not quite as fancy as the enclosure here.

Well, of course, it's not quite that simple: for a start there are FPGAs and FPGAs, rather as there are differently-specified processors for your home-computer and indeed different engines for your family car, be they petrol or diesel or whatever. Just saying 'well, it has an engine, four doors and four wheels' doesn't really cover it, in the same way that the efforts made to find an FPGA affordable enough to be used in the little Mojo doesn't mean that anything more expensive is overpriced.

What we have in DAVE is pretty much a cost-no-object device. Indeed, the price of the LX 75 version of the Xilinx Spartan-6 FPGA used in its DAVE DAC is dangerously close to what Chord charges for an entire

### 'DAVE focuses on transients and the way they affect timing'

Mojo, reflecting the fact that it has more than ten times the processing capacity of the FPGAs used in the company's past products. It's this processing power that enables the most advanced iteration of Watts' WTA (Watts Transient Aligned) filter, with 164,000 taps making use of 166 DSP cores for the filtering alone. The bespoke 17th-order noise-shaping code alone demands more processing capacity than is used for the whole of Chord's Hugo [see PM's boxout, below].

As ever, the DAVE focuses on what Rob Watts feels is the vital part of the way a converter works: the transients in music and the way they affect both timing and the realism of what's being heard. In presentations he has referred to the way our ears use even the subtlest of timing clues to place objects around us in space, and thus our

**ABOVE:** In typical Chord style, controls are kept simple – just up/down and left/right buttons, plus a volume knob. Large, clear display offers four colour modes, including auto-dimming

perception of the world, and it's this that informs so much of his work, from the little Mojo all the way up to the DAVE.

### A 'DIGITAL PREAMP'

In practical terms, the DAVE offers both single-ended and balanced XLR outputs, and is described by Chord as a 'Digital preamp' rather than a DAC, emphasising the point that it can be used straight into a power amplifier as well as via a conventional preamp or integrated amp. This preamp mode is turned on and off using the top-panel buttons, which can also revert your DAVE to 'DAC mode', giving a fixed output: 3V via the RCAs and 6V via XLR. Plugging headphones into the front panel socket takes the unit out of DAC mode, allowing volume adjustment, and defeats the RCA/XLR outputs.

As you might expect from Chord, its DAVE offers a wide-ranging digital format compatibility handling content at up to 768kHz/32-bit and quad-DSD (DSD256/11.2MHz) via its asynchronous USB Type-B input. It also extends to 384kHz LPCM via the four BNC coaxial inputs provided, and up to 192kHz via the two Toslink optical inputs and the three-pin XLR AES input. Pay attention to the manual though, as none of the sockets is labelled.

It's possible to switch the unit between 'PCM+' and 'DSD+' modes, determining how incoming content is handled. In the former, it can handle DSD256, but using decimation, while in DSD+ it handles the DSD content natively for optimal sound. This can involve some juggling with ⇨

### WATTS IN A NAME

The Watts Time-Aligned (WTA) filter at the heart of Chord's DAVE employs an algorithm developed by audio consultant Robert Watts, who first came to fame when he co-formed Deltec Precision Audio (DPA) in the 1980s. Since DPA closed in the late 1990s Watts has had a close association with the Chord Electronics design team. Nevertheless, while his innovative Pulse Array DAC technology has powered Chord's digital products since the DAC64 – introduced some 15 years ago – it's only in the last few years with the smash-hit Hugo and Mojo USB DAC/headphone amps that this know-how has achieved its true commercial potential.

In its latest generation, and running on a capacious Spartan 6 FPGA, Watts' technology employs a combination of 256x oversampling (parallel-processed to 2048x) and truncation to a (5-bit) bitstream, with an unprecedented 17th-order noise shaping to maintain a huge dynamic range across the useable bandwidth of all incoming sample rates. Interestingly, Watts maintains it's not the extended frequency response provided by these high sampling rates that improves sound quality, rather the improved timing of transient musical detail. PM

## DAC/HEADPHONE PREAMP



**ABOVE:** As if being an exceptional DAC and preamp weren't enough, DAVE also includes a very high-quality headphone amp, with a full-size 6.35mm socket and the company's crossfeed system

the remote if you are having a listening session with a mix of DSD- and PCM-based music, and also involves a 20sec delay for each switchover while DAVE gets its act together, but of course it's the purist way of doing things!

The BNC inputs also support a 'dual-data' mode, in which 176.4kHz files can be sent to the DAC as two separate 88.2kHz datastreams, one for each channel. This functionality is available, for example, on Chord's own Blu CD Transport, and two such 'dual-data' devices can be accommodated. It's also worth noting that its DAVE provides two sets of dual-data digital outputs, again on BNC connectors, 'for use with future unannounced Chord Electronics products' [see adjacent interview with Chord's John Franks].

This is a remarkably flexible piece of digital equipment, with extra features extending to phase switching, a user-selectable high-frequency filter and Chord's excellent four-step crossfeed switching to give a more speaker-like effect when listening through headphones. After a brief familiarisation, DAVE soon becomes simple to use, either via the five buttons on its top-panel – the large one is the volume control – or the comprehensive remote handset, aided by the large, clear display.

Some of the multiple display modes – four in all – that DAVE offers are garish, but I can see the logic of them. If you want to keep things simple, go for mode 2 [illustrated in our pictures], which is simple black and white, as opposed to mode 1, which displays the incoming sampling frequency by the same colour-changes found on other Chord devices. Mode 3

replicates mode 1 with a graduated blue background, while mode 4 is mode 1, but with display blanking after 30sec if no buttons are pressed. If you're a 'darkened room' listener you'll probably go for mode 4 as the display is very bright!

### POWER AND DELICACY

It doesn't take much time with DAVE to realise that the sound here is every bit as impressive as all the clever stuff under the hood. PM's lab results tell their own story [see p39], but every bit of that technical finesse is translated into the most remarkable music-making ability, whether with CD-quality files or content pushing the upper limits of today's high-resolution offerings.

What struck me immediately was that DAVE 'does' piano, a notoriously difficult instrument to reproduce in any manner corresponding even slightly to the experience of sitting close to one being played in anger. Opening up my listening with a couple of recent jazz releases – GoGo Penguin's *Man Made Object* in 44.1kHz/16-bit [Blue Note 0602547648341] and Olivia Trummer's *Classical To Jazz One* in 96kHz/24-bit [Neuklang NCD4131, via Qobuz] – I was immediately taken by the sheer scale and power of the instruments centre-stage, to the point where one could hear the impact of hammer on string, the shifting of the dampers, everything.

That was as true with Trummer's delicate classical-based pieces – her vocals also sounded delicious – as it was with the driving GGP tracks, with Chris Illingworth's piano shining out against

'What struck me immediately was that DAVE "does" piano'

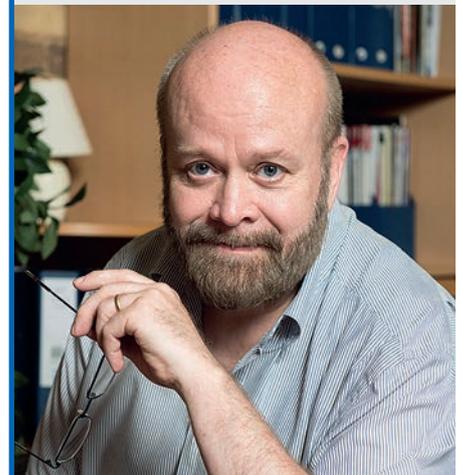
## JOHN FRANKS

We caught up with Chord Electronics founder John Franks 'on tour' in the US with Rob Watts and new friend DAVE, and asked how the current six-strong DAC range stacks up. 'Mojo and Hugo are clearly aimed at mobile users (but benefit from a line-level output option), with the larger Hugo TT satisfying the demands of desktop and static system users. The 2Qute, from the Chordette range, is a straight-up converter with no amplification, while audiophiles will appreciate the performance advantages of the QBD76 and QBD76 HDS (DSD-capable) models. For the ultimate in fidelity, there's DAVE which has a new headphone amp design.'

So what's with DAVE's four 768kHz 'dual mode' digital outputs? Franks says they're 'for Chord DAC/power amps that will accept the DX connection', adding that 'A range of DAC/power amps is under development using a completely new approach which offers simple analogue design – to maximise transparency from the digital domain to loudspeaker terminals – but with the dynamic range and distortion performance of DAVE.'

Other future products will also include 'ADC converters using a mix of discrete integrators and Pulse Array technology. We're targeting a 135dB dynamic range, no noise floor modulation, highly advanced decimation filters offering zero aliasing, and DAVE-standard distortion performance for domestic and pro-audio products.'

As John Franks puts it, 'Exciting times are ahead!'



## DAC/HEADPHONE PREAMP



**ABOVE:** Fixed and variable RCA/XLR (balanced) analogue outs [left] are joined by DSD-compatible USB, four S/PDIF (on BNC), AES/EBU and two Toslink optical digital inputs. Dual-data 768kHz digital outs (on BNC) will service future Chord products

the powerful engine-room of Nick Blacka's bass and Rob Turner's drums and percussion, the latter album emphasising the percussive character of the pianoforte to thrilling effect.

And wow, is this DAC both weighty and fast, capable of growling out the deepest bass notes while simultaneously untroubled by the speed and complexity of rhythms – traits as well suited to trio jazz as they are to large scale orchestral works.

Simply, DAVE delivers remarkable instrumental timbres and detail, as for example when running in DSD+ mode to play the Cleveland Orchestra/Szell programme of Wagner orchestral highlights in DSD64 [from Sony Classical 4988009254838]. These 1960s recordings sound just glorious, with beautiful fluidity and bite, room-shaking dynamics, and shiver-inducing timbre and texture to that Wagnerian brass in the *Götterdämmerung* Prelude.

### SPECIAL AND CAPTIVATING

It's not just the sheer power on tap here, but also the way that Chord's DAVE casts broad, deep, precisely-focused soundstage images before the listener. Especially with archive recordings, the switch from PCM+ to DSD+ mode pays dividends in the sharpening-up of the sonic picture and instrumental timbres alike, and freeing just a shade more of that considerable dynamic ability. As I write, 'Siegfried's Funeral Music' is filling the room, and it's just a little hard to concentrate...

Make an abrupt mood-shift to the soundtrack from Paul McCartney's 'On reflection, perhaps not such a

smart move' *Give My Regards To Broad Street* [Parlophone CDP 7 46043 2], and while the recording is patchy and the occasional bits of dialogue laughable, when it's good it sounds magical through the Chord, from the luminous recording of 'Yesterday' to the George Martin brass arrangements on 'Wanderlust' and the exuberant spirit of 'Silly Love Songs'. That's the beauty of what DAVE can bring to a system: the ability to make even recordings one may once have overlooked sound both special and captivating.

'Revelatory' is a pretty strong term to describe a piece of hi-fi equipment, but that's just what Chord's DAVE is. Furthermore, while most of my listening was via the USB input from my dedicated Mac Mini, it's just as striking when fed via the optical or coaxial inputs, and offers a remarkably good headphone amp into the bargain, with that crossfeed facility effective in making the sound much less 'in the head'.

By any standards, this is a remarkable piece of equipment, but is it the best DAC you can buy right now? On this showing, I wouldn't bet against it. ☺

### HI-FI NEWS VERDICT

A rare high score for Chord's DAVE, but then this is no ordinary digital-to-analogue converter. From the handcrafted quality of its casework to the sheer quantity of proprietary engineering within, this is a standard-setting product, and when you hear it in action all that hard work – and the price – is more than justified by a scintillating performance. From lab to listening room, this is an outstanding product.

Sound Quality: 91%

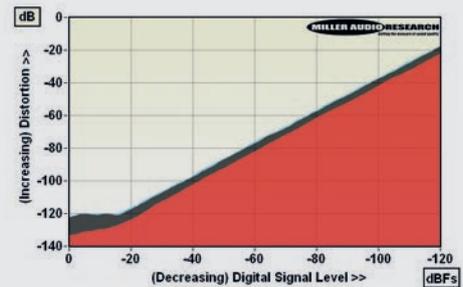


### CHORD DAVE

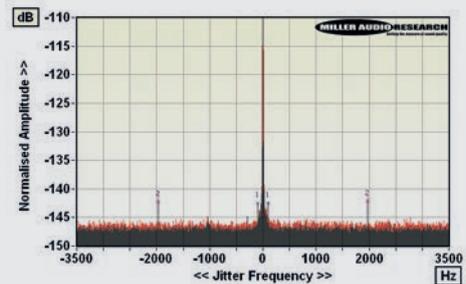
In 'Preamp mode' the maximum output is around 12V (+3dB on the display for 0dBfs in) or 6.05V in the fixed output 'DAC mode' – the latter conferring a very impressive 117.3dB A-wtd S/N ratio, linearity better than  $\pm 0.05$ dB over a 100dB range and distortion that's lower than from any other DAC we've tested. Robert Watts, Chord's digital designer, claims a distortion of 0.000015%/1kHz under idealised conditions but with a -2dBfs USB input, via the balanced outs and with a tuneable notch filter, I was able to resolve a vanishingly low 0.000007% THD at 1kHz and 0.00008% at 20kHz. Even with a -30dBfs digital input, 1kHz distortion (pure noise rather than harmonics) is still <0.0001% at 1kHz and <0.00015% at 20kHz [see Graph 1, below]. This is an astonishing technical achievement by Chord, though the subjective advantage is open to debate.

Watts has also programmed his WTA filter to ignore test impulse patterns so it's impossible to 'see' its pre/post ringing behaviour in the time domain (and thus hamper anyone attempting to reverse-engineer its coefficients), however its rejection of alias images is an amazing >145dB while its magnitude response is -0.04dB/20kHz, -0.35dB/45kHz and -3.1dB/90kHz with 48kHz, 96kHz and 192kHz files, respectively. Jitter is also vanishing low at 6-8psec via all digital inputs at all sample rates from 44.1kHz-192kHz [see Graph 2].

Chord claims its DAVE DAC 'redefines DAC measured performance' and I would be inclined to agree. Readers are invited to view comprehensive QC Suite test reports for the USB and S/PDIF DAC performance of Chord's DAVE DAC by navigating to [www.hifinews.co.uk](http://www.hifinews.co.uk) and clicking on the red 'download' button. PM



**ABOVE:** THD vs. 48kHz/24-bit digital signal level over a 120dB dynamic range (S/PDIF 1kHz, red; USB input 1kHz, black and 20kHz, blue). Note revised Y scaling



**ABOVE:** High res. jitter spectra with 48kHz/24-bit data over S/PDIF (black, with markers) and USB (red)

### HI-FI NEWS SPECIFICATIONS

Max. output level /Imp. (Balanced)	6.05Vrms / 32ohm
A-wtd S/N ratio (S/PDIF / USB)	117.3dB / 117.3dB
Distortion (1kHz, 0dBfs/-30dBfs)	0.00002% / 0.00009%
Dist. & Noise (20kHz, 0dBfs/-30dBfs)	0.00008% / 0.0001%
Freq. resp. (20Hz-20kHz/45kHz/90kHz)	+0.0 to -0.04dB/-0.4dB/-3.1dB
Digital jitter (48kHz/96kHz / USB)	6psec / 8psec / 5psec
Resolution @ -100dB (S/PDIF / USB)	$\pm 0.05$ dB / $\pm 0.05$ dB
Power consumption	18W (1W standby)
Dimensions (WHD) / Weight	338x60x145mm / 7kg

