

Chord *Hugo TT2* & *M Scaler*

TWO LONG-AWAITED NEW DIGITAL PRODUCTS FROM CHORD ELECTRONICS ARE NOW IN FULL PRODUCTION. TRUE, *HUGO TT 2* IS A REVISION OF ITS MID-RANGE DIGITAL-TO-ANALOGUE CONVERTOR MORE RADICAL INSIDE THAN OUT, BUT IT'S COMPLEMENTED BY THE *M SCALER*, A REMARKABLE DIGITAL-TO-DIGITAL CONVERTOR THAT REPRESENTS THE MOST SOPHISTICATED UPSAMPLER IN THE WORLD

ANDEW HARRISON

A sporty 'TT' suffix was added to Chord Electronics' transportable *Hugo* DAC when it expanded into *Hugo TT* (for 'Table Top'), a static and souped-up version. Inside *Hugo TT*'s near-square aluminium case beat the heart of the regular *Hugo*, the circuit transplanted wholesale complete with jumper leads to patch rear sockets to the Micro-USB ports on the miniature PCB.

Even the lithium-ion batteries were carried over, two cells upgraded to four and then supplemented with 10 farad-worth of super capacitors to augment the supply. Notwithstanding the mobile power packs, the *Hugo TT* was no longer a road-warrior gadget but a domesticated stay-home DAC that harnessed the sound of the *Hugo* in a painless separates package.

The new *Hugo TT 2* looks superficially the same, having an identical 234 x 222 mm footprint but benefitting from a gentle redesign of the exterior. A larger volume orb has been moved to a scalloped cut-out on the front, making it easier to reach and read the multi-colour volume control. Incoming sample frequency is still represented not by numbers but by colours, and the transparent porthole on top has been enlarged to reveal more of the circuit board and its kaleidoscopic LEDs.

The cryptic chroma scale remains, including five enigmatic shades of blue to denote frequencies from 192 to 768 kHz PCM. A pair of steel ball-bearing buttons gives access to a basic menu (input, filter, headphone crossfeed, display dim, output mode), and a third is for standby. It's a cleaner design overall, thanks also to the removal of the on/off rocker switch and IR receiver aperture.

However, this simple facelift belies a radical rebuild inside. The *Hugo TT 2* is based on the *Hugo 2* digital architecture, featuring a Xilinx *Artix-7* FPGA to run all filter DSP along with a revised 12th-order noise shaper that replaces fifth-order. The following pulse array convertors are now tenth- rather than fourth-element. And whereas the first *TT* was effectively a little *Hugo* lost in a big case, the *TT 2* is now several steps ahead of its portable brethren. A custom four-layer circuit board fills the case from side to side, and it's gifted a more powerful FPGA

from the same series (*XC7A35T* versus *XC7A15T*), with 86 208 MHz DSP cores working in parallel to form a 93,304-tap FIR filter. That compares to 45 cores in the *Hugo 2* and half as many filter coefficients, 'only' 49,152 taps.

The *TT 2* loses the lithium batteries but gains three times as many super capacitors, totalling 30 farad. As designer Rob Watts explains, "super caps are there not just to deliver power – they have the benefit, together with the large input inductor, of completely isolating *TT 2* from the mains".

Available output through the RCA and XLR sockets is so high, it's rated sufficient to power efficient loudspeakers – up to 7 watt unbalanced and 18 watt balanced output into 8 ohm, with vanishingly low milliohm impedance.

With great power comes greater power supply demands. The *Hugo TT* survived on a 12V/0.5A wall-wart to top up its batteries. The *TT 2* now comes with laptop-style SMPS mini brick specified at 15V/4A – a rise from 6 to 60 watts.

Despite the isolation afforded the *TT 2* by super caps and inductive filtering, I found system sensitivity to SMPS placement, overall sound exhibiting foreshortening of stage depth and vexing low-level lispiness. After many trials, I found plugging the brick into anywhere but the same six-way board as the amplifier provided best results.

Audio output can be fixed at line level (2.53 V unbalanced) or adjusted in 1dB steps by a digital volume control using fixed – rather than floating-point – precision, to avoid noise-floor modulation. In-band performance is stated as 350dB SNR, and in use I found it effectively as transparent as a passive transformer volume control.

Sound quality

Comparing new *Hugo TT 2* to the original *TT*, the outward changes were minor; the internal changes huge; and the sound differences colossal.

The first *Hugo TT* had a very clear, open sound with noteworthy spatial width and depth that enabled a diffuse sound cloud nicely detached from the loudspeakers. As with other D-A units from the



Reference system

Mytek *Brooklyn DAC/Longdog PSU*
 Mytek *Stereo192-DSD DAC*
 Apple *Mac mini (2012)/Audirvana/CAD USB cable*
 Music First Audio *Passive Magnetic pre-amp*
 Chord Electronics *SPM 1200C power amp*
 Bowers & Wilkins *802D*
 Nordost *Valhalla 2* power and interconnect cables
 Nordost *Valhalla* bi-wire speaker cable

Chord-Watts partnership, it had a dynamic sound to keep feet tapping, with nimble well-timed bass lines, if perhaps not as pacy and exciting as some models. It's what I would call a 'lean into' sound, with a slightly dark tonality and creamy 'undigital' character. That's not to say overly rich; on the contrary it had the trademark lean but textured and profound bass partnered with an extended and unpretentious treble. Ultimately it was the smooth and soft tone which made it an easy listen, all the while revealing recording details aplenty.

Avoiding motoring clichés, especially those involving Tourist Trophy vehicles, has been difficult up to this point. But the *Hugo TT 2* seems to find sixth in a four-speed box, with a violent shift upward in resolution and immediacy.

A fresh perspective

It throws a fresh perspective on familiar recordings, adding height, picking out newfound details in the background, yes, but also heightening the importance of what's in the foreground. An example would be 'I've Seen All Good People' from *The Yes Album* [24/192 HDtracks], where a hand shaker punctuates the second verse. It was always there but now the objective quality of the instrument moving through air becomes apparent, beautifully timed.

The following number 'A Venture' opens with Tony Kaye's offstage piano which gradually fades up and forward. I have heard this countless times before but only now while following the tinkling arpeggio do I hear a finger briefly slip onto two keys, likely an inadvertent fluff rather than jazzy chromaticism.

Four switchable digital filters are included. The default FIL1 is labelled 'neutral incisive' and executes here the fullest effect of the unit's WTA (Watts Transient Aligned) algorithm in two stages. It oversamples with the proprietary linear-phase code to 16FS – for example, taking CD data to 705.6 kHz – before a second WTA filter iteration oversamples again to 256FS (eg, 11.2896 MHz). Alternatively FIL3, described in the manual as 'warm', skips the second WTA filter, and so is more broadly similar to the fixed filter in older DACs such as the *Hugo TT*, albeit with around four times the number of coefficients.

Even-numbered FIL2 and FIL4 follow 1 and 3 respectively with an additional low-pass filter (–3 dB at 40 kHz), designed to clear out some of the unwanted ultrasonic hash on certain hi-res PCM recordings.

Listening tests showed FIL1 as clearly the most etched and precise in character, stark on occasion but in the long run an addictive choice. FIL2 was marginally less precise in character and I thought it may be subtracting some rhythmic intelligibility in

complex time music. Before I'd worked out FIL3's mode of operation I found it redolent of the wider and almost creamy sound of a Mk 1 *Hugo*, meaning (in hair-splitting comparative terms at least) a slightly clumsier bass, and less precise stereo fixtures. And FIL4 was a fractionally rose-tinted take on FIL3.

Enter the M Scaler

Digital upsamplers as separate boxes appeared in the late '90s, spearheaded by Data Conversion Systems with its specialised studio-grade format converters. It repackaged the dCS 972 for domestic use after audiophiles reported significant sonic benefits when upsampling CD audio to 24/96. And it was upon hearing a dCS *Elgar* DAC with *Purvell* upsampler that I was drawn to the digital side again, soon thereafter investing in the 'affordable' combination of *Purvell* with *Delius* DAC.

That was 20 years ago; now more elevated oversampling or switchable upsampling is typical within every one-box DAC and with the exception of dCS and its oligarch-priced Vivaldi, upsamplers have all but disappeared.

Until now. Or rather, until recently as the *M Scaler* engine has been out for two years as a component of the *Blu MkII* CD transport, developed as part of Watts' continuing work on increased transient accuracy by extending filter lengths.

The goal is to approach the ideal $\sin(x)/x$ response in a linear-phase filter, which requires far more coefficients than are found among other audio DSP applications. Where most DAC designers are content with a few hundred FIR 'taps' to replicate the function, Rob Watts started his partnership with Chord Electronics with the *DAC 64* and its 1024-tap WTA filter. Since then more powerful FPGAs have enabled the progression to 18,432 taps in the QBD76; 26,368 in the *Hugo*; right up to 164,000 in the flagship *DAVE* DAC. The M in *M Scaler* nods to the use of one million – 1,015,088 in fact – filter taps, which is said to provide perfect reconstruction to the 16.7-bit level.

A filter to extend that reconstruction to the 24-bit level would take 256 million taps by the same reckoning, and an unacceptable delay using current technology. The headline innovation though is hitting the 1-million tap mark.

"There must come a point when we can no longer hear an improvement with doubling of tap length," Watts commented. "Given that 0.5M taps against 1M taps is a big change, I think longer WTA tap lengths would give a benefit, but I can't see that 256M is needed!"

The *M Scaler* is based on a powerful Spartan-7 *XC7A200T*, upsampling CD audio to 705.6 kHz,



“If listening to the Hugo TT 2 sounds like engaging overdrive compared to even Chord’s earlier over-achieving DACs, the addition of the M Scaler must be the audio equivalent of finding the supercharger”

and 48 kHz-based streams up to 768 kHz. This is passed to compatible DACs (*Quest*, *Hugo TT 2*, *DAVE*) over dual BNCs, bypassing the DAC’s first WTA filter which is no longer required.

It has inputs for USB, S/PDIF on BNC and Toslink; and Toslink, single- and dual-BNC outputs, but regrettably no asynchronous USB output. To allow M Scaler to remain usable in AV applications, a video mode drops tap length to 666,666, reducing latency to 104 ms. An intelligent mode can automatically engage this by detecting 48 kHz sources.

Given, say, 48 kHz family input, output can be 96, 192, 384 or 768 kHz. Passthrough mode allows ready comparisons with and without upsampling. This is not bit-perfect though and ‘bypass’ audio earns Gaussian dither at the 24-bit level, and 2.78 dB of attenuation in order to match the reduced output of upsampled audio. Incoming DSD meanwhile is always converted to PCM and downsampled to 705.6 kHz, with a 6 dB reduction in level compared to DSD conversion by the *Hugo TT 2*.

Sound quality

If listening to the *Hugo TT 2* sounds like engaging overdrive compared to even Chord’s earlier over-achieving DACs, the addition of the *M Scaler* must be the audio equivalent of finding the supercharger.

It’s an instant transformation, yet takes time to unravel. The effect is of bass tightened even further, multiplying apparent LF reach and slam. Image focus is incredible, more layered, and sharpened into compact and discrete pinpoints. On some recordings it marshals sound toward the centre, reducing vagueness in the outlands around the speaker.

There’s still a sizeably wide stereo panorama, where recorded, and a good illustration of the clinical precision in placement would be the live recording of the UK première of Shostakovich’s *8th Symphony* [BBCL 4002], captured before a bronchial Festival Hall audience in 1960.

Years of listening have left me acquainted with the general coughs and splutters, but the *M Scaler* could practically enable the calling out of the individual seat numbers of the afflicted, while a physician would diagnose their particular respiratory complaint, so explicit is the reproduction of the audience effects.

The *M Scaler* renders music drily, crisper and unsullied by some of legacy digital’s colorations, namely woolly bass and gently smeared edges. The treble quality lacks any euphonic sweetness, bafflingly brittle but crystalline and sharp. Comparing DSD direct into the *TT 2* to that upsampled by *M Scaler*, for example, the former sounds fruity, organic and rich in every timbral colour, against the less emotive precision of upscaling. Returning back to the *M Scaler* version though, the untreated DSD now simply sounds untenably louche and messy.

Conclusion

The *Hugo TT 2* alone is a significant advance on other DACs in its category. Adding the *M Scaler* delivers front-row, reach-out-and-touch musical excitement that utterly transforms digital, whether 16-, 24-bit or DSD. The result is not perfection of course – and sure to be bested by superlatives to come – but right now the pair present an extraordinary breakthrough in digital reproduction.

Hugo TT 2 £3995
M Scaler £3495

Chord Electronics
www.chordelectronics.co.uk
01622 721444