Outboard DAC with S/PDIF and AES/EBU interfaces
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Electrocompaniet ECD1

Remember TIM? And the Norwegian company that coined the term in the '70s? We've been listening to its upsampling DAC and making some telling comparisons

Review: **Keith Howard** Lab: **Paul Miller**

For audiophiles of a certain age the name Electrocompaniet will always conjure up recollections of the original Electro power amps, based on a design by Matti Otala. Otala, a Finn, had set the cat amongst the pigeons in the late 1970s by coining the term transient intermodulation distortion (abbreviated TIM or TID) for a feedback-related distortion mechanism that was supposed to be a new discovery but, said numerous old-school amplifier designers, was nothing of the sort. While that controversy raged – and Otala went on to 'discover' interface intermodulation distortion (IID) too – Electrocompaniet, a Norwegian company, introduced an amplifier based on Otala's TID-busting circuit design. It went on to achieve minor classic status, and in the process to establish its manufacturer's high-end credibility.

Electrocompaniet's ECD1 upsampling DAC is nothing like so old, of course, but it is nonetheless greying at the temples. Introduced as long ago as 2002, when banks would have queued up to loan you the money to buy one, it accepts 16- or 24-bit digital inputs with sampling frequencies from 32 to 96kHz and upsamples them to 192kHz at 24-bit resolution. There's nothing remarkable about that since Philips CD players were doing essentially the same, albeit at fixed input sampling rate and with lower-resolution DAC chips, fully 20 years earlier. But at the time of the ECD1's launch there was an audio industry buzz about the benefits of upsampling, and hi-fi hacks were getting their underwear in a bind contending that upsampling and oversampling are not the same thing.

Actually the ECD1 shows its age more internally than externally [see Lab Report] but there is one item missing on the back panel which we increasingly expect to see on modern DACs – a USB input to allow the streaming of audio from a computer. Now it's true to say, in the ECD1's defence, that the USB input on many DACs does not give the best results, but if you intend to stream audio via USB then clearly the ECD1 is not for you. Which does not mean, of course, that it cannot be used with a computer. As it provides coaxial and Toslink S/PDIF inputs alongside its balanced AES/EBU inputs, it can be hooked up to any computer that has a coax or optical digital output.

A SMALL GRIPE

Operationally there's not much else to report: as with any DAC, you select the required digital input channel, connect a preamp (or whatever) to the output and away you go. The only front panel control on the ECD1, other than the central on/off switch, is a push button that toggles between the digital inputs, the selected one being indicated by an LED. Disappointingly, the indicators don't change colour or otherwise confirm when a digital source is connected and locked.

As many other DACs do nothing more it would be unfair to single this one out for criticism for not providing a display of input sampling rate, but as this is something which annoys me I'll take this opportunity to make a general call for this feature to be more routinely included. It is very useful to know, for example, when you play a DVD-A (you remember them...) whether an 88.2 or 96kHz recording is emerging from the player's digital output unmolested or, on instruction from the disc, has been downsampled to 44.1 or 48kHz. It is no less useful, when playing audio from computer, to know whether the operating system (Vista, Windows 7, OS X) is downsampling the signal: either because the output device doesn't support the recording's native sampling rate or because the audio output format is specified incorrectly. All it takes is a few LEDs on the DAC to make this important information immediately available to the user. Audio industry at large, please take note!

I do most of my listening to music files stored on hard disk these days, via a latest version Mac mini running Windows XP. The Mac mini's compactness – which, allied to its quietness and un-computer-like styling, make it so suited to this role – is also its Achilles' Heel in that it has no room for

RIGHT: Blue LEDs show which of the four digital inputs is selected but don't indicate when a digital source is connected and locked. There is also no display of incoming sample rate

ABOVE: Electrocompaniet's aesthetic is minimalistic but with a hint of decadence afforded by the gold coloured buttons. These control on/off and toggle digital inputs

expansion cards, and no ExpressCard slot for adding a sound card as you would to a laptop. So apart from the built-in optical S/PDIF output, the only way of extracting digital audio from it is by using an external audio interface connected via USB or FireWire, the latter currently being the preferable option as it offers multichannel capability up to 24/192 (but watch this space: hi-res multichannel USB DACs are, apparently, on the way).

Of these options only the integral optical output is directly compatible with the ECD1 but both of the FireWire interfaces I use – RME Fireface 800 and Prism Sound Orpheus [*HFN*, Jan '10] – have S/PDIF outputs which, conveniently, should allow direct comparison between the ECD1 and their onboard DAC stages when playing both 44.1kHz material ripped from CD and 88.2/96kHz media ripped from DVD-V/DVD-A or obtained as a download.

I say 'should' because it didn't quite work out that way. For reasons I was unable to identify, when the Fireface 800 and ECD1 were combined there was a persistent low-level digital 'chirping' in the analogue output that made reliable comparisons impossible. No such problem arose with the Orpheus, so the comparison between its onboard DAC stages and the ECD1 went ahead as planned. More typically, of course, the ECD1 will be used with an optical disc player as the signal source so – reminding myself which way up a CD goes – I also used it with a Sony XA5400ES CD/SACD player. This has both coax and optical S/PDIF outputs but no AES/EBU output option, unfortunately, so the ECD1's balanced digital input went untried. The comparison between the ECD1 and Orpheus proved to be a fascinating one, from which emerged no overall winner. Instead it became clear, after a lot of listening, that each DAC stage has its particular strengths – as a consequence of which my preference toggled between them according to the item being played.

ADDICTIVE SOUNDS

One particularly revealing track, favouring the ECD1, was Diana Krall's 'Narrow Daylight', from *Girl In The Other Room* [Verve 0602498620465, CD layer]. The Electro DAC has a particular affinity for female voice, the more so when the accompaniment is not overly complex and there is no driving rhythm. Then its ability to reproduce a natural sense of warmth, space and dynamic really shines through. Its sound was addictive on this track, the Orpheus onboard DAC sounding better organised but a little lacking in bloom, air and sheer listenability by comparison.

> 'The Electro-DAC has a particular affinity for the female voice'

I have the 24/96 stereo version of this track too, ripped from the Dual Disc release [Verve 06024 98648247]. Intriguingly, I preferred this via the Orpheus which benefited more noticeably from the higher resolution, revealing – for example – breathing noises of which I had been much less aware on the 16/44.1 version. Set against this spruced-up, effortlessly detailed portrayal, the ECD1 sounded a little contrived, a little embellished – still big and open-sounding on the vocal, but missing some of the telling detail that the Orpheus uncovered. In other words, it delivered less fully on the hi-res potential of 24/96.

Another insightful track was The Beatles' 'Come Together', from the remixed *Love* album [Parlophone 0946 3 80789 2 0]. About the only disappointment of this CD/DVD issue is that it provides no hi-res stereo version: you have the choice of 16/44.1 stereo on the CD or 24/96 surround on the DVD-A, as if multichannel capability were the latter's only benefit. So I had to use the CD version in comparing the ECD1 to the Orpheus, but it proved telling enough.

This track has a lot more going on in it, and it's driven forward by that insistent, almost awkward rhythm. Both these characteristics favoured the Orpheus, its better organisation keeping the whole track more intelligible while sustaining the relentlessness of its progress. By comparison the ECD1's undoubted exuberance sounded a little messier, a little lacking in transparency and control.

TOO BIG A FEAST

Over the Christmas holiday I found myself talking to a friend who is knowledgeable about classical music (but not hi-fi) about how I regard certain works as, effectively, unreproduceable because of their sheer scale. The example I quoted was William Walton's oratorio *Belshazzar's Feast*, a piece which scintillates in the concert hall but is just too overwhelming for most, if not all, audio systems.

Because of this I rarely listen to the work at home, but my conversation encouraged me to revisit it when listening to the ECD1, specifically the DVD-A release of ⇨

UP AND OVER...

A lot of words have been spilt over the years trying to drive a wedge between oversampling and upsampling. Actually, it's a distinction that DSP theory doesn't make, since both are examples of what is more properly termed interpolation. The difference is that in oversampling – which is a synchronous process – the output sampling rate is an integer multiple of the input sampling rate (hence 4x, 8x, *etc* oversampling) whereas with (asynchronous) upsampling this need not be the case. Otherwise the purpose and key benefit are identical with either process: to increase the sampling rate sufficiently that low-cost, high-accuracy, stable digital reconstruction filtering can be used instead of an analogue network, with only a low-order analogue output filter required downstream of the DAC chip to remove the remaining image spectrum.

ABOVE: Plenty of connections on offer with one optical and two coaxial S/PDIF digital inputs joined by an AES/EBU (XLR) option. There are coaxial and optical digital outputs as well as both single-ended (RCA) and balanced (XLR) analogue outputs

André Previn conducting the LSO and Chorus [EMI 7243 4 92402 9 2]. Quite why this is a 24/48 transfer when, presumably, a 24/96 or 24/192 transfer could have been made from the analogue master is something only EMI can explain, but it still throws the gauntlet down to any hi-fi system presumptuous enough to take it on.

I chose one of the easier passages for the comparison, namely the opening 'Thus Spake Isaiah', and – even though by now I had a good idea how the ECD1 and Orpheus squared up to each other – was surprised again at how different they sounded. It wasn't identifying these differences that was so difficult as reaching a conclusion as to which presentation was preferable. True to form, Prism Sounds' Orpheus delivered a drier sound with flatter imaging whereas the ECD1's soundstage had more depth and its overall sound was somehow more sweeping and lyrical.

But the Electro dealt more in generalisations while the Orpheus attended to the details. There was a greater sense with the Orpheus of the choir sound being an amalgamation of individual voices and there was also a tension to the orchestral playing that the Electro rather glossed over. I know which I'd want were I a recording engineer – the hear-through analysis offered by the Orpheus – but I can imagine some listeners preferring the Electro's world view for everyday use at home, particularly those who feel that digital audio often lacks in expressiveness.

NO CONTEST HERE

It was time to switch to the Sony source and two recent additions to my CD collection, yet to be transferred to hard disk: Quatuor Ebène's acclaimed performance of the Debussy String Quartet [Virgin Classics 50999 519045 2 4] and Steve Reich's *Proverb*, conducted by Paul Hillier [Nonesuch 79430-2].

This time there was absolutely no question about which sound was superior. As I began playing the second movement of the Debussy for the very first time, via the Sony's onboard DAC, my spirits fell. Here was a lively performance let down by a hopelessly fuzzed recording with little spaciousness and sat-on dynamics. It occurred to me that I wouldn't bother to rip it to hard disk after all. But via the ECD1 there was a transformation: the plucked strings had power, suddenly there was a recording acoustic worthy of the name, and the sound acquired a sparkle to match the playing!

Proverb begins with one then two soprano voices at either side of the soundstage singing the same refrain in canon, generating some challenging discords as they do so. Via the ECD1 each voice had a distinct character and was placed in a large, reverberant acoustic, whereas via the Sony's DAC the voices' timbral qualities were fuzzed and the acoustic generalised.

HI-FI NEWS VERDICT

Connected to many a middle-market CD player, the ECD1 will elevate its sound quality to a different class with improved clarity, spaciousness and joie de vivre. But this venerable DAC is beginning to show its age in some respects. It majors on the broad brush strokes of music reproduction but in the process misses out on some of the subtleties that more transparent DACs unearth.

Sound Quality: 79%

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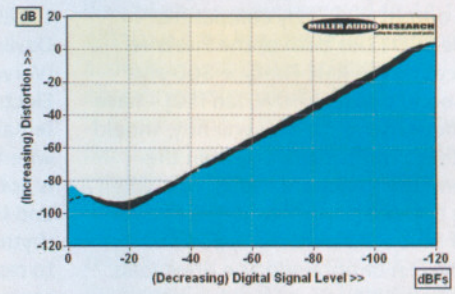
LAB REPORT

ELECTROCOMPANIET ECD1 *(£1290)*

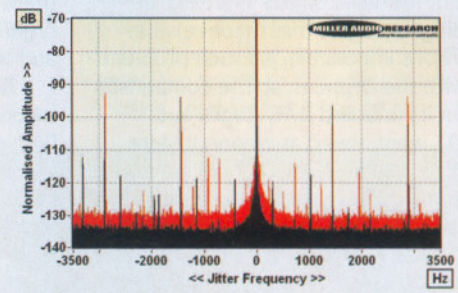
Launched in 2002, but utilising Crystal's CS8420 asynchronous upsampler and CS4397 24-bit/192kHz DAC (both of which are now more than ten years old), the ECD1 is necessarily a product of its age. The venerable upsampler may operate up to 192kHz but it will not accept 192kHz digital *inputs*, and so both 96kHz and 192kHz source material are reduced to a –1dB/45kHz bandwidth with a mild +0.1dB peak at 38kHz. Otherwise, 48kHz and 44.1kHz inputs are treated to a ruler-flat response, good to within one-hundredth of a dB from 20Hz-20kHz.

The ECD1 includes a fully discrete filter and analogue preamp stage with full-sized rather than surface-mount components. Compact circuit design is more typical these days, enabling better control of circuit impedances, resonances and interference. Perhaps as a result, the ECD1's 93dB A-wtd S/N ratio (re. 4.8V from the balanced outputs) is closer to 16-bit than 24-bit in performance. Distortion, mainly 2nd/3rd harmonic in nature, is also higher than usual at 0.004-0.008% across 20Hz-20kHz but, importantly, this is still not *high* while being admirably consistent with frequency [see Graph 1, below]. Partially reflected in the S/N results, the ECD1's noisefloor is not especially 'clean' with numerous peaks dotting the spectrum [see Graphs online] and contributing to the untidy-looking jitter spectra [Graph 2, below]. Its >1000psec jitter with 48kHz data is readily bettered by more modern DAC implementations.

Readers are invited to view a full QC Suite report for the Electrocompaniet ECD1 DAC by navigating to *www.hifinews.co.uk* and clicking on the red 'download' button. **PM**



ABOVE: Distortion versus digital signal level over a 120dB dynamic range using 24-bit data at 1kHz (black) and 20kHz (blue)



ABOVE: High resolution jitter plots showing 48kHz/24-bit data (black spectrum) versus 96kHz/24-bit data (red spectrum).

HI-FI NEWS SPECIFICATIONS

Maximum Output Level/Impedance	4.78Vrms / 100ohm
A-wtd S/N Ratio	92.5dB
Distortion (1kHz, 0dBFs/–30dBFs)	0.0041% / 0.0063%
Distortion (20kHz, 0dBFs)	0.0083%
Frequency resp. (20Hz-20kHz)	+0.0dB to –0.01dB (48kHz Fs)
Digital jitter (24-bit: 48kHz/96kHz)	1095psec / 685psec
Resolution @ –100dB	±0.3dB
Power consumption	15W
Dimensions (WHD)	483x83x255mm