SACD transport, upsampler/network player, DAC and clock
Made by: Data Conversion Systems Ltd, Cambs
Supplied by: dCS Ltd
Telephone: 01954 233950
Web: www.dcsltd.co.uk
Price: Trans, £24.5k; Upsampler, £12.5k; DAC, £20k; Clock, £9.7k

dCS Vivaldi Digital System

Following in the wake of the Debussy, Puccini, Paganini and the Scarlatti comes dCS's latest multi-box flagship, the Vivaldi. Is this the digital playback system for all seasons? Review & Lab: **Paul Miller**

'Derivative' is not a word that appears in the dCS dictionary. Instead, this Cambridge-based company prefers to innovate whenever and wherever possible, not simply to be different, but in its ongoing quest to be *better*. In fact just about the only facet of this four-box digital front-end that's not entirely bespoke is the network platform fitted inside its Upsampler, this being a 700-series module from StreamUnlimited [see *HFN* Jan '13, p57]. But before we explore the nitty-gritty, we need to appreciate the bigger picture.

dCS's Vivaldi is a very big picture indeed, a multi-box system comprising [in top-to-bottom order, adjacent] an upsampling CD/SACD digital Transport, an outboard DAC, outboard Upsampler and dual-mode Clock. The Vivaldi is also the company's first flagship since the Scarlatti in 2007 and its new industrial design is realised in spectacular, sweeping curves and matching, full-colour TFT displays.

ALL BLACK & WHITE

In the event, dCS runs these displays in greyscale mode, with red-coloured icons for obvious indication of error. They even have their own PSUs and FPGAs and can be timed-out for truly 'silent' operation. The four Vivaldi units also have the same control board, boasting several hundred times the processing power of the Scarlatti. This not only ensures the new code is running well within limits but there's also plenty of capacity to accommodate future ideas and updates.

Each box has a limited range of soft-touch buttons which, with a bit of practice, can be used to navigate through the various configuration menus. There's a heavy alloy IR remote that's most useful for basic operation of the Transport but most users will inevitably gravitate towards the dCS app available on the iPod/iPhone/iPad now, and Android, Mac OS X and Windows PC platforms in Feb '13.

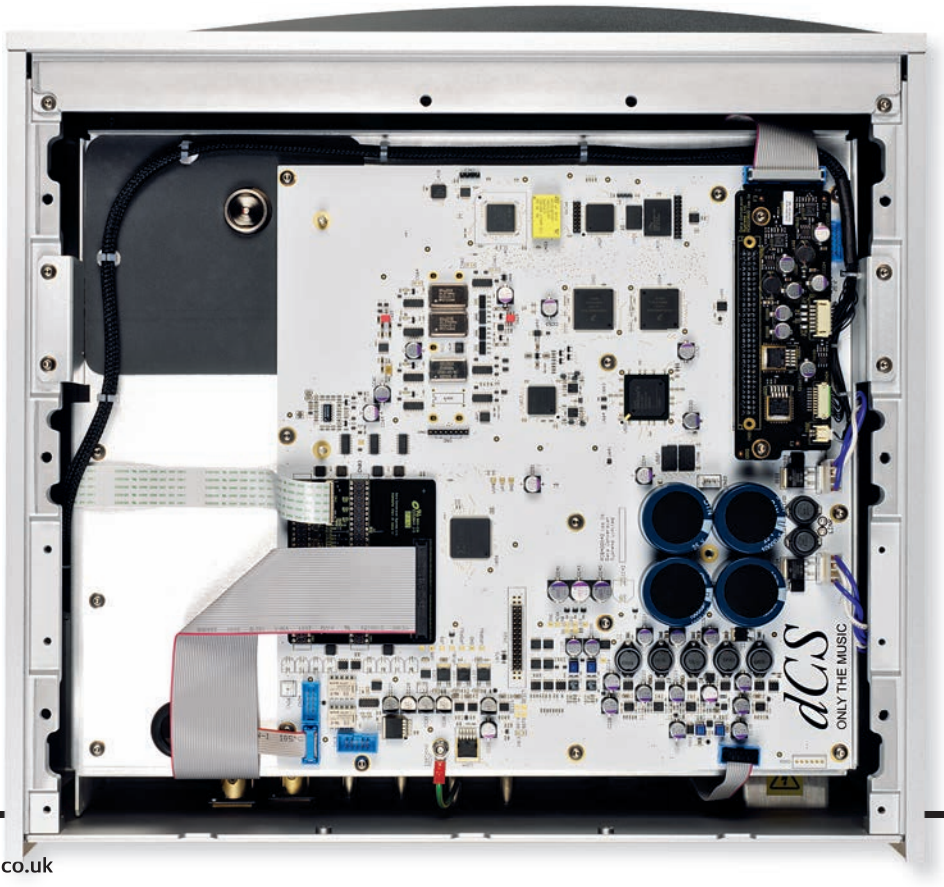
The app allows you to view and select music sources, including USB stick, iPhone, NAS and UPnP renderers. You can also browse and select music by location, artist or album. All relevant track metadata is provided for the selection in play (or queued) while global controls deal with play, pause, fast forward/reverse, DAC volume, DAC phase and upsampling rate.

'Wedded to physical media – then begin with the Transport'

PHYSICAL OR VIRTUAL?

Where you start with this magnificent tower rather depends on your priorities as a listener, because you're not obliged to drop £67k on the entire system. If you are wedded to disc-based formats then your journey will begin with the CD/SACD Transport and DAC. If you've ripped your disc collection, are acquiring hi-res music downloads and want to replay via a USB drive or wired network then you'll be looking at the Upsampler/DAC combination. Whichever route you take, the addition of dCS's stabilised 44.1kHz/48kHz (word) Clock is the icing on its digital cake.

Housing a TEAC VRDS Neo mechanism, the Vivaldi Transport is a physically massive beast, even if in operation it's reassuringly slick and light on its feet. In common with the Upsampler and DAC, the Transport also includes its own user-programmable upsampling, taking CD data to 24-bit/352.8kHz DXD while SACD is communicated as dCS-encrypted 1-bit/



RIGHT: The reason for the CD/SACD transport's physical size is clear – our inside shot shows how the power supplies are separated from the control board and massive Teac VRDS Neo mech

LEFT: Each fascia is milled from a 16kg slab of alloy and the flowing curves, distinctive to each component, make for a bold design statement. The units can be controlled via the limited array of buttons, but dCS's iPad app is preferred

2.8MHz DSD. Both these high-rate data forms are output via the dual AES interface while native CD and downsampled SACD data is available via standard AES/EBU and S/PDIF outputs for use with legacy DACs.

DAC AND UPSAMPLER

The real heart of the system is the Vivaldi DAC. Now boasting the very latest dual-mono Ring DAC [see boxout, below], integrated volume control and selectable 2V/6V output, it will drive any power amplifier directly. Even without the Transport it supports PC/Mac via USB (but not USB drives) and includes four AES/EBU (single or dual-mode) inputs, two S/PDIF on coax and one (96kHz) Toslink optical. Hawk-eyed readers may spot another input labelled 'SDIF', an alternative S/PDIF digital interconnect standard *sans* Philips available exclusively in Japan. More importantly, as dCS is a key driver of the new standard, both DAC and Upsampler support DOP (DSD over PCM) via all their digital inputs.

The Upsampler is arguably the most accommodating source component in the Vivaldi stack, accepting digital audio data from any legacy source, including disc players, PC/Macs *and* USB sticks or networked through its UPnP streaming client interface. It offers the same upsampling options as the DAC (LPCM to 352.8/384kHz DXD or transcoding to dCS-encrypted 1-bit/2.8MHz DSD) and yet routing the CD/SACD transport via the Upsampler to the DAC still results in an incremental improvement in sound quality.

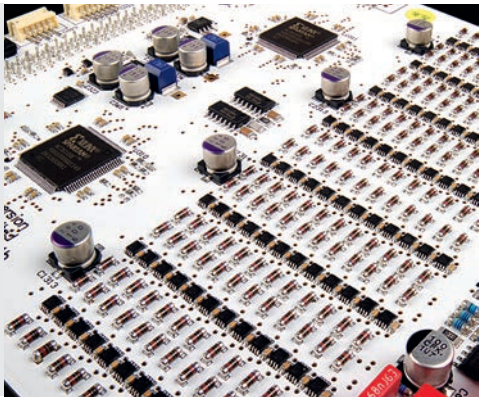
The DAC and Upsampler also ostensibly offer the same range of digital filters, although there is some subtle variation in code. The filters even process incoming DSD, but this is a 'lengthening' rather than reconstruction filter that deals with DSD's ultrasonic requantisation noise. Six filters operate with 44kHz/48kHz and 192kHz inputs and four with 88kHz/96kHz/176.4kHz (including SACD). Filters 1-4 are all FIR types with progressively less ringing, trading stopband rejection for reduced acausal distortion. Filter 5 is a minimum phase apodising type with no pre-ringing, while the linear phase Filter 6 offers the same response as 5 but with a very steep cut-off.

SETTING THE CLOCK

Depending on configuration, the Upsampler can act as master clock for USB or network inputs (M appears on its display) or slaved to an external word clock from dCS's outboard Clock or DAC. Likewise the DAC, with dCS Transport or Upsampler, can be set to 'M', with a clock feed from DAC to source, free-running in 'A' mode, or locked ⇨

RING DAC

First proposed by dCS back in 1991, its Ring DAC converter is now a highly evolved and practical technology, combining the pure monotonic conversion of a genuine 'single-bit' DAC with the operation of today's PWM bitstream-style converters. Instead of truncating incoming data to a stream of single bits, dCS reduces the 16/24-bit wordlength to an average of 4.6 bits whose 24 possible values are governed by the 48 'identical' current sources that comprise the Ring DAC (the matrix, opposite). This differs from common PWM DACs that use these bits to control the length of *time* a single current source is held open or closed. Naturally, dCS's 48 current sources can never be truly identical in size and so the mapping of bits to current sources is randomised, trading fixed errors that would appear as harmonic distortion for an inaudible increase in random noise. The mapping is achieved via two FPGAs whose algorithm may be updated by dCS.

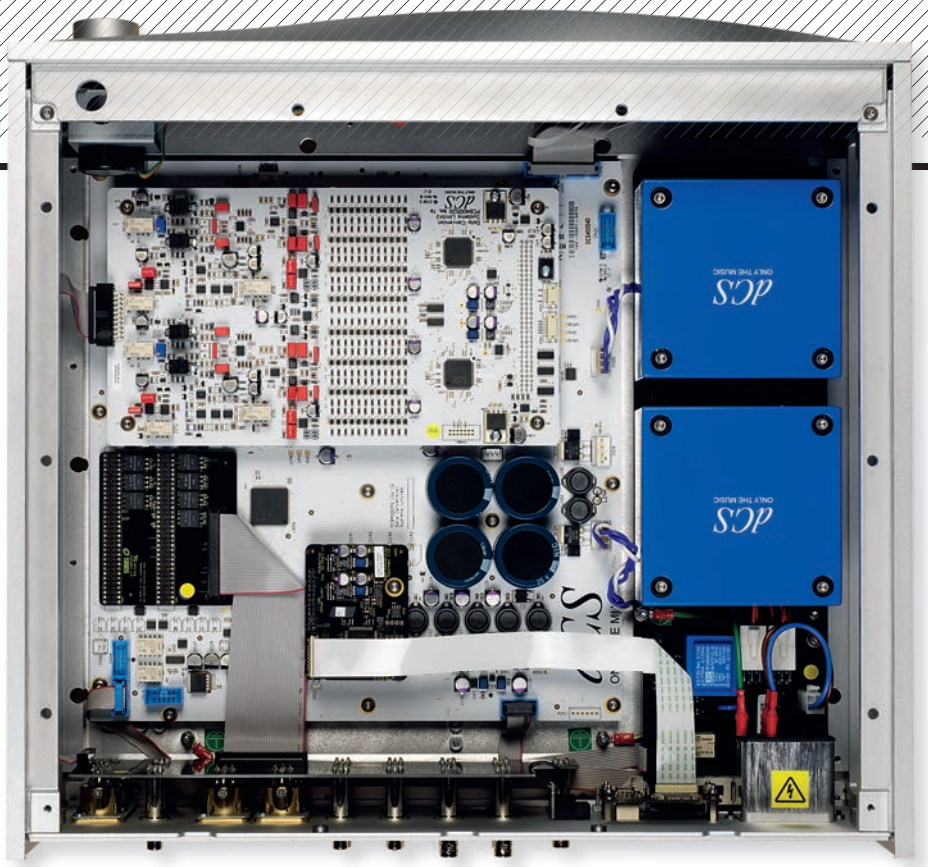


dCS'S DAVID STEVEN

While David Steven, dCS's Managing Director, was visiting *HFN*'s lab facility, we took the opportunity to discuss how his company sees the future of high quality music consumption. 'At dCS we believe digital audio has never been more exciting. With the increasing availability of high resolution music and the flexibility of digital playback systems music lovers now have a number of ways to get great sound.

'Our development philosophy has always been to remain source agnostic, attempting to get the very best measured and musical performance from all types of music whether from a silver disc, over a home network or directly from a PC. The Vivaldi range was designed with flexibility, performance and ease of use in mind and can be used in single, 2, 3 or 4-box guises. The array of inputs refects how we believe people listen to music now and in the future and it also has a number of output configurations supporting both DXD and DSD upsampling.

'We have invested a huge amount of R&D effort into next generation versions of our dCS Ring DAC, Digital Processing Platform and Clocking System. These technologies deliver performance levels beyond anything we have achieved in the past and although Vivaldi still supports CD and SACD our main development focus now is on network streaming, USB audio and control interfaces such as the Vivaldi Controller application.'



ABOVE: The 96 latches (a matrix of 2x48) that comprise the Ring DAC core are visible here with the two driving FPGAs sitting alongside [see boxout, p23]. The balanced analogue output lies to the left

to any 44.1kHz-192kHz external word clock ('W' mode). In the full four box Vivaldi system you'd set the Transport, Upsampler and DAC to 'auto word clock mode' and as the Clock generates both 44kHz and 48kHz masters, operation is seamless.

Finally, your choice of filter is remembered by incoming sample rate while clock preference is remembered by selected input – one more reason why your dealer needs to provide you with a 'set and forget' installation. All you need do is listen, which is what we're doing next.

SUBLIME SACD

Yes, this is the most exquisite digital front-end I've had the pleasure of auditioning, albeit with the following provisos: ensure the upsampling is synchronous (44.1kHz to 176.4kHz or 352.8kHz and 48kHz to 192kHz or 384kHz) and avoid transcoding (keep LPCM as LPCM and SACD/DSD as DSD). I stuck with the default Filter 1 despite a brief dalliance with Filter 5.

> 'A living, breathing monument to the original performance'

With the Vivaldi DAC also performing preamp duties via a balanced connection to a Krell S-1500 power amp and B&W 802 loudspeakers, the Opus 3 (analogue) recording of Eric Bibb's *Blues, Ballads And Work Songs* [Opus 3 SACD 22111] sounded truly sublime. Bibb's picking of that Martin seven-string truly lifted the pace of the classic 'Cocaine Blues', both guitar and his richly-textured voice delivered with realistic but wholly agreeable intensity. This ability to tease out the subtlest of details, the micro-dynamics and faintest gradations in tonal colour, and present them amidst a far bolder musical architecture is, it seems, a quality specific to the Ring DAC itself. Eric Bibb and colleagues sounded utterly lifelike, the low grumbling resonance of the sousaphone contrasting with the spritely, articulate snap of the mandola, each performer clearly exposed, each playing in perfectly integrated harmony.

Similarly, I've never heard Beat Kaestli's *Invitation* [a Chesky Hi-Def jazz recording – SACD348] sound *this* spacious, this compelling. His close-miked vocals, the drums and bass all had a distinct body and presence that all but palpably radiated from the soundstage. These were more than mere images, mere shadows of performers but viscerally solid, robust and richly-coloured instruments with an ambience all their own.

Moreover, whatever disc was in play, I was not aware that either deep bass or high treble had a perceptible limit – the acoustic 'envelope' simply extended subterranean deep and blue sky high to reflect the natural bandwidth of the instruments. No boom, no artificial 'zing', the Vivaldi would reliably tread a path of composed neutrality.

ABOVE: Connections include S/PDIF (BNC/RCA), AES and dual-AES (XLR) supporting LPCM/DXD to 352.8/384kHz and dCS-encrypted DSD (as 1-bit/2.8MHz) plus 44.1kHz and 48kHz-centric wordclocks (also on BNC). The Upsampler adds network and USB B

Turning to the Upsampler as source with both USB (stick) and network inputs, the character of the Vivaldi ensemble, its transparent guiding hand, was just as evident. Listening to Glen Hansard's *Rhythm And Repose* [96kHz/24-bit FLAC download; Anti/Epitaph 45778720361 – see p88] was a truly moving if conflicting experience, the contrast between the mournful tenor of the vocalist and the exquisitely accurate reproduction of strings, percussion and bass once again exposing the inherently natural disposition of the Vivaldi system.

So natural is the sound, each disc or download takes on the quality of a living, breathing monument to the original performance. These are musical sculptures that inspire comparison with objects of beauty.

VIVALDI ROCKS

'But can the Vivaldi rock?' I hear you ask. Elliott Sharp's *Terraplane* [88.2kHz/24-bit FLAC download; Sky Road Songs] answers by way of example, this full-on and thoroughly eclectic mix of blues and electronica is so pumped full of energy that most systems will give up the ghost. Not here, and not now. Instead, the Vivaldi stood its ground, deftly navigating the foaming rapids that swirl through this album. So, yes, the demure, self-effacing Vivaldi can also boogie with the best of 'em.

HI-FI NEWS VERDICT

Hugely flexible, hugely capable and, well, just plain 'huge', the Vivaldi system represents a milestone in the development of digital audio. I have never heard music delivered so richly imbued with colour from a digital source so obviously colour*less* in its own right. Which, of course, is exactly how it should be. The conclusion even suggests itself – the dCS Vivaldi is truly a digital playback system for all seasons.

Sound Quality: 90%

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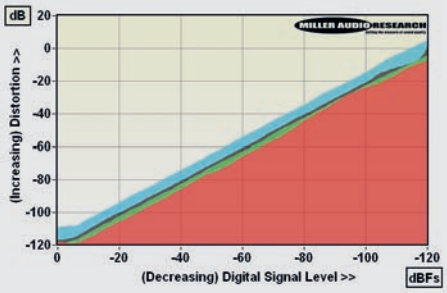
LAB REPORT

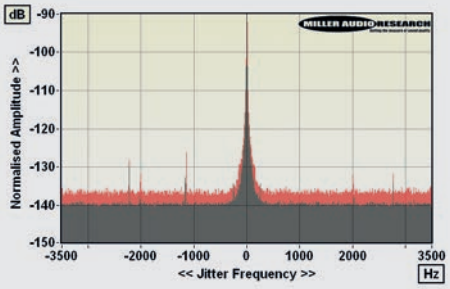
dCS VIVALDI SYSTEM

This short lab report cannot do justice to the Vivaldi's myriad technical features, so I'll direct readers to the comprehensive QC Suite test reports available via the red 'download' button at *www.hifinews.co.uk*. In a nutshell, the Vivaldi DAC outperforms the Scarlatti [*HFN* Feb '09] and Debussy [*HFN* Dec '10] in all key respects – jitter is now <30psec via SACD, S/PDIF, USB and network inputs (all sample rates) with just the Ring DAC's uncorrelated noise 'skirt' still visible [see Graph 2, below]. Stereo separation is 130dB midband and the output impedance a fabulously low 0.5ohm. The A-wtd S/N ratio is a wide 109dB (2V mode) and low-level resolution good to ±0.4dB at –120dB and ±0.6dB at –130dB. There is a fractional increase in distortion (from 0.00002% to 0.00004%) between 2V (2.04V) and 6V (5.87V) output modes with 24-bit/0dBFs inputs as the merest reflection of strain on the balanced output stage, but at these stupendously low levels, who's counting? Even at very high frequencies, distortion remains very low (0.00025% at 20kHz/0dBFs and 0.00015% at 20kHz/–10dBFs) while the trend of distortion versus digital level is very close to the theoretical 'diagonal' line [see Graph 1, below].

Frequency responses depend on choice of Filter (all permutations are graphed via our test downloads), with Filters 1-4 delivering a ruler-flat line, ±0.02dB from 20Hz-20kHz with 44.1/48kHz media but with progressively reduced stopband attenuation (125dB, 35dB, 12dB and 6.1dB respectively). With LPCM-based media, the apodising Filter 5 has no acausal distortion, a flat response (–0.05dB/20kHz) and excellent 125dB stopband rejection but significant post-event ringing. SACD is flat to –0.2dB/80kHz (Filter 1) and –7.8dB/80kHz (Filter 2). **PM**



ABOVE: THD vs. digital level over 120dB. S/PDIF and network inputs (48kHz/24-bit; 1kHz, red); USB (1kHz, green); CD (1kHz, black; 20kHz, blue)



ABOVE: 24-bit/48kHz jitter spectra – 48kHz/24-bit over S/PDIF (black) and via network (red)

HI-FI NEWS SPECIFICATIONS

Maximum output level (Balanced)	2.04Vrms at 550mohm
A-wtd S/N ratio (CD/SPDIF/USB/network)	108.9-109.1dB (balanced out)
Distortion (1kHz, 0dBFs/–30dBFs)	0.00002% / 0.0002%
Dist. & Noise (20kHz, 0dBFs/–30dBFs)	0.00025% / 0.0011%
Freq. resp. (20Hz-20kHz/40kHz/90kHz)	0dB to –0.02dB/–0.1dB/–13.1dB
Digital jitter (CD/SACD/SPDIF/USB/net.)	116/30/20/10/10psec
Res. @ –100dB (S/PDIF / USB / network)	±0.2dB / ±0.2dB / ±0.2dB
Power cons. (Trans/Ups/DAC/clock)	15W / 21W / 10W / 10W
Dimensions (WHD, Transport/DAC)	444x196x435/444x151x435mm