Vivaldi
Technical Overview

dCS Vivaldi Technical Overview

Vivaldi redefines state of the art in digital playback and represents the pinnacle of our 'no compromise' approach to product design - setting a new standard for the future of digital audio.

Launched in late 2012 Vivaldi is a complete digital playback system that offers unmatched sonic and measured performance. Designed for maximum flexibility with an array of input and output configurations it is easily set up and optimised for music systems with various digital sources.

Featuring the latest groundbreaking technology from dCS including next generation versions of the dCS Ring DAC™, Digital Processing Platform and Clocking System it will transform your listening experience, taking your music collection to levels you have not heard before.

Vivaldi Upsampler
- Accesses music from any digital source and converts the audio from its native sample rate to either high resolution DXD (24 bit data at 352.8 or 384 kS/s), DSD (1 bit data at 2.822 MS/s) or standard high resolution PCM (24 bit data up to 192 kS/s).
- Network connectivity to stream high resolution audio files stored on a computer or on network storage via UPnP™. Asynchronous USB input also allows direct connection of a PC, supporting high resolution audio up to and including 192kS/s and DSD over USB.
- Apple™ authenticated and supports playback of iPod/iPhone stored digital media, bypassing the internal DAC to ensure optimal performance.
- An array of independently selectable digital inputs and filter options elevates the performance of Red Book CD from CD Players or high resolution audio from digital streamers and servers to a previously unsurpassed level.

Vivaldi DAC
- Features standard digital inputs in addition to an asynchronous USB interface. The enhanced digital volume control allows direct connection to a power amplifier so that in the majority of systems there is no need for a separate preamplifier. Maximum output can be set at either two or six volts to suit different amplifier and speaker combinations.
- Featuring the latest generation dCS Digital Processing Platform designed to handle all high resolution musical formats up to DXD (24 bit data at 352.8 and 384kS/s) plus DSD, The optimised DSP filters available will ensure you can extract every last nuance of musical detail and feeling and tune the system to suit your personal preference.
- Utilises the latest generation of our state of the art dCS Ring DAC™ that delivers enhanced dynamic range, reduced jitter, improved channel separation and greatly improved musical realism.

Vivaldi Master Clock
- A powerful yet simple to use Grade 1 master clock. Featuring two banks of clock outputs capable of outputting different frequencies, the new auto clocking mode in Vivaldi improves ease of use and minimises jitter.
- Used as part of the Vivaldi digital audio playback system it improves on an already spectacular sound and takes it into an entirely new domain. Images snap into sharper focus and the music displays a substantially greater sense of authority and power as well as, most importantly, offering noticeably higher resolution of detail.

Vivaldi Transport
- Extracts revelatory levels of detail from both CD and SACD. All signal processing is controlled by electronics designed by dCS and it uses the TEAC Esoteric VRDS Neo™ mechanism which provides a brushless motor with heavy flywheel for stable disc rotation and super rigid construction.
- Features a Dual AES output that supports dCS-encrypted DSD to a dCS DAC from CD or SACD. Also offers the option of upsampling CD data to DXD.

Digital Processing Platform

The dCS Vivaldi range features a number of exciting new technology developments from dCS with one of the biggest being a complete redesign of our powerful digital processing platform. This platform is based around Field Programmable Gate Array (FPGA) chips, Digital Signal Processing (DSP) chips and a microcontroller system. All of these run code developed and maintained by dCS.

The two FPGAs used in previous generation of processing platform have been replaced in Vivaldi by a single SPARTAN 6 ™ device with more than twice their capacity <u>combined</u>. The FPGA features 100,000 Configurable Logic Blocks (CLBs), higher operating speed and a more flexible infrastructure. We have taken advantage of the hugely increased capacity of this FPGA to stream-line inter processor communications, greatly increasing the maximum processing capacity of the system.

Other major enhancements are increased flash memory size, FPGA RAM and additional parallel interfaces to the DSPs all of which improve the capacity, flexibility, speed of data transfer and performance of the platform.

Our PCM interface and Phase Locked Loop (PLL) circuitry are essentially discrete and this means our hardware is completely controlled and reconfigurable by software. The latest version of our Digital Processing Platform features an enhanced PLL system where we have greatly improved the linearity of the Phase detector circuit, allowing us to put more gain around the PLL for further improved jitter performance. We have also taken the opportunity to enhance and improve our clock distribution system to provide greater flexibility and integrity in complex-clocked systems.

The overall result of these enhancements is much cleaner and consistent clocking, streamlined inter-platform connectivity and much lower jitter.

dCS Ring DAC™

The legendary dCS Ring DAC™ combines exceptional linearity with very high speed operation. It is designed like no other DAC and has been instrumental in our pioneering efforts to develop high resolution audio at very high sample rates. The new Ring DAC™ used in Vivaldi has been completely redesigned to take advantage of new technologies and represents the single biggest R&D project dCS has undertaken in the last 20 years.

The excellent channel separation delivered by previous versions was due in part to the balanced architecture and the "Dual Mono" design of the board. The new Ring DAC design takes this approach even further.

Enhanced Ring DAC Core
All previous generations of the Ring DAC core consisted of high-speed quad latches and metal-film resistors. The new Ring DAC uses individual latch chips to eliminate on-chip crosstalk between latches and improve jitter. Additionally, the total number of latches has increased to make better use of the available Ring DAC dynamic range.

Twin Reference Generators
The ultra-low impedance, low-noise reference generator has been replaced by a separate lower noise generator for each channel, reducing co-channel interaction at this super-critical point in the chain.

Analogue Circuitry
Further improvements to the analogue circuitry include redesigned gain switching for better consistency between 2v and 6V settings and higher precision servo circuitry to reduce DC offsets even further. Analogue stages and circuit board layout have been optimized for yet lower noise and further improved crosstalk.

Performance Enhancements
The Ring DAC mapping ROMs have been replaced by a pair of high-speed FPGAs. These are programmed from flash memory each time the DAC powers up, so that performance improvements or new Ring DAC operating modes can be added by a software update.

Measured Results

The technical results of these new developments are significantly lower noise, improved distortion and minimised crosstalk. The sonic results are an unrivalled musical performance achieved through improved channel separation, staggering dynamics and much improved resolution of detail.

The Vivaldi DAC lived up to our performance expectations for the new hardware. **Completing the dual-mono approach has improved the Left-Right crosstalk at 20kHz by a staggering 50dB compared to the previous generation**, enabling the DAC to resolve even firmer sonic images.

Improved power regulation and the revisions to the Ring DAC core has dropped the audio-band noise floor by 3dB – an improvement that is very hard to engineer.

Harmonic distortion and spurious responses have improved by 5dB, due to several of the design improvements, including the individual latches and the FPGAs.

The mechanical improvements to the Vivaldi Transport have reduced the acoustic noise level by a very creditable 10dB.   Our experience with previous generations of dCS products demonstrated that first-rate mechanical design is an essential ingredient. The isolation performance of the Vivaldi case, coupled with the new clocking system, has reduced the system jitter even further, unveiling even more fine detail.

Vivaldi is without a doubt our biggest achievement yet, redefining state-of-the-art in digital audio.

Industrial Design

At dCS our ambition is to make world beating, life enhancing products by following a design approach that balances world class craftsmanship with leading edge technology. The industrial design of the stunning Vivaldi system uses subtle curvature to provide light and movement which reflects the fluid nature of sound. The strong geometry speaks of the engineered quality and assurance.

The Vivaldi fascias give each element a unique character when used in isolation. The general material and finish is machined high grade aluminium and buttons and controls are made with a matching aluminium finish. Each Vivaldi front panel has a different set of curves that are carved out of a solid block of high-grade aluminium (weighing 10 to 16kg) by a 6-axis CNC milling machine.

The top plate of each Vivaldi unit is made from a thick aluminum sheet, machined with asymmetrical cavities. Pads of acoustic damping material attached inside the cavities greatly reduce ringing, while the asymmetrical design helps to break up vibration modes.

The new mains transformers run cooler and output greater power. They are a significant part of the weight and a source of mechanical vibration, so they are mounted on a specially damped sub-chassis, to provide more isolation from the sensitive electronics.   The transformers themselves have resilient mounting pillars built into their cases to help dissipate acoustic energy. The DAC features 2 mains transformers – one for the logic circuits and one for the analogue circuits. The Transport also features 2 transformers – one for the motors and one for the processing electronics.

A similar mounting plate is used to damp vibrations generated by the Esoteric VRDS Neo VMK3 CD/SACD mechanism. The quartz crystal oscillator is an electro-mechanical device – so it is vulnerable to external mechanical vibrations, which result in clock jitter. To address this problem, the Digital Processing boards in the system are directly attached to a damped base plate. The plate is made from two sheets of aluminium that are bonded together with their crystal grains crossed, so the result is acoustically very dead.

Using quality components and carefully executed chassis design is important but of equal importance is the PCB design. With all dCS products PCB layout is done by hand with the major dCS boards being 8 layer circuit boards. No computer programmed auto routing scheme could approach the results that are achieved by our skilled designers who has considered every part, pad, plane and trace and its impact on performance.

User Interface & Control

dCS Vivaldi features a complete upgrade of the dCS user interface. New graphics and icons give the user interface a cleaner appearance and simpler user experience while the full colour TFT display now runs on its own FPGA. This approach lowers noise on the digital processing platform, resulting in improved overall performance.

The complete Vivaldi system can be controlled using the dCS Premium Remote control that is supplied as standard with Vivaldi DAC. An optional extra is a fully programmable Nevo Q50 that contains a number of advanced macro commands.

Alternatively a full listing of IR and RS-232 commands are available on the Support section of the dCS website (www.dcsltd.co.uk) so that any learning remote can be used to control the system.   The Vivaldi system will support automation systems through its bi-directional RS-232 control capacity.

The new Vivaldi Controller app will allow users to control the browsing, selection and playback of network based music via the Vivaldi Upsampler and DAC.   Using the elegant yet simple app users will be able to view music sources, select playback devices and create/store/edit playlists. While in playback mode the app will also allow users to control many key features of the dCS system including; Upsampler and DAC input selection, DAC volume/phase and Upsampling options. Vivaldi Controller app will be available on the following systems; iOS, Android, Windows Desktop and Mac OSX.

Clocking

dCS Vivaldi features a completely redesigned clocking architecture that provides state of the art measured results with simple ease of use.

Vivaldi Master Clock features two banks of clock outputs capable of outputting different frequencies. The Vivaldi DAC has 3 word clock inputs while the Upsampler has 2 so setting the Clock's Group 1 outputs to 44.1kHz and Group 2 to 48kHz means that when Upsampler and DAC are set to 'Auto-Word' they will both lock to whichever clock frequency is synchronous with the data. Both Upsampler and DAC will multiply the clock frequency as necessary so a suitable clock is always available and the user does not need to change any settings at all.

The third clock input on the DAC is intended for systems that have a unit in the chain that has no clock input so that when there is a source not synched to the Master Clock the DAC will use this clock input which is derived from the audio stream.

iPod and iPhone Connectivity

Another exciting new development in the Vivaldi range is the addition of a USB input that allows music to be played from an external USB memory device or an iPod or iPhone.   The Vivaldi Upsampler has been certified Made for iPod™ and Made for iPhone™ and using our award winning asynchronous techniques it is possible to achieve a remarkable level of performance when using an iPod or iPhone as a source.

Summary

The dCS Vivaldi range introduces a new architecture that redefines state of the art in digital playback. The flexibility of the input and output configurations and ease of use means it is equipped to get the best out of every music source; from USB, iPod/iPhone, network streamed audio to CD and SACD.

Optimising the latest groundbreaking technology from dCS Vivaldi offers unmatched sonic and measured performance. It has been designed to provide music lovers with a unique solution that will transform their listening experience, taking their music collection to levels they have not heard before.

Technical Specifications

Name	Vivaldi DAC	Vivaldi Upsampler	Vivaldi CD/SACD Transport	Vivaldi Master Clock
Type	**Digital to Analogue Converter**	**Digital to Digital Converter**	**Upsampling CD/SACD Transport**	**Master Clock**
Colour	Silver or Black	Silver or Black	Silver or Black	Silver or Black
Size (LxDxH)	444mm/17.5"x 435mm/ 17.2"x151mm/6.0"	444mm/17.5"x435mm/17.2"x 125mm/5.0"	444mm/17.5"x435mm/17.2"x 196mm/7.8"	444mm/17.5"x435mm/17.2"x 125mm/5.0"
Weight	16.2kg / 35.65lbs	14.2kg / 31.3lbs	23.2kg / 51.1lbs	13.6kg / 29.9lbs
Consump-tion	23W typical, 30W maximum	15W typical, 18W maximum	28W typical, 40W maximum	10W typical, 12W maximum
Control	• IR or RS232 • dCS Premium Remote (Standard)	• IR or RS232 • dCS Premium Remote (Option) • dCS Vivaldi Controller App	• IR or RS232 • dCS Premium Remote (Option)	• IR or RS232 • dCS Premium Remote (Option)
Function	Uses proprietary latest generation dCS Ring DAC™ and Digital Processing Platform technology to operate as a standalone DAC or as part of a digital system.	Accesses music from any digital source and converts audio from its native sample rate to either DXD (24 bit data at 352.8 or 384 kS/s), DSD (1 bit data at 2.822 or 3.07 MS/s) or standard high resolution PCM (24 bit data up to 192 kS/s)	Designed to read both CD and SACD. Optional DXD and DSD upsampling. Uses the TEAC Esoteric VRDS Neo™ mechanism . All signal processing controlled by electronics designed by dCS.	Grade 1 master clock featuring two banks of clock outputs capable of outputting different frequencies,
Inputs	• 2x Dual AES or 4x AES/EBU • 1 x USB2.0 interface on a type B connector, operates in asynchronous USB mode • 3x SPDIF (2xRCA + 1xBNC) • 1x Toslink optical • 1x SDIF-2 • 3x word clock inputs on 3x BNC connectors	• RJ45 – acts as UPnP renderer • 1x USB 2.0 interface on B-type connector • 1x USB 2.0 interface on A-type connector • AES3 on a 3-pin female XLR connector. • 4x SPDIF on 2x RCA Phono, 1x BNC and 1x TosLink optical. • 1x SDIF-2 interface on 2x BNC connectors + Word Clock. • 2x Word Clock Input on 2x BNC connectors.	• 1x word clock input accepts 44.1, 88.2 or 176.4kHz.	• 1x Reference input on BNC connector can be used to lock to an external atomic clock or GPS reference at 1, 5 or 10MHz, TTL or AC compatible.
Outputs	• 1 pair balanced, floating analogue outputs on 2x 3-pin male XLR connectors • 1 pair unbalanced analogue outputs on 2x RCA connectors • All outputs may be set to 2V or 6V • 1x word clock output	• 1x Dual AES interface on 2x 3-pin male XLR connectors, outputs dCS-encrypted DSD or DXD OR 2x AES3 interfaces • 2x SPDIF on 1x RCA Phono and 1x BNC • 1x word clock output	• 1x Dual AES interface on 2x 3-pin male XLR connectors • 1x AES3 on 3 pin Male XLR • 2x SPDIF on 1x RCA Phono and 1x BNC • 1x SPDIF optical on Toslink • 1x SDIF-2 interface on 2x BNC	• 8x word clock outputs, each group of 4 is independently buffered and may be set to 44.1, 48, 88.2, 96, 176.4 or 192kHz.
Maximum Sample Rates	• USB: 24/192 PCM & DoP (DSD over PCM) • Dual AES: 24/384 PCM & encrypted DSD • Single AES & SPDIF: 24/192 PCM • Toslink: 24/96 PCM • SDIF-2: 24/96 & DSD	• UPnP: 24/192 PCM • USB: 24/192 PCM & DoP (DSD over PCM) • Dual AES: 24/384 PCM & encrypted DSD • Single AES & SPDIF: 24/192 PCM • Toslink: 24/96 PCM • SDIF-2: 24/96 PCM or DSD	• Dual AES: 24/384 PCM, DoP (DSD over PCM) & encrypted DSD for SACD data • All other outputs carry 16/44.1	
Perform-ance	**Residual Noise:** Better than −113dB0 @ 20Hz - 20kHz unweighted. (6V Setting). **L-R Crosstalk:** Better than -115dB, 20-20kHz. **Spurious Reponses**: Better than −105dB0 @ 20 - 20kHz.	**Spurious Responses:** Better than −100dB0 @ 20Hz - 20kHz for Fs> 32kS/s, 20Hz – 14kHz for 32kS/s		Better than +/- 1ppm when shipped. Typically +/-0.1ppm when shipped and stabilised.
Updates	CD-R or USB	CD-R or USB	CD-R	CD-R

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