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HI-FI+ GUIDE TO AUDIO SOURCE COMPONENTS 2018

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HI-FI+ GUIDE TO AUDIO SOURCE COMPONENTS 2018

(Sponsored by Kiseki)

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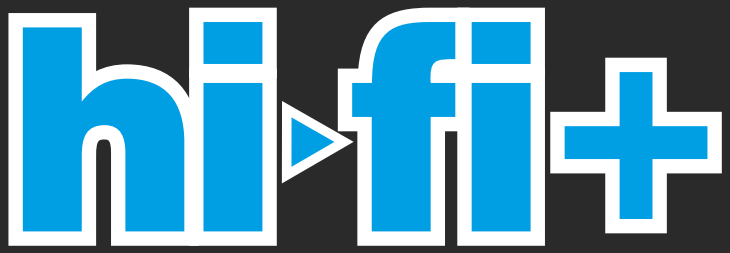

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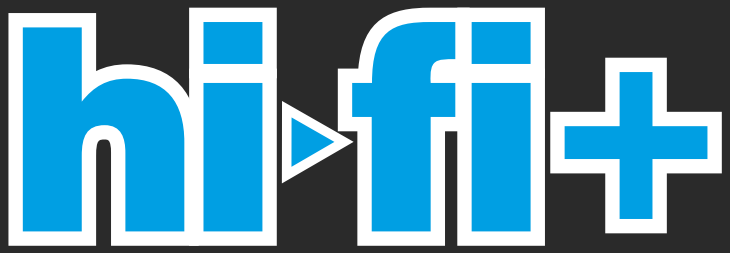


WELCOME to the *Hi-Fi+ Guide to Audio Source Components – 2018*.

Audiophiles of a certain age may recall Ivor Tiefenbrun of Linn Products almost evangelically promoting the notion that source components are the most important elements in the entire audio signal chain. What seemed a radical concept back in the 1970s has come to seem like a perfectly logical idea over time.

After all, if source components fail to get music reproduction done right at the very front end of the system—so the logic goes—how can anything else in the system hope to put things right further down the line? The point: Source components are vitally important so it's worth your while to take care in choosing the equipment you will rely upon to unlock your favourite music.

With this thought in mind, this Guide represents a 'sampler' of sorts to show you where the latest source component design philosophies and product concepts are headed. To this end, our Guide provides several key elements:

- A tightly focused **U Need 2 Know** section that provides highlights and technical details on 35 new analogue and digital source components.
- An interview with **Herman van den Dongen of Kiseki** (Kiseki is a manufacturer of world-class moving coil phono cartridges and an icon in the analogue audio world).
- An interview with **Mike Moffat of Schiit Audio** (Schiit Audio makes high value but also extremely high performance digital audio source components and amplification components. Moffat is Schiit Audio's Vice President and head of digital design).
- A selection of **35 *Hi-Fi+* reviews of noteworthy analogue and digital source components.**
- **Indices of all *Hi-Fi+* analogue and digital source component reviews** from Issue 100 – Present), with links to online content.
- Feature Article: **How to Be Your Own Turntable Guru.**
- Feature Article: **What is Roon?**
- **Encyclopaedia Analogia:** A glossary of Analogue Audio terms and acronyms.
- **Encyclopaedia Digitonia:** A glossary of Digital Audio terms and acronyms.

We hope you find this Guide entertaining, thought-provoking, and informative, and we especially hope that it inspires you to choose source components carefully, set them up well, and enjoy them (and your music) thoroughly. Happy listening.

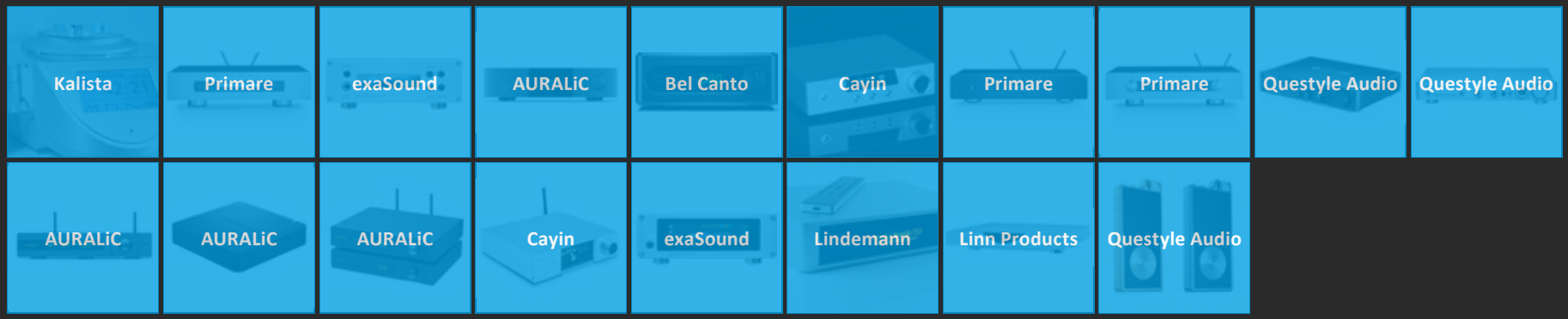
– Chris Martens and the *Hi-Fi+* team.

GUIDE TO AUDIO SOURCE COMPONENTS 2018 HI-FI+

U NEED 2 KNOW

ANALOGUE SOURCE COMPONENTS

DIGITAL SOURCE COMPONENTS



A SAMPLER OF NEW-GENERATION ANALOGUE AND DIGITAL SOURCE COMPONENTS

GUIDE TO AUDIO SOURCE COMPONENTS 2018 HI-FI+

HIGHLIGHTED TURNTABLES

Acoustic Solid Machine

The Solid Machine offers a level of performance that we believe more expensive models from our competitors will struggle to match. This is due to our refusal to compromise on key areas including the use of our own high precision "zero tolerance" bearing. In addition, it uses a heavy 60mm thick aluminum platter that acts a powerful flywheel to ensure smooth, cogging-free rotation. The use of a separately located motor provides an extremely efficient means of preventing residual motor vibration from reaching the platter and disturbing the stylus. The combination of natural leather and acrylic sheet for the platter mat has been carefully chosen to provide effective damping of any vibration within the record.

The Solid Machine can accommodate up to three tone arms, which should satisfy even the most demanding audiophile. The Acoustic Solid Machine provides stereo images that are palpable in their reality. The bass is convincing in its extension and timing and this comes together with the other parts of the frequency range to produce an analogue playback that has a feeling of smoothly flowing, just like real music. Listening to a turntable of this quality, it is easy to see why analogue playback is gaining in popularity.

Technical Specifications

Drive mechanism: Belt Drive

Main bearing type: high-precision "zero tolerance" bearing

Platter diameter, weight, and material: Solid Aluminium,12kg, Height 50 mm

Suspension system or chassis system: Not specified

Tonearm lengths supported: Up to 12"

Can be supplied with Jelco SA750/850/950 or AS WTB 213

Other special features: Can take up to 3 Arms

Pricing: £3795 without arm; £4595 with Jelco SA750

Manufacturer's URL: https://www.acoustic-solid.com/en/

brianandtrevors booplinth

Booplinth is the first plinth designed to upgrade the performance of any Linn LP12 turntable. Booplinth's advanced low mass, one-piece bamboo plinth design is a proven and fundamental performance upgrade for any Linn Sondek LP12 turntable—regardless of age or specification. Every booplinth offers the same consistent upgrade performance by reducing vibration all the way to the stylus tip, revealing more of the recorded information from the vinyl groove.

"The booplinth represents the biggest and most musically fundamental upgrade I've yet heard to the LP12." Roy Gregory, *Hi-Fi+*, July 2015.

As a leading specialist audio house, we adopt the same obsessive approach with all our chosen audio components and system configurations.

Technical Specifications

Drive mechanism: Not applicable

Main bearing type: Not applicable

Platter diameter, weight, and material: Not applicable

Suspension system or chassis system: Not applicable

Tonearm lengths supported: Not applicable

Other special features: Booplinth's advanced low mass, one-piece bamboo plinth design is a proven and fundamental performance upgrade for any Linn Sondek LP12 turntable—regardless of age or specification

Pricing: £1,950 inc. VAT. Book a demonstration and hear more from vinyl with booplinth

Manufacturer's URL: www.brianandtrevors.com, www.booplinth.com

HIGHLIGHTED TURNTABLES

Kuzma Ltd Stabi M

Stabi M turntable is a classic looking turntable with a lid accepting up to 12-inch tonearms. Stabi M features a very rigid outer frame and inner sub chassis, which are isolated by four dampers; three adjustable feet are used to level the whole turntable. A heavy, 12 kg, three-layer platter is driven by a three-phase DC motor via a stiff plastic belt. The platter reaches 33 rpm in less than 2 seconds. This gives the platter sufficient energy as required to reproduce the most complex musical peaks without any strain.

Technical Specifications

Drive mechanism: DC motor is housed in triple brass housing and powered by an outboard power supply with fine speed adjustment, start/stop on front panel and with remote control. Plastic belt is machined thus giving the platter very strong torque

Main bearing type: On top of the diamond polished steel shaft is a ruby ball thrust bearing supported by a resin thrust plate and sliding sleeve immersed in two oil baths

Platter diameter, weight, and material: Platter size is 316 mm, 12 kg, with three-layer construction (aluminium-acyrlic-aluminium)

Suspension system or chassis system: Four highly damped supporting towers with dual layers of isolation material

Tonearm lengths supported:

- Up to 12 inches. Arm boards with cutouts for all popular tonearm types are available
- Kuzma offers a variety of tonearm types, sold separately

Other special features: Fast remote platter start allows you to go to your listening seat and start listening music when you are ready

Pricing: £14,995

Manufacturer's URL: www.kuzma.si

Linn Klimax LP12

Our flagship Klimax LP12 turntable offers the pinnacle of vinyl reproduction, setting the benchmark worldwide for all other turntables on the market.

Over 40 years' worth of research and development has gone into this latest evolution of the turntable that turned the hi-fi industry on its head back at the beginning of Linn's journey to make better sound. Each precision-engineered upgrade has uncovered more music from the depths of the record groove.

It includes the best of Linn's precision-engineered upgrades, and because it's modular, you can update it whenever we release a new upgrade. A Klimax LP12 is an investment that will amaze and reward you for years to come.

Technical Specifications

Drive mechanism: Belt-driven with precious metal brushed DC motor and external motor control unit

Main bearing type: Patented single-point, oil filled bearing

Platter diameter, weight, and material: 299.8mm diameter, 3.6kg, two-piece Mazak alloy platter

Suspension system or chassis system: Three-point sprung/suspended sub-chassis and 'Trampolin' isolation baseboard with suspended feet

Tonearm lengths supported: 9-inch standard Linn mount. Other armboards available for Rega, SME, Naim ARO

Is a tonearm included: Ekos SE machined titanium/stainless steel tonearm with ultra-low friction bearings

Other special features: Every Linn Sondek is made by hand by one person who signs their name when they are happy with it. And each one is upgradeable so that an original Sondek LP12 from 1973 can be upgraded to the latest specification

Pricing: The complete turntable, including all of Linn's top-performing components, is £18,670

Manufacturer's URL: www.linn.co.uk/hifi-separates/turntables/complete#klimax-lp12

HIGHLIGHTED TURNTABLES

Thorens® TD 190-2

The TD 190-2 is the big brother of the TD 170-1. Plinth and platter have more mass, which in combination with the electronically controlled DC motor enhances the silent running as well as the sound. It therefore doesn't matter if you prefer the delicate sound of a violin or rather some powerful guitar riffs.

Technical Specifications

Drive mechanism: Precision-machined flat belt (inside)

Motor: Electronically controlled DC motor

Operation: Fully automatic, 33 ⅓ /45/78 rpm

Main bearing type: Sintered bronze bushing, solid stainless steel spindle shaft with spherical tip

Platter diameter, weight, and material: Non-magnetic aluminium 12-inch platter, 700g

Suspension system or chassis system: Chassis system

Tonearm lengths supported: 9-inch. Thorens TP 19-1/ 9-inch including Ortofon OMB 10 cartridge

Other special features: Not specified

Pricing: £469

URL: www.thorens.com

Thorens® TD 203

The TD 203 is a high quality out of the box solution from Thorens®. The turntable comes fully assembled and is factory-set but also leaves aficionados room to fine-tune and adjust the performance to their personal preferences. The tonearm, for example, offers facilities to adjust azimuth and overhang. The pick-up cartridge can be easily changed in a matter of minutes.

The new tonearm TP 82 is a uni-pivot design—a first in this class. The TP 82's bearing is a carbide tip resting within an intricate arrangement of five very small bearing balls. The arm tube is made from rolled aluminium. Anti-skating bias is provided by a small weight. The tonearm comes pre-installed with the Thorens® TAS 257 cartridge, a high-quality moving-magnet pick-up suitable for all MM phono inputs.

Technical Specifications

Drive mechanism: Precision-machined flat belt (inside)

Motor: Servo-controlled 12V DC motor

Operation: Manual, 33 ⅓ /45 rpm

Main bearing type: Sintered bronze bushing, solid stainless steel spindle shaft with spherical tip

Platter diameter, weight, and material:
- Sub-platter: 7.4-inch, ABS
- Platter: 12-inch, 800 g, ABS

Suspension system or chassis system:
- Three natural rubber stands on MDF chassis
- Oscillating rubber absorbers on motor housing.

Tonearm lengths supported: 9-inch Thorens TP 82 unit-pivot rolled aluminium tonearm with counterweight anti-skating and TAS 257 MM-pick-up

Other special features: MDF plinth with high gloss lacquer in red, black or white. Includes a specially designed transparent Perspex dust cover, external power supply, RCA interconnects, stylus gauge, cartridge alignment protractor

Pricing: £619

Manufacturer's URL: www.thorens.com

HIGHLIGHTED TURNTABLES

Thorens® TD 903

Paying homage to the legendary TD 150 and TD 160 models of the sixties and seventies, Thorens® has reinterpreted the sub-chassis turntable with a state-of-the-art, ground-up development using the latest materials.

Highest fidelity and dynamics were our main priorities during the development of the new turntable series. However, we also placed great importance on user-friendliness, a timeless aesthetics as well as flexible configuration and upgrade options while retaining the traditional sub-chassis design.

The sub-chassis is made of triCom, an aluminium/POM composite characterised by excellent damping properties and high stiffness. The bearing is made of sintered bronze with a Teflon thrust pad and optimized for smooth running. The steel axle supported therein provides very low, constant friction and thus presents a uniform load to the motor.

Technical Specifications

Drive mechanism: Precision-machined flat belt (inside)

Motor: Servo-controlled AC synchronous motor

Operation: Manual, 33 ⅓ / 45 rpm

Main bearing type: Constant friction sintered bronze bushing with Teflon thrust pad

Platter diameter, weight, and material: Aluminium sub-platter, 12-inch frosted quartz glass outer platter, 2.7 kg

Suspension system or chassis system: Classical Thorens® sub-chassis architecture. Three adjustable conical springs with visco/propylene layer in the spring elements

Tonearm lengths supported: 9-inch, 10-inch, and 12-inch. Thorens TP 92 / 9-inch rolled aluminium tonearm with magnetic anti-skating

Other special features:

- To reduce vibrations, the motor is mounted directly onto the dampened sub-chassis
- Two of the turntable's three feet can be levelled from above, which facilitates setup
- The sub-chassis is suspended by means of three conical springs, which can be adjusted from above in order to achieve uniform tension
- The TD 903 is upgradable to a TD 905 or even TD 907 with different damping systems, platter variants and tonearm options
- Available in white or anthracite structured enamel, and Zebrano

Pricing: £6,289

Manufacturer's URL: www.thorens.com

HIGHLIGHTED TONEARMS

Kuzma 4Point 9

4Point 9 is a lighter and shorter version of our top of the line 4Point tonearm. It is 9 inches long and is provided without a VTA tower, thus reducing size and mass. These changes now allow the 4Point 9 tonearm to be mounted on almost any turntable so that more analogue enthusiasts can experience why the 4Point tonearm has such a high reputation worldwide.

Technical Specifications

Tonearm length(s) available: 9-inch (note, though, that the 4Point tonearm is also available in 11-inch and 14-inch versions)

Tonearm arm tube construction: Tapered aluminium tube with removable headshell and azimuth adjustment

Bearing type: Kuzma unique 4 spikes (4point) zero play bearings

Anti-skate system: Weight and thread

Fixed or removable headshell: Kuzma unique no-compromise removable headshell

Tone arm cable construction, available terminations: Silver wiring with RCA, XLR, or 5pin DIN connectors: other wires on request

Other special features: Fully adjustable and repeatable VTA, azimuth adjustments

Pricing: £3,495

Manufacturer's URL: www.kuzma.si

Linn Ekos SE

Setting the performance benchmark, Ekos SE features advanced materials carefully selected for their sound performance and low resonance properties. These minimise interference, resonance, and microphony, meaning you'll hear even more from your vinyl collection.

Whether it's the first or 50th track of the day, the ultra-low friction bearings and temperature-compensated precision-springs ensure that exceptional performance is maintained.

And, of course, every Ekos SE tonearm is hand-built to the highest quality standard and precision-engineered to last, so that you can continue to enjoy your vinyl collection for decades to come.

Technical Specifications

Tonearm length(s) available: 9-inch (229mm Effective Length)

Tonearm arm tube construction: The arm tube is machined from titanium to reduce resonance

Bearing type: Precision miniature ball bearings for vertical and horizontal motion

Anti-skate system: Adjustable spring and filament design

Fixed or removable headshell: Fixed, with slot and Linn 3 point cartridge mounting

Tone arm cable construction, available terminations: 5-pin DIN termination within the tonearm. Linn T-Kable available for external DIN to RCA or XLR connection in 1.2/1.8m lengths

Other special features: The Ekos SE tonearm is the perfect partner for any cartridge. Specify Kandid, Linn's reference moving coil cartridge for the ultimate performance from your LP12 turntable

Pricing: £4,000

Manufacturer's URL: www.linn.co.uk

HIGHLIGHTED PHONO CARTRIDGE

Kiseki Blue N.S. moving coil phono cartridge

The Kiseki Blue Blue N.S. is the first 'New Style' Kiseki Phono cartridge.

The typical, but shorter, Kiseki body is machined out of solid Aluminium. The generator is built from the finest parts available. Two years of experimenting and testing all possible materials and techniques has resulted in the finest Kiseki Blue cartridge ever.

Kiseki cartridges are hand made in limited quantities to ensure the finest sound. Each Kiseki Blue N.S is a work of art.

Technical Specifications

Cartridge Type: Low output moving coil cartridge

Output levels: 0.44 mV

Cartridge body construction: Body is machined from solid aluminium

Cantilever construction: Solid Boron rod, 0.28mm in diameter

Stylus Shape: 0.12 × 0.12 Nude line contact diamond, mirror polished,

Weight: 8g

Recommended tracking force: Not specified

Other special features: VTA: 20 degrees

Pricing: £1,695

Manufacturer's URL: www.kiseki-eu.com, www.kiseki-usa.com

UK Distributor: www.symmetry-systems.co.uk

Kiseki Purpleheart N.S. moving coil phono cartridge

The Kiseki Purpleheart N.S. is a true beauty in every sense. Physically, it is made of rare Purpleheart wood, which turns from brown to a golden purple in direct or indirect sunlight. It sports a boron cantilever the diameter of a human hair. The generator is built from the finest parts available. Two years of research and development, testing of all possible materials has resulted in the finest Kiseki Purpleheart cartridge ever.

Kiseki cartridges are hand made in limited quantities to ensure the finest sound. Each Kiseki Purpleheart N.S. is a work of art.

Technical Specifications

Cartridge Type: Low output moving coil cartridge

Output levels: 0.48 mV

Cartridge body construction: Body is machined from Purpleheart wood

Cantilever construction: Solid Boron rod, 0.30mm in diameter

Stylus Shape: 0.12 × 0.12 Nude line contact diamond, mirror polished

Weight: 7g

Recommended tracking force: Not specified

Other special features: VTA: 20 degrees

Pricing: £2,495

Manufacturer's URL: www.kiseki-eu.com, www.kiseki-usa.com

UK Distributor: www.symmetry-systems.co.uk

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HIGHLIGHTED PHONO CARTRIDGE

Kuzma CAR 60

CAR 60 is our top of the line MC cartridge and features a diamond cantilever and micro ridge stylus. The housing, made from aluminium and brass, is very rigid and inert. Due to the cartridge's shape it is very easy to see the diamond stylus tip and thus easy to set up the cartridge.

Technical Specifications

Cartridge Type: Low output moving coil cartridge

Output levels: 0.3 mV

Cartridge body construction: Outer body is machined from solid aluminium, while the inner body is made of gold-plated brass and holds the whole motor assembly

Cantilever construction: The diamond cantilever is very stiff and rigid, thus having minimum vibration and allowing the diamond stylus tip to transmit to the coils groove information only.

Stylus Shape: Micro ridge

Weight: 17g

Recommended tracking force: 2.00g

Other special features: Silver wiring, rhodium pins, and diamond cantilever

Pricing: £10,995

Manufacturer's URL: www.kuzma.si

Linn Kandid

Kandid is Linn's best moving coil cartridge yet, designed to extract as much musical detail from vinyl records as possible.

The front housing has been removed to take out potential sources of resonance and we have also replaced the metal front yoke screw with a polymer version to eliminate magnetic interference to the coils.

The stylus and cantilever have been repositioned within the body of the cartridge in order to achieve the most accurate audio reproduction. Kandid uses the finest nude diamond, micro-ridge stylus and benefits from a ceramic boron cantilever for ultra low mass and extremely high rigidity. It is constructed around a machined-from-solid, 7075 aluminium alloy body for complete rigidity and includes our unique triple-point mounting system to ensure a more rigid and accurate coupling.

Technical Specifications

Cartridge Type: Moving coil

Output levels: Output at 1 kHz @3.45 cm/s: 0.4 mv

Cartridge body construction: Precision machined 7075 Aluminium 'nude' design with triple-point mounting

Cantilever construction: Ceramic boron cantilever

Stylus Shape: Nude line-contact (micro-ridge) diamond stylus

Weight: 5.7g

Recommended tracking force: 1.72–1.77g

Other special features:

- Exposed motor housing, reducing resonance sources
- Cantilever angle offset from 23° to 20°, allowing correct alignment and symmetrical flux lines when tracking force is applied, ensuring forces on coils and core remain equal in all directions, avoiding any deformation

Pricing: £3,210

Manufacturer's URL: www.linn.co.uk

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HIGHLIGHTED PHONO STAGE

Atoll Electronique Atoll PH100

The Phono preamp. PH100 is an external module in a black steel chassis with a 4mm front panel (black or silver).

Power supply is made up of two top-of-the-range, very low noise transformers (one per channel) as well as four voltage regulators.

The unit is supplied in a metal box in order to remove all interference to the audio stages.

The whole circuit uses only discrete components; it does not use any link capacitors.

The different setups for MM/MC input impedance are directly accessible from the back of the unit.

Technical Specifications

Cartridge types supported: MM/MC

Gain level(s):
- Gain MM 40 dB
- Gain MC High 47 dB
- Gain MC Low 60 dB

Cartridge loading options:
- Input Impedance 47k or 100k
- Input Capacitors 100 pF or Zero

Phono EQ profile(s) supported: Not specified

Circuit highlights: Dual Mono PSU

Inputs: RCA inputs

Outputs: Not specified

Other special features: None specified

Pricing: £390

Manufacturer's URL: http://www.hdh-audio.com/PHONO.html

Audion Premier MM phono stage

The Audion Premier Moving Magnet valve pure class A active phono stage is hand built and is best suited for use with standard or low output moving magnet cartridges. The phono stage is easily matched with most cartridges and, being an active stage, it does not need such close matching as you would with a transformer-based product. Upgrade options are available for this model. The MM phono stage is an active class A stage using a transformer-less design.

Technical Specifications

Cartridge types supported: Moving magnet

Gain level(s): +46db

Cartridge loading options: Transformer-less design will work with most MM cartridges

Phono EQ profile(s) supported: RIAA

Circuit highlights: Valve-powered RIAA phono stage using active power supplies and 2 × Russian NOS 6H23N valves

Inputs: 2 × RCA 47K input sensitivity – 2.0mV distortion @ 1V – <0.015% with no feedback

Outputs: 2 × RCA 47K output at line level. Noise CCIR <80db

Other special features: None specified

Pricing: £999

Manufacturer's URL: www.audion.co.uk

HIGHLIGHTED PHONO STAGE

Audion Select MC1 step up transformer

Designed to mate with our active stage MM phono stage, the Select MC1 step up transformer has both 1:10 and 1:20 switchable ratios (so 25 ohm and 100 ohm cartridges can be used). This is aimed at covering almost 90% of high-end MC cartridges. Designed to work down to 20hz and over 60khz.

Technical Specifications

Cartridge types supported: Moving coil

Gain level(s): @25R 26db and @100R 21db

Cartridge loading options: 1:10 ratio 100R and 1:20 ratio 25R

Phono EQ profile(s) supported: SUT step up transformer to be used with a powered RIAA phono stage

Circuit highlights: SUT step up transformer using super permalloy lams

Inputs: 2 inputs (left/right) switchable for 25 or 100-Ohm loads

Outputs: 2 × stereo outputs (left/right)

Other special features: The Select MC1 provides a ground lift switch

Pricing: £1,049: standard model; £1,499: partial silver wired model

Manufacturer's URL: www.audion.co.uk

Thorens® MM FLEX

The Thorens MM Flex is a high performance moving magnet phono preamplifier that can be fitted directly to the rear of your turntable by means of the unique Velcro™ strip. This allows it to be attached to your turntable without any irreversible modification. Also, thanks to this system, the MM Flex can be removed and re-fitted without the use of tools.

Technical Specifications

Cartridge types supported: Moving magnet

Gain level(s): 39 dB at 1 kHz

Cartridge loading options: 47k Ohms + 220 pF fixed

Phono EQ profile(s) supported:

RIAA curve accuracy: ±02 dB max
THD+N: <0.05%
Signal-to-noise-ratio: >70 dB
Crosstalk: >50 dB

Circuit highlights: None specified

Inputs:

- Sensitivity: 3.3 mVrms for -10 dBV output (316 mVrms)
- Connections: 1 pair of RCA sockets (left/right)

Outputs: Impedance: 47 Ohms. 1 pair of RCA sockets (left/right)

Other special features:

- Power supply: 24 V DC/630 mA
- Power consumption: 1.76 W
- Weight: 140 g (not including power supply)
- Dimensions (W×H×D): 100 mm × 30 mm × 30 mm (42mm including connectors)

Pricing: £129

Manufacturer's URL: www.thorens.com

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HIGHLIGHTED PHONO STAGE

VAC/Valve Amplification Company, Inc. Renaissance phono stage

All Class A triode phono stage developed from the cost-no-object VAC Statement Phono. Three inputs, three gain settings (MM, MC medium output, MC low output), variable loading, external power supply, and mono switch.

Technical Specifications

Cartridge types supported: MM & MC

Gain level(s): 44, 62, and 68 dB

Cartridge loading options: Variable resistance and capacitance

Phono EQ profile(s) supported: RIAA

Circuit highlights: Six ECC83 twin triodes in Class A1, passive EQ

Inputs: Three inputs; units built from February 2018 forward support balanced inputs

Outputs: RCA. Optional balanced XLR

Other special features: None specified

Pricing: $9,900 US

Manufacturer's URL: http://www.vac-amps.com

Zesto Audio Andros 1.2 Phonostage

The design is inspired by a grand piano; this award-winning product is still considered to be one of the most musical phonostages available. It is quiet and dynamic with plenty of headroom for your delicate passages. It has a clear stereo image with maximum channel separation and minimal phase distortion. It's easy to use! You can adjust on the fly without clicks or pops so you can hear the changes. The Andros 1.2 has enough adjustments to match most cartridges with 10 MC load positions, two MM loads, and an MC gain switch for high or low-output cartridges.

Technical Specifications

Cartridge types supported: Both MM and MC

Gain level(s): 67dB MC and 47dB MM

Cartridge loading options:

- Loading is adjustable 'on the fly'
- 10 position MC loading positions
- Two MM load settings"47K Ohms and 15K Ohms

Phono EQ profile(s) supported: RIAA

Circuit highlights:

- 100% Analogue tube circuitry with no solid-state devices anywhere in the signal path
- High quality MC transformers built into the circuitry

Inputs:

- MC = transformer balanced XLR or single ended RCA
- MM = single ended RCA

Outputs: One pair of single-ended RCA

Other special features:

- Ground lift switches
- Gold plated sockets and connectors

Pricing: USD $4,700. Plus duty, VAT and shipping

Manufacturer's URL: www.zestoaudio.com/andros-1-2/

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED PHONO STAGE

Zesto Audio Andros Tessera Phonostage

The Tessera can accommodate up to four tonearms with two completely independent dual mono channels. Each channel has 12 MC load positions, two MM load positions, three gain settings for MM & MC, and ground lift switches. Built into the Tessera circuit design are superior quality MC transformers, large enough for the multiple windings and extra shielding. It's easy to use! All adjustments can be done on the fly without clicks or pops so you hear the changes and settings are saved when you switch between channels. The unit is extremely quiet at -90dBu with a dual chassis design and very musical with a large dynamic range.

Technical Specifications

Cartridge types supported: Both MM and MC

Gain level(s): Three-position gain switch:
MC = 60, 65, 70dBu;
MM = 40, 45, 50dBu

Cartridge loading options:

- 12-position MC loading from 50 to 1000 Ohms
- Two-position MM loading for 47K & 68K Ohms

Phono EQ profile(s) supported: RIAA

Circuit highlights:

- 100% Analogue tube circuitry with no solid-state devices anywhere in the signal path
- All switching is done with reed relays

Inputs: Two pair MC, balanced XLR or RCA
Two pair MM, single ended RCA

Outputs: Pair of balanced and single ended outputs, with output transformers driven by dedicated output tubes

Other special features:

- Ground-lift switches
- Gold plated sockets and connectors
- Elegantly designed 16 gauge steel enclosure with extensive grounding

Pricing: USD $12,000, plus duty, VAT and shipping

Manufacturer's URL:
www.zestoaudio.com/andros-tessera/

HIGHLIGHTED ANALOGUE ACCESSORIES

Zesto Audio Andros Allasso Step Up Transformer

Unlike most step-up transformers, which are customized to a specific phono cartridge with few adjustments, Zesto Audio's Allasso is the most versatile SUT on the market. It has four gain settings with four step up ratios plus a 10-position MC load switch for each Gain/Ratio setting, giving you 40 adjustments in Stereo and 40 in Mono.

Designed to work on any phonostage with a standard 47K MM input. All the adjustments are easily accessible on the front panel and can be done "on the fly" without clicks or pops. There are no math skills required to adjust; it's just you and your ears as you listen and find the best match for your cartridge or your next one.

Technical Specifications

Purpose and function(s) of the accessory:
The Allasso Step Up Transformer amplifies the delicate signal from your MC cartridge. You install it between your turntable and phonostage. Designed for audiophiles that have MC cartridges that are difficult to match or own more MC than MM cartridges and don't want to buy another phonostage.

Intended Applications: Allasso is for use with low-output MC cartridges and powered MM phonostages that provide RIAA equalization

Other special features:

- Four gain settings of 12dB, 16dB, 18dB and 22dB
- Four step up ratios of 1:4, 1:6, 1:8 and 1:12
- 10 MC load settings
- Two ground-lift switches
- Highest quality multiple turn ratio
- MC transformers with extra shielding

Pricing: USD $2,995. Plus duty, VAT and shipping

Manufacturer's URL:
www.zestoaudio.com/andros-allasso/

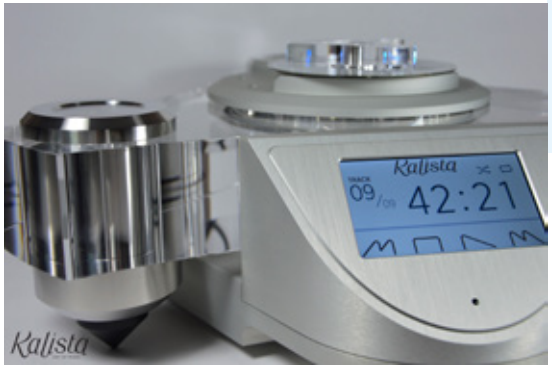
GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED CD-SACD PLAYERS & TRANSPORTS

Metronome Technologie Kalista DreamPlay CD

The Kalista DreamPlay CD is the last generation of the famous CD turntables manufactured by Metronome Technologie, fully designed and hand-made in France.

This pure CD transport is considered by many the King of its kind…



Technical Specifications

Disc Types: Compact-discs, CD-RW

Streaming/connectivity capabilities: Not applicable

Supported Internet Streaming Content applications: Not applicable

Digital Inputs: Not applicable

Digital Outputs: S/PDIF, AES EBU, TOSLink

Analogue Outputs: Not applicable

DAC section – PCM decoding capabilities: Not applicable

DAC section – DSD decoding capabilities: Not applicable

Distinctive digital section features: Not applicable

Distinctive analogue section features: Not applicable

Frequency response: Not applicable

Signal-to-Noise ratio: Not applicable

THD + N: Not applicable

Pricing: €34,000

Manufacturer's URL: http://www.kalista.audio/en/

HIGHLIGHTED CD-SACD PLAYERS & TRANSPORTS

Primare CD35 Prisma CD and Network Player

A state-of-the-art dedicated CD drive, all-new reference balanced DAC stage feeding a finely tuned balanced analogue output stage, and Prisma connectivity and control technology combine to create in the CD35 Prisma CD player a complete digital music source, and quite possibly the best CD player Primare has ever built.

Prisma provides multi-room/multi-zone connectivity and control for playback of stored and streamed media, wired or wireless, all managed from any mobile device through a dedicated system control app.

In addition to Bluetooth®, AirPlay, and Spotify Connect, Prisma features Chromecast built-in, a unique streaming portal allowing effortless direct connection to hundreds of streaming applications for the best possible performance and user experience.

Also available: CD35 – CD player only, without Prisma.

Technical Specifications

Disc Types: CD

Streaming/connectivity capabilities: Comprehensive multi-room/multi-zone, LAN, WLAN, Bluetooth®, AirPlay, Spotify Connect, Chromecast built-in, and RS-232 connectivity and control

Supported Internet Streaming Content applications: Bluetooth®, AirPlay, Spotify Connect, and Chromecast built-in

Digital Inputs: USB-A, LAN, WLAN, Bluetooth®, AirPlay, Spotify Connect, and Chromecast built-in

Digital Outputs: 1 × RCA; 1 × Toslink

Analogue Outputs: 2 × RCA; 2 × XLR

DAC section – PCM decoding capabilities: Up to 192kHz/24 bit

DAC section – DSD decoding capabilities: Up to 128/5.6MHz

Distinctive digital section features: To allow for playback of virtually any digital source with absolute accuracy and musicality, the state-of-the-art ESS ES9028PRO SABRE, a 32-bit, 8-channel PRO series DAC chipset using their patented HyperStreamDAC technology, was selected for outstanding performance

Distinctive analogue section features: Fixed and variable balanced outputs allow the CD35 Prisma to function as a standard source component, or, when connected to high quality powered speaker from its variable output, as the centerpiece of a superb all digital music system

Frequency response: 20Hz–20kHz -0.3db

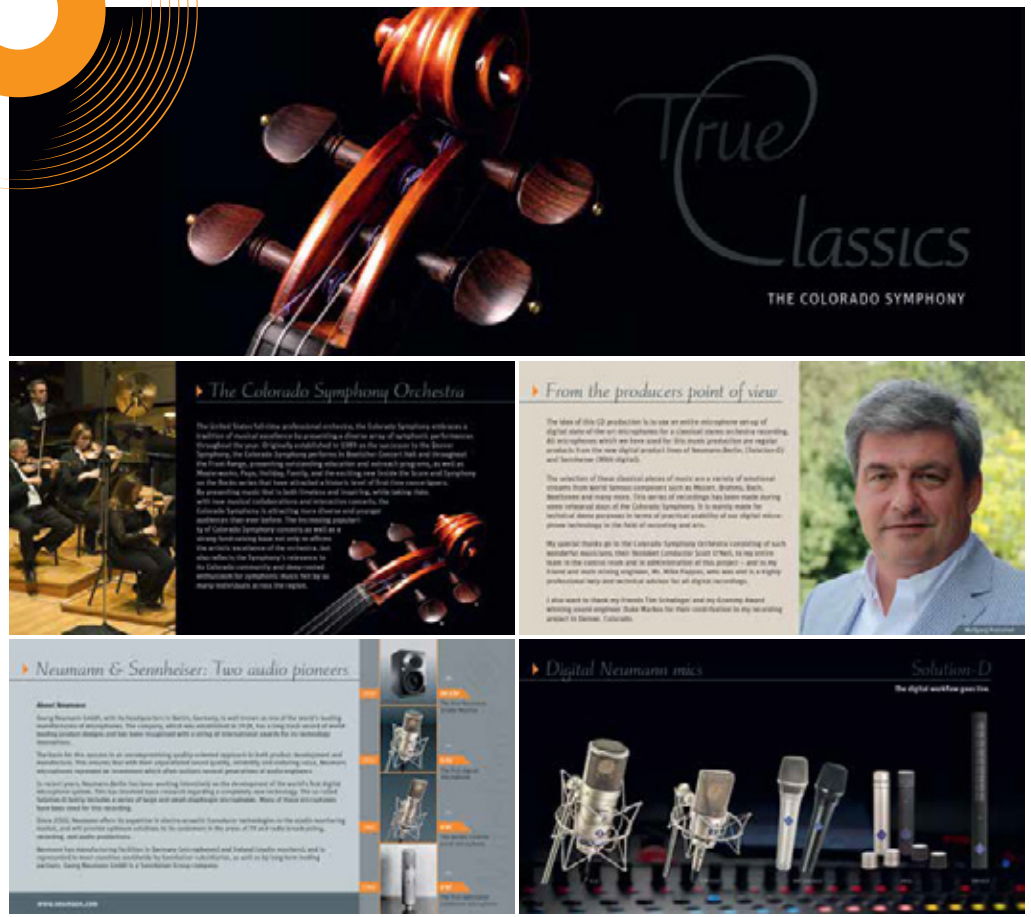
Signal-to-Noise ratio: 110dB/AES17

THD + N: 20Hz–20kHz 0.01%

Pricing: CD35 Prisma £2,750 Inc. VAT; CD35 (without Prisma) £2,400

Manufacturer's URL: www.primare.net

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+



AVAILABLE EXCLUSIVELY FROM hi-fi+

We at *Hi-Fi+* are proud and excited to bring you the new *True Classics* double CD, priced at £17.99 +p&p.

This deluxe recording features 18 of the best known classical works, beautifully played by the Colorado Symphony and conducted by Scott O'Neill. They have also been recorded to highlight the best sound quality, thanks to the work of producer Wolfgang Fraissinet, who – being CEO of audio engineering experts Neumann – probably knows more about microphones than almost anyone else in the business. This must have double CD in its exclusive presentation case is perfect for any music lover or audiophile.

To purchase please visit www.hifiplusstore.com

HIGHLIGHTED DIGITAL-TO-ANALOGUE CONVERTERS (DACS)

exaSound e32 DAC

Designed and hand-built entirely in Canada, exaSound's DACs are highly appreciated by reviewers and customers. After successfully introducing the word's first DSD256 DAC, the company continued the tradition of excellence with the e32 stereo flagship model. Leveraging the world's highest performance ES9028PRO DAC chip enabled us to create the next generation of Reference Class conversion. e32 offers Zero-configuration comprehensive sample rate support, all the way up to native DSD 256 and 32 bit PCM at 384 kHz/ DXD. e32 features a high resolution volume control with IR remote and a headphone amplifier that can drive the most demanding headphones. The e32 DAC offers vanishingly low noise and distortion with highly accurate, extended frequency response, which form the foundation for our natural, dynamic sound and ultimate subjective appreciation.

Technical Specifications

Digital Inputs:

- USB 2.0 – ZeroJitter™– true asynchronous interface with error correction
- S/PDIF
- TOSLINK

Streaming/connectivity capabilities:

- Roon Ready for instant music library setup
- exaSound PlayPoint network player provides comprehensive streaming capabilities

Digital Outputs: Not applicable

Digital Filter(s): Forget guesswork – Zero-configuration automatic filter selection for every format and sampling rate

Clock capabilities/Jitter: FemtoMaster™ – Our quad-clock architecture, with 82 femtosecond master clock and 3 auxiliary stream-control clocks, minimizes jitter for maximum timing accuracy, image development, and bass extension

PCM decoding capabilities: ENclusiv™ zero-configuration comprehensive sample rate support: PCM/DXD: 44.1kHz to 384kHz at 32 bits resolution

DSD decoding capabilities:

- DSD: 2.8224, 3.072 MHz
- DSD2: 5.6448, 6.144 MHz
- DSD4: 11.2896, 12.288 MHz

Distinctive digital section features: GalvanicInfinity™ – affords complete galvanic isolation of all digital inputs for ultimate external noise reduction. FPGA core for fast, low jitter processing. Display and user interface are implemented with a separate PIC processor for minimizing digital noise

Analogue outputs:

- Simultaneously driven, gold-plated balanced XLR, unbalanced RCA
- Headphone amplifier 4W / 16Ω

Distinctive analogue section features:

- Truly balanced design – yields the best analogue noise performance and lowest distortion
- ZeroResolutionLoss™ – an exclusive volume control with three-way volume synchronization
- Ultimate clean power, with 11 linear power conditioning stages, and an upgradable external power supply

Signal-to-Noise ratio: A-weighted, 2 Vrms: 128dB

THD + N:

- 1kHz, 0dBFS/0.00021%
- IMD (Intermodulation Distortion at 19kHz+20kHz; 0dBFS 2nd order): 144dB/0.000006%

Pricing: Award winning, reference level fidelity at a sensible price. US $3,499

Manufacturer's URL: www.exasound.com

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED DAC/PREAMPS & DAC AMPS

AURALiC VEGA G2 Digital Audio Processor

The original VEGA has been a favourite among discriminating listeners. Now, the all-new VEGA G2 pushes the boundaries of digital music. Extensive research and development went into making the VEGA G2, a high-performance Digital Audio Processor that excels at the conversion and streaming of high-resolution digital music formats up to DSD512. Completely new inside and out, the VEGA G2 breaks new ground in the world of premium, high performance digital processing thanks to many new innovative features including galvanic isolation and an extremely precise 72 Femto clock. What's more, the VEGA G2 is the industry's first signal-independent "Master DAC", helping it to redefine the sound of digital audio.

Technical Specifications

Digital Inputs: AES/EBU, Coaxial, TOSLINK, USB 2.0 (x2), Gigabit Ethernet, Tri-band Wi-Fi

Streaming/connectivity capabilities: Network shared folders, USB Drive, Lightning Server, UPnP/DLNA media server, TIDAL, Qobuz, Internet Radio, AirPlay, Bluetooth, SongCast, and RoonReady

Digital Outputs: Not specified

Digital Filter(s): Six advanced digital filter modes

Clock capabilities/Jitter: This signal-independent "Master DAC" offers Jitter-free 0peration, utilizing its extremely precise dual-frequency 72 Femto Master Clock

PCM decoding capabilities: PCM 44.1kHz to 384kHz at 16-, 24-, and 32-bit resolutions

DSD decoding capabilities: DSD64 – DSD512

Distinctive digital section features: The VEGA G2 is uniquely able to use its extensive memory cache so that it has no need to lock on to the frequency of the source signal, using its own extremely precise 72 Femto Master Clocks to govern timing

Analogue outputs: Single-ended RCA, balanced XLR

Preamp/amplifier features: Fully passive volume control based on a unique resistor ladder attenuator network built by AURALiC. Drawing no current once set, this innovation completely eliminates the possibility of interference

Amplifier power output, if applicable: Not applicable

Signal-to-Noise ratio: Not specified

THD + N: Not specified

Pricing: USD $5,699 / £5,499

Manufacturer's URL: http://auralic.com

HIGHLIGHTED DAC/PREAMPS & DAC AMPS

Bel Canto Design Ltd C5i

The C5i Integrated Amplifier is simplicity and musicality in one compact chassis, that controls all of your sources, is versatile, and easy to use.

Technical Specifications

Digital Inputs:
- Two S/PDIF (RCA), two TOSLINK, one USB. Maximum data input rates:
- S/PDIF and TOSLINK: 24-bit data at 192KS/s
- USB: 24-bit data at 96KS/s

Analog Inputs:
- Line-level input and phono input:
- Line in impedance: 11 k Ohms
- Phono in impedance: 47 k Ohms/150pF
- Phono accuracy: +/-0.5dB, 50Hz–15kHz

Digital Outputs: Not applicable

Digital Filter(s): Slow Roll-Off Linear Phase

Clock capabilities/Jitter: Low jitter master clock: < 250fs RMS

PCM decoding capabilities: Not specified

DSD decoding capabilities: Not specified

Distinctive digital section features: None specified

Analogue outputs: Speaker outputs via two sets of WBT NextGen binding posts, RCA line out, headphone output via 6.35mm jack (output levels: 300mA peak at 4Vrms)

Preamp/amplifier features: High dynamic range linear switching amplifier

Amplifier power output, if applicable:
- Power Output 1% THD: 120Wpc @ 4 Ohms, 60Wpc @ 8 Ohms
- Peak Output Current: 30 amperes
- Minimum Load: 3 Ohms per channel
- Damping factor: > 1000

Signal-to-Noise ratio: Not specified
- IMD (CCIF): 0.0003%, 1W, 14:15KHz, 4 ohms
- Dynamic Range: 115dB
- THD + N: 0.003% 1W, 1KHz, 4 ohms

Pricing: Not specified

Manufacturer's URL: www.belcantodesign.com

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED DAC/PREAMPS & DAC AMPS

Cayin iDAC-6

The iDAC-6 is a feature-packed true balanced D/A converter. With a footprint of less than 10 inches × 10 inches, the DAC supports all the expected digital inputs (USB, AES/EBU, coaxial, optical) and analogue outputs (XLR and RCA). It features an interesting dual output stage and five built-in digital filters, allowing users to fine-tune the iDAC-6 for different sonic preferences. The iDAC-6 employs minimalist design and is extremely compact; it is well built with a solid chassis formed from aluminum alloy with sand blast finishing, and can easily fit in as a desktop or household audio appliance.

Technical Specifications

Digital Inputs: USB Audio, AES/EBU, Coaxial, Optical

Streaming/connectivity capabilities: Not applicable

Digital Outputs: Not applicable.

Digital Filter(s):

- Sharp
- Short Delay Sharp
- Slow
- Short Delay Slow
- Super Slow

Clock capabilities/Jitter: Not specified

PCM decoding capabilities: Up to 32-Bit/384kHz

DSD decoding capabilities: DSD64, DSD128

Distinctive digital section features: 32-bit AKM AK4490 chips operates in dual-mono mode, five built-in digital filters, support for DoP via Coaxial and AES/EBU

Analogue outputs: XLR, RCA

Distinctive analogue section features: Genuine balanced DAC circuit, user selectable 4x6N1B tube buffer stage, Line out and Pre-out (with volume control), DAC and analogue circuit are powered by independent linear regulated power supply out of an in-house toroidal transformer

Signal-to-Noise Ratio:

- Tube: ≥ 105dB (A-weighted).
- Transistor: : ≥ 110dB (A-weighted)

THD + N:

- Tube: ≤ 0.8% (Fs = 192kHz).
- Transistor: ≤ 0.004% (Fs = 192kHz)

Pricing: US $699

Manufacturer's URL: http://en.cayin.cn/products_info?itemid=9

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

CARY AUDIO

MQA roon ready Spotify TIDAL

Cary Audio DMS-500

Cary Audio DMS-500
High resolution Internet/LAN audio player and DAC
– Smartphone control via dedicated App
– USB-flash drive and SD-Card reader
– Qualcomm aptX® lossless fi™Bluetooth, AirPlay
– Pre-amp function
– Free firmware updates with more features and services every time
Made in USA

Cary Audio brings the music into your home since 1989.
Expect great sound from our vacuum tube or solid-state amplifiers, state-of-the art digital players and processors.

CARYAUDIO.EU **+ 372 880 35 80**

HIGHLIGHTED DAC/PREAMPS & DAC AMPS

Primare I15 Prisma Integrated Amplifier and Network Player

The I15 Prisma integrated amplifier is a compact, full-featured multi-room/multi-zone system control and power centre providing 60 watts of power per channel, advanced digital to analogue conversion, and complete digital media access and system management by way of proprietary Prisma connectivity and control technology.

In addition to Bluetooth®, AirPlay, and Spotify Connect, Prisma features Chromecast built-in, a unique streaming portal allowing effortless direct connection to hundreds of streaming applications for the best possible performance and user experience.

Continuing a Primare tradition of delivering astonishing performance from compact and elegant devices, the I15 Prisma, with its three-quarter sized cabinet, offers even greater possibilities for providing the highest-quality music performance and access to any and every room in the house.

Technical Specifications

Digital Inputs: 1 × USB-A, 1 × USB-B, 1 × RCA, 1 × Toslink, 1 × 3.5mm digital/analogue, WLAN, LAN

Streaming/connectivity capabilities: Comprehensive multi-room/multi-zone, LAN, WLAN, Bluetooth®, AirPlay, Spotify Connect, Chromecast built-in, and RS-232 connectivity and control

Digital Outputs: 1 × RCA

Digital Filter(s): Not specified

Clock capabilities/Jitter: Not specified

PCM decoding capabilities: Up to 192kHz/24 bit

DSD decoding capabilities: Up to 128/5.6

Distinctive digital section features: For playback with absolute accuracy and musicality, a high performance 32-bit stereo AKM AK4490EQ chipset was selected, supporting up to 768kHz PCM and 256/11.2MHz DSD. This ability to handle higher resolution file formats allows for potential future software upgrades

Analogue outputs: Pre Out – One pair RCA

Preamp/amplifier features: The I15 Prisma is an integrated digital and analogue, multi-room/multi-zone music system control center and amplifier – capable of providing exemplary performance whether the source is analogue or digital, stored or streamed, wired or wireless – managed through a proprietary mobile app

Amplifier power output, if applicable: 2× 60W at 8Ω; 2× 100W at 4Ω

Signal-to-Noise ratio: >90dB digital / >80db analogue

THD + N: <0.05%, 20Hz–20kHz, 10W at 8Ω

Pricing: I15 Prisma £1900 including VAT

Manufacturer's URL: www.primare.net

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED DAC/PREAMPS & DAC AMPS

Primare I35 Prisma Integrated Amplifier and Network Player

The I35 Prisma is the latest iteration of Primare's now iconic 30 Series integrated amplifiers and is the first to use the new UFPD 2 power system, a radical reworking of Primare's award-winning UFPD all-analogue Class-D technology.

Providing 150 watts at 8 ohms of absolutely linear amplification across the entire audible bandwidth, the I35 Prisma delivers naturally fast, clean, and agile sound with an unprecedented ability to bring music to life. In addition to balanced analog inputs, the I35 Prisma includes a full-featured DAC stage, as well as Prisma connectivity and control technology.

Also available:

- I35 – analogue-only inputs, without DAC or Prisma
- I35 DAC – analogue and digital inputs, without Prisma

Technical Specifications

Digital Inputs: 1 × USB-A, 1 × USB-B, 2 × RCA, 4 × Toslink, WLAN, LAN

Streaming/connectivity capabilities: Comprehensive multi-room/multi-zone, LAN, WLAN, Bluetooth®, AirPlay, Spotify Connect, Chromecast built-in, and RS-232 connectivity and control

Digital Outputs: 1 × RCA

Digital Filter(s): Not specified

Clock capabilities/Jitter: Not specified

PCM decoding capabilities: Up to 384kHz/24 bit

DSD decoding capabilities: Up to 256/11.2

Distinctive digital section features: The DAC stage features the new flagship AK4497EQ, a premium 32-bit stereo chipset supporting up to 768kHz PCM and 22.4MHz DSD. This ability to handle higher resolution file formats will allow for the potential of future software upgrades

Analogue outputs: Line Output: 1 pair RCA / Pre Out: 1 pair RCA

Preamp/amplifier features: The I35 Prisma is an integrated digital and analogue, multi-room/multi-zone music system control centre and amplifier – capable of providing exemplary performance whether the source is analogue or digital, stored or streamed, wired or wireless – managed through a proprietary mobile app

Amplifier power output, if applicable: 2× 150W at 8Ω; 2× 300W at 4Ω

Signal-to-Noise ratio: >100 dB

THD + N: <0.01%, 20Hz–20kHz, 10W at 8Ω

Pricing: I35 Prisma £3900; I35 DAC £3,550; I35 £3,000 – all prices include VAT

Manufacturer's URL: www.primare.net

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED DAC/PREAMPS & DAC AMPS

Questyle Audio Engineering CMA600i

The CMA600i combines all of Questyle's patented technologies into a cost effective all-in-one preamp, DAC, and headphone amplifier. With a completely separate preamp section the CMA600i fits seamlessly into your home system with the ability to switch between digital and analogue sources. With unbalanced 6.35mm headphone outputs as well as a true fully balanced 4-pin XLR output, the four current mode amplifier circuits can drive the most demanding headphones on the market. In fact, current mode circuits are far more capable than simple power specifications might suggest. With support for up to 384kHz and DSD256, via patented 'True DSD' implementation, the CMA600i offers outstanding sound quality and features for a very reasonable outlay.

Technical Specifications

Digital Inputs: S/PDIF RCA, Toslink Optical

Streaming/connectivity capabilities: USB (WASAPI, ASIO, KS)

Digital Outputs: S/PDIF RCA

Digital Filter(s): PCM Mode: IIR (MP) and FIR (LP) switchable; DSD mode: no filter

Clock capabilities/Jitter: 30psec (USB)

PCM decoding capabilities: Support for up to 384kHz/32-bit

DSD decoding capabilities: True DSD (no DOP conversion) up to DSD256

Distinctive digital section features: Not applicable

Analogue outputs: RCA unbalanced, XLR balanced stereo output

Preamp/amplifier features: RCA unbalanced input with separate analogue input switch on the front panel

Amplifier power output, if applicable:

- 220mW@300Ω; 950mW @32Ω(normal headphone jack)
- 630mW @300Ω; 1900mW @32Ω (balanced headphone jack)

Signal-to-Noise ratio:

- Headphone amp – 113 dB, non-weighting
- Preamp out – RCA > 105dB; XLR: > 121dB (non-weighting)

THD + N:

- Headphone amp. THD+N: 0.00057%@1kHz, Po = 100mW, 300Ω / 0.0034%@1kHz, Po = 50mW, 32Ω
- Preamp. THD+N: RCA: < 0.00082%; XLR: < 0.00064%

Pricing: £1,099

Manufacturer's URL: www.questyleaudio.com

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED DAC/PREAMPS & DAC AMPS

Questyle Audio Engineering CMA400i

The CMA400i follows on from the highly regarded CMA600i, focusing on the desktop DAC and headphone amplifier category. The CMA400i uses the same AK4490 chip as the CMA600i, to offer up to 384kHz and DSD256 support, and also mirrors the CMA600i's four current mode amplifier circuit topology to drive the most demanding headphones on the market. In fact, current mode circuits are far more capable than simple power specifications might suggest. The CMA400i is a true 'swiss army knife' of headphone amps with 4-pin XLR and 2.5mm balanced outputs, and a 6.35mm single-ended output, with gain switches to match more sensitive IEMs or headphones. The CMA400i forgoes the analogue preamp input of the CMA600i, but adds a convenient DAC/AMP toggle to switch seamlessly between headphone and lineout operation.

Technical Specifications

Digital Inputs: S/PDIF RCA, Toslink Optical

Streaming/connectivity capabilities: USB (WASAPI, ASIO, KS)

Digital Outputs: S/PDIF RCA

Digital Filter(s): Not specified

Clock capabilities/Jitter: Not specified

PCM decoding capabilities: Support for up to 384kHz/32-bit

DSD decoding capabilities: True DSD (no DOP conversion) up to DSD256

Distinctive digital section features: Not applicable

Analogue outputs: RCA unbalanced, XLR balanced stereo output

Preamp/amplifier features: Fixed/Variable output, direct DAC or amp switch

Amplifier power output, if applicable:

- 106mW@300Ω; 980mW@32Ω (normal headphone jack)
- 418mW@300Ω; 3920mW@32Ω (balanced headphone jack)

Signal-to-Noise ratio: Preamp out – RCA: >110dB; XLR: >113dB (non-weighting)

THD + N:

- Headphone amp. THD+N: 0.0013%@1kHz, Po=100mW, 300Ω 0.0016%@1kHz, Po=50mW, 32Ω
- Preamp. THD+N: RCA: <0.0009%; XLR: <0.0009%

Pricing: £799

Manufacturer's URL: www.questyleaudio.com

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED STREAMERS & SERVERS

AURALiC ALTAIR Wireless Streaming DAC

The ALTAIR is the best-sounding way to bring sophisticated, feature-rich high-resolution streaming to your system. An outstanding DAC in its own right, the ALTAIR is also capable of streaming the highest resolution files over Wi-Fi, connecting to all your favourite music from network shares, lossless Internet services, or even a locally connected/installed drive. With 15 ways to connect the possibilities are endless, but sound quality is at the heart of the ALTAIR. Its Tesla G1 hardware gives it the power and flexibility for great-sounding high-resolution playback of formats up to DXD and DSD256. Innovative features, automatic OTA updates, and elegant design make the ALTAIR hard to beat amongst today's streamers.

Technical Specifications

Type: Streamer/Server

Digital Inputs: AES/EBU, Coaxial, TOSLINK, USB 2.0 (x2), Gigabit Ethernet, Tri-band Wi-Fi

Streaming/connectivity capabilities: Network shared folders, USB Drive, Internal music storage (optional), Lightning Server, UPnP/DLNA media server, TIDAL, Qobuz, Internet Radio, AirPlay, Bluetooth, SongCast, and RoonReady

Digital Outputs: USB 2.0 for compatible DAC

Clock capabilities/Jitter: Dual frequency 120 femtosecond clock

Distinctive digital section features: The Tesla G1 hardware platform packs enormous processing power, built around a high-performance Quad-Core Cortex-A9 processor running at 1GHz, with 1GB DDR3 RAM and 4GB storage. Automatic updates keep Tesla G1 ready for peak performance at all times

Internal storage options: Internal 2.5-inch HDD/SSD bay

External storage options: USB 2.0 to external drive

Signal-to-Noise ratio: Not specified

Other special features: The purpose-built Lightning OS and Lightning DS control app turn the ALTAIR into a feature-rich music server for your entire library. Connect to your system, log in to your Wi-Fi network, and start exploring hi-resolution streaming

Pricing: £1,749

Manufacturer's URL: http://www.auralic.com

HIGHLIGHTED STREAMERS & SERVERS

AURALiC ARIES MINI Wireless Streaming Node with Linear PSU

Compact and lightweight, the ARIES MINI packs all the functionality of our award-winning ARIES Streaming Bridge into a space-saving and affordable package, with the addition of a high-performance DAC for analogue output to your system. Whether you're looking to outfit your hi-fi with streaming capabilities for the first time, or to provide the missing link between multiple listening environments, the ARIES MINI is the perfect combination of connectivity, features and sound to discover what high-resolution streaming is all about. Performance is further enhanced with the addition of our low-noise linear PSU.

Technical Specifications

Type: Streamer/Server

Digital Inputs: Gigabit Ethernet, Dual-band Wi-Fi, USB 2.0 for external storage

Streaming/connectivity capabilities: Network shared folders, USB drive, internal storage (optional), UPnP/DLNA media servers, TIDAL, Qobuz, Internet Radio, AirPlay, Bluetooth, SongCast, and RoonReady

Digital Outputs: USB 2.0 for compatible DAC, Coaxial, and TOSLINK

Clock capabilities/Jitter: Not specified

Distinctive digital section features: A customized version of the AURALiC Tesla hardware platform with Quad-Core processing and extended memory means the ARIES MINI is ready for the most demanding high-resolution music files, including DXD and DSD256

Internal storage options: Internal 2.5-inch HDD/SSD bay

External storage options: USB 2.0 to external drive

Signal-to-Noise ratio: Not specified

Other special features: The purpose-built Lightning OS and Lightning DS control app turn this streamer into a feature-rich music server for your entire library. Connect the ARIES MINI to your system, log in to your Wi-Fi network, and enjoy

Pricing: £449 (ARIES MINI) + £249 (Linear PSU upgrade)

Manufacturer's URL: http://www.auralic.com

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED STREAMERS & SERVERS

AURALiC POLARIS Wireless Streaming Amplifier

From digital to vinyl, local to Internet, the POLARIS is everything you need to unite your musical world. Combining technologies created for AURALiC's standout VEGA DAC and ARIES Streamer, the POLARIS is an all-in-one audio system with an award-winning pedigree. It's a streamer, DAC, digital music server, pre-amplifier, and 120-watts-per-channel power amplifier in a single box—just add speakers and you're ready to go. Tesla G1 hardware gives the POLARIS plenty of processing power to stream the highest resolution music over Wi-Fi, and because it incorporates AURALiC's Lightning software architecture it functions as a robust and feature-rich media server in its own right. POLARIS is true audiophile streaming in a single, high performance component.

Technical Specifications

Type: Streamer, Server, DAC, Pre-amp, Power Amp

Digital Inputs: AES/EBU, Coaxial, TOSLINK, USB 2.0 (x2), Gigabit Ethernet, Tri-band Wi-Fi

Streaming/connectivity capabilities: Network shared folders, USB Drive, Internal music storage (optional), Lightning Server, UPnP/DLNA media server, TIDAL, Qobuz, Internet Radio, AirPlay, Bluetooth, SongCast, and RoonReady

Digital Outputs: USB 2.0 for compatible DAC

Clock capabilities/Jitter: Dual frequency 120 femtosecond clock.

Distinctive digital section features: The Tesla G1 hardware platform packs enormous processing power, built around a high-performance Quad-Core Cortex-A9 processor running at 1GHz, with 1GB DDR3 RAM and 4GB storage. Automatic updates keep Tesla G1 ready for peak performance at all times

Internal storage options: Internal 2.5-inch HDD/SSD bay

External storage options: USB 2.0 to external drive

Signal-to-Noise ratio: Not specified

Other special features: The purpose-built Lightning OS and Lightning DS control app turn the POLARIS into a feature-rich music server for your entire library. Connect your favorite speakers, log in to your Wi-Fi network, and start exploring hi-resolution streaming

Pricing: £2,875

Manufacturer's URL: http://www.auralic.com

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED STREAMERS & SERVERS

Cayin iDAP-6 Digital Audio Player

Cayin sees the need to offer an integrated solution to organize our digital music library, enjoy the convenient of Home Networking, and widen our life with Internet music. We offer the iDAP-6, a desktop digital transport and network player that supports all common digital file formats and provides comprehensive digital output options to multiple D/A equipment at the same time.

With a footprint of less than 10 inches × 10 inches, the iDAP-6 offers impressive digital capabilities. PCM supports up to 32-Bit/384kHz, DSD supports up to DSD256 with I2S, up to DoP128 with USB, AES/EBU and Coaxial.

Technical Specifications

Type: Digital Transport and Network Player

Digital Inputs: Not applicable

Streaming/connectivity capabilities:

- Ethernet (RJ45) or WiFi networking
- Playback Hi-Res file on NAS or shared resource through Samba, DLNA, and Airplay
- Transmit or receive through Bluetooth v4.1

Digital Outputs: I2S (HDMI), USB, AES/EBU, Coaxial (RCA and BNC), Optical

Clock capabilities/Jitter: Two Femtosecond Crystal Oscillators with RMS jitter below 0.1ps@10Hz – 1MHz and phase noise below -166dBc / Hz@1MHz offset

Distinctive digital section features: None specified

Internal storage options: Not applicable

External storage options: USB OTG Storage and SD card

Signal-to-Noise ratio: ≥ 148dB (A-weighted)

Other special features: Supports Internet Radio and playback streaming services such as Tidal and Spotify through DLNA players (e.g., Bubbleupnp)

Pricing: USD $799

Manufacturer's URL: http://en.cayin.cn/products_info?itemid=109

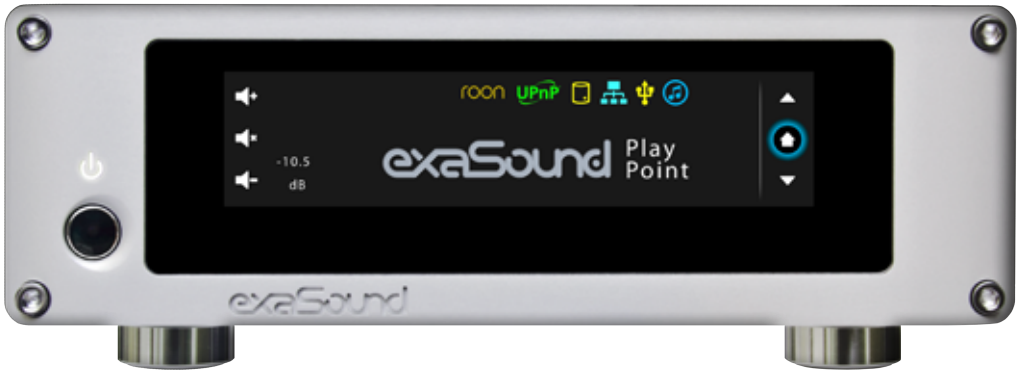
GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED STREAMERS & SERVERS

exaSound Audio Design exaSound PlayPoint Network Audio Player

The PlayPoint connects exaSound DAC to the home network and delivers a seamless, life-like streaming music experience. The sound is astonishingly dynamic and clean, with vanishingly low jitter, distortion, and noise levels. The PlayPoint supports various configurations:

- Roon Ready RAAT endpoint, Roon Server.
- It comes with a built-in UPnP music library server.
- It can be controlled with UPnP, OpenHome, and DLNA apps from iOS and Android tablets and phones.
- The PlayPoint can be used as a Network Audio Adapter (NAA) endpoint with Signalyst HQ Player.
- The PlayPoint supports Apple AirPlay.
- Music libraries can be stored on Network Access Storage (NAS).
- The PlayPoint works with external Roon or HQ Player servers for advanced upsampling applications.



Technical Specifications

Type: Ethernet to USB bridge, Roon Server, Roon RAAT Endpoint, UPnP Server, UPnP Renderer, NAA Endpoint, and AirPlay Endpoint

Digital Inputs:

- Ethernet, Wi-Fi 801.11ac
- USB 3.0 compatible with USB 2.0 and USB 3.0 HDD, SSD drives

Streaming/connectivity capabilities:

- Roon RAAT, UPnP, OpenHome, HQPlayer NAA, AirPlay, and MPD
- Tidal is available via Roon, Bubble UPnP, and AirPlay.
- Spotify and Quobuz available via 3rd party apps

Digital Outputs: USB 2.0–ZeroJitter™ – true asynchronous interface with error correction

Clock capabilities/Jitter: Not applicable

Distinctive digital section features:

- **ZeroJitter™** asynchronous bitperfect streaming
- **GalvanicInfinity™** USB isolation with e20, e12, e22, e28, e32 DACs
- **ZeroResolutionLoss™** volume control with all-time 0dB full-scale streaming 4-way volume synchronization, volume trimming for individual channels

Internal storage options: High-performance SSD drive for storing media libraries

External storage options:

- Network Atached Storage (NAS)
- Locally attached USB disk
- Up to eight USB disks supported via USB hub

Signal-to-Noise ratio: Determined by the connected external DAC

Other special features:

- **ENclusiv™** Comprehensive Sampling Rate support in stereo and multi-channel:
- Native DSD64, DSD128, DSD256 up to 12.28MHz
- DXD 352.8kHz /True 32-bit
- PCM 44.1 to 384kHz /True 32-bit
- Zero-configuration touch screen user interface, Web interface
- Remote support, remote upgrade

Pricing: USD $1,999

Manufacturer's URL: https://www.exasound.com

GUIDE TO AUDIO SOURCE COMPONENTS: U NEED 2 KNOW HI-FI+

HIGHLIGHTED STREAMERS & SERVERS

Lindemann musicbook:DSD

The musicbook:DSD is a versatile signal source which, in addition to digital and analogue inputs, also offers a USB interface, Bluetooth receiver, analogue preamp, and headphone amplifier. Depending on the model, the musicbook:DSD can also be fitted with a network player and a CD drive. The musicbook:DSD follows a new approach: irrespective of the source, all digital input signals can be converted into DSD. This high-resolution signal is merely filtered in the Lindemann converter and translated into an analogue signal without further intermediate steps. The gain in sound quality is dramatic: greater dynamics, brilliant tonal colours, and a new, absolutely "lifelike" atmosphere that is reminiscent of analogue reproduction. DSD is the new analogue!

Technical Specifications

Type: Streamer, USB-DAC, analogue pre-amplifier

Digital Inputs: Two optical and two coaxial digital inputs for SPDIF signals (LPCM)

Streaming/connectivity capabilities: NAS, TIDAL, Qobuz, digital and analogue inputs

Digital Outputs: None

Clock capabilities/Jitter: Ultra-low jitter dual-frequency DPLL-Clock

Distinctive digital section features: Unique re-sampling of all digital formats into a 1-bit signal (DSD128, DSD256)

Internal storage options: None

External storage options: NAS

Signal-to-Noise ratio: Not specified

Other special features: One of the best sounding streamers on the market

Pricing: £2,994–£4,167 (depending on model)

Manufacturer's URL: www.lindemann-audio.com

Linn Klimax DS

Klimax DS is the world's best dedicated digital streaming source.

First introduced in 2007, this was the world's first truly high-end network music player, setting a benchmark that has stood the test of time. Now completely re-engineered with our Katalyst DAC Architecture, Klimax DS has raised the bar still further.

Developed with a single aim—the best musical performance possible— Klimax DS preserves every last musical detail. Every aspect of its design has been optimised for performance; the machined-from-solid aluminium enclosure has separate rooms for the circuit boards inside to protect the signal at every stage, while the analogue outputs are isolated from noise by dedicated, high quality transformers.

Technical Specifications

Type: Network music player

Digital Inputs: Ethernet

Streaming/connectivity capabilities: Supported streaming services include Qobuz, Tidal, Spotify Connect, CALM radio, and Tune-In. Compatible with UPnP and OpenHome

Digital Outputs: Exakt Link

Clock capabilities/Jitter: An internal, ultra-low jitter clock

Distinctive digital section features: Exakt Ready, Space Optimisation, custom upsampling and digital volume control implemented in an FPGA

Internal storage options: None

External storage options: Network attached storage and cloud storage

Signal-to-Noise ratio: Not specified

Other special features: Chassis is machined from a solid aluminium billet. Klimax DS is hand-built to order

Pricing: £15,800

Manufacturer's URL: https://www.linn.co.uk/hifi-separates/network-music-players/klimax

HIGHLIGHTED STREAMERS & SERVERS

Questyle Audio Engineering QP2R and HB2

The QP2R with HB2 hub brings the two worlds of portable and home listening together. On the go the QP2R is unquestionably one of the finest DAPs available. Combined with the HB2 the QP2R becomes your fully functioning home source and DAC, with remote control and RCA digital/analogue out but also, most importantly, offering sound quality able to rival full size home systems. The QP2R holds 64GB internally but will also accommodate an SD card up to 2TB, providing masses of storage. Operating with DC battery power has advantages over AC mains supply, whilst the patented current mode amplification circuit is well acknowledge for its ability to be at once highly resolving, at the same time as maintaining superb musicality.

Technical Specifications

Type: Portable high-res digital audio player with optional hub.

Digital Inputs: USB

Streaming/connectivity capabilities: USB DAC input or internal playback

Digital Outputs: S/PDIF RCA, Minijack Optical

Clock capabilities/Jitter: Best of class: less than 10psec jitter

Distinctive digital section features: None specified

Internal storage options: 64GB internal memory

External storage options: Micro SD, max 2TB

Signal-to-Noise ratio: 106dB RCA out, 100dB @ 1kHz (Unbalanced phone), 102dB @ 1kHz (Balanced phone)

Other special features: The supplied remote controls all the DAP features for easy control from a distance

Pricing: Individually QP2R £1199, HB2 £599. Purchased together, £1699

Manufacturer's URL: http://www.questyleaudio.com

Herman van den Dungen of Kiseki

***Hi-Fi+*: Given that many see this as a 'golden era' for digital audio design, what draws you instead to create analogue audio source components?**

Herman van den Dungen: I am sorry to say that whatever has happened and has been improved in digital audio design, it doesn't really move me. Already the step from LP to CD was a tough one, but OK at least you still had something in your hands. What a difference (it makes), to be able to put an LP on turntable or a disc in a CD player drawer. CD top loaders still "feel" better.

Analogue audio source components usually comprise four or five key classes of equipment: turntables, tone arms, phono cartridges, phono stages, and—in some instances—reel-to-reel tape decks. Which of these are areas of particular expertise for you and your firm?

A long time ago we experimented with the Hadcock tone arms we were importing. Let's say these needed some "medical care" after arriving from (the manufacturer's) premises. We did that together with Eddie Driessen of Pluto-fame. He went on with The Pluto tone arms and turntables. We ended up being involved in the Kiseki cartridges.

Within your areas of product expertise, what are specific design principles you seek to follow, and why?

We always have focused on building Moving Coil cartridges. While the principle is simple, there is a nice choice of materials available and it is always a surprise which material choice or combination gives what results. Think of different materials for coil bodies, cantilevers, coil wires, magnets, poles, not to forget the bodies. A good thing is also that precision nowadays is an easier thing to get than in the past.

From your point of view, is there anything 'new under the sun' in the world of analogue design or have we reached a stage where we are continually refining existing concepts?

I feel we have reached a stage of refining existing concepts. But the variations are so numerous that we still have enough possibilities in front of us.

If you do see breakthroughs in analogue audio design (and are at liberty to say), what are some that you presently are working on?

"Breakthroughs": what a dangerous expression that is! I hope to be able to develop a range of small precision assembly tools, which will make assembly and production of phono cartridges easier, faster, more consistent, and in the end, less expensive. I want to accomplish the same for analogue electronics. We did that for tubes already and will for solid state too. I feel that the high-end industry is shooting itself in

GUIDE TO AUDIO SOURCE COMPONENTS: MASTER DESIGNER HERMAN VAN DEN DUNGEN HI-FI+

the foot by making beautiful stuff at prices they cannot justify anymore or most people cannot afford anymore. Such a pity.

What qualities should buyers look for when choosing new turntables & tone arms? What about phono cartridges and phono stages? How about reel-to-reel tape decks?
Look if you like what you see. Listen if you like what you hear. Decide if the price fits you. Check the community to see if your conclusion isn't too far away from what experienced users are stating; read what professional reviewers are writing about your choice. Find a reference reviewer who feels and thinks like you.

What do you consider your top one or two analogue audio product achievements thus far? What makes those products special from your point of view?
For phono cartridges, my answer would be the Kiseki Lapis Lazuli cartridge, for the art and pleasure of listening to it. I wish I still had one—with a (working) cantilever, I mean ...

What components do you use in your own reference analogue system?
I have several systems. I am using Krell, Duntech, PrimaLuna, (original) Sonus faber, Kiseki, and a Njoe Tjoeb 4000 cd player.

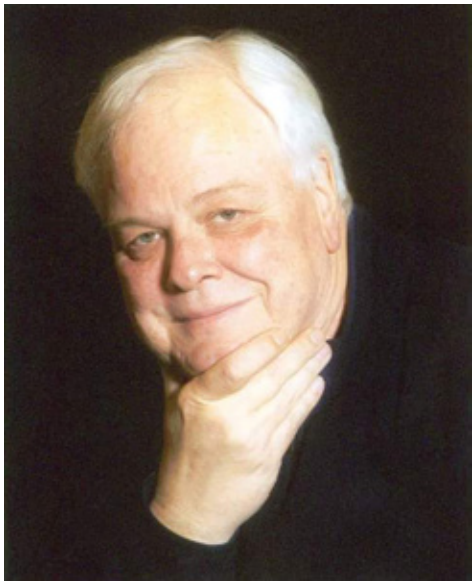
If you could only use four or five analogue discs to do a quick assessment of the performance of an analogue audio rig, which discs would you choose? Or, if you specialise in reel-to-reel tape decks, what four or five tapes would you use for a preliminary assessment of the sound quality of a deck?
First a good quality test LP and then the discs nearest to me at that moment (which definitely is fitting my personal taste, or otherwise it wouldn't be there) and fitting the mood I am in at that moment.

What set-up or installation tips would you give the newcomer… and what guidance would you give to the expert?
None. I would advise the newcomer to follow the instructions coming with the turntable. If no good instructions come with it, it's not a good turntable. Both newcomer and the expert I would advise to read articles in the qualified press as so much experience is there, it can only help everybody learning from it. Also, on YouTube you can find nice instructions from qualified experts. Or get yourself a qualified dealer and ask if you can watch him doing (turntable and tone arm set-up) while explaining what he is doing.

The 'Analogue v. Digital' debate has raged for over 30 years. In your opinion, what special sonic attributes make analogue audio uniquely appealing and worthwhile?
It's original sonics. It has "feelings" you can touch, looks you can see. It's the emotion of the original. +

GUIDE TO AUDIO SOURCE COMPONENTS: MASTER DESIGNER HERMAN VAN DEN DUNGEN HI-FI+

Mike Moffat, Vice President and digital design 'guru' of Schiit Audio



***Hi-Fi+*: How did you become interested in digital audio design?**

Mike Moffat: I designed analogue stuff for years. When digital first came out in the 1980's it sounded so much like ass that I became interested in doing all I could to improve it.

Digital audio source components come in many forms: digital disc players and transports, DACs, combination DAC/amps and DAC/preamps, 'All-in-One' components, servers, streamers, and more. Which of these are particular areas of expertise for you and your firm?

We are primarily a manufacturer of non-source products; we speak DACs and amps—especially multi-bit DACs and progressive technology amps.

Within your areas of product expertise, what are specific design principles you seek to follow, and why?

(In each case we want a product that) measures good, sounds better,(and that sells) at prices those other than professional athletes and movie stars can afford.

Which performance parameters do you think have the greatest overall impact on digital audio sound quality?

Multi-bit, multi-bit, multi-bit, and multi-bit.

What do you consider your top one or two digital audio product achievements thus far? What makes those products special from your point of view?

Bringing quality digital audio down to price points that regular folks can afford.

What do you see as the comparative merits of higher-than-CD resolution PCM, DXD, and DSD digital audio file formats? Which of these formats do your top products support and why? Is there still a place for disc-based digital audio playback?

GUIDE TO AUDIO SOURCE COMPONENTS: MASTER DESIGNER MIKE MOFFAT HI-FI+

We do PCM. Back in the 1990's there was HDCD, then DVD-Audio, (and then) SACD, which by and large are unsupported and dead today. DSD and DXD are already on life support. The only high quality format that has stood the test of time is PCM over the entire 35-year history of consumer digital audio. We will continue to support PCM.

What components do you use in your own reference digital audio system?
(I use) all Schiit stuff for digits and amps, as well as too many headphones and several sets of speakers.

Consumers can potentially deliver digital audio files to their systems in a number of ways. How do you assess the relative benefits of streaming devices, dedicated music servers, or PC-based servers—especially in terms of sound quality?
I like silver discs, but I am old. They have a certain captivating sound about them, although they lack the convenience proper to servers.

If you could only use four or five digital recordings to do a quick assessment of the performance of a digital audio component, which recordings (and formats) would you choose?
The George Solti recording of Wagner's Ring cycle (not digitally remastered); Lucinda Williams' *Car Wheels on a Gravel Road*; Leo Kottke's *Dreams and All That Stuff*; the Rachmaninov 3rd Symphony, Ashkenazy, Concertgebouw; and the Mahler 8th Symphony, Solti, Chicago VSO Chorus.

If you are at liberty to say, what will be the next digital audio products from your company and when will we see them?
We may be dipping into (development of) source components, while work on 'The Gadget' continues.

(Ed. Note: Schiit Audio's 'The Gadget' is a potentially revolutionary device that transposes the musical pitches of digital recording without altering tempo or timing in any way and without degradation of sound quality. For example, 'The Gadget" allows listeners to hear what music would sound like if instruments, instead of using A = 440Hz tuning, instead used A = 430Hz tuning, or other tuning schemes as desired. Thus far, 'The Gadget' has been demonstrated only in prototype/proof-of-concept form.)

The 'Analogue v. Digital' debate has raged for over 30 years. In your opinion, what special sonic attributes make digital audio uniquely appealing and worthwhile?
Digital offers particular benefits in terms of signal-to-noise ratio, bottom end response, dynamic range, and low distortion.+

GUIDE TO AUDIO SOURCE COMPONENTS: MASTER DESIGNER MIKE MOFFAT HI-FI+

SELECT HI-FI+ REVIEWS

ANALOGUE REVIEWS

TURNTABLES
Kronos Sparta/Sparta 0.5
SME Model 15A
TechDAS Air Force II
VPI Prime Signature

TONEARMS
Audio Origami PU7
Kronos Helena
Kuzma 4Point 9-inch
Vertere SG-1

PHONO CARTRIDGES
Clearaudio Goldfinger Statement
DS Audio DS-1
Koetsu Blue Onyx
Rega Aphelion

PHONO STAGES
Audio Research Reference 3
Gold Note PH-10
Pass Labs XP-25 (w/follow up)
Vertere PHONO-1

ANALOGUE ACCESSORIES
Booplinth
Pristine Vinyl Vivac RCS2 record cleaner
Linn Lingo power supply for LP12

DIGITAL REVIEWS

CD-SACD PLAYERS & TRANSPORTS
CH Precision D1
Hegel Mohican
Kalista Dreamplayer
PS Audio DirectStream Memory Player

DACS
dCS Vivaldi
Merging NADAC
Moon by Simaudio Evolution 780D
Nagra HD DAC

DAC/PREAMPS & DAC/AMPS
AURALiC VEGA G2
Chord Electronics DAVE DAC
Hegel Rost
Moon by Simaudio Neo ACE

SERVERS/STREAMERS & WIRELESS BRIDGES
Innuos ZENith SE MkII
Linn Klimax
Naim Uniti Core
Roon Nucleus+

SELECT REVIEWS OF SOME OF OUR EDITORS' FAVORITE SOURCE COMPONENTS

GUIDE TO AUDIO SOURCE COMPONENTS 2018 HI-FI+

Kronos Sparta/Sparta 0.5 turntable

by Alan Sircom

There is something cool about older audio technologies – it's the large spinning parts and the engineering. But there are levels of cool – few compare to an old Studer or Nagra. The original Kronos turntable, with its three-layer construction and counter-rotating platters, is a notable exception. However, it's a costly, limited edition affair: partner it with an arm, cartridge, and phono stage of similar standing, and you'll have a bill somewhere north of £60,000 for the whole vinyl replay chain.

The Kronos Sparta is a more attainable proposition. In fact, it makes the whole counter-rotating platters concept attainable in stages, because you can start with a Sparta 0.5 and then purchase an upgrade kit that includes the additional subchassis, platter, and motor required to turn this into a full-blown Sparta.

As the name suggests, the Sparta is stripped-down. "We were inspired by the legendary city of Sparta in designing this turntable," says designer Louis Desjardins. "Our goal was to embody its values of strength, durability, and unwavering efficiency." Although presumably without going into battle naked. Joking aside, I think the pared-back Sparta looks more business-like and purposeful than its bigger brother, and in some ways I prefer that to the larger, more ornate Kronos.

The Sparta features a solid frame base with four suspension towers and the motor housing, from which hangs the subchassis and platter (or platters) off o-rings: two per tower in the basic model. The Sparta 0.5 sports a single subchassis, with a mounting plate for one tonearm.

If you are upgrading the Sparta, you need to replace the bars inside the towers to accommodate the extra platter and sub-chassis, double the number of o-rings, (from two per side to four) on each of the four tower heads, and then use these to bolt the upper and lower subchassis together. You also need to unbolt a plate on the underside of the base, releasing the power connecting cable for the second motor, and adding length to the main motor, swapping out the stubby chrome motor tower with a taller one on the far side of the deck in the process. This also gives you an understanding of just how well-engineered this deck really is, and the fact you can perform the whole upgrade armed with two Allen keys and a screwdriver (supplied) is a mark of how the project is so well thought through.

In fact, the only aspect that needs a little care is making sure the two decks counter-rotate at the same speed. The flat power supply (designed to be slimline enough to sit under the Sparta's base-frame) has speed control adjustment, but here's the trick for upgraders – get the main platter up accurate first, then strip back and add the second platter and attach a small piece of masking tape marked with a vertical line to both platters. If they cross at the same points in every rotation, the two platters are perfectly aligned. If that crossing point begins to move, adjust the speed control of the second platter.

Our deck came supplied with the new Kronos Helena arm, which we will cover in a brief separate review elsewhere in this Guide. Moving away from Kronos-based products, we used the Helena with a vdH Crimson XGW cartridge moving coil cartridge into the award-winning Pass Labs XP25 two-box phono stage to complete the vinyl playing front end of the system. This ended up being one of those perfectly balanced systems, with the energetic and exuberant way the Crimson cartridge pulls information off the disc being in perfect step with the harmonic structure the Pass Labs bestows to the RIAA equalisation process. In effect, this combination (aided by Dr. vdH's obsessive attention to detail, itemising every parameter of that particular 'Stradivarius' cartridge, and the XP25's ability to attend to those parameters perfectly from its front panel) dials out any upsets in the phono replay chain, and anything getting in the way comes down to the turntable and arm.

GUIDE TO AUDIO SOURCE COMPONENTS 2018: ANALOGUE REVIEWS HI-FI+

This honesty of cartridge and phono stage could be a death sentence for the reputation of some turntables, exposing upper-mid blooms here and ringing top ends there. But not the Sparta 0.5 and especially not the Sparta. The latter took everything thrown at the turntable in its stride. Let's dispense with the well-recorded, neatly manicured LPs that form audiophile listening tests – it does supremely well with these – but let's be honest: Cantate Domino [Proprius] has been used to sell record players for decades because it sounds great on almost anything. Contrast this LP with Main Offender, Keith Richards' solo project from 1992 [Virgin]; a very well recorded album, but one cut to give a very live feel. As a consequence, it's a trade-off between the rim-shots of Steve Jordan's drumming and the almost 'back of the studio' vague sound of the backing vocals. It teeters on a number of edges: too bright and the percussion swamps the recording; too dark and the vocals begin to sound like everyone has a heavy cold (and Richards sounds more 'medicated' than usual); too rhythmically imprecise and it sounds like a rehearsal.

Main Offender is an album that gives no quarter to the audio signal chain. But get it right and the whole thing comes together brilliantly, and it makes you realise that 'Keef' is more than just a caricature of a drug-addled guitarist. He can pen a good tune, and controls a surprisingly tight band using just those five strings (he famously never uses a low E string). You'll never know that with turntables that are simply 'good' or 'great' – it will all sound a bit of a cacophony and a mess. Kronos is beyond that. The Sparta 0.5 untangles the sound-knot of the track 'Bodytalk' well, without sacrificing the music or the information. But the Sparta itself teases out a surprising amount over and above that. It makes it 'real'. There is also a distinct by-product that this album highlights – Sparta allows you more scope to turn the music up. Once again, this comes down to the hidden good recording within; it can easily sound thin and compressed just like most Rolling Stones recordings, which gives Main Offender a very precise volume ceiling – play it too loud and it quickly becomes aggressive it seems. However, this is a mark of how good the Sparta 0.5 is and how the twin-tub Sparta improves on the basic performance of the single platter – you can play an LP loud on the 0.5 and really, really loud on the full-fat Sparta. The recording delivers more headroom through the 0.5, and then still more as you upgrade.

The Sparta isolates the LP from the rest of the world. I know this is seemingly the goal of every turntable maker from the dawn of time, but the Sparta follows the Kronos in actually delivering the goods. The only vibrations here seem to be from the groove itself. The Sparta 0.5 retains a tiny amount of mechanical vibration inherent in most vinyl replay systems, which comes across as almost a smearing of bass notes that you can just about detect on 'The Word Girl' by Scritti Pollitti [Cupid and Psyche '85, Virgin]. But you can only notice this when hearing what the full Sparta is not doing and working back, so used are we to this sound from LP. Even the exceptional The New York Scene from the Marty Paich Big Band [Discovery] shows this – and that is a true audiophile record. Through the standard 0.5, this album has pace and dynamic range aplenty, but there is a touch

of blurring of the horn section when the band is at full tilt. This is what I've come to expect from the record, because you heard that on everything this side of an old Voyd Reference. The full Sparta just sweeps that away, and all that's left is the vinyl.

When I played the Kronos, I felt it was like the best of all decks with none of the downsides. In fairness, that the full counter-rotating system is permanently in place on the big deck meant it's hard to process what is going on and what the Kronos was getting so right. The step from Sparta 0.5 to Sparta explains this perfectly. What you are getting is convergence: the lack of resonance, vibration, or anything from the full Sparta sets this deck apart from the rest, and the result is simply full vinyl disclosure. You might spend two hours or more stripping back the 0.5, adding the extra platter, rebuilding it, getting the two belts in place (perhaps the most fiddly part of the whole process) and getting the speed of the counter-rotating platters in sync… and then know it was money well spent within two bars of music for that reason.

Sometimes there are 'improvements' that are more about spending money than actual performance benefits, and sometimes there

GUIDE TO AUDIO SOURCE COMPONENTS 2018: ANALOGUE REVIEWS HI-FI+

"Regardless, it's extremely light, extremely rigid, and critically damped… the Holy Trinity of tonearm goodness."

are changes to the sound that don't improve the performance in a linear fashion. These are the kind of changes that end with 'hmmm… I'll think about it'. That's not how the two-deck Sparta pans out. You have one platter, you try two, you buy two. It's that simple. If I were demonstrating this, I'd be happy to spend time installing that second platter on site, because I'd always go home with an empty van and a full wallet. But it's not that the Sparta 0.5 is half a deck, or an obviously compromised stepping-stone to the full two-platter experience. Anyone could happily live with the Sparta 0.5 for years: right up until the moment you try the second platter; then there is no going back. Very highly recommended. +

Technical Specifications

Sparta 0.5, Sparta

Rotational speed: 33.3 rpm & 45 rpm.
Tonearm length: 9" to 10.5"
Power supply: dual channel pure Class A linear DC
Motors: 2432 precious brushes DC motors (qty 1 in Sparta 0.5, 2 in Sparta)
Motor mounts: Delrin capped aluminium tubes
Platters type: Composite compressed phenolic/aluminium, balanced.
Platter weight: 12kg
Drive: 1 silicone/viton 2.3 string belt per platter
Service interval: 5 years (clean and re-oil)
Main bearings: dual hydraulic isolated inverted sleeve and ball.
Lubricant: 8 ml. variable viscosity synthetic oil
Service interval: 5 years (clean and re-oil)
Suspension: full floating top suspended
Elastomers: 317 o-rings, viton/silicone proprietary mix
Dimensions (W×D×H): 51 × 36 × 28cm
Weight: 32 kg
Price: £14,000 Sparta 0.5, £20,000 Sparta (upgrade £7,000)

Manufactured by: Kronos Audio Technology
URL: www.kronosaudio.com

Distributed by: Decent Audio
URL: www.decentaudio.co.uk
Tel: +44(0)5602 054669

SME Model 15A turntable

by Jason Kennedy

Not a lot seems to change at SME's HQ in the picturesque town of Steyning, West Sussex. Men in white coats have been building high quality turntables and arms there for so long that several generations of local engineers have toiled at the machinery. So the sale of the company to the Cadence Group last autumn must have sent shockwaves through a company that has been in private ownership since the 1950s. But things are looking a lot more positive now; the new owners have brought in aerospace engineer Stuart McNeilis as CEO and he has already refurbished the paint shop and plans to increase the workforce in anticipation of burgeoning future demand. In the past, SME gave the impression of patiently waiting for the business to come to it – it had, after all, established a reputation for making the finest quality arms and turntables in the business. But there's no doubt that appointing a UK distributor and encouraging international partners will likely increase sales for the company. It is encouraging to note that McNeilis intends to bring in design as well as engineering skills, so that SME can continue to expand and refine its range. With the death of founder Alistair Robertson-Aikman (ARA) in 2006 the company was left without a real turntable enthusiast at the helm, so some input on the R&D front will presumably be welcomed

The last product to be developed prior to this change of ownership was the Model 15 turntable, which was the first totally new turntable from the brand since the Model 10 in 1999. The earlier Model 20 and 30 have been refined to their third and second generations respectively as well as growing in girth with what ARA called the "long wheelbase" treatment (that is provision for a 12inch arm) in that time, but new models are pretty rare.

The Model 15 was initially intended to be a more grown up version of the Model 10, but ended up rather closer to the rather more substantial Model 20. It takes its high-mass platter from the 20/2 (which is smaller than that on the current 20/3) and has suspension towers that are very close to those on the 20/3 but 8mm shorter. Each tower supports the plinth and platter on 10 rubber 'O' rings, a weight of 11 kilos being suspended on 30 rings altogether. The towers are adjustable in height and set-up involves using the supplied spacer to set the correct gap between the subchassis and plinth. The spacer alone says a lot about SME: all it needs to be is the right thickness, it could be made of plastic, but not only is it precision made in aluminium and engraved with a part number, but this small block is finished to the same standard as the turntable and arm. Which makes it less surprising when you learn that SME makes its own nuts and bolts.

The Model 15 actually feels bulkier than its 11kg weight suggests. It's a lot easier to move with the platter removed, for example. Despite being made of aluminium, the two slabs that form the bulk of the turntable are very thick, the lower one being the heaviest. Each suspension tower has a damped piston within it and the main bearing under the platter is likewise controlled in order to keep resonance at bay. It's a suspended design but not a springy one like a Linn LP12, rather it's a high mass system of a kind that is unusual even in the widely varying world of turntable design. Set up is a case of removing two bolts from the sub platter and winding another four up into the sub platter, SME clearly doesn't want this part moving in transit. Fit the belt and carefully place the platter over the spindle, its top surface is softer than it looks and easy to mark.

Next you need to adjust the suspension posts so that the aforementioned spacer fits easily beneath each. This can be done with the supplied hex driver that is also made by SME. Now the platter is ready to spin, but first connect the power supply's DIN plug to the lower plinth, a job that's considerably easier on the 15 than the 20. The option exists to connect an earthing wire to a gold plated ground post under the top plinth, but this is only necessary if there are hum problems. Once the platter has been spinning for a while you can check the speed with the supplied strobe disc and an appropriate 50 or 60Hz light source, if it needs adjusting this is done with the buttons on the power supply. The latter is a reasonably slim box with a power inlet and fixed supply cable of

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"It's hard to say which is more accurate, but I know which one was the more enjoyable."

adequate length to place it several feet away from the turntable.

Once the turntable is levelled and spinning at the correct RPM, you can fit a tonearm. The suffix on the name Model 15A indicates that it's supplied with a Model 309 SPD arm. This is the least expensive of the tonearms that are based on the mighty Model V that re-established the brand in the early 1980s. The 309 has a removable headshell and dynamic rather than spring downforce, but is otherwise very similar to the V. It doesn't have the nicety of threaded VTA adjustment but retains the sliding base with rack and pinion control, which is easily the most straightforward stylus alignment system in the business. Downforce adjustment requires the supplied hex driver again, it screws the counterweight back and forth and locks it in place.

All that's then required is to fix the cartridge in the headshell, set downforce, and use the supplied protractor to move the whole arm until it sits within the provided guidelines when the stylus is on the appropriate point. With the 309 there is an extra stage; the removable headshell means that azimuth also needs to be set; the angle of the cartridge seen from the front. As the 24 page instruction manual points out this is best done with a mirror. Finally VTA can be set with the same gauge that does alignment and the markings on the side of the arm. It really is a doddle by turntable standards, and if you are buying the thing the dealer does it for you of course. Still it's nice to tweak should you feel the urge.

One tweak that is easy to experiment with is the supplied record clamp, another beautifully machined and finished piece of aluminium that has a coarse thread so that it can be put on and taken of with ease. It comes with a large washer that goes under the vinyl, raising the centre so that the clamp can bend the record very slightly into a convex shape and thus flatten out warps. It also provides greater damping of the disc, which has the effect of reinforcing the bass and dropping noise slightly, resulting in greater perceived dynamic range. I have to admit a preference for unclamped listening, however; without it the sound has more harmonic structure and better timing, a combination that increases musical engagement. It's hard to say which is more accurate, but I know which one was the more enjoyable.

The sound that the Model 15A produces when equipped with a Transfiguration Proteus moving coil is extraordinarily calm and clean – the notes literally come out of an inky black background like magic. I put on Bugge Wesseltoft's *Trialogue* [Jazzland] and was struck by the way that the percussion notes in particular had a solidity and presence in the context of such a quiet background. SMEs have always been good at reproducing notes with a sense of body, regardless of whether they are highs, lows or mids, and the 15 has the same ability. It's not something that many digital systems can do in the treble and a lot of turntables get a bit thin or rolled off at that end of the band as well. The bass is really powerful too, even without the clamp, it's not perhaps the fastest when it comes to stopping and starting, but if you want to feel an organ or synth note you won't be disappointed.

The low noise floor also provides plenty of dynamic contrast between notes, instruments and voices, which makes it easy to hear what individual musicians are contributing to the performance. This is undoubtedly related to the powerful sense of three-dimensional solidity in the imaging. There is always space around acoustic sources because the turntable opens up such a deep soundstage for them to unfold in. Surface noise can be more intrusive than average but it's nothing that a more fastidious attitude to vinyl cleaning wouldn't sort out. Meanwhile there's the distraction of tone, specifically the trumpet on Patricia Barber's 'Constantinople' [*Modern Cool*, Premonition], which really shines over her clattering use of the piano strings as percussion and the low bowing of the double bass.

This combination of turntable and arm only stumbled once with my repertoire of test discs. Ongoing favourite, Astral Weeks by Van Morrison [Warner Bros], has the track 'The Way Young Lovers Do' at the start of the second side and it's not an easy one to get right. There's such a jumble of voice and instruments, and the recording is not the greatest, so it takes a very good sense of timing to play the track in a coherent

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"The Model 15 has very little character of its own, which means that it can reveal an awful lot about the records it spins."

fashion. The SME fares relatively well in decoding this difficult track, but I have heard it more temporally ordered elsewhere. More well-recorded pieces flow beautifully however, and this is a turntable that has no additive distortion to speak of; its sins are only of omission and those are not only hard to spot but don't get in the way of the musical experience.

I have long been a fan of the SME 20/3 and, as it was to hand, I put the two up against one another to see how they differed. The four footed and pricier turntable with the mighty Model V arm delivers a more solid, assured, and three dimensional sound than its sibling. It produces more depth of image and greater resolution of reverb and harmonics, too. Essentially the character is the same, but you get more of the detail off the disc.

I also tried a different cartridge in the Model 309, this time Rega's Aphelion MC that I usually use in a Rega RP10. This brought some real daylight and rhythmic bounce into the picture, making the Trialogue album more atmospheric and mesmerizing at the same time; the soundstage remained deep and the bass very powerful, perhaps a little bit too much so. I reduced downforce to the bottom of the cartridge's recommended range, which helped the lows and didn't undermine the endless vista produced by the second track on the album, Dan Berglund's 'Valiant', a slower deeper piece that proved remarkably compelling. This assembly of turntable, arm and cartridge seemed to shine with the slower tempo tracks, digging out all the tonal richness of the Marty Paich Big Band's rendition of 'I've Grown Accustomed to Her Face' [The New York Scene, Discovery]. In truth this tune was absolutely delightful, showing that Art Pepper, Victor Feldman, and Jimmy Guiffre at the height of their powers could play show tunes in sublime fashion.

Technical Specifications

SME Model 15A turntable

Type: Full-size, suspended subchassis, 3-phase motor-drive turntable
Rotational Speeds: 33 ⅓ RPM, 45 RPM, 78 RPM
Supported Tonearm Length(s): 9-inch to 10-inch arms supported
Drive Mechanism: Belt driven via 3-phase, brushless outrunner inductance motor
Speed Control: Closed loop speed control with proportional plus (PI) algorithm.
Platter Type: Machined from aluminium alloy with diamond-turned Isodamp surface
Platter Weight: 4.6kg
Bearing Type: 19mm (3/4") machined from high chrome tool steel, ground super finished and supported in a sealed housing
Plinth Configuration: Suspended subchassis with fluid damper and resistive ground path for acoustic signals
Dimensions (H×W×D): 176 × 428 × 378mm
Weight: 18.5kg

SME 309 tonearm

Type: One piece magnesium tone arm with detachable headshell
Tonearm Length: 232.32mm
Effective Tonearm Mass: 9.5g
Offset Angle: 23.204 degrees
Signal Cable Length: 1.2m Van den Hul cable with SME RCA connectors
Weight: 717g
Price: £8,052 inc Model 309 SPD

Manufacturer: SME Ltd
Tel: +44(0) 1903 814321
URL: www.sme-audio.com

UK Distributor: Padood
Tel: +44 (0) 1223 653028
URL: www.padood.com

There is no doubt that the Model 15 is very much an SME turntable. The Model 15 has very little character of its own, which means that it can reveal an awful lot about the records it spins. Build quality is in another league to the vast majority of turntables because so few manufacturers have the engineering facilities that a company which provides precision engineering to the aerospace and medical industries can offer. It may not have as many feet as the bigger models, but that does little to undermine its capabilities when it comes to resolving all the fine details locked away in a vinyl groove. If SME can continue to expand its range with turntables and arms of this calibre, its future looks as stable as the sound those record players produce. +

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TechDAS Air Force Two turntable

By Alan Sircom

Of all the high-end superdecks, few generated quite as much interest as TechDAS' Air Force One. Everything on a turntable that could be pumped up or held down by air or vacuum, was… and was made to a standard that most other turntable makers could only dream of. With the Continuum project now history, the 'One has become the turntable among 'Vinylista Extrema'. However, the price of the 'One is a big ask for many enthusiasts, and the Air Force Two goes some way to address this (a still cheaper Air Force Three was shown at the Munich High-End 2015). This new turntable is a far smaller, transcription style design, with provision for three different arms. Weird and wonderful!

TechDAS took all the elements of the Air Force One and worked out what could be simplified. This isn't an easy task: simplifying an air bearing or a vacuum hold-down system without fundamentally wrecking the advantages of such components in the process is extremely difficult, especially as Nishikawa-san (TechDAS designer and CEO) is convinced – rightly, in my opinion – that compression is pivotal in the design of any air-bearing system. This means the default, lower-cost way of making an air-bearing (a fishtank pump) is out of the running, and any TechDAS design has to rely on a custom-made solenoid-valve system with extremely small air holes, and an air condenser to cancel out ripple. And, like it's bigger brother, the Air Force Two is required to be capable of being used with more than one tonearm, although in standard guise, for most people one arm is probably more than enough. While there is no 'easy way' put simply, the easy way to cut costs is not the right way to make a cheaper Air Force One.

Given that important set of limiting criteria imposed on the Air Force Two design before one fires up the CAD program, just how can you reduce prices? Well, first you remove the option of three different platter surface materials, replacing the 29kg stainless steel platter with a 10kg, solid cast aluminium design in the process. And you replace the air suspension system with oil-damped adjustable towers in each corner of the turntable plinth. And that's about it. OK, so this means a redesigned, slightly smaller, lighter plinth, but the free-standing asynchronous, DC-controlled AC motor block, the air bearing and vacuum disc hold down, the adjustable speed control, and the separate (yet silent) air pump/condenser/power supply box are essentially the same. There is also a commonality of design, although the Air Force Two is more squared off. Although not by much; in fact, the shape of the Air Force Two is not regular, and it's reasonably large, too.

That 'commonality of design' is well worth exploring. Although by its very nature, the Air Force Two is a handbuilt design, absolutely nothing about it gives the game away. This is not in anyway intended as a backhanded compliment, but the TechDAS designs have that air of reliable professionalism that you might find in a military component instead of a domestic turntable. Don't misunderstand this; such equipment is designed to be heavy duty, easy to operate device, capable of doing something complicated millions of times with almost no complaint. The Air Force Two has the same confidence about it. It's push-button control, and those push-buttons light up when activated. Speed control is shown on a blue LED panel on the control block in front of the deck, and speed adjustment (both 33/45rpm speed change, and fine-tuning of speed) are given equal emphasis. This air of complete reliability also comes from the cast upper and lower

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chassis, the big and powerful build, and the grey on grey finish that makes it look like it should be archiving vinyl in the Library of Congress or the British Library.

The Air Force Two's standard armboard position limits the options to a 9" or 10" arm, but the outrigger rear arm position can also take a 12" arm. Nishikawa-san is the distributor of Graham arms in Japan, which is why so many users end up recommending the Phantom as a natural partner to TechDAS designs, but in reality almost any arm can show what it is capable of sitting on the Air Force Two's subchassis. Construction and build are not simple, but this has more to do with physically moving the substantial parts around, rather than any strange installer voodoo. Given that I suspect most Air Force Two owners will either be 'tear up the manual' types who view the set-up procedure as something to be relished, or wealthy types who would happily pay someone else to do the installation job for them, I suspect going into detail about building a TechDAS in the home is little more than self-flagellation. Just remember that, when it comes to turntable set-up and Aesop's fables, "slow and steady wins the race", so take your time!

Once set-up, the Air Force Two becomes the ultimate analogue musical reproduction machine,, and it stays that way. It's rock solid, both figuratively and metaphorically: the performance it makes is powerful, deep, and completely controlled, and the reassuring build and absolute stability means it will stay that way for years to come. This is not some high-end extravaganza that you need a road map to navigate to its off-switch – instead, the Air Force Two has all the operational nicities of something like classic Technics direct drive turntable, writ large.

The truth is, I burned through a lot of LPs in very short order listening to the TechDAS Air Force Two, because playing music through this deck is such a pleasure. It manages to combine the authority, weight, and solidity required of a high-end deck with a lot of the easy and unforced sense of timing found in more down-from-the-stratosphere models. The Air Force Two breathed life into an old favourite of mine; a Decca SKL of Gilbert & Sullivan's overture to *The Pirates of Penzance* from the late 1950s. It was one of those 'you are there' moments, where more than half a century vanished and you were listening at the New Savoy Theatre in London. This was a remarkable play of a remarkable recording; the recording completely pitch-stable (a by-product of living in the digital age is turntables that are not pitch-perfect soon get outed), vibrant, and jumping out of a near silent background, despite the intervening years.

So it went on, through Joe Jackson [*Night and Day*, MoFi], Zakir Hussain [*Making Music*, ECM], even to Martha and the Vandellas Dance Party [Gordy, reissue]. This last was telling, because it sounded at once fabulous and awful. Fabulous because it delved deep into the recording, and awful because the deeper you went, the more you realised there wasn't much to salvage beyond the stock Motown sound. That the Air Force Two didn't try to make a silk purse out of a sow's ear in the slightest was a significant bonus for the turntable design.

Technical Specifications

Type: Belt-driven turntable with air-bearing and vacuum hold-down
Drive system: Belt drive with surface polished lyurethane flat belt
Chassis: Precision aluminum castings, weight 32.6 kg
Platter: Solid aluminum (A5056), weight 10 kg
Motor: AC synchronous motor. Speed controlled by DC amplifier
Speed: 33.3rpm /45rpm, Precise speed adjustment function
Wow & Flutter: below 0.03% (W.R.M.S)
TT dimensions (W×D): 685 × 460mm
Total weight: 47kg

Air Pump and Supply Unit
Power consumption: 50W
Dimensions (W×D×H): 43×16×24cm
Weight: 10kg

Accessories supplied with Air Force Two:
Tonearm base wood × 1 (drilled for specified tonearm)
Platter cover "The Platter Top"
× 1 AC power cable × 1 (180cm length)

Optional items & Accessories
Special Damping Table
Second Tonearm Base
Tonearm base wood for supplement (for 1st and/or 2nd tonearms)

Price: £28,898

Manufactured by: TechDAS
URL: www.techdas.jp

Distributed by: Absolute Sounds
URL: www.absolutesounds,com
Tel: +44(0)208 971 3909

Most of all, though, the Air Force Two shines thanks to the absolute authority it imposes on the music, and yet it's not so authoritarian as to refuse to allow the music to let its hair down a little. Even complex polyrhythms, such as found in the intrinsically funky West Cost big band meets ska in 'Footprints' from the Jazz Jamaica All Stars *Massive Vol.1* [Gearbox], are not an issue here. The Air Force Two's absolute (yet not clinical) precision snaps the album into sharp focus, letting those Zappa-esque vibrophone runs play on beautifully.

The TechDAS Air Force Two is one of those turntables that takes 'Awesome' in its stride. It always sounds awesome, even when it's resolving something straightforward like Tom Waits voice. But when faced with an orchestra, complex music, or the kind of rhythmic drive that's supposed to be the domain of lighter-weight turntables, the Air Force Two just gets out of the way and lets the music shine through. Just shy of £30,000 is a lot to pay for a turntable, but you do get a lot of highly recommended turntable, too! +

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VPI Prime Signature turntable and arm

by Alan Sircom

When it was launched back at the end of 2016, the VPI Prime changed the game, proving to be one of the best turntables we'd heard at anything close to the price. So impressive, in fact, that I bought the review sample within seconds of first hearing it. The Prime Signature – first seen in 2016 – is what happens when you take that Prime design and extend it to its present logical limits.

In fact, the success of the Prime allowed VPI to radically shake up its entire line, looking closely at some of its past glories with a more measured eye, and making some tough decisions in the process. As a result, the Prime Signature is top of VPI's fourstrong 'Production Turntables' range (with the aforementioned Prime, the re-introduced Scout, and the all-in-one Player filling in the rest of the line). There is also a 'Reference Turntables' line, based around the three-footed Avenger design, and sometime soon there look set to be a 'Bespoke Collection' line featuring made-to-order versions of models like the VPI Classic. Regardless, the Prime design is core to the Production Turntables line.

So core, in fact, it's hard to describe the Prime Signature without reflecting it in the Prime itself. To recap, the original Prime features a vinyl wrapped MDF chassis, bonded with an 11 gauge steel plate, and featuring four Delrin corner posts for isolation and mechanical grounding. The deck features a 500 RPM (300 RPM in the US), 24 pole, AC synchronous motor, housed in a separate aluminium and steel machined assembly. It sports an inverted bearing with a hardened stainless steel shaft and a 60 Rockwell chrome hardened ball, spinning in a phosphor bronze bushing, all of which sits on a PEEK thrust disc, and the belt side load is placed at the centre of the spinning bearing for zero 'seesaw' or 'teeter-totter' effects. The Prime also features a 9kg aluminium platter, and the arm is a 10" variant on the company's ever-popular JMW unipivot tonearm complete with the useful VTA base that allows vertical tracking angle to be adjusted on the fly. Renaissance offers both a phono and XLR breakout box for the arm at purchase (the XLR box is a £175 option otherwise). The Prime was the first turntable to offer a completely 3D printed arm-wand (wired with Discovery wire), pivot housing, and counterweight outrigger. Finally, the original Prime sits on four custom-made isolation spiked feet and includes a clamp.

The Prime Signature improves on the original in several obvious ways. Perhaps most immediately obvious is an aluminium plate, in place of the steel plate in the Prime. This makes the chassis thicker and heavier than the Prime, and the aluminium plate is visible as the silvery 'meat' in the black, vinyl-wrapped chassis sandwich (the steel plate on the Prime is hidden from view). This performs the same resonance and feedback control as the steel chassis plate on the Prime, but also improves chassis damping.

The Signature sits on its own four feet, which are a step up on the standard issue feet on the Prime. In fact, eagle eyed VPI followers might spot that these are the same feet found on the Classic Signature; solid, conical, adjustable feet with metal rings at their base. Their tower covers atop the chassis are also chrome plated to match (these are flat black in the Prime). These feet are required because of the additional weight of the Prime Signature chassis.

The additional thickness of the Prime Signature platter and the taller Signature feet mean the motor housing needs to be taller and its aluminium and steel housing is therefore heavier and also better at controlling vibration, resonance, and feedback relative to what is basically the same AC motor in the Prime. Finally, while the platter remains the same as the Prime, the Signature features the heavier stainless steel record weight (which is an option for the Prime… more on this later). The result of all this additional size and mass means the Prime now ships in two boxes instead of one (the second for the platter).

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Perhaps slightly less immediately obvious are the changes to the tonearm between the Prime and Prime Signature. This new model uses the 3DR version, in place of the 3D model on the Prime. Aside from the new 'metallic black' gloss finish (which looks great in the flesh), the 3DS is internally wired with Nordost Reference wire, through to the terminal block. Finally, alongside the motor housing, the Delrin posts and armboard have all received a higher grade of stainless steel. Having done my time in a precision small turned parts factory, I'm guessing by looking at the two armbases side-by-side this has meant a move from Type 304 to Type 316 or even Type 440. What that means to non-steelheads is a move from standard stainless steel (which is slightly dull, but has good tensile strength but less good hardness) to the kind of steel used in watch cases, surgical implements, or cutlery, which combines a brighter look with very good tensile strength and very good to excellent hardness. OK, so I just hugged my inner nerd, here, but it was important in padding out the story!

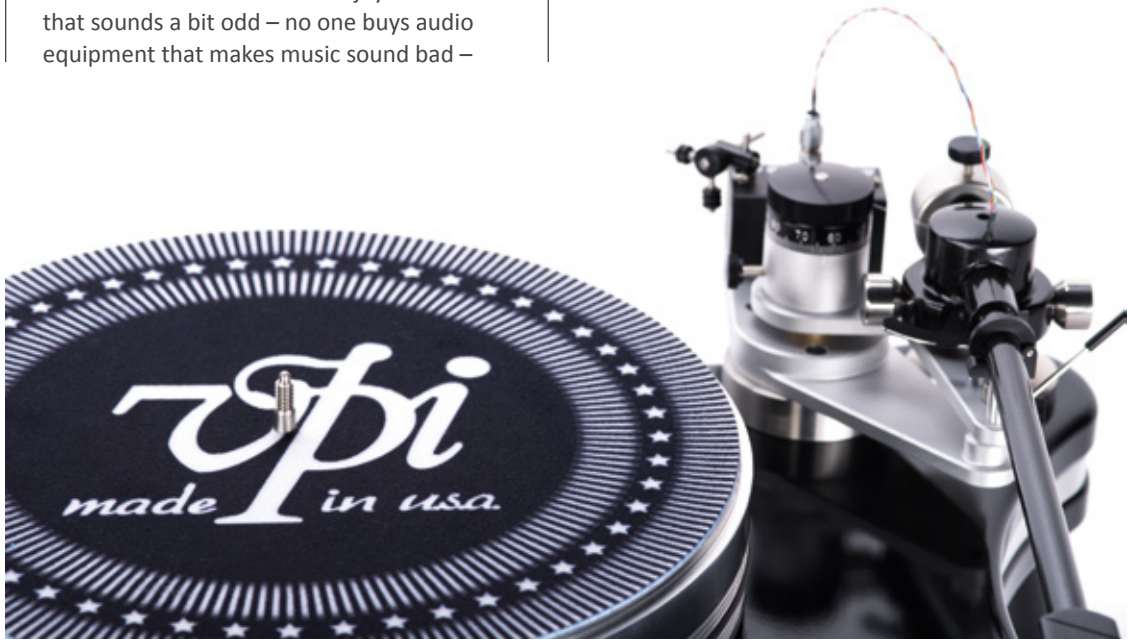
There are almost two reviews here; the Prime Signature in its own right, and the Prime Signature viewed through the medium of the original Prime. Both are equally valid ways of thinking about the Prime Signature.

Starting with those approaching the Prime Signature from new, what you are met with is an extraordinarily confident presentation. The Prime Signature always has its feet on the ground, and presents a sound that is solid and stentorian in its depth and range, but also possessed of a sense of musical structure and remarkable midrange openness and, although it sounds almost paradoxical following the use of words like 'solid', filigree beauty at the top. It's hard to think of this in musical terms, and wind up thinking of its performance more like Gaudi's still unfinished La Sagrada Família cathedral in Barcalona. If you've seen (or seen pictures of) this stunning architectural work, you'll know it rises up from a solid base to produces endlessly fascinating and diminishing towers diminishing to points. Structures dance around other structures; it's bewildering, complex, and one of the most organic looking structures man has ever made. And the VPI Prime Signature has something of the same properties to the way it makes music. Sounds rise organically out of a solid, near noiseless foundation. It's closer to listening to just the record than most turntable replay systems at anywhere near the price. In fact, the one that gets closest to the Prime Signature here, is the Prime itself.

Audio reviewers use LPs a bit like test discs. We play the same recordings over and over again, because they contain useful passages that show us what a product is doing. For example, I use an old Decca SXL of the D'Oyly Carte and the LSO playing *The Pirates of Penzance* because few recordings I've heard since give a better sense of stereo image placement and stage width, depth, and height. The problem with all that is we end up listening to those pieces so comprehensively that they become almost musically bankrupt. The Prime Signature is like the musical reset button, which makes these recordings come back to life, for the reasons you used them in the first place.

Yes, the Prime Signature does all the hi-fi things, and does them exceptionally well, in fact. There is a sublime sense of midrange honesty that comes through on small-scale, predominantly acoustic recordings like Beck's Sea Change [MoFi], but there's also a wealth of dynamic range that comes across when listening to 'It's All Right With Me' from the Marty Paich Big Band album *The New York Scene* [Discovery], and there's endless detail on offer from any of the excellent Chasing The Dragon direct-to-disc cuts. The soundstage too is excellent, with great depth and even height on offer in the aforementioned Decca disc.

More than all this, however, is that the Prime Signature retains that elusive property that VPI got so right on the Prime, and the Classic before that: It makes music enjoyable. I know that sounds a bit odd – no one buys audio equipment that makes music sound bad – but there are a lot of systems that make a big, elegant, and sophisticated sound that no-one in the world could actually sit down and enjoy, where as the Prime Signature makes a big, elegant, and sophisticated sound that makes you want to pull out those old Led Zeppelin albums and play them at a decent lick. Yes, if your record collection comprises two copies of *Cantate Domino* and one of Jazz at *The Pawnshop*, the Prime Signature's sonic credentials will please you every bit as much as other great decks, but if you view such audiophile confectionary as meaningless fluff, this will make those Fall records sound fun when you need a bit of sonic abuse. This comes because the Prime Signature is both fundamentally pitch stable, and because it has a truly outstanding sense of rhythm and timing.



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"The Prime Signature retains that elusive property that VPI got so right on the Prime, and the Classic before that: it makes music enjoyable."

Like the standard 3D arm, the 3DR works well with almost any cartridge, but is particularly good with Benz, Dynavector, Lyra, Ortofon, and Soundsmith designs. That covers most of the bases today, but a surprising number of VPI decks end up sporting one of those brands of cartridge, and do so for a reason… they sound great together. The best part of this, however, is the 3DR retails the 3D's ability to wring the best out of lower-end cartridges but not hold back more up-market designs. And also as with the 3D arm, it has an almost seamless frequency response, with the unipivot's natural tendency for mild roll-off at the extremes ably countered by the turntable design, the Prime Signature and its attendant 3DR arm strike such a perfect balance it makes you wonder why you need to move beyond this level.

Moving to the second part of the test, the best way of viewing the Prime Signature as a Prime owner is thinking of this like the dating game. Imagine you are dating a witty, intelligent, and beautiful girl who could easily be a model. You are invited home to meet the family, only to discover that her sister is brighter, wittier, and models clothes for Victoria's Secret. There is absolutely nothing wrong with the Prime – it remains one of the best turntables you can buy at anything close to the price – but once you try out the Signature, you are in sexier sister territory. You aren't settling for second best with the Prime, but the Prime Signature just gives you that little bit more, all round.

Finally, there is chance for a little spot of parts raiding between Prime and Prime Signature. Interestingly, the only available option – the better record clamp – is the only one that works. I'm not entirely convinced that it's a move for the better, as it can sound slightly dynamically slugged, and I suspect this is a stepping-stone for the full spindle/periphery clamp duo. However, trying the standard clamp on the Prime Signature is a lot worse, as it seems to give the sound a bit of a unnecessary 'bounce' in the upper midrange. I expect if you go full clamp, the Prime gets closer to the Signature, but the Signature still has the edge.

The VPI Prime Signature has big shoes to fill because the Prime itself is so damn good. It fills those shoes easily, however, because it is so damn better. Not a transformation, but it does all the things the Prime does, and does them better. It's more dynamic, more expressive, more rhythmically integrated and driven, and a lot more detailed. It's sufficiently better enough for this Prime owner to think about signing up, even though the Prime does all the right things already. Looks like VPI has another winner on its hands, and the Prime Signature comes very highly recommended indeed! +

Technical Specifications

Type: Belt-driven, non-suspended turntable, with 3D printed unipivot tonearm

Turntable

Chassis: Black textured vinyl over MDF, with a sandwiched aluminium plate
Isolation: Four adjustable stainless steel corner assemblies
Motor: 500rpm, 24-pole AC motor in a separate aluminium and steel housing
Bearing: Inverted design, hardened stainless steel shaft, 60 Rockwell chrome hardened ball, phosphor bronze bushing, PEEK thrust disc
Platter: machined 6061 grade aluminium, 9kg
Wow & Flutter: > 0.03%
Speed accuracy: > 0.04%
Rumble: > -82dB

Tonearm

Pivot to spindle distance: 258mm
Effective length: 273.4mm
Overhang: 15.4mm
Offset angle: 19.98°
Average RMS distortion: 0.311%
Internal wiring: Discovery wire, optional Nordost Valhalla
Dimensions (W×D×H): 53.5 × 40 × 12cm
Weight: 36.75kg
Price: £6,000

Manufactured by: VPI Industries Inc
URL: vpiindustries.com
Distributed by: Renaissance Audio
URL: www.renaissanceaudio.co.uk
Tel: +44 (0)131 555 3922

"You aren't settling for second best with the Prime, but the Prime Signature just gives you that little bit more, all round."

GUIDE TO AUDIO SOURCE COMPONENTS 2018: ANALOGUE REVIEWS HI-FI+

Audio Origami PU7 and Uniarm

by Steve Dickinson

The call was from the inestimable Johnnie Nilsen at Audio Origami in Glasgow, who wanted to tell me about his new tonearm, the Uniarm which, you won't be surprised to learn, is a unipivot design. Johnnie is rightly proud of the reputation his established gimballed tonearm design, the PU7, has gained for itself. The Uniarm is his claim to a state of the art unipivot tonearm.

Not long after the call, two parcels arrived in fairly quick succession. The first contained an immaculate black Audio Origami PU7 tonearm, a distant descendant of the much-praised Syrinx PU3. The second, a lustrous silver Audio Origami Uniarm, an entirely new design that unipivot intended, Johnnie told me, to fill the gap left by the Naim Aro. Arriving first, the PU7 got to bear the brunt of my thumb-fingered ineptitude, but aided immeasurably by Johnnie's excellent online video setup guide, the Avid Diva II, Ortofon 2M Blue, and PU7 were soon intimately acquainted and made beautiful music together. Johnnie also kindly sent me a Dynavector DV10X5 high-output moving coil cartridge, the better to do his arms justice. After a little acclimatisation using the Ortofon, the remainder of the listening done for this review took place with the Dynavector installed on each arm in turn.

The contribution a tonearm makes to turntable performance is one of those things people have opinions about. The Avid Diva II is a very good, if mechanically uncomplicated, turntable which achieves its performance through a first-rate bearing and careful engineering; when equipped with the ProJect Carbon tonearm, it puts in the sort of entertaining performance entirely consistent with its price – and one that is rather better than many of its peers. Replacing the tonearm with one costing four times as much, and more than the price of the turntable itself, probably doesn't make all that much sense on paper, but the PU7 raises the performance of the Avid to a degree which was entirely unexpected. This, perhaps, reflects the fact that both companies take considerable care to get the fundamental engineering properly sorted.

Those familiar with the Syrinx will certainly recognise its DNA in the PU7, albeit I suspect they'd be hard-pressed to find any of the PU3's flaws and foibles in the AO design. The PU7 might reasonably be thought of as a PU3, reimagined and reengineered to do things more consistently and reliably. That does, however, risk doing Audio Origami a disservice; the PU7 is far more than merely a reworked PU3, Johnnie has put a great deal of careful thought into this arm's design and execution, reflected in the impeccable fit and finish, and the painstaking, perhaps even obsessive, attention to detail and quality. Some tonearms impress, or intimidate, visually through their sheer complexity. Not so with the PU7. It is undoubtedly a thing of great beauty, the elegant simplicity of line combining to produce a tonearm which easily justifies its cost in appearance alone. When you factor in the three weeks it takes Johnnie to complete an arm, the £2000 asking price starts to look like a bargain. When you hear it, any remaining doubts quickly evaporate.

Borodin's *Polovtsian Dances* [RCA Red Seal, RL25098] is one of those regulars I pull out for occasions like this. With the PU7, the performance was quick, dynamic and confident. The arm gave a sense of calmness and security which left the ProJect arm sounding somewhat coarse and crude in comparison. In its own terms, the ProJect arm is fun, engaging and lively, but the PU7 concedes nothing in terms of pace, energy, and dynamics – it also brings a sense of scale and authority, which makes for a much more mature performance. Bass was solid and weighty with the instruments having an excellent sense of mass, but this wasn't at the expense of detail; the PU7

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"The PU7 felt more like a new friend, keen to explore the outer reaches of my music collection."

is extremely insightful, illuminating inner detail and nuance with a nicely judged sense of balance. Despite its title, I tend to think of the Polovtsian Dances as an orchestral suite rather than a series of dances, but the PU7 brought a rhythmic integrity to the performance which rendered many parts considerably more dance-like.

Sometimes, even the most expensive and highly-engineered tonearms achieve degrees of solidity, security and consistency at the cost of a bluff bluntness which renders the performance a tad stolid, or a slight greying at the expense of tonal colour. Like a slightly imperious butler, such tonearms seem to radiate disapproval of your musical choice and render it up grudgingly. The PU7, in contrast, felt more like a new friend, keen to explore the outer reaches of my music collection. Thus encouraged, I put on Jeff Wayne's *War of the Worlds* [CBS, 96000], another, er, warhorse which keeps getting trotted out partly because I find recorded speech so revealing. Richard Burton's voice was rich and sonorous, with the arm providing a very good rendition of its distinctive timbre, the orchestral introduction had very good scale and pace, and excellent textures, tunefulness and inner detail. Despite the weight and mass, rhythmically, there was plenty of movement and forward motion, with a real sense of the percussion setting to work.

And so it went on, the PU7 adding a sense of purposeful control and authority, without any suggestion that the control was achieved by constraint. If it eschews a 'look at me' aesthetic, it also spurns any 'listen to me' approach to music making; its contribution to the performance is discreet, yet fundamental, detail and expressiveness is abundant, without being thrown in your face, and nuance goes hand in hand with weight and scale. A neat trick. Equipped with the PU7, the Avid turntable put in a performance I'd hitherto had no inkling it was capable of, despite having heard Avid TTs with different and costly arms in other circumstances.

So then I unpacked the Uniarm. Audio Origami offers a standard matt silver, beadblasted, finish on its tonearms – the silky black anodised finish of the PU7 is an extra cost option. The Uniarm came in this standard finish and I have to say, much as I love the look of the black, the silver is so beautifully done I personally would be entirely happy to take either arm in this basic finish.

The Uniarm addresses some of the shortcomings of unipivot designs by machining the arm, with pivot bearing cutout, and headshell from one piece of aluminium (including the finger lift), for unimpeachable rigidity. Thus, a unipivot has the ability not only to trip along lightly with the best of them, but the potential to

deliver scale, weight, and authority to boot. The pivot bearing is sapphire, seating into a tungsten cup. Audio Origami supply a small phial of sticky silicone damping fluid whose use is optional, but seems to aid stability.

Setup was barely more complicated than the procedure for the PU7, indeed the unipivot's lack of need for azimuth adjustment more than offset the slightly tricky matter of aligning a cartridge in an arm with more degrees of freedom than a gimballed design. The Uniarm also comes with a very clever baseplate which replicates the Linn mount, and both types of Rega mount (threaded tube and three-hole) within the same, beautifully machined, collar. This will make it much easier to accommodate one's arm on turntables of differing types (but, ironically perhaps, meant I needed an adaptor from Avid to convert from its standard SME mount).

Going back to the *War of the Worlds*, Richard Burton's voice was more natural, still sonorous, but devoid of any hint of emphasis on any particular part of its frequency envelope. The opening theme, when it entered, still had that portentous feel, but with a lightness of touch, and a subtlety, I'd hitherto not noticed. The opening chords resolve a cadence where the last note is sustained. What I'd not noticed before was the subtle crescendo on that sustained note. It is there of course, when you go back, but to have it pointed out on music I've played to death over the years is enlightening. And enlightening is a very good way to describe

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"The PU7, in contrast, felt more like a new friend, keen to explore the outer reaches of my music collection."

how the Uniarm goes about its business, both in terms of the degree of insight and musicality it brings forth, and in the way the music seems so light on its feet.

Percussion, in particular, is lively, fast, and detailed, with subtle inflections brought out to great effect. The closing section of Mike Oldfield's *Incantations* [Virgin, VDT101] uses a repeated motif played on vibraphone, and for many years I've been trying to replicate a memory of hearing this piece on a friend's top-end Linn LP12 back in the 1980s. The woody sonority of the vibraphone, the feeling of rhythmic solidity yet with a sense of 'bounce' has proven elusive. But here it was again, yet more than that, there was also an inflection on the off-beat which I had not been properly aware of. This extra pulse contributed to the momentum of the piece, keeping up a subtle pressure and driving the music forward.

Pitch and tunefulness are also exemplary, no doubt this is a corollary to the natural and unforced sense of timing the Uniarm allows. Music drives along when necessary, and it is propulsive without being relentless, while bass is both agile and tunefull. Dave Grusin's *Mountain Dance* [Arista, GRP5010] skips along, yet is constantly underpinned by a repeating ostinato bass riff. It is easy to ignore the contribution this bass makes to the coherence of the piece, focussing instead on the piano and the effortlessly subtle percussion, but via the Uniarm this bass riff is just so darn tuneful it takes its rightful place at the heart of proceedings. Guitar and bass on Joni Mitchell's 'God must be a boogie man' from Mingus [Asylum, K53091] explodes with a speed and precision which takes the breath away. Charles Ives' *A Symphony, New England Holidays* [CBS, M42381] has all the scale, drama, dynamics and impact I could wish for, yet its complex timing is rendered intelligible, and tonal colour and subtle detail is beautifully expressed. I've heard criticism of the bass quality from unipivot designs in general, to the extent that unipivots are all about midrange and concede bass depth and weight to gimballed designs. Yet here was bass with utterly sufficient scale and weight, while remaining fluid and agile, and supporting rather than dragging down the music.

What the Uniarm does so effectively is allow the listener to perceive a piece's gestalt while also presenting all the individual components without any suggestion of deconstructing it. This is closer to how you experience live music, being aware not only of the parts and their respective contributions, but most importantly, perceiving the music as a whole. Some systems throw detail in your face, but without enough precision (and context) to enable the listener to make sense of it all. This can be exciting (in the same way that plummeting down a snowy hillside on a tea tray would be exciting), but ultimately unsatisfying and fatiguing. The Uniarm's remarkable resolving powers, coupled to its stability and timing precision, allows music to unfold naturally in front of the listener, and any drama is all in the performance, not the presentation. It's been a while since I listened to a vinyl system which had me looking forward to getting home from work so I could play some music, and my music collection has also expanded in hitherto unexplored directions.

All of which makes the Uniarm's £1,500 asking price look like a bargain. For me, it is the arm I'd take from this pairing, but there is also something very special about the PU7 which the Uniarm, for all its capabilities, doesn't negate. The PU7 is a very grown up arm, it brings confidence, gravitas, and insight, yet isn't afraid to get down and boogie with the best of them. It also offers more options in terms of configuration – length, effective mass, which may suit some cartridges better. The Uniarm is keen to make its mark. Like the PU7, it doesn't draw attention to itself, preferring to let the music do the talking. And boy, does it communicate. Which of these two arms you ultimately prefer may well depend on what you are partnering it with, and what sort of music and presentation you are looking for. There are no winners or losers here, just two limbs of a very convincing argument. +

Technical Specifications

Audio Origami PU7

Type: gimbal bearing phono pickup arm
Tonearm length: 239.3mm (Rega geometry, mount distance 222mm), 228.6mm (Linn geometry, mount distance 210.4mm)
Effective tonearm mass: 11g standard, configurable up to 20g
Offset angle: 23 degrees (Rega), 24.1 degrees (Linn)
Weight: (typical customer configuration) approximately 900g
Signal cable length: variable (typical 1.2m)
Price: £1,999 (standard specification); extra finishes and lengths at additional cost, by arrangement. As tested (9" length, black finish) £2,460

Audio Origami Uniarm

Type: unipivot, sapphire bearing pickup arm
Tonearm length: 239.3mm (Rega geometry, mount distance 222mm), 228.6mm (Linn geometry, mount distance 210.4mm)
Effective tonearm mass: 11g
Offset angle: 23 degrees (Rega), 24.1 degrees (Linn)
Weight: approximately 650g
Signal cable length:variable (typical 1.2m)
Price: £1,499 (standard specification); extra finishes at additional cost

Manufacturer: Audio Origami
Tel: +44 (0)7581 184189
URL: www.audioorigami.co.uk

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Kronos Helena tonearm

by Alan Sircom

The Canadian firm Kronos is best known for its spectacular turntables, most of which feature dual, counter-rotating platters. The sole exception to this format, thus far, in the Kronos Sparta 0.5 turntable reviewed elsewhere in this Guide, which is a single-platter model that can, however, be upgraded after the fact to become a full-fledged, dual platter Sparta.

Perhaps because Kronos turntables are so visually stunning, it is often easy to overlook the superb tonearms with which they are often supplied. In the case of our recent review of the Sparta 0.5/Sparta, the turntable came fitted with Kronos' new Helena arm. A 10-inch version of the 12-inch Black Beauty unipivot tonearm (also designed and built by Andre Theriault of Montreal), it's an arm within an arm, with wood fairings between the inner and outer carbon-fibre arm tubes. Louis Desjardins is convinced this arm tube design is virtually indestructible, and given he has a habit of whacking one against the architrave of a nearby door at full force, leaving a tonearm-shaped imprint on that door frame in the process, he's probably right. Regardless, it's extremely light, extremely rigid, and critically damped… the Holy Trinity of tonearm goodness.

Like the Black Beauty, the Helena is also an inverted unipivot (actually I think it's a 'non-inverted unipivot' as opposed to most unipivot designs), using a large ball bearing on the armtube and a large oil-filled metal cup on the arm base. The counterweight (also doubling as the azimuth adjustment) is underslung, in the manner of Vertere and the Michell Technoweight). It connects to the outside world using a top-mounted twisted quartet of lead-out wires, which mount to a terminal block on the base of the Sparta. This makes it essentially a one-deck arm and there appear to be no plans to supply the arm for other turntables. Anti-skate is not needed because the arm's pivot point is on the same horizontal plane as the groove/stylus contact point, thereby removing vertical leverage: why add an unnecessary oscillating system?

During our tests we used the Helena with a vdH Crimson XGW cartridge moving coil cartridge into the award-winning Pass Labs XP25 two-box phono stage to complete the vinyl playing front end of the system. This ended up being one of those perfectly balanced systems, given the energetic and exuberant way the Crimson cartridge pulls information off the disc being in perfect step with the harmonic structure the Pass Labs bestows to the RIAA equalisation process. In effect, this combination (aided by Dr. vdH's obsessive attention to detail, itemising every parameter of that particular 'Stradivarius' cartridge, and the XP25's ability to attend to those parameters perfectly from its front panel) dials out any upsets in the phono

replay chain, and anything getting in the way comes down to the turntable and arm.

While the Sparta 0.5/Sparta is a superb analogue platform, the arm is outstanding too. There's little need for discussion about alternatives in this context, the Helena is the perfect partner for the Sparta and vice versa. Other arms – even ones considerably more expensive and with outstanding reputations – are simply not a consideration. You'd be hard pressed to find better.

There's a fairly basic term in all this audio stuff, a signal that gets lost in all the noise. But it's there at the bottom of every page of this magazine – 'hi-fi'. And it's short for 'high fidelity'. The goal of every audio device should be an ever-higher fidelity to the original sound. The Sparta and Helena achieve that. Very highly recommended. +

Technical Specifications

Helena tonearm

Type: carbon fibre unipivot tonearm
Bearing type: proprietary ball and spherical mirror unipivot
Armtube: overall high modulus carbon-fibre composite, selected wood fairings between inner tube and outer shell
Effective length: 266.7mm
Effective mass: medium
Overhang: 15.4mm
Pivot-to-spindle distance: 251.3mm
Max. tracking error: 0.0159
Cartridge weight compatibility: 7–16g
Shipping dimensions: 42 × 14.5 × 11.5cm
Shipping weight: 3kg
Price: £6,500

Manufactured by: Kronos Audio Technology
URL: www.kronosaudio.com

Distributed by: Decent Audio
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GUIDE TO AUDIO SOURCE COMPONENTS 2018: ANALOGUE REVIEWS HI-FI+

Kuzma 4Point 9 tonearm

by Alan Sircom

OK, so regular readers already know the score here. We've loved the Kuzma 4Point tonearm in all its guises since first we saw it. And the 4Point 9 – the latest, smallest, cheapest, and possibly the best version of the 4Point – already won an award in the last issue even before this review was published.

This isn't a 'tail wagging the dog' review, though. We had already performed the listening tests required by the time of the award, even if those listening notes weren't fully written up. From the outset though, it was clear that this was something special, and deserving of that award up front.

Kuzma presently makes 11 arms using four basic configurations; three unipivots, four gimballed bearing designs, an air-bearing parallel tracker, and now three models using the company's unique four-point bearing design. The first of these was the 11" 4Point launched a decade ago, and this was followed by an even larger 14" arm. Both arms received some of the highest praise for their performance, but that performance came at a price; both financially, and by placing heavy requirements on the turntable itself. The unique offset arm design on the first two arms allowed for a spot of geometric magic (meaning that a 14" arm could be mounted in a turntable capable of accepting a 12" arm, for example), but the physical construction of the arms meant they automatically limited the number of compatible turntables.

The 4Point 9 redraws the map. As the name suggests, it retains Kuzma's four-point bearing. This features two points to allow vertical movement, in a manner similar to a double-unipivot design, the second pair allow horizontal movement. All four are designed to have minimal starting and moving friction, and zero play in any playing direction. For those of us more used to conventional tonearms, there's a feeling of slack in the bearings in some movements that feels a little alien, but is perfectly normal for the design. This also gives the arm a sort of bulls-eye look from the top, with the aluminium arm-tube (with its vertical spike and cup bearings) fitting around the (rather than over) the arm tower with its horizontal bearing assembly. The main difference between the 4Point 9 and previous 4Point designs, is this arm tower now sits directly on the Kuzma arm base, where the larger designs place a VTA adjustment tower at the arm-base point and the arm itself sits on an outrigger.

With no offset VTA tower, the 4Point 9 takes up no more space and adds not much more significant mass than any other 9" tonearm. Of course, with no offset VTA tower, the 4Point 9 can adjust VTA, but not while a record is playing, and I suspect the removal of layers of additional components needed to build that VTA tower help make the 4Point 9 sound so good. In saying this, I realise I may unleash the Wrath of Gregory, as the former Editor of this parish is extremely keen on tonearms that adjust VTA on-the-fly (and in using a VPI, I can see the point of this, too), but the rigidity and solidity the removal of the tower brings to the party is attractive enough to overcome any issues over per-album adjustment.

Not having on-the-fly VTA adjustment also promotes a slightly less anal-retentive way of listening to albums, where microscopic changes to VTA for each album you play can lead to a more OCD approach to the record playing ritual. I am in two minds about this – a lot of the joy of playing records is that ritual process. You engage with the music in a more physical way when you take the album out of the sleeve, place it carefully on the platter, give it a swipe with the record brush (and possibly a zap with a Zerostat), let the record come up to speed, then carefully cue up the stylus. Carl Jung would approve, and would probably also like the additional listen-stop-adjust-repeat machinations required to get VTA 'just right'. However, the downside to this is you can spend so much time on the adjustment, you run out of time to play the record, or you hear the opening bars so many times in the adjustment stage, you tire of the recording by the time it comes to playing it. Sometimes, the simplest approach is the best.

Let's not get too carried away by the 'simple is best' ethos. This doesn't extend as far as the pithy maxim of Lotus founder Colin Chapman: "Simplify, then add lightness." This is not a tonearm stripped back so far as to make it a fragile flower. The 4Point 9 still weighs 920g, has the bombproof build of Kuzma designs, and is still more than capable of taking practically any cartridge ever produced. However, compared to the significantly heavier 4Points, that does fit Chapman's maxim after all!

Depending on your prior experience with tonearms, installation is either extraordinarily complex, or slightly more complex – but more accurate – than the norm. In other words, if you are used to fitting conventional arms (like Rega or SME designs), the process of setting up the tower

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then adding the arm might seem ornate and overcomplicated. On the other hand, if you come from a unipivot world, this is a robust dream of an arm. And, if you are used to parallel trackers, especially some of the more 'homespun' designs, this arm goes together like a clockwork jigsaw puzzle. Kuzma provides exceptionally good instructions and a good set of tools anyway. It's not Ikea-easy, but if you can understand the manual that comes with your car enough to check fluid levels and change a headlamp, you can install the arm. This is, however, the kind of tonearm where you don't want to lose the manual, and you should allocate several hours to both installation and fine-tuning.

Kuzma designed this arm to take any cartridge and sit on any deck, and as a consequence supplied the arm with a suitably high mass cartridge (the company's own CAR 40 moving coil) to sit in that removable headshell, and a variant of the Stabi S turntable –the T-Shaped brass entry-level into Kuzma's turntable systems – to provide a base of operations. Prior to this, the 4Point really was only considered suitable for the higher-end Stabi M and XL models, and this automatically trebles the price (or more). While the shape of the high-end turntable industry has changed of late (the days of using brand X's arm on brand Y's turntable are fading, as so many turntable makers now produce their own arm, and vice versa), the nature of the 4Point 9 brings it more in line with other arm makers.

Unless you've heard the bigger 4Points, the sound of the 4Point 9 is unexpectedly good. You would expect it to perhaps couple the best points of a unipivot (that sense of musical freedom and midband clarity) with the best of a conventional arm (the authority and extension), and it does that… with bells on! You almost immediately begin to hear where your old arm was letting the side down, and realise just what your cartridge was failing to extract from the record. Plucked double bass is an obvious draw, because suddenly you are hearing the finger-squeaks and textures of the plucking process (as you might when hearing the recording through a unipivot) but with the substance and intensity you can only get from conventional bearings. But it's not just plucked bass; everything has less arm in the way. Records I've known and used for decades both as reviewing tools and for enjoyment were unveiling details lost to one form of bearing or another. More importantly, you don't hear this in an analytical sense; you hear it as an absence of arm-sound, pushing the onus of the audio system performance onto the cartridge and its characteristics. I've only experienced such disappearing arm performance a handful of times, and they have usually been with arms that were significantly more expensive, significantly more fragile, or significantly more expensive AND fragile.

Naturally, I didn't stay with the CAR 40 and played with a number of cartridges both suitable (Lyra Delos) and demanding (Ortofon MC7500) and in all cases the arm didn't just acquit itself, it highlighted all that was good – and occasionally not so good – about the cartridge. Let's put it this way, I thought I knew how good the Delos can sound, but I was hearing more arm than cartridge in a previous life. And the CAR 40 is no slouch, either. Put simply, the Kuzma arm gets out of the way so well it makes good cartridges sound better, and really good cartridges sound fantastic!

The limitation is although the 4Point 9 dramatically lowers the weight of the arm compared to its bigger brothers, it's still a heavy arm by today's standards. That puts it beyond the load-bearing capacities of the springs of many of today's most popular suspended turntables, such as the Linn LP12. I'm not sure if this is even a limitation today as so many high-end decks are high-mass designs that eschew suspension systems, and the Linn fraternity tend to stay within a very limited set of tonearm options anyway (basically, Linn arms, second-hand Naim Aros, and the occasional Roksan Nima). In fact, the 4Point 9 is so good, you have to think those owners of suspended decks with springs incapable of coping with a 900g+ tonearm are missing a trick – a Stabi S or something like a Pear Audio/Fletcher Audio/Nottingham Analogue turntable coupled with this arm and a good cartridge will happily see off many of the high-spec bouncy-castle decks.

The Kuzma 4Point 9 is the four-point bearing concept stripped to its bare bones, without the longer tonearm and on-the-fly VTA adjustment. The performance of the Kuzma 4Point 9 is therefore a direct result of that bearing technology. And – stripped to its core – the four-point bearing is a real star. We already sort of knew that from its older brothers, but bringing this technology down to more real-world levels, it suddenly becomes throws the sonic limitations of conventional unipivot and gimballed-bearing tonearms into sharp focus. It also brings the absolute top-end of tonearm design down to a far wider audience. Finally, if you have a Kuzma Stabi of any vintage, and can't quite make the financial or size commitment to the bigger 4Points, this is by far the best arm you can buy. Highly recommended, and a new reference point irrespective of cost – this might just be the best arm you can buy today. +

Technical Specifications

Type: four-point nine-inch tonearm with detachable headshell
Bearing type: four pivot
Maximum cartridge mass: 35g
Effective mass: 13g
Effective length: 229mm
Arm-mount distance: 212mm
Spindle-pivot distance: 212mm
Offset angle: 23°
Armtube: conical aluminium
Bias adjustment: Yes
VTA adjustment: Yes
Arm mount: Kuzma
Wiring: Silver as standard, options available
Connections: XLR, 5pin
Total mass: 920g
Price: £3,495

Manufactured by: Kuzma Ltd
URL: kuzma.si

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GUIDE TO AUDIO SOURCE COMPONENTS 2018: ANALOGUE REVIEWS HI-FI+

Vertere RG-1 turntable and SG-1 tonearm

by Alan Sircom

There are two ways of looking at Vertere's turntables and arms. The first is 'what on earth is a cable company doing making vinyl products?', and the second is 'why did Touraj Moghaddam take so long to make a new turntable and tonearm?' Vertere is a brand associated with high-performance cables, from the value-driven Pulse D-Fi to the hand-built range. But Vertere is also the brain-child of the designer of the Roksan Xerxes, Radius, and TMS turntables, and the Artemiz, Tabriz, and Nima tonearms. The RG-1 turntable and SG-1 arm were something of inevitability.

In fact, Touraj's return to vinyl came with a sharp intake of breath; Vertere's first LP-based product – the Reference tonearm – appeared on the scene at CES 2013. All £27,000 of it. This is the most expensive 'serious' tonearm by a country mile (I'm excluding those one-off specials made out of blood diamonds and panda eyelashes and built for oligarchs and despots). Is there a market for such a thing? Patently so: the first batch sold immediately, and orders for this arm are coming in steadily. In fact, the result of the interest in this arm was effectively a green light for the turntable, and ultimately a more affordable arm. Which brings us to today.

The turntable comes in two basic guises, SG-1 (presumably for 'standard grade') and RG-1 ('reference grade', perhaps). We went with the RG-1. Principally, the design brief is very similar, and those familiar with designs like the Xerxes and especially the TMS might see some common themes, albeit taken to their logical extremes. In both Vertere turntables, the plinth itself is a three-and-a-bit layer design, with 30mm clear acrylic upper and lower plinths, a 15mm clear acrylic mid-plinth, and a 25mm 'sub-plinth' (that practically everyone else would call a sub-chassis). These form a three-stage compliant and two-stage rigid system, with the turntable sitting on hard rubber/stainless steel adjustable feet, with 3mm acrylic disc stand-offs providing the rigid part, and a dozen decouplers (made of tuned silicone rings on bobbins) providing the compliance. The result is a deck somewhere between the bouncy freedom of a Linn LP12 or an Avid Acutus, and the constrained movement of an SME Model 20, but mostly in the horizontal plane. Vertical movement of the platter is fairly limited. While I don't think it's necessarily fair to both parties to keep bringing Roksan into proceedings, this compliant/rigid mix is a factor in the design of the Xerxes and TMS, but the SG-1/RG-1 turntables take this to another level.

How the two decks differ is in the motor (both are 48-pole synchronous motors sitting in a contact support housing, which is itself articulated on bearings, but the SG-1 has a 1.5m length of Pulse-C cable, and the RG-1 uses Pulse R) and more significantly, the platter and bearing. Where the SG-1 has a single-piece platter with a 3mm acrylic disc as the interface between LP and platter, the RG-1 is a higher-mass two-piece aluminium alloy, machined to interference-fit tolerances, and placing much of the overall platter mass to the periphery for the best balance between weight and inertia. The bearing itself might be similar between the two decks, but the SG-1 uses a high copper phosphor bronze, while the RG-1 uses aerospace grade phosphor bronze model, and this spells a slight – 2.5micron – difference in tolerance in the RG-1's favour. The mass of the platter also demands the difference in bearing, as the bigger platter would damage the SG-1 bearing in daily use. Both need to be relubed with Vertere's own LG-1 oil, and require approximately 12-15 drops every 15-18 months. It's notionally possible to upgrade from SG-1 to RG-1, but the cost of the upgrades makes it more expensive than ponying up for the bigger deck at the outset. You'd lose out to the tune of about £3,500 or so.

The SG-1 arm comes in two basic guises – standard internal wiring, and hand-built wiring for an additional £1,150. However, it's worth remembering the arm is supplied without tonearm cable, and in Vertere's line, that means you need to factor anything from £285 for D-Fi to £5,250 for Pulse hand-built, with most people thus far opting for the £1,050 Pulse-B or £2,600 Pulse-R cables. As this means the basic cost of the RG-1/SG-1 combination (sans cartridge) can vary from £19,585 to £26,700 depending on cable choices, this is a fairly major consideration.

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The SG-1 arm uses what Vertere calls a Tri-Point Articulated (TPA) bearing. Essentially, the bearing is made up of three silicon nitride balls forming an equilateral triangle below the stainless steel pivot point, all bonded into the aluminium yoke. This supports an underslung counterweight (which is also good for correcting azimuth) on an aluminium outrigger, and a carbon-fibre wrap armtube ending in a bonded machined aluminium alloy headshell. Along the length of the armtube is a fine-tuning weight adjustment that doubles as a resonance control (the last time we saw something similar was in an arm by Funk). Anti-skate is through the typical hanging weight system, although there are no OEM parts in the SG-1.

I used this combination with the Benz Micro SLR Gullwing cartridge; a combination that worked so well together, there was no need to change. As the deck and arm get shown to more people, so more cartridge options get tried, and it seems versatility is the key.

Good turntables make you play more records, really good turntables make you delve deeper into your record collection, but the exceptional ones make you rush out and buy more records. That is precisely what the Vertere RG-1/SG-1 combination does. You listen, you look at your record collection, and say to yourself "it's not enough". Pretty soon, you are ram-raiding your credit card through the doors of the nearest record store, buying up everything vinyl you hear of, and receiving hand-written birthday cards from Jeff Bezos of Amazon, thanking you for all the business.

This is a turntable that's all about the energy and exuberance of music. That could easily be dismissed as being excitable or forward, but it's nothing of the sort. Instead, this turntable presents the leading and trailing edges of music with an accuracy that few other source components can match, whether analogue or digital. It has the kind of pitch precision that direct-drive supporters always think impossible from belt-drive, but with that inherent lower noise floor that belt-drive supporters use to dismiss direct drive.

The difficulty with commenting on a really good turntable is you end up just listing records. You burn through several albums, bringing out the focal point of the music on each and each one could be used as comment on specifics about the record deck. So, when I put 'Royals' by Lorde [Pure Heroine, Universal], I was shocked by the clarity of the front-and-centre vocals, the greater dynamic range than the CD and the precision of the beat. And yet, when I moved over to Dexter Gordon's Go [Blue Note], I was more in the groove, enjoying the laid-back cool of the album. Interestingly, as you moved from album to album, you could hear the difference in recording instantly; rather than focus on the music content, the way different mixes change is a fine indicator of performance, and the Vertere aced this test.

Every time I write a sentence here, it seems to come up with discussing the 'energy' of the system. For good reason, the energy of the music is reproduced brilliantly. But there is more to this than sheer energy. It's a masterful performance, with an integrated, contiguous sound from deepest bass to soaring treble. Soundstaging is unforced and natural – neither painting too broad a picture nor reducing stage width. It's dynamic too, with sound rising from a super-quiet noise floor for vinyl. And crucially, even the surface noise doesn't intrude; it just 'floats' above the music.

With so many super-decks, the performance fails to shine until the rest of the system is at a similar level. Often they sound overblown and ponderous until the rest of the system catches up. That's not the case here, and that makes the Vertere truly world class. This is a source component that shows just how good it is on very humble equipment, and continues to show how good it is right up the food chain. In fact, I'd argue that those big decks that sound ponderous unless all the boxes are ticked, just sound ponderous.

At the very least, Vertere joins Avid, Linn, and SME as UK contenders for the international

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high-end turntable/arm title fight. However, I think it's more than that. It might just be the best of the lot of them. It's possible that someone willing to spend more than £50,000 on some form of über-turntable isn't even going to put a deck like the RG-1 on their shortlist. From a sound-quality perspective alone, they should, because it stands toe-to-toe with the best of the über-decks. In fact, it jumps up and down on the toes of a lot of them.

I'm going to stick my neck out here. I think there's a sweet spot in turntable design now. It starts with the Brinkmann and AMG priced designs and ends with turntables like the VPI Classic Direct Drive and the Kronos. Beyond this, you tend not to buy 'better', you just buy 'more'. And the Vertere is right smack in the middle of that sweet spot.

It might be Londoner bias. It might be I've not spent enough time with the Premier Cru decks. It might even be that my system isn't resolving enough or lacks the bottom-end drive and energy that demands bigger turntables with more stentorian bass lines. But there's something so very right about the Vertere RG-1 turntable with the SG-1 arm that it makes me wonder how the hell I'm going to afford this combination. And that leads to a very dark place, because it makes me wonder about the Reference arm, too… +

Technical Specifications

Vertere RG-1 turntable

Type:
Belt Drive
turntable
Motor:
48 Pole Synchronous

Motor Mount:
Acetal Platform – DBearing Housing:
Aerospace Grade
Phosphor Bronze

Plinth Structure:
Clear Cast Acrylic, 30mm top and bottom plinths, 20mm sub-plinth, and 15mm mid-plinth

Isolation System:
Three-stage compliant; 12 decoupler sets/12 tuned silicone rings/bobbins. Two stage rigid: 3mm acrylic disc and stainless steel/hard rubber feet

Speeds:
33.3 & 45 rpm (< 0.2%)
Wow & Flutter:< 0.02%

Rumble:
< -85dB

Size and weight: not specified

Price: £17,500

SG-1 tonearm

Type:
Tri Point Articulated

Bearing Structure:
Captive silicone nitride ball (x3)
with precision stainless steel point

Effective Length:
240mm

Overhang:
17.5mm

Offset Angel:
22.9°

Internal Wiring:
Pulse Hand-built
or Standard

Tonearm Cable
(Optional): Pulse Hand-built, Pulse-R, Pulse-B, Pulse-C & D-Fi

Weight (with standard counterweight):
397g

Price: Tonearm £1,800–£2,950
Cable £285-£5,250

Manufactured by: Vertere Ltd
URL: www.vertereacoustics.com
Tel: +44(0)203 176 4888

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The Clearaudio Goldfinger Statement Cartridge

The stylus tip might not be the only part of a hi-fi system that wears out, but it is definitely the most obvious and often the most expensive. After all, dragging a rock down a plastic ditch is always going to be a high-impact occupation – and given the pressures and prices involved, that impact could well be on your wallet. Factor in the risk of accelerated wear from misalignment or wandering set-up and the very real risk of a catastrophic accident if your friend, pet or cleaner gets a little bit frisky (not to mention the possibility of clumsiness on your part or sheer bad luck) and it rather suggests that you'd have to be insanely rich or just plane insane to contemplate investing darned nearly five figures on anything as fragile and impermanent as a moving-coil cartridge. Which in turn invites the question, why ARE there so many seriously expensive cartridges to choose from?

Exotic moving-coils are one of the last bastions of hand-built micro manufacturing. Painstakingly constructed in tiny numbers by an even smaller number of skilled artisans, these craftsmen have accumulated the years of experience necessary to produce such exacting work the hard way – glued to the eyepieces of a binocular microscope. But to really understand just how precise this work needs to be, it's necessary to translate it onto a more appreciable, real-world scale. Consider it thus: a 12" tonearm has an effective length of around 300mm and supports a cartridge whose stylus contact patch with the groove wall should be between 2 and 6 micrometers. Let's blow that up to 1,000 times the size: now our tonearm is 300 meters long while the cartridge, rather than 25mm long is 2.5 meters in length – the size of a small car. What's happened to the size of the contact patch between the stylus and the trench it is now running it? It's 1000 times the size, making it anything up to 6mm long! That's a 6mm contact patch hanging on the end of a 300meter beam. Suddenly the notion of precision manufacturing takes on a whole new meaning.

The physical results are genuinely exquisite in their delicacy and attention to detail and the musical results are, in many ways, just as magical. It seems bizarre that such nuance and subtlety, colour and power can stem from such a fundamentally crude process, but therein lies the artistry and that's what justifies the price. There's an old adage in audio (yes – another one) that says, don't listen to the next cartridge up the range unless you can afford to buy it. What they don't tell you is, that the further up the range you get, the truer that is. Once you've heard what a really top-flight cartridge brings to a system, it's hard to go back; and because the cartridge is, quite literally at the very tip of the signal chain, every single component downstream gets the benefit. Flagship cartridges might seem ludicrously expensive, but by the time you've invested in a decent turntable and tonearm, their musical impact makes them a borderline no-brainer. It soon ceases to be a question of what's sensible and rapidly becomes what's possible…

Even amid the rarified atmosphere at the tip of the high-end MC pile, Clearaudio's Goldfinger Statement comes with a pretty breath-taking £8,995 price-tag. There ARE more expensive cartridges – but not many! By the time you reach this level, exotic materials and semi-precious stone seem almost *de rigeur*, but the Goldfinger still manages to cut a swagger. Not content with a body that's milled from solid gold (helping account for its substantial 17g weight), it even sports a half-carat diamond on its face plate, ostensibly as a guide to accurate cueing but let's be honest, really just to be bling!

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"The latest Goldfinger brings a new sense of flow and shape to performances, a sense of purpose and dedication that brings them vividly to life. It brings a holistic quality to good performances and reveals what makes the great ones great."

Does the flash Harry exterior hint at unnecessary excess? It's hard to argue against the notion but Clearaudio struggle manfully to do so. With such rare and specific products, differentiating one model from another is essential to protecting your customers and their investment. Okay, a shard of diamond might be a little OTT, but the point needs to be made in such a way that it's not easily duplicated – or amended after the fact. More pertinently, the gold bodywork offers its own benefits in terms of resonant behavior – even if its lack of mechanical resilience mandates the use of plastic screws to fasten it to the headshell. Don't whatever you do, over-tighten the fixings. Even with the plastic bolts you can strip the soft threads of the star-shaped top-plate, rendering the cartridge unusable. Proceed with caution – and then back off the gas!

All of which might make the Goldfinger Statement a figure of fun – the Austin Powers of the audio world – except that it is genuinely, startlingly good! As a long time user of its predecessor, the astonishingly precise and detailed Goldfinger V2 (the cartridge from which the Statement needs to visually distance itself) I was able to compare the two cartridges side by side. That diamond is almost unnecessary! Listening to the two cartridges, they're impossible to confuse. Sure, they share a house sound, in as much as the Statement possesses all the resolution, transparency and dynamic discrimination of the V2, but it also brings a sense of body, presence, instrumental colour and musical impact that leave the V2 sounding like an insubstantial shadow of its bigger, brighter and better younger brother. There really is little or no comparison between the two cartridges and the Statement is exactly that – a serious statement of musical intent.

But best of all, that substance and body, the drive and power that the new cartridge possesses in spades isn't just about weight and impact. Clearaudios have always been quick and dynamic, but the Statement extends the already impressive dynamic range of the V2 – a function I'm guessing of the finer wire and more powerful magnetic field delivering lower-level signals and faster rise times – while maintaining its surefooted agility and sense of place. By adding a broader tonal palette and greater sense of physical volume to instruments, it almost focuses and directs their contribution to the music. The result is, for all the Statement's other impressive attributes, by far its most significant advance; the latest Goldfinger brings a new sense of flow and shape to performances, a sense of purpose and direction that brings them vividly to life. It brings a holistic quality to good performances and reveals what makes the great ones great. The best conductors become a towering presence, their orchestras an extension of their purpose. Berglund's Sibelius cycle on EMI has never sounded so dramatic and powerful, while Barbirolli's Vaughan-Williams has the perfect mix of poise and emotional range, one minute jaunty and the next all threatening anticipation.

This range of musical expression is a key analogue attribute and the Goldfinger Statement takes it to new levels. More importantly, it's universal in its appeal. It matters not whether you play the LSO or Elvis Costello, the sheer presence in the performance, whether it takes the form of almost abrasive guitar riffs or the most delicate of hanging notes, adds to the musical impact and the emotional response it produces. The Attractions literally drive a track like 'Little Triggers', the drum kit having a physicality that hits home, the bass a tactile and fluid quality that pulls you into its wake. Turn to the space and power of the Rutter Requiem or the delicate immediacy of Suzanne Vega's 'Tom's Diner' and the Statement is just as adept, bringing a quality that I can only describe as "concentration" to the music. Each instrument or voice is more solid, richer, more vibrant and more present in space, making most cartridges sound either hopelessly pale and insubstantial or clumsy, overblown and overwrought.

Is the Clearaudio Goldfinger Statement over stating its case? No, I really don't think it is. Instead it is moving you closer to the presence and energy of live music. It doesn't overstep the mark or exaggerate for effect. It simply gives you more of what separates the live from the recorded. By doing what Clearaudio's have always done and then grafting on a whole new set of performance attributes, the Statement has seriously raised its game. Much as the Atlas (and Etna) have added new breadth to the established Lyra sound, the latest Goldfinger moves Clearaudio into virgin territory. The V2 was a very good cartridge indeed, but its replacement represents a step-change in performance, making it not just the best Clearaudio (by far), but one of the best cartridges ever. +

Technical Specifications

Type: Low-output moving-coil cartridge
Cantilever: Boron rod
Stylus Profile: Clearaudio Micro HD
Output: 0.9mV at 5cm/s
Weight: 17g
Compliance: 15cu
Coil Wire: 24kt gold
Recommended VTF: 2.8g (±0.2g)
Recommended Loading: >100 Ohms
Price: £8,995

UK Distributor: Sound Fowndations
Tel: 44(0) 118 981 4238
URL: www.soundfowndations.co.uk

Manufacturer: Clearaudio Electronic GmbH
URL: www.clearaudio.de

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DS Audio DS-W1 Optical Cartridge and Equalizer

"Instead of a set of coils or a magnet on the end of that cantilever, there is a tiny plate with an even tinier slot cut in it."

by Roy Gregory

Despite the total dominance of electro-magnetic pick-up technology – be it fixed or moving-coil in nature – there has always been a steady stream of alternative offerings or variations on the theme when it comes to extracting a meaningful signal from the squiggly grooves embedded in the surface of LP records. It's not too hard to understand why, given the all too audible flaws inherent in and challenges presented by both moving-magnet and moving-coil designs. Throw in the essential mechanical crudity of the process and it's hardly surprising that designers and end-users alike crave a more sophisticated and elegant solution. Yet, such is the dominant nature of these 'conventional' designs that they totally define the context in which any alternative is viewed or judged.

On the most obvious level, products like the Soundsmith Strain Gauge cartridges or the subject of this review, the DS Audio DS-W1 optical cartridge, dispense with the requirement for (and cost of) a conventional RIAA/phono-stage – the necessary functionality being included in the price of the cartridge. That doesn't just muddy the water: depending on whether you have a pre-amp with a built-in phono-stage, you already own the phono-stage of your dreams, how much you paid for the phono-stage you already have, whether it's salable (should you want to sell it), or whether you actually own any sort of phono-stage at all, the real cost of owning such a device might vary dramatically – along with the competition against which you might compare it.

But like I said, that's just the most obvious example. Start to examine DS Audio's DS-W1 in any detail and even a rudimentary understanding when it comes to the mechanics of phono replay should indicate that this cartridge is definitely swimming against the analogue stream. In a world seemingly obsessed with ever longer tonearms and the low-compliance cartridges they demand, the DS-W1 is both light and lively, weighing in at a mere 6.5g and with a compliance of 15cu vertically and 25cu laterally. That suggests that you'll need the sort of lightweight arm that has long faded from fashion if you want to avoid resonance issues and actually benefit from the DS Audio's advantages. Right about now you are probably wondering just what those advantages might be and what could possibly make them worth the bother and brain-ache of building them into your system? Which makes it time to discuss what makes the DS-W1 so different – and so special.

Don't let the 'optical' in the DS Audio's title deceive you. The DS-W1 uses an entirely conventional Shibata stylus and boron cantilever to trace the record's groove. However, instead of a set of coils or a magnet on the other end of that cantilever, there is a tiny plate with an even tinier slot cut in it. The matching PSU/equalizer box powers a tiny LED beam that shines through that slot, a photo-electric cell measuring how and by how much the movement of the cantilever causes the slot to occlude the beam. The result is a device with an incredibly low moving mass and a lightweight reading system – which helps explain why the DS-W1, a fully clad cartridge, is lighter than most naked designs. It also produces an amplitude proportional output, as opposed to the velocity proportional output of conventional electro-magnetic designs. This means that, at least in theory, it suffers from neither the pre-emphasis of high-frequencies nor the slowing of low frequencies that afflicts those conventional designs, as well as making the task of the matching equalizer considerably easier.

Open the large box in which it arrives and the DS-W1 itself is remarkably nondescript, with a simple

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matt black body that is neither particularly distinctive nor decorative. The solid block of the equally black energizer/equalizer matches the cartridge's plain-Jane looks, and its beautifully finished casework sat on four adjustable spiked feet, complete with shoes if you need them. There's a front-panel on-off switch and one set of inputs and two sets of outputs on the rear, all via single-ended RCA sockets. Why two sets of outputs? Partly because the DS-W1 reads low-frequency signals rather more accurately than most electro-magnetic cartridges, one set offers subsonic filtering with a roll-off starting at 50Hz, while the other goes lower, to 35Hz before tapering. Which you use will depend on your turntable, system, and situation. I used the full-bandwidth output without issues, although that's partly because of the lengths I went to when it came to choosing a matching tonearm.

With its low mass and 'interesting' compliance, the DS-W1 is seriously picky when it comes to tonearms. Do the sums and you quickly realize that the average 9" tonearm (Linn, SME, Rega, Graham et al.) offers an effective mass of around 11g resulting in a fundamental resonance of around 7.5Hz – which is distinctly borderline. For a theoretically ideal 10Hz you'd need an arm like the ultra-light SME III or original Mission 774 – both around 5g effective mass. Instead, I opted for the 9.1g AMG 9W2, which nudges the fundamental resonance back to a shade over 8Hz, safely within the comfort zone. That might not sound like much of a difference, but believe me, you can hear it instantly in the solid presence and stability it brings to the sound. Of course, you could use tonearm damping, but in a cartridge that is itself essentially un-damped, the downsides are all too audible. It's another indicator that this cartridge isn't just different; it behaves differently too.

As soon as you start to set it up, it becomes apparent that the DS-W1 is super-sensitive to VTF and VTA/SRA (or tracking force and arm-height if you must). From the first moment the stylus hits the groove you can't miss how quick and clean it is, completely free of overshoot or exaggeration. But it would be easy to conclude that it is either thin and lightweight (if you have the VTA wrong), or has a lumpy, detached bass (wrong VTF or wrong tonearm). Nor does it respond in a gradual, progressive manner to adjustment. Instead it's either wrong or it's right, with little or no margin for error, and with increments that are too small to measure. But patience is the name of the game: get the right VTF, the right VTA, and the right tonearm and this thing sings! It also lights up. Indeed, one reason that the DS-W1 has attracted quite so much attention is the illuminated red strip that graces its nose as soon as it's powered up, leading the US distributor to dub it "The Nightrider". But there's much more to this cartridge than just a fancy lightshow.

Despite being one of the most exacting audio devices I've ever set-up, the DS-W1 is truly worth the effort. It's tempting to try and equate its performance to other cartridges: it's also a mistake. To understand just how good the DS-W1 really is you need to also appreciate that it's fundamentally different, both in operation and presentation. By eliminating the electro-magnetic generator from the pick up, DS Audio has totally changed the way a cartridge delivers music. It has not only created a lower moving mass, but altered its natural mechanical resonant behavior and sonic thumbprint, too. Throw in the absence of electro-magnetic damping and you have a transducer that is lightning fast AND ultra responsive. The result is musical reproduction from LP that's as devoid of baggage and padding as it is astonishingly linear, as unforced and unexaggerated as it is natural in terms of tonality and perspective. Which might just be a recipe for sounding bland, except that the DS-W1's astonishing speed and unfettered dynamics (micro and macro) give it that breath of intimacy that brings music and musicians vividly to life; helped by the total absence of grain, within the notes themselves, or the spaces between them.

Never have I heard a cartridge that can capture instrumental textures or vocal nuance, the skin of a drum and the air inside it, or the rasp of bow on strings as naturally and effortlessly as this. This isn't the spot-lit presentation and bouncy bass of a typical high-end moving-coil: it is something altogether more delicate, more subtle, and (if you get it right) more real. The DS-W1 doesn't pump up the drama or fatten up the bottom end. Instead it allows musicians and recordings to speak for themselves, in voices that are at once recognizable and authoritative. Its attack and pace give bass transients natural impact, and shorn of false weight and emphasis, its timing is sure-footed and agile.

Technical Specifications

Type: Phono cartridge with optical reading
Cantilever: Boron Rod
Stylus Profile: Shibata
Weight: 6.5g
Tracking Force: 1.5g
Compliance: 15cu vertical, 25cu horizontal
Output: 500mV (from matching PSU/equalizer)
Price: £6,250

Manufactured by: DS Audio
URL: www.ds-audio-w.biz

UK Distributor: Sound Fowndations
URL: www.soundfowndations.co.uk
Tel: +44(0)118 981 4238

If there's a better cartridge for playing baroque or small ensemble music (classical, jazz or pop) I've yet to find it: if there's a more believable cartridge when it comes to vocal reproduction, solo or choral, I've yet to hear it. Which makes DS Audio's DS-W1 pretty special. There are cartridges with bigger names, cartridges with bigger sounds, cartridges that deliver more drama, and cartridges that also perform their own brand of transductive magic – but they all cost more than the DS Audio, especially when you take the phono-stage into account. Having said that, you might be trading your existing phono-stage for a new arm if you want to really hear what the DS-W1 can do: it's well worth considering, 'cos this cartridge really is that good. +

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Koetsu Blue Onyx

by Jimmy Hughes

In an age of hype, where everyone ceaselessly self-promotes to gain attention and market share, Koetsu represents an oasis of calm. Founder Yosiaki Sugano (1907 – 2002) was a man of many parts – artist, musician, swordsman, calligrapher, business executive, and father. He drew inspiration from the 17th century Japanese artist Honami Koetsu (1558-1637).

So what else but to adopt the name of his hero Koetsu when deciding to manufacture high quality MC pickup cartridges back in the late 1970s? Amazingly, the company seems never to have advertised its products, nor produced any sales leaflets. All the same, word quickly spread among audiophiles, and the Koetsu legend was born. In 2014 Koetsu still doesn't have an official website. Twitter? Facebook? What's that?

With Koetsu, Hearing was Believing. Once you'd experienced a Koetsu, little-else sufficed. The original models were quite large, with a rosewood body covering. Later models slimmed down a little, and featured exotic body materials, from lacquered Urushi finishes, to the use of natural gemstones including Jade and Onyx.

Sugano's minimalist approach soon earned him mythical status in hi-fi circles. It's said his 'death' was erroneously reported no less than three times – something that apparently pleased him no end! It all became part of the Sugano legend, adding to the mystique of this most unusual of brands. Finally, though, reports of his death were not greatly exaggerated, and the legend died just a couple of months short of his 95th birthday. However, the Koetsu name lives on through Sugano's son, Fumihiko, who was trained to take over his father's legacy, and keeps the brand clouded in mystique to this day.

Koetsu cartridges still enjoy near-mystical status; the creations of a quiet infinitely-patient sage, steeped in ancient wisdom, slowly and painstakingly crafting transcendental products – and all this passed down the line from father to son, master to new master. Inevitably, the legend is somewhat at odds with the reality. But still the myth lingers on, and with good reason.

There is a magical quality to the sound of a Koetsu – something beyond measurement and statistics. Naturally, precision engineering and using only the best materials have long been an essential part of the mix. But the end result exceeds the sum of the parts. Call it art; call it alchemy; call it BS – for those with ears, a Koetsu was (and is) special.

The Koetsu experience comes at different price points – from (relatively) affordable to 'is that a misprint?' Even the basic models sound excellent, but as you move up the range, the sound grows increasingly rarefied. Many Koetsu pickups feature 99.9999 purity copper wire for their coil windings with a special silver cladding that consists of a silver sheath slowly drawn over the copper conductor, but the Blue Onyx is said to be Platinum Coiled. As ever, details are sketchy – so we presume the copper is Platinum sheathed. The motor assembly employs Samarium Cobalt magnets for their concentrated power.

The cantilever is made from boron, but perfectionists with even deeper pockets can go for an optional one-piece diamond cantilever and tip. This avoids the interface between stylus tip and cantilever, and increases rigidity, albeit for an extra £3,666. People say you can't put a price on perfection; actually, perfection costs precisely £11,066!

The body shell is fashioned from powder blue Onyx, so each cartridge has a uniquely beautiful appearance – like a piece of

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"Clarity is quite stunning. The way this cartridge separates individual vocal lines, and allows subtle instrumental passages to be heard, borders on the miraculous."

exotic jewellery. It's not a small cartridge, incidentally – 23mm long and 14mm deep – and also quite heavy at 14.8g. Your chosen tonearm will benefit from a heavy counter weight. Optimum playing weight falls between 1.8g to 2g. 1.8g offers slightly greater transparency and fine detail, but 2g reduces surface ticks and improves tracking slightly. Now, we're always told not to trust our 'first impressions' when evaluating hi-fi. But calm rational objectivity can be difficult once something like the Koetsu Blue Onyx begins to play...

The Blue Onyx sounds impressively sharp, yet at the same time, beautifully refined with an effortless velvety smoothness that's almost uncanny. It's every bit as detailed and dynamic as you could wish for, yet wonderfully poised and relaxed-sounding. In musical terms, the presentation is effortless and natural. The music seems to 'happen' between your loudspeakers; voices and instruments materialise before your very ears.

The timbre is somehow both mellow and sharply focused – smooth and subtly shaded, yet crisp and tactile. It's a beguiling mix of opposites; sonorous warmth and silky smoothness, hand in glove with immediacy and crisp attack. Dynamically, the Blue Onyx 'projects' with an impressive sense of power. The sound is very energetic and colourful, yet unexaggerated and truthful too.

With a full and solid bottom end, liquid midband, and brilliant translucent highs, there's much to ravish the ear. Transient detail is pin-point sharp, yet without aggressiveness, and always wonderfully homogenous. This ability to produce vivid, sharply-focussed detail without sounding 'hard' or over-driven is very much a Koetsu trademark.

I found the Blue Onyx musically engaging and positive-sounding, while remaining relaxed and refined. This mix of opposites is apparent on most sorts of music, particularly human voice. Whether it's an unaccompanied solo singer, massed choral forces, or the lead vocals in a rock or pop track, the Blue Onyx delivers natural believable results.

Clarity is quite stunning. The way this cartridge separates individual vocal lines, and allows subtle instrumental passages to be heard, borders on the miraculous. It's also good at recreating a sense of aural space – revealing the natural hall ambience behind individual voices or instruments. As a result, each retains more of its identity.

Yet, for all its vividness, the Blue Onyx is surprisingly easy to listen to. It delivers a very coherent sound. Opposing contrasts – high and low, loud and soft, sharp and smooth – co-exist in perfect balance. So the end result is harmonious and cohesive, and the music unfolds in a way that gives you more time to listen – more time to unravel the individual strands that form part of the whole.

It's the polar opposite of a sound that is aggressive and 'forward' – bombarding the ear with a welter of unrelated leading edges so the brain struggles to make sense of it all. The Blue Onyx is delightfully easy to listen to. It delivers a very 'ear-friendly' sound. Your brain has less processing to do, so it's better able to take in the entire musical scene, and make better sense of the whole.

But please understand – the refinement of the Blue Onyx is something innate; not something false that's grafted on to each recording regardless. It's very much a pickup that faithfully reflects the individual qualities of each recording – an open transparent window on the music. It will sound sweet and beguiling one moment, then tack-sharp and crisp the next – often during the same track.

Clearly, the Blue Onyx is one magnificent cartridge. It's among the finest you could ever hope to hear, with few peers when it comes to turning those squiggly grooves into living breathing music. You'll listen to it with rapt attention – much as you'd listen to real musicians playing live in front of you. Each Blue Onyx is made to order, so there may be a long delay before you get one. But, don't let that put you off; the wait will be worth it! +

Details

Price: Koetsu Blue Onyx moving coil cartridge (boron cantilever) £7,400. Diamond Cantilever Version £3,666

Distributed by: Absolute Sounds
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Tel: 020 8971 3909

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Rega Aphelion MC cartridge

by Jason Kennedy

Rega published a book last year, an autobiography of sorts that charts the oft challenging history of the company and its products; they called the book *A Vibration Measuring Machine* (reviewed in *Hi-Fi+* Issue 149). This tells you a lot about Rega's approach to designing turntables, one where the aim is to extract maximum detail from the vinyl groove with the minimum of distortion being introduced by the 'measuring' process. While most other turntable makers appear to base their designs on what went before, Rega pioneers new technologies and techniques, and as a result makes some of the best turntables available at their given price points. In fact, few turntables equal the Rega RP10 in my opinion.

Having achieved turntable nirvana, Rega realised that it needed a cartridge that was good enough to let people hear what its turntables could do. Rega's approach to developing a serious moving coil cartridge has been as unique as anything that has been done for the turntables. The vast majority of MCs have a tie-wire that secures the back end of the stylus to the body of the cartridge and this fixing can be adjusted to tune the characteristics of the transducer. In the Apheta 2, Rega created an MC without a tie-wire so it could be produced without the need for hand tuning, thus creating a cartridge with greater consistency of character than usual. They did this by designing a rhomboid pivot pad suspension with butyl rubber that has a molecular migration characteristic, in other words, it bonds to the cantilever and the cartridge body over time without the need for any adhesive. It's pretty clever stuff even by the standards of moving coil design.

The body is machined from aluminium to very high precision and houses an 'ultra-low mass' generator, that is the iron cross that supports the coils. This is considerably smaller than usual and the signal is generated by a neodymium magnet system, which itself is very compact indeed. You can see as much by looking closely because the cover is transparent polycarbonate, which keeps dust out and protects the fragile wiring without adding mass. The Aphelion is differentiated from the Apheta 2 by its cantilever and stylus; the former using a boron rod with a slot in the end that holds a vital profile diamond stylus. There is a loop in the Aphelion body to protect the stylus from knocks, which adds mass and potential for resonance but replacing the stylus is always going to be a pricey procedure on a cartridge like this, so it's a compromise worth making.

The Aphelion is unusual in the Rega range in having some luxury lavished on its presentation. It's supplied in a machined aluminium case and comes with a torque wrench designed and made for Rega cartridges. This ensures that all three of the mounting bolts have the same torque and thus do not put the cartridge body under stress that could effect its high precision construction. Three mounting points ensure a solid fixing to Rega headshells, but with other arms you are limited to the usual two, which was how I started using it in an SME V arm on a Model 20/3 turntable. A Tom Evans Groove+ SRX MkII provided phono amplification and EQ duties and had its loading set to the 100 Ohms impedance recommended by Rega. This combination allowed the Apheta to go about resolving vast swathes of fine and coarse detail, which meant that the characteristics of the records played came through loud, clear, and relaxed. The bass for instance reflects both the solidity of the SME turntable and the timbre of the drums and guitars producing it. On 'The Wardrobe Master of Paradise' [Conjure, *Music for the Texts of Ishmael Reed*, American Clavé] there is a good variety of percussion instruments, particularly hand beaten drums, which the Aphelion was able to clearly differentiate while allowing Taj Mahal's singing to retain oodles of character. The imaging was positively holographic, especially when the sax player came in and you could hear his intonation and technique while simultaneously getting wrapped up in the song. On another tune from the same album, 'Oakland Blues', Olu Dara's trumpet playing takes centre stage and sounds so inspired that this just had to be a live, improvised session.

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Technical Specifications

Type: Low output moving coil phono cartridge
Stylus/Cantilever: Slot-mounted, vital profile diamond, with Boron cantilever
Tracking Force: 1.75g–2g
Load: 100 Ohms
Compliance: Not specified
Output: 0.35 mv
Weight: 6g
Price: £2,998.00

Manufacturer: Rega Research
URL: www.rega.co.uk

For a change of style I put on 'Dancing with the Moonlight Knight' [*Selling England by the Pound*, Genesis, Charisma] where it was easy to distinguish every note and nuance of the playing, not to mention the dynamics which were positively astonishing. The Aphelion was however designed with considerably lower mass turntables in mind so I swapped it onto a Rega RP10 and put Tom Waits' *Swordfishtrombones* [Island] under the stylus, which resulted in all of the above plus solid gone, on it, kick ass timing, and even more of the character of the recording. The acoustic nature of the studio and effects, the interplay between musicians and the full space and depth of reverb became clear as day. A proper 3D, 10K experience without goggles or speakers in the ceiling! The home cinema world has a long way to go before it creates a sense of realism like this, if it ever will; shutting the eyes helps with suspension of disbelief.

The RP10/Aphelion combination produces the most lifelike results I have encountered with vinyl, and if there is vitality in the music you will hear all of it with this record player (phono stage allowing). The Marty Paitch Big Band's The *New York Scene* [Discovery] features Art Pepper and Victor Feldman in tight formation creating a sense of tension that is just magic on the opening number. The recording gives a very different perspective on the various instruments, but the whole thing swings like nobody's business.

The low mass of the Aphelion and its three hole fixing make it perfect for Rega turntables, but its qualities shine through elsewhere as my experience with the SME revealed. It's speed, detail resolution, and neutrality are in the premier league but don't expect something to warm up your record collection. This MC is designed to measure the bumps in the groove with maximum precision and deliver a signal that is a very accurate representation, so much so that you will find it hard to tear yourself away. If you want to hear the true nature of your record collection there are few better tools for the job. +

Audio Research Reference Phono 3 phono stage

by Alan Sircom

Launched at the tail end of last year, the Reference Phono 3 phono stage by Audio Research marks a significant change in the company, and it's not just cosmetic. The new Audio Research reflects the changes in the audio market, as we move further from products that are sublime on the inside only, to products that take every aspect of the design and build process seriously.

The Reference Phono 3 is a perfect example of that change in stance. It needs no back story and makes no apologies for itself, being extremely well made inside and out. There are little design touches in the Reference Phono 3 that combine to make this a far more acceptable product to a wider audience, losing the 'lab gear' look of previous models. In fairness, the Reference series has been steadily improved inside and out for several years, but if you compare this 2016 model with the original Reference Phono made at the turn of the century, the toggle-switches, rattling case, and contrasting slimline grab-handles have all been replaced, making the product look more like it belongs in the home, not the test-bench. It's strange how powerful this change is, because the Reference models of a decade and a half ago seemed timeless, yet look old-fashioned by today's standards.

Of course, the big industrial design change is the move to that central black panel and large, softer-touch buttons. This harks back to very early Audio Research designs and first re-appeared in the G-Series line. It filtered through to the Reference range last year, and this year – with the Foundation series – it looks set to be a root-and-branch design change through the whole ARC line-up. Personally, I think it a marked improvement on what went before, even though I liked what went before.

Any product bearing the 'Reference' name in Audio Research has some big shoes to fill, but arguably none bigger than the Reference Phono 2 SE this new model replaces. The 'Ref 2' and 'Ref 2SE' were some of the most highly praised and keenly sought after top-notch phono stages on record, and was in direct lineage to the cost-no-object Reference Phono 10 two box model. The Phono 3 doesn't exactly tear up the rule book and start again, and ostensibly the layout is similar even if the design has changed. The row of six push buttons to navigate through every part of the ARC's extensive menu system and the large green vacuum flourescent dot matrix display panel remain 'effectively' unchanges, as do the five levels of loading and the 71dB of active gain used in cartridge matching. This is a better

thing than it first seems because the original navigation system was already easy to drive, and the near infinite level of cartridge matching remains state-of-the-art.

Like its predecessor, the Reference Phono 3 is underpinned by an extremely sophisticated logic control (extremely sophisticated for a valve phono stage, that is – this isn't International Space Station grade stuff). You can adjust every parameter through a menu tree, from the amount of time the Reference Phono 3 will run before switching to standby, through gain settings, valve operational life, display brightness, and EQ. Depending on your take on the whole phono equalisation debate, however, this menu system might be completely upside down – I know of collectors who have gone through their LPs and mark whether they are best played through RIAA, Columbia, Decca, or one of several lesser known equalisation curves. The Reference Phono 3 offers the listener the option of scrolling through the Big Three – RIAA, Columbia, and Decca – but you'll need to run through all five main pages of the menu system to get to these. Listeners who change valves once every 2,000-4,000 hours, who never adjust the display brightness or standby settings, and who use the same cartridge month in, month out – but who might change EQ curves once or twice in a listening session – have to tab through a lot of pages to get there. Fortunately,

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the remote obviates all this, as it has one-touch access to curves, loading, and even tube hours.

I'm trying to sit on the fence deliberately here, because the equalisation arguments rage long and hard. For my part, I have a handful of older LPs (mostly Deccas) that seem to benefit from changing tone curve, and as a consequence the placement of EQ at the 'coffee and liqueurs' page of the menu seems wholly appropriate. No doubt others will get exercised over the same thing. Regardless, I'm pleased there are alternate tone curves on the Reference Phono 3 (as there were on its predecessor), and when called upon, they work extremely well; as in fairness they did on the Reference Phono 2 that went before.

The change from Ref 2 to Ref 3 comes in the guise of two additional 6H30 valves in the analogue stage (now bringing the total number of 6H30 valves in the Ref 3 to seven – six in the analogue stage – plus a solid-state rectifier and a 6550 in the power supply). These two additional valves do not replace the input FETs introduced in the Reference 2, they just add linearity to the analogue stage. Although an oversimplification, that basically means the power supply stage is effectively half of a mono valve power amplifier in its own right, dedicated to feeding the three 6H30 valves for each channel. For a phono stage, that is heroic amounts of clean power delivery.

The transatlantic design team (electronics from Plymouth, in Minnesota, USA, product design from Vicenza, in Veneto, Italy) has come up with something more than just a nice case. In moving away from Audio Research's classic design lines, the chassis has developed some elegant aluminium side panels that look great, but aren't just for show: they help dissipate heat and resonance away from the all-important internals.

A cynical reading of the Reference Phono 3 would be "two more tubes and a nicer case. Is that it?" But, as ever with such things, the real-world take on this is that the Phono 3 is redesigned from first principles, incorporating the best elements of the Reference Phono 2 rather than simply 'cloning' its predecessor. In fact, the Reference Phono 3 is more like a synthesis of what Audio Research has learned from the rest of its Reference range, distilled into one big phono stage. Those two additional valves help linearity in a manner akin to that discovered in the Reference 10 and Reference 6 preamps.

Having a phono stage that is built like a power amplifier does have a short-term downside. It takes forever to run in. Whether it's those Teflon capacitors (there are a lot of those) or the tubes bedding in or simply some mystery X factor that means the amp needs time to get used to its environment, but as with previous Audio Research products – and especially those in the Reference line – this takes hundreds of hours to come truly on song. It sounds good to excellent out of the box, but keeps on improving for the next few hundred hours (Audio Research itself suggests 600 hours… and not 600 hours of it gently warming up in a corner, 600 hours of active record playing). You could easily be talking a year of record playing before the amplifier comes on song. As I left the keys to my time machine in 1789, and this review isn't beamed back from mid next year, there is still some room for improvement in the sound of the Reference Phono 3.

"While few phono stages sound 'arthritic', when listening to the Reference Phono 3, one gets an underlying sense of agility."

That sound combines the texture, soundstage spaciousness, and richness of valve phono stages with the detail and silent backgrounds of solid state. This is a balance, but it's both a dynamic one, and one that will appeal to many, many listeners. This sense of balance makes for a presentation that is extremely realistic, irrespective of the music played. Of course, the more live and acoustic the recording, the more 'real' it sounds, but even an old 45rpm 12" single of 'Two Tribes' by Frankie Goes To Hollywood [ZTT] sounded 'realistic'. In fact, this Trevor Horn throwing a studio at a remix is jaw-dropping on the least impressive audio equipment, but here it sounded unfeasibly dynamic, rich, and impressive. Listen to this dance-music-meets-1980s-paranoia masterpiece through a system worthy of the Reference Phono 3 and you'll be left gasping by the end of the piece. Switch back to more

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"This is a balance, but it's both a dynamic one, and one that will appeal to many, many listeners."

traditionally audiophile-chummy, dynamic recordings like Tennestedt's powerful version of Mahler's Third Symphony [EMI], and you'll be in the same state. This is not LP replay for the casual user; it's for protracted musical sessions and enjoyment red in tooth and claw.

The Reference Phono 3 also always seems to have reserves in the tank. This doesn't mean it never gets out of low gear, more that it is entirely unflappable. You might not think of a phono stage in terms of its musical robustness, but once you have experienced the authority of an phono amplifier (and let's be clear on this, the Reference Phono 3 should be classed an 'amplifier' not a 'stage'), its hard to look back at less robust designs.

Yet for all that unflappability, there's one key word that effectively sums up the defining characteristic of the Reference Phono 3: agile. While few phono stages sound 'arthritic', when listening to the Reference Phono 3, one gets an underlying sense of agility. It reacts to the most subtle changes in timbre, tone, or dynamics without the least concern, and to such an extent it makes many rivals seem slightly ponderous. More interestingly, the handful of phono stages that match the Reference Phono 3's agility often do so by sounding 'twitchy' in comparison. 'A Night In Tunisia' from Art Blakey and the Jazz Messengers' *A Night At Birdland Vol 1* [Blue Note] is a perfect example of what this phono stage does so well. The opening drum and percussion passages are full of subtle textures and dynamics, then the rest of the band kicks in like a whirlwind. The Reference Phono 3 tracks these changes perfectly and deftly, with outstanding (here comes that word again) agility.

Here's the thing. There are some who take the whole 'user adjustable EQ curves' aspect as intrinsic to a good phono stage. There are some who insist on absolute adjustability of cartridge loading as key to good phono reproduction. There are some who demand a low noise floor from their benchmark phono stages. Even in high-end audio's thermosphere (the one beyond the one beyond the stratosphere, populated by aurora, meteorites, and ballistic missiles), typically you might have to make do with a 'two out of three ain't bad' approach to phono stage design. The Reference Phono 3 is that rare exception that ticks all the boxes: it is quiet, it is almost infinitely adjustable, and it does come with a profusion of EQ options. However, what makes the Reference Phono 3 really shine is that if you are simply a 'fit and forget' kind of listener, who will never delve deep into listening out for the optimum loading for each channel of a cartridge, and who will never, ever play anything other than the standard RIAA curve, the Reference Phono 3 still has much to offer, in sound quality terms.

The term 'reference' still has meaning for Audio Research, and it doesn't use the term lightly. The Reference Phono 3 is a true reference point in turntable replay, as it extracts a remarkable amount of information from the cartridge, and yet plays it in a manner that invites you to listen to more and more albums. Those hundreds of hours of run-in will never be viewed as a chore, more as a pleasure, unveiling both what your records are capable of and just how much better your Reference Phono 3 gets. And those hundreds of hours will pass quickly, too. From a position of not firing the ejector seat on my own career at least, there can be no 'best' in high-end audio, but the Audio Research Reference Phono 3 is one of those rare devices that gets closer to 'best' than most. Highly recommended. +

Technical Specifications

Type: Hybrid phono stage
Tube Complement: (6)-6H30P dual triodes, plus (1 each) 6550WE and 6H30P in power supply
Controls: Six Push Buttons: Power, Menu, Option, Enter, Input, Mute
Inputs: 2× RCA stereo pair, earth tag, RS232 comms
Outputs: Balanced XLR pair, single-ended RCA pair
Frequency Response: ±.2 dB of RIAA, 10 Hz to 60kHz; 3 dB points below 0.3Hz and above 300 kHz
Distortion: Less than .002% at 1.0V RMS 1kHz output
Gain: Selectable 51 dB (Low) and 73 dB (High) at 1kHz BAL; 45 dB (Low) and 67 dB (High) at 1kHz SE. (MC and MM compatible)
Input Impedance: 47k Ohms and 100 pF SE. Selectable loads: 1000, 500, 200, 100, 50 Ohms, and Custom
Output Impedance: 400 ohms Balanced, 200 ohms SE. Recommended load 50k–100k Ohms and 100 pF. (10k Ohms minimum and 2000 pF maximum)
Phono Equalization: (selectable) RIAA, Columbia, and Decca
Dimensions (W×H×D): 48 × 19.8 × 41.9cm. Handles extend 4 cm forward of the front panel
Weight: 16.6 kg
Price: £11,998

Manufactured by:
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URL: www.audioresearch.com

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Gold Note PH-10 phono stage

by Nicholas Ripley

Gold Note's extensive range of products are less well known than they deserve to be. After you read this review of the Gold Note PH-10 phono stage – and especially when you read the price of this component and what it has to offer – you'll wonder why the company doesn't receive more top-line recognition.

The PH-10 is a decently sized black or silver box with a knob, a small screen, and a logo that looks like it should be a Roman coin. The logo is reiterated on the top panel and as a watermark on the screen. Through a series of turns and pushes of that one knob, you can navigate a surprisingly deep and rich series of phono set-up and use options, far above the things you'd expect for the price.

At this level, and often way beyond this price point, adjusting cartridge loading or gain is performed by adjusting a series of DIP switches. Lose the manual or have the kind of long-sightedness that gets to almost everyone over 40 and that becomes a chore. Gold Note, on the other hand, make such adjustments easy, quick and simple. The PH-10 offers nine different load impedance options and four levels of output. You have two phono inputs, and the option of balanced or single-ended output, and there is even an optional valve power supply (not supplied) and a range of other upgrades including an EQ curve enhancer, gain stage enhancer, and an optional valve output stage. There's even a USB port for upgrades.

The really clever part is using that 2.8in TFT screen to navigate the options open to you, by scrolling round the screen itself. Top left corner, you have the choice of cartridge input. Top right, the ability to switch between MM and MC in very broad terms. Bottom left, load and gain options, then the option to turn the display off, and whether optional cards and power supplies are fitted. In between all these is a representation of the EQ curve used, and yes... you can switch between RIAA, Decca, and Columbia curves. The optional enhancer, as the name suggests, allows you to tweak those curves slightly.

In short, this is not some fit-and-forget phono stage made for someone getting into vinyl replay; it's a serious and upgradable phono stage capable of incredibly fine-tuned performance, and precision of both input and EQ curve. As it's all adjustable on the fly, the PH-10 affords the listener the chance to delve into their earlier record collection to try and choose the right curve. This is a bit of 2017 controversy, with some thinking that the moment stereo came about, pressing plants switched over to the RIAA curve *en masse*, while others point to recordings made into the mid 1960s that might have been cut on lathes working to older curves (especially Columbia, it seems) given there is anecdotal evidence to support both sides of the argument, and that sadly most of the people who were driving those lathes at the time are no longer with us, this is likely an argument that will never see full resolution, but given the chance I am willing to experiment with different EQ curves and the differences can be very noticeable.

It's here that I would like to recommend an upgrade for the PH-10, one that might be buried in its optional plug-in cards. I think there are those for whom even two cartridges are not enough, and they would love to tangle with their right cartridge for the right record and the right EQ curve – those who use VPI arms with more than one arm-wand for example. For such people, I'd love to see a means whereby a number of cartridge loadings and possibly EQ fine-tunings could be stored and recalled for later listening. I must admit this is less for me than it is for people I know whose record collecting doesn't just border on the obsessive; they have made their home in camp OCD and become citizens of Compulsivia. Actually, I can see the store and recall preset option being pretty useful for reviewers, too.

In use, the PH-10 is an effortless record-playing companion. It doesn't grumble, complain, or have a hissy fit if left on for too long. It does get a little warm in use, but not to the point of great concern. It is slightly odd

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"The PH-10 is an effortless record-playing companion. It doesn't grumble, complain, or have a hissy fit if left on for too long."

the first time you turn out all the lights in the room and this eerie red glow eminates from the vents, but it's not distracting in normal use. I actually prefered it with the screen on rather than off, although I suspect it sounds fractionally better with the screen off. It certainly benefits from several hours quietly playing music to itself, even to the point where a reverse-RIAA feed from a CD player on repeat would be a good burn-intool.

If I am being truly honest, I am not the ideal reviewer for a tool this flexible. I'm more of a 'set it, then forget it' guy, but I do appreciate a good, thorough set-up procedure. And then I want the device to perform flawlessly. The Gold Note PH-10 did both extremely well. Setting two cartridges – one an Ortofon MM and the other a Lyra MC – was a little like safe-cracking (two turns to the left, click, three to the right, click), but the screen made things move fast (if you know your cartridge's settings, otherwise it's a lot of trial and error) and I had two good cartridges ready to roll in a few minutes.

And then it came to the listening. For some reason, I expected something of an extreme, either extremely soft-sounding or very harsh and hard-edged. In fact, I got neither of these things. What I got instead was a fast, accurate, and very detailed phono stage that is whisper quiet. That last is key; this is one of the quietest phono stages I have experienced at anything close to this price tag – just the faintest white noise unless you go crazy with the volume control.

The speed of the PH-10 also surprised me. Digging into my past, I pulled out *Surfer Rosa* by the Pixies [4AD]. On 'Where Is My Mind' the Pixies' famous quiet-loud dynamic requires a phono stage that is quicksilver fast and extremely dynamic, and the Gold Note aced this test superbly. You know it's good when it reminds you of the end of the 1980s, and not the ending of *Fight Club*, but let's not talk about that.

I was a litle concerned that a product with multiple EQ curves could be a Jack of all Trades, especially as many of the phono stages I have liked in the past have used passive RIAA circuits. But I needn't have worried, this is no Jaco of all Trades, as I stuck on 'Donna Lee' from the eponymous Jaco Pastorius album [Epic], any hint of deviation from the RIAA curve would be picked up by listening to his fretless bass and impossibly brilliant playing (bass players I know swear he had at least 18 fingers and three arms hidden somewhere). The PH-10 picks up everything, and you can follow every line (note – follow, not understand... that takes a higher order of musical nous than is handed out to mortal man). The sheer mastery of Jaco's playing can actually distract one from critical listening, as it's almost too much of a good thing. In this case however, the PH-10's high-speed abilities coupled with its accurate EQ curve helps make this track even more alive than I remember it.

The Jaco track also highlighted the mostly excellent soundstaging abilities of the PH-10. It throws a very wide and stable image out well past the loudspeakers, with just the central bass plus multi-tracked congas (one to the rear of the left channel, another more to front right). All these elements in the mix are right-sized and rock solid. It has a good balance too, not too forward into the mix, but not pushing back into a cavernous soundstage like a faux valve phono preamp. For the money in particular, this is absolutely spot on.

I like the fact that the Gold Note PH-10 fights way above its weight, creating a superb, well-built, and extremely flexible phono stage that is easy to use when you need it and yet is also capable of being tweaked and adjusted to even the most obsesive audio nut's wildest dreams. I love the fact that even beyond this there are a whole series of upgrades that unlock even more options along the way. I'm more than happy with it in basic guise, however. If you are looking for a £4,000–£5,000 phono stage but have a niggling lack of £4,000–£5,000 burning a hole in your pocket, the Gold Note PH-10 might just be the ideal option. +

Technical Specifications

Type: Phono Pre-amplifier with SKC and TFT colour display
Analogue inputs: 2 separate independent stereo RCA
Input sensitivity: 0.1mV MC up to 7.0mV MM
Input impedance: 9 selectable options [10Ω 22Ω 47Ω 100Ω 220Ω 470Ω 1000Ω 22KΩ 47KΩ]
Gain: 65dB MC – 45dB MM with 4 options [-3dB 0dB +3dB +6dB]
Line output level (fixed): stereo RCA @ 2Volt and balanced XLR @ 4Volt
Equalization Curve control: 3 selectable curves [RIAA – Decca-London – American-Columbia] with enhanced option for each
Subsonic filter: 10Hz/36dB octave
Frequency response: 20Hz–20KHz [Enhanced 20Hz–50KHz] @ +/-0.3dB
THD (Total Harmonic Distortion): < 0.05% MAX
Signal to noise ratio: – 89dB
Dynamic response: 105dB
Output impedance: 50Ω
Finish: Black or silver
Dimensions H×W×D: 8 × 22 × 26cm
Weight: 4Kg
Price: £1,350

Manufactured by: Gold Note
URL: goldnote.it

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Pass Labs XP-25 phono preamp

By Alan Sircom

Pass Labs is a firm favourite among our US counterparts. One of our sister title's mainstay reviewers – Tony Cordesman – owns several Pass Labs products in his system, including this – the XP-25 flagship two box phono stage. On the basis of its performance, it's not hard to see why.

Pass Labs has always stuck to its guns. It makes amplifiers, and although it does list two loudspeakers in the range, it's an amplifier brand first and foremost. The brand is the high-end expression of Nelson Pass, one of this industry's best respected electronics designers who, when not only builds 'em big, but builds 'em small (First Watt) and invites others to build 'em too (Pass DIY).

Pass (the man) is something of a visionary in amp design, and that means his designs have an ethos behind them, one that's common to all. Put simply, it's a kind of Occam's Razor of circuit design; a simpler design is better than a more complex one. This means the right number of components in the signal path (too few and the product performance begins to suffer, too many and it might look good on the test bench, but not sound as good in the listening room). To this end, the circuit must exhibit the maximum linearity long before any application of local or global feedback is considered. And in practice, this means careful selection of components in that signal chain, both in terms of the right device for the specific task, and careful matching and evaluation of components before they go on to the PCB. And this set of ground rules have been handed from Pass (the man) to Pass (the brand) and even on to Pass protégé Wayne Colborn, who designed this particular model

Pass Labs is resoundingly solid-state, and recognises a good power supply when he sees one, and the XP-25 is a two box affair; the off-board power supply module feeds the phono stage proper through a DIN-25 connector. Keen eyed types might notice two DIN-25 connectors on the power supply; this can be used to also feed the XP-20 line preamplifier. Pass recommends a separate power supply for both devices where possible, but that the manual discusses the requirements of aftermarket DIN-25 cables is more likely to mean people have asked the question rather than Pass thinks the cable it supplies is underperforming.

When it comes to high-end phono preamps, they seem to fall into two categories; preamps that allow adjustment of EQ curve, and those that allow fine tuning of cartridge loading. A few do both. This one stays firmly with the RIAA curve, but affords the user a wealth of adjustment over the loading of the cartridge. This does demand some careful thought on the part of the listener. The XP-25 is the sort of phono stage that has simple 'Moving Magnet', 'Moving Coil' settings; you need to know the basic parameters of your cartridge before you start twiddling knobs.

The front panel of the XP-25 (the business end, at least; the power supply just has one blue LED in the middle of that thick front panel) has three large control dials, similar to those found on Copland and – if you can remember this far back – Cello. From left to right, these adjust resistive loading, reactive or capacitive loading and gain. There's also a row of smaller buttons, to select input (there's provision for two decks, as well as balanced and single-ended output), a low-pass filter setting and a mute button. With nine different resistive settings, six capacitive and three levels of gain setting, if you think you just can 'wing it' with 162 different permutations, some of which will deliver a very loud sound through your loudspeakers, good luck with that. My take on this: RTM (Read The Manual).

OK, so if reading a manual brings you out in hives, here's the basic tale. You are on reasonably solid ground to assume the

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"With nine different resistive settings, six capacitive and three levels of gain setting, if you think you can just 'wing it'... good luck with that."

combination of resistive at 47kOhms and 100pF of parallel capacitive and gain of 53dB loading spells 'moving magnet' (I'm not sure how many MM enthusiasts will use a £10,000+ phono stage, but the settings stand regardless) and pretty much the same with a 66dB loading puts you in moving iron territory. If you are using a moving coil, you need some records you are familiar with, some intellectual rigour, and time. Mute your preamp, turn the gain to 66dB or 76dB (depending on output of your moving coil cartridge), the resistive load to 100 ohms and 100pF reactive. Unmute the preamp. Give it a couple of minutes to settle down and play anything between 10 minutes and an hour's worth of music you know well. Move to 50 ohms, and think like an optician (better or worse?) only listening out for indistinct bass or sharp treble. Repeat the process until you find a spot where the sound seems at its best. Now do the same with the reactive settings. Use a variety of albums to ensure you aren't setting the XP-25 too specifically for the sound of an LP instead of the sound of all your albums. This whole process could take a day or more, but eventually you'll find your cartridge's happy place and when it's done, it stays done. Note, this might be somewhat different to the data provided by the cartridge manufacturer, because different wires between cartridge pin and phono stage input can alter the capacitive loading required in the phono stage itself. Just remember when you are done to jot down the settings, just in case some passing three year old plays 'safecracker' and messes them up.

Once setting is over, you are left with a remarkably silent background from which to play your music. There's virtually no gentle hush from the electronics or self-noise from the cartridge, just near silence. Then you put a needle in the groove, and all the struggle of setting up the right loading just melts away. This has one of those sounds that makes you long for more legato in the word 'satisfying'. It's not lush or thick or woolly sounding, but it has so a complete an absence of grain, hardness, stress or solid-state edge that you might be mistaken for thinking there are some triodes in there. And yet, it doesn't sound like a valve amplifier, it's not warm or dark or rich or any of those descriptors often appended to hollow-state designs. It's something between those two poles.

In a way, it's a very American sound; inviting, expansive, incredibly detailed, focused on the flow of music from bar to bar rather than necessarily its time signature and tempo. It doesn't underplay these aspects of musical performance – it expressed the dynamism and pace of Surfer Rosa by the Pixies with all the drive and intensity this piece of music needs – but it accents the orchestration and majesty of a recording rather than its abrupt passages. It's perhaps no surprise then that many of the XP-25's strongest supporters tend to be those from the jazz and classical loving end of the spectrum. Don't be fooled into thinking this is a phono stage designed only for classical or jazz; instead think that its refinement, its complete absence of grain and its ordered sense of musical flow are the first things music lovers of these genre seek from a phono stage, and they it here in droves.

The one slight caveat with the phono stage part of the two box XP-25 is that it is so sensitive, you need to be a little aware of potential hum-fields around the device. It's not the kind of phono stage that can sit too close to a big turntable power supply and even its own PSU is best given some distance. This is more a 'shelf management' issue than a problem per se, because the benefits of the XP-25 are so great, it's worth taking the trouble to get it right. But if you are the kind who treats their system with slapdash and reckless abandon, you need to be more careful with the XP-25 than some. Mind you, a £10,000 phono stage with more than 150 different setting options isn't likely to be used by someone who has the word 'slapdash' in their regular vocabulary.

Technical Specifications

Inputs: 2× RCA inputs for phono, earth tag
Outputs: single-ended RCA, balanced XLR
Gain options: 53dB, 66dB, 76dB
Resistive loading options: 30 ohm, 50 ohm, 100 ohm, 160 ohm, 250 ohm, 320 ohm, 500 ohm, 1k-ohm, 47k-ohm
Reactive loading options: 100 pf, 200 pf, 320 pf, 430 pf, 530 pf and 750 pf
RIAA response: ±0.1dB 20Hz–20kHz
Distortion (MC): < .005 % THD @ 1mV
(MM): < .002 % THD @ 10mV
Unweighted noise: -93 dB ref. 10 mV (MM), -85 dB ref. 1 mV (MC)
Dimensions (W×H×D, per chassis): 43 × 10 × 30cm
Weight: 25kg
Price: £12,000

Manufactured by: Pass Labs
URL: www.passlabs.com

Distributed by: Select Audio
URL: www.selectaudio.co.uk
Tel: +44(0)1900 601954

The Pass Labs XP-25 is a real keeper. Careful setting makes it bring out the best in your turntable system and brings out the majesty in the music on the platter. It's expensive, yes. It's got character, too. But you can't help but be impressed by the sound it makes in the process. Highly recommended. +

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Vertere Acoustics MG-1 turntable, SG-1 arm, and PHONO-1 phono stage

by Alan Sircom

Even by the standards of the average workaholic, Touraj Moghaddam of Vertere Acoustics has had a busy few years. First came the cables, then *that* tonearm (the one that costs as much as a new BMW), followed by a matching turntable, more cables, another, more attainable, turntable and tonearm, a complete revision of the cable line, then a turntable platform and equipment stands, taking on the UK distribution of FM Acoustics, and now a third, still cheaper, turntable, and a new phono stage. All this in less than half the time it takes to mature a barrel of whisky. What a slacker!

If Vertere's top deck's RG-1 handle stands for 'Reference Groove' and the SG-1 is short for 'Standard Groove', then the new MG-1 tested here means 'Magic Groove'. Doubtless, the joy-sponges who seems determined to suck the fun out of life will start foaming at the mouth about this name (as they did when they took Apple to task about where they kept the magic in 'the magical iPad'), but when you actually listen to the thing, 'Magic Groove' fits well.

Followers of the Vertere range will notice that it's not hard to see the family resemblance. The 'good', 'better', and 'best' nature of the turntable line-up can clearly be seen in the thickness of the two-layer plinth and sub-chassis. There's a lot more to that than meets the eye, but the fact the largest is almost twice the thickness of the smallest is the immediate take-away detail. Vertere has also recently discovered a metallic black print material that works with acrylic, which looks good without sounding bad.

The MG-1 turntable itself really is like a scaled-down version of the SG-1, which is itself like a scaled-down version of the RG-1, so if you like the sound of the big one, but can't quite reach that kind of outlay, the SG-1 and now the MG-1 will perform in the same vein. The MG-1 retains scaled-down versions of the main bearing and platter assembly, the plinth, and isolation system. The big change between the bigger decks and the MG-1 is perhaps the removal of the middle layer of isolation. The three-layer decoupled sandwich layout of the SG-1 and RG-1 is replaced by a smaller, two-layer decoupled platform with rigid insert, and both the one-piece platter and the bearing housing are smaller and lighter.

What is unchanged, however, is the excellent record player motor assembly from its bigger brothers. This assembly is basically floating in a rigid mount, so it delivers constant belt tension, which means it drives the platter at constant speed as the motor compensating frequency is below 1Hz. As the three elements of this whole unit (motor, sub-chassis, and platter) are designed to move as one, even belt wear over the years is less of an issue, and – aside from the odd drop of oil to the bearing every year or so – the Vertere turntable designs are made to be maintenance-free.

Unlike the SG-1, there is no immediate upgrade pathway in the turntable itself (you can upgrade the SG-1 to RG-1 by replacing the main bearing and platter assembly), but I suspect that might not be a big concern for people who go for the MG-1. The deck shares the same external power supply as used in the bigger designs, and there is an optional dust cover, although not a hinged lid. Touraj has found a way of making a hinged lid that doesn't interfere with the sound quality, and it even has a support system for the turntable. However, it is still in prototype form and you could buy something in the region of eight MG-1 designs for the same price as this when it comes to market.

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"The bigger RG-1 and SG-1 package could more than handle such a task, but could the MG-1, SG-1, and PHONO-1?"

A larger dust cover designed for the SG-1 and RG-1 also fits.

We won't spend too long on the SG-1 tonearm, primarily because it would be going over old ground. We reviewed it when we looked at the RG-1 turntable back in Issue 114, and it remains unchanged. To recap, the SG-1 arm uses what Vertere calls a Tri-Point Articulated (TPA) bearing, made up of three silicon nitride balls forming an equilateral triangle below the stainless steel pivot point, all bonded into the aluminium yoke. This supports an underslung counterweight (which is also good for correcting azimuth) on an aluminium outrigger, and a carbon-fibre wrap armtube ending in a bonded machined aluminium alloy headshell. Along the length of the armtube is a fine-tuning weight adjustment that doubles as a resonance control. Anti-skate is through the typical hanging weight system, although there are actually no OEM parts in the SG-1. The arm comes in two basic guises, with standard or handmade wiring, and there is a large range of arm cables.

The new kid in town, however, is the phono stage, called the PHONO-1. This one-input, single output, solid-state MM/MC stage is designed to have maximum flexibility in cartridge loading. It has two sets of DIP switches flanking the shielded central RIAA and preamplifier stages. The input loading sections (made up of two banks of eight switches each) allow for 15 resistance and nine capacitance settings, while the eight-switch bank for gain allows for ten different positions. Having these DIP switches on the main PCB prevents them from being accidentally moved, but it does mean you need to open the top of the case each time you want to adjust the settings. There is also a three-way ground switch at the rear of the PHONO-1. This allows for 'hard ground', 'ground lift' and 'soft ground' and depending on your system, one of these will produce very slightly less hum than the others.

The assemblies for power supply and phono stage, both use gold-plated PCBs chosen for best performance, and the two sections are physically separated and partially shielded from one another in the case itself. The screening can surrounding the RIAA and amplifier stages isolates the cartridge input from the noisier active stages.

"You can use the PHONO-1 with any cartridge!" Said Touraj. I took him at his word, and out came an old Ortofon MC7500 cartridge. This was – how can I put it nicely? – evil. The MC7500 is a fabulous cartridge from the 1990s, but it was virtually a cartridge in search of a phono stage good enough to cope. When it was launched, most were supplied with Ortofon's own step-up transformer, because it delivered 0.15mV. Say that figure to most phono stage makers and you can see the blood drain from their faces. "That's not a moving coil," they say, "that's a single piece of wire wrapped around a magnet." They then mumble something that makes them sound like a muted McEnroe. Touraj just smiled and said, "Cool, let's try it!"

This was a doubly difficult test for Vertere, because the MC7500 is not the kind of cartridge you would normally put on a deck and arm at this level. In 2017 prices, it would be north of about five grand in terms of index-linking and performance. The bigger RG-1 and SG-1 package could more than handle such a task, but could the MG-1, SG-1 and PHONO-1?

Of course it could! The MG-1's two-compliant, one-rigid isolation system, offset with nine decoupling points may be scaled down from the SG-1, but it has the same basic concept, and returns the same basic performance, just in microcosm. It has the same sense of extremely dynamic, exciting sound, coupled with the same sense of that sound rising out of the darkest of backgrounds. It's perhaps not quite the 'sound of no turntable' (the bigger decks achieve that goal), but the influence on the music is minimal.

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"You really jump out of your seat when the drums kick in. It's absolute maximum excitement."

The dynamic range on this turntable is phenomenal, bettered only by a few, and two of those in the Vertere range. Play 'Where Is My Mind' by The Pixies on their awesome *Surfer Rosa* LP [4AD] and that quiet-loud-quiet structure that defined many of their songs takes on an edge-of-the-seat quality. You really jump out of your seat when the drums kick in. It's absolute maximum excitement. Couple this with being in lock-step to the timing, and huge amounts of detail, and it's hard not to be swept up by the presentation.

The soundstage is impressive, too, with a great sense of presence and lots of room filling detail. My go-to record for testing this is the Decca SXL of the Overture to *The Pirates of Penzance*, by the D'Oyly Carte and the LSO, and the Vertere doesn't disappoint. It's full of foot-stamping energy and entertainment, with an infectious sense of rhythm (again), but the width, depth, and even height of the image is impressive. It presents the music forward of the loudspeakers slightly, which is part of the whole 'excitement' thing, and fun too.

Where the cost-cutting exercise shows itself probably doesn't matter in context. Use it with really full-range loudspeakers in a big room, and compare the MG-1 package with one of vinyl's big guns and the bottom end is a little reticent. The VPI Prime Signature tested in this issue, for example, has a more stentorian, deeper bass than the Vertere design. But, in the context of fast-moving, brisk and clean sounding loudspeakers that might not excavate that last octave (as might be partnered with a turntable of this price), the MG-1 frequently wins out in the speed stakes, and the dynamic range it produces in this kind of setting makes it hard to beat.

Technical Specifications

Vertere Acoustics MG-1 turntable
Type: Belt Drive Turntable
Platter: Single piece precision aluminium alloy, 3mm bonded acrylic record surface
Bearing: Precision hardened stainless steel, in high copper content Phosphor Bronze housing
Plinth Structure: 2× 20mm clear cast acrylic
Isolation System: Two-stage compliant and single-stage rigid system, with nine decoupler sets and combination alloy/foam/SS ball feet
Motor Drive P/S: Precision Crystal Referenced
Speeds: 33.3 and 45 rpm (< 0.2%)
Wow and Flutter: < 0.02%
Rumble: < -85dB
Price: £4,500

Vertere Acoustics SG-1 arm tonearm
Type: Tri-point articulated tonearm
Effective length: 240mm
Overhang: 17.5mm
Offset angle: 22°
Construction: Aluminium headshell, wrapped carbon fibre armtube, stainless steel counterweight, carbon silicon Nitride ball bearing (×3)
Weight: 387g
Price: £1,800

Vertere Acoustics PHONO-1 phono stage
Type: MC/MM preamplifier
Inputs: 1× RCA stereo pair, earth tag
Outputs: 1× RCA stereo pair
Frequency Response: 20Hz–20kHz ±0.2dB
Noise: < -78dB (AWD)
THD+N: 0.03%
Gain: 45.4dB–61.4dB
Impedance settings: 47kΩ (MM), 78Ω–1.45kΩ (MC)
Capacitance (MM): 100pF, 470pF
Capacitance (MC): 100pF-1.02µF
Dimensions (W×H×D): 21 × 23.5 × 5.5cm
Price: £999

Manufactured by: Vertere Acoustics
URL: www.vertereacoustics.com
Tel: +44(0)203 176 4888

This is one of the most confident vinyl front-ends you can buy, and not just 'at the price'. The MG-1 turntable delivers much of what the better and best Vertere turntables can produce, the SG-1 arm is already a known good 'un, and the PHONO-1 is one of the most naturally sounding phono stages I've heard in a long time. I subjected all three to some hardcore, old-school Ortofon torture cartridge of doom, and the only limitation it presented was the phono stage didn't go quite as loud as possible. This whole package – preferably armed with a more real-world, but still very good, cartridge – will give you such a strong taste of the top-end of the high-end and more. Highly recommended! +

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booplinth custom LP12 plinth

by Roy Gregory

Linn's venerable LP12 Sondek – over 40 years young – has become so synonymous with the succession of upgrades that have been applied to the basic deck since its launch, that it's now almost impossible to talk about the turntable without applying some qualifying suffix. Of course, most of those upgrades have originated with Linn itself, reaching so deep that platter apart, pretty much nothing else remains of the original – although any Sondek can be updated to current spec if the inclination exists and funds allow. In fact, these days, there is no one Sondek, but three distinct levels of parts and all the pieces to step between them.

But one element of the deck has remained almost untouched since the earliest days: aside from adding corner braces and reinforcing blocks early on, Linn has left the plinth essentially unchanged, a decision that has opened the way for a recent flurry of alternative plinths from third party sources – although interestingly these have tended to concentrate on aesthetic or practical considerations, offering alternative woods or extended footprints intended to accommodate longer tonearms. Now comes yet another 'after-market' plinth for the LP12, but this is very definitely a plinth with a difference…

Whereas virtually all the other LP12 plinths, whether they come from Linn or alternative suppliers, feature the same simple hardwood picture frame construction, the booplinth is built from bamboo – a material that isn't actually a wood at all. So much has been written about this almost 'magical' material (magical at least from a sonic standpoint) that I won't repeat it all here, but the key thing to know is that this fast growing, carbon-positive grass is formed from long, resin bound fibres. Its tubular structure means that in order to create useable sheets of material you can actually make things from, you need to slice it into strips that are then pressure laminated to form slabs. The end result is incredibly strong, resilient and yet relatively light. It also creates a random structure built from differential strips of a random material, and as well as being seriously random that makes it deeply dispersive in nature, aided by its fibre/resin matrix nature. Its mechanical appeal is matched only by its eco credentials, which explains why it is cropping up in everything from the shelves in hi-fi racks to loudspeaker cabinets – with readily demonstrable sonic benefits all round. This is the material from which the booplinth is built.

But that's not the only major difference between boo and the neighbours. The other thing that sets this plinth apart is that it's CNC machined from a single slab of bamboo. Compare that to the standard LP12 plinth that consists of no fewer than 17 separate structural elements, including separate strips of wood that are attached to the inner face of the frame and act as shoulders on which the top-plate rests. In contrast, the booplinth's one-piece construction is both stronger and mechanically more stable, while the nature of the process that creates it guarantees that those bits that are supposed to be level and parallel actually are, those corners that are supposed to be 90 degrees really are right angles – and stay that way. One of the great, unresolved debates in Linn folklore revolves around which age and/or colour of plinth sounds best. The answer is, they all sound different, irrespective of vintage or hue, and if you look at how they're made and what they're made from, that's really no surprise. The booplinth doesn't just promise superior sonic and mechanical performance, it should also deliver much greater consistency.

Which all sounds good until you come up against the wince-inducing price tag of £1,650. Yep – you read that right: around three times the cost of a replacement plinth from Linn (there's a reason that they make them that way).

Now, I could tell you how difficult it is to CNC mill bamboo, that the complex multi-profile shape of the LP12 plinth requires machining in two stages, from above and then below and that that means that with a CNC machine dedicated to the task you can still only produce six plinths a day. I

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"Aside from adding corner braces and reinforcing blocks early on, Linn has left the plinth essentially unchanged."

could point out that both the manufacturing technique and the material itself result in greater precision and closer tolerances, that the price should include installation, and that the booplinth comes in four different colours (to start with): and it would all be true – but it would still cost £1,650. Such a serious price-tag asks some pretty serious questions and demands equally serious answers. It's not just a case of does the booplinth make a difference, but how big is that difference and, just as importantly, where (if at all) does it fit into the great hierarchy of LP12 upgrades? I don't normally indulge in 'awayday' reviews that involve visiting alien listening rooms and systems, but in this instance, it really was a necessity. The need for multiple decks and on the fly changes meant a visit to Brian and Trevor's in Manchester: audio consultants, Linn specialists, and the people behind the booplinth.

They still had the pair of (as near as possible) identical 'tables that they'd demonstrated at the Bristol show – 'junior' Sondeks with bonded sub-chassis, AC motor, Lingo power supply and each carrying an Akito tonearm and Adikt MM cartridge. Internals were of similar vintage and the cartridges had almost identical running times. But in this case and to take things a step further, the decks were both swapped on and off the same shelf and connected to the same Lingo and tonearm cable, eliminating acoustic and cable/ancillary variation and narrowing sonic differences down to the plinth and nothing else – which made the extent of the musical difference between the two decks all the harder to credit. Playing familiar material, the bamboo plinth wrought such a monumental improvement in clarity, timing, tonality, pace, dynamics and separation that it rendered the result a slam dunk – even before you consider the substantial musical benefits. Because that's the real clincher here: the booplinth isn't just better hi-fi, it makes significantly more sense of the music and delivers a substantially more convincing performance. Leave the increase in intelligibility to one side, this was the most convincing 'tune' demo I've ever heard, making the LP12 better at exactly what LP12s are supposed to be best at.

Record after record revealed the same result, bass notes that gained shape, character, and attack, better separation between instruments, more presence, more immediacy, more sense of real people playing real instruments, more music and less system. Listening to Suzanne Vega's revisiting of 'Tom's Diner' (on Close Up Vol 2, People And Places) the muddy grumble that filled the lower registers on the deck with the standard plinth was transformed by the booplinth into discrete bass guitar notes with pitch, leading edge attack, texture, tone and detail. Vega's voice stepped forward, more convincing, more immediate and far more natural – and the cello? I'll leave that to your imagination. On this simplest of tracks the difference was unmissably obvious: what was ordinary, congested, and compressed with the standard plinth was rich, vibrant, alive, and musically compelling with the booplinth. And, as things get more complex, the differences became both more obvious and more musically significant.

With my hands firmly on the demonstration tiller, the next step seemed obvious (at least to me): I had intended to work my way up the LP12 hierarchy to see where the booplinth fits in, but it dispatched the standard plinth with such negligent aplomb that the only logical response was to wheel out a fully loaded LP12, complete with Keel, Radikal, Ekos SE, Kandid cartridge and on-board Urika phono-stage – or, around £5K plays £15K. No contest you might well think – and you'd be right: the booplinth-ed deck, bonded sub-chassis, cheap arm, MM cartridge and all, absolutely buried the LP12 Klimax. Playing 'Listen To The Radio' from Nanci Griffith's Storms, you couldn't fault the detail coming off of the Linn flagship, but the song was leaden, lacking pace and its normal insistent sense of rhythmic drive. The individual elements were all there, but they just didn't hang together. The rhythmic hitch kick that propels the song into its second verse passed almost unnoticed and the piano break lacked separation, shape, and attack. Back in the land of boo and normal service was blessedly restored: the track sprang forward with proper musical enthusiasm,

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"Such a serious price-tag asks some pretty serious questions and demands equally serious answers."

Nanci's vocals took on a carefree, engaging quality, locked to the rhythm, that hitch kick propelled the song forwards (just as it should) and the piano took on a presence and stabbed attack to its phrases that had been entirely absent on the Klimax deck equipped with the standard plinth.

Which of course, left only one other thing to do: drop the Klimax innards into a booplinth. Trevor duly obliged and we sat back to see whether the natural order had been restored. Which it had, but only in part. Now, all the benefits of the Klimax rig were working for it and finally working together – it's just that even so, the 'junior' set up (somewhere between an LP12 Majik and an Akurate) got uncomfortably close. It might not have matched its bigger and much more expensive brother in terms of subtlety and detail, but boy was it fun to listen to – the very quality which established the LP12's reputation in the first place.

Which brings me to perhaps the most interesting thing about the booplinth. It doesn't just slot straight into the LP12 upgrade logic, it jumps the queue straight to first place. Doesn't that upset the front-end first apple cart? Actually, no. If the turntable is the foundation of and defines the record player's quality, then what's the foundation of the turntable? That would be the plinth – the mechanical element that ties all the others together. Think about the parts that make up the deck, how they interrelate and what happens to noise generated within the structure and suddenly it all starts to make sense – and suddenly the venerable LP12 has got a whole new lease of life. It's 30-years since I last owned a Linn Sondek, but all of a sudden, I'm taking the idea seriously again.

The booplinth represents the biggest and most musically fundamental upgrade I've yet heard to the LP12 – and that includes all the various Linn parts. For anybody who has played with bamboo in an audio system already, that probably won't come as a surprise: it's the scale of the improvement that's going to be the shock. How much of that is down to the material and how much to the improved manufacturing accuracy and mechanical integrity is impossible to say, but the sonic and musical results are simply astonishing. £1,650 is a lot of money – but to put it into context, it's way less than you'll be charged for a Keel, a Radikal or a Urika and the booplinth makes a bigger and musically more important difference than those three put together. The booplinth is available in natural bamboo and cherry, ebony, or black stains – with dark rumours of a Nextel option too. It's time to pick a colour, because no matter how new or old your LP12, or how far up the upgrade ladder it's climbed, the booplinth should be your first/next priority. Once you've heard it there's no going back. But look on the bright side – the LP12 has never, ever sounded this good, this musically engaging, or this much downright fun. +

Details

booplinth – engineered bamboo plinth upgrade for the Linn LP12
Replaces existing wooden plinth
Price: from £1,650

Manufactured by: The Booplinth Company
URL: www.booplinth.com
Tel: +44 (0)161 766 4837

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Pristine Vinyl ViVac RCS2 Record Cleaning System

by Alan Sircom

The clues to the pros and cons of a Record Cleaning Machine are lodged in the name. The record cleaner part is increasingly vitally important, because as people buy up 'mint' albums from eBay (which turn out to be nothing of the sort) and from second-hand dealers at ever-increasing costs, a record cleaner does much to turn the clock back, making that LP sound as best it can. On the other hand, the 'machine' part means most record cleaners are big, noisy cubes that should be housed in a garage or a machine shop, and definitely not a listening room.

The Pristine Vinyl ViVac cleaner goes some way to address the needs of the home user, by making the cleaner small enough, good looking enough, and quiet enough to make its way into the listening room. OK, so in use it vibrates and hums a little, so no listening to a record while you are cleaning another, but turn the Pristine off and it's smaller than most record decks, and represents just another shelf in your system. By bringing the cleaner into the listening room, and by not making it sound like you are trying to start a tractor with a howitzer, it means you are more likely to clean a record. By making the process quick (when you get adept and the ViVac is primed and ready to go, cleaning takes about a minute and change per side), it means you are likely to clean more records, too. The logic is if it's in the room where the records live and where the records are played, it will get used, but using your record cleaning machine means dragging a bunch of records into the basement like some kind of hipster dungeon master, you'll give up the cleaning schedule after a few goes.

This dichotomy between 'record cleaning' and 'machine' is not trivial. Most of us keep our records (or at least most of our records) in the listening room. This is ideal, because the journey from shelf to platter is only a few feet. However, putting a RCM into the equation often throws this delicate ecosystem out of balance, because you either need to move the big, heavy, and often ugly box of noise into the listening room, or move the records to be cleaned into another room. What usually happens is either an orgy of record cleaning once or twice a year, or the records simply don't get cleaned, and sooner or later the RCM ends up being attic fodder.

There are, in fact two ViVac models: the RCS1 where the cleaning fluid is applied with a squeezy bottle and the RCS2 (tested here) where the cleaning fluid is applied by an electric pump and swing arm. The base model will be upgradable. It comes in some nice shades of tree, along with matt black

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"The Pristine Vinyl ViVac cleaner is small enough, good looking enough, and quiet enough to make its way into the listening room."

and white, with other funky colour schemes to order.

There is no great reinventing the wheel here. Keen eyed followers of all things RCM will notice some similarities between this design and a Keith Monks, although this shows some increased refinement in terms of getting fluid onto the record (using a push button connected to a small dialysis pump, rather than a hand-operated dispenser) and improved cleaner arm and platter bearings. It also goes for a manually operated brush, rather than a combined fluid dispenser/brush arrangement seen in the Monks designs. This is a good idea, because it allows more accurate dispersion of the cleaning fluid, but it means if there's a few weeks of inactivity, you should prime the brush with a small squeeze bottle of fluid. Pristine supplies its own fluid – using a vegetable-based anti-static cleaning agent combined with distilled water. Or, you can roll your own using something like Ilfotol or Kodak anti-static wetting agent, again heavily diluted.

There's another thing common to both the Pristine and KM – the 'cotton' reel that is commonly considered to pick up the dirt from the LP and wick it away to the gunk tank. This is wrong on two counts. It's not cotton – cotton would expand in the fluid, so it's a reel of nylon thread. This should last for about 1,000 albums before it needs replacing. More importantly though, it's not there to collect gunk; the thread is designed to give the vacuum pump space to operate. Think of the nozzle on a domestic vacuum cleaner: if you cover that nozzle with your hand, all it does is latch itself to your hand, stay immobile, and eventually overheat, but with a small air gap, the vacuum still sucks dust away, but can move more freely. Of course, in the process the thread does end up getting dirty and collecting dust and dirt; a small amount of thread (around a centimetre) is pulled off each time you move the vacuum arm across to the centre of the record. This thread is then sucked into the waste container when the vacuum arm drops off of the record after a cleaning sweep.

All this Keith Monks homage is very much 'a good thing'. The KM has been road tested extensively in its time. Practically every British record library of note that has an 'archive' has a Keith Monks, and dozens of the machines were used day-in, day-out in more up-market record and hi-fi stores for decades. Some of them are still in use today, despite many being built more than 40 years ago.

It's extremely difficult to determine levels of record cleaning (beyond a surface inspection) because even the most basic cleaner will remove years of crud, rendering that LP not entirely worthy for subsequent testing. However, experience suggests the amount of before vs. after difference in grunge around the instruments in the mix and background vinyl noise is directly proportional to the level of deep cleaning, and this is a transferrable listening skill. The Pristine Vinyl lived up to its name. Records lift off the platter in pristine condition, both on the surface and deep in the grooves. I used a crinkly late 1960s of Rachmaninov's Concerto No 2 in C Minor [Anievas, New PO, EMI] which is not a particularly stellar copy of an excellent rendition, and the Pristine Vinyl cleaner wiped away many of the intervening 47 years. It couldn't do anything about the scratches, but many of the more minor pops and crackles simply disappeared while others diminished significantly. I repeated that with some 1980s pop I am seriously not proud of still having in my collection, and it repeated the same cleaning, even if it couldn't make the music listenable again.

I would suggest that ultrasonic cleaners deliver an even deeper clean and remove yet more of that background noise on an LP, but do so at significantly increased cost, noise, and pet angst. This is more than a 'good enough' solution though; the Pristine Vinyl cleans very deep – the ultrasonic solutions are for those with archival application on their minds or record collections that stretch into the high tens of thousands.

Technical Specifications

Price: £1,995 (RCS2 as tested), £1,795 (RCS1)
RCS1-RCS2 Upgrade: Expected to cost around £350

Manufactured by: Pristine Vinyl Ltd
URL: www.pristinevinyl.com
Tel: +44(0)1837 871 288

In fact, the Pristine Vinyl makes the record cleaning process so easy and direct, that two observations spring to mind. First, it could be a test for scrupulousness: vinyl-loving dealers with their own record cleaning services may try to dissuade you from investing in the Pristine Vinyl, because they will lose you as a regular record-cleaning client. And second, because record cleaning becomes so trivial a project, you may be tempted to put the record straight back in its original sleeve. Instead, buy some modern antistatic sleeves and keep the newly cleaned records cleaner for longer.

The Pristine Vinyl is more than just another RCM. It brings record cleaning into the listening room without making the listening room look ugly and without making jet engine noises. It will make you clean records more often, and that will make you enjoy them all the more. Highly recommended! +

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Linn Products Lingo 4 power supply for the LP12

by Alan Sircom

Linn's evergreen classic Sondek LP12 turns 45 this year, and the latest version of the Lingo power supply is one big part of its birthday present. The other big part of the celebration – the Urika II phono stage – is the subject of next month's test. For those new Lingo or Urika II buyers, the company is also reissuing a classic, limited edition fluted version of its plinth. Although the afromosia plinth is gone, the new fluted plinths are available in black ash, cherry, oak, rosenut, and walnut.

Regardless of product, Linn's lines are neatly sub-divided into Majik, Akurate, and Klimax: not so much 'good, better, best', more like 'best, bester, bestest'. The modern LP12 is no different. The Lingo is the Akurate level power supply, an upgrade to and more, erm, accurate than the relatively simple Majik unit, but not as precise as the DC motor system deployed on the Klimax level Radikal power supply. The original Lingo dates back to 1990, and – although it went through two significant changes in the intervening 28 years – the basic filtered twin crystal oscillator circuit in an external power supply box was very much in the 'if it ain't broke, don't fix it' camp.

However, there were many lessons to be learned from the Radikal power supply, launched in 2009. This lived up to the name in that it made the fairly radical move from an AC to DC motor, using a calibration system that measured from the turntable sub-platter itself, and required a full-sized Akurate or Klimax power supply box. However, while the idea of referencing the actual speed of the platter to the motor is a good idea, on the AC motor used in a Sondek LP12 that alone doesn't open up a whole can of 'better'. Something more was needed.

That 'something more' involved a move to digital. The new Lingo 4 creates a precision sine wave in the digital domain, which is converted to analogue and amplified to drive a new AC motor. Couple this with both the Radikal's feedback system (a sensor mounted near the motor reads a mark on the inside of the outer platter), and more decoupling between motor and top-plate, and the precision of the system is clearly audible.

Physically, there are several changes between Lingo 3 and Lingo 4. The main circuit board now sits under the Sondek's sub-chassis (LP12 aficionados with long memories might recall this as the place where the Valhalla power supply used to be mounted), the motor needs to be replaced, with the speed reference eye mounted close to the new 12V motor, and the old power supply box gets radically slimmed down to be just a nondescript switch-mode power supply that is designed to be hidden from view. Like every step in the development of the Sondek LP12, the Lingo 4 is entirely retrofittable, although it requires the work of a Linn-trained dealer to install and set it up. It's also likely that if you turn up at said dealer with a fully original turntable from 45 years ago, there are other upgrades along the way that might be more practical. Like a whole new turntable. On the other hand, any plinth made after 1984 (unless it was left in a sauna for a few years) could be brought to 2018 specification… there are almost no other products anywhere in the consumer electronics world that could make the same claim.

As Linn has long made a big thing of not letting end-users mess around inside the turntable, describing the installation process is academic. Actually, it's like taking the turntable to a health spa. Trained vinyl-spinning masseuses will take your LP12, upgrade its Lingo, re-set the deck, and it comes back looking (and sounding) invigorated. You just pick up the tab!

The thing about upgrades to the LP12 is there are so many of them in circulation. Linn has sold well over 100,000 Sondek LP12s over the years, and while there will be many that are no longer in use, or just acting like the vinyl equivalent of an old Mercedes 190E and still slogging on without repair or reset, there are tens of thousands still current, well-maintained, and being used in

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good systems. The Lingo 4 makes things easy for those tens of thousands of decks… it's upgrade time! Unless the LP12 already has a Radikal, or has some fundamental flaws that need addressing first, the Lingo 4 is simply a 'must-have' addition to the LP12. Even if you have changed so many parts in the LP12 that it almost isn't a Linn anymore, the performance of the Lingo 4 might make you think about returning to the Glaswegian fold. It's that significant.

The weird thing about the Lingo 4 is that notionally at least all it does is make the turntable slightly more precise in terms of spinning at 33.33rpm and 45 rpm. On the one hand, this is not rocket surgery and we have been spinning records at their correct speed since the 1950s. On the other, spinning records at the correct speed is precisely what the LP12 is already very good at doing, so we should be gilding the lily here. We're not.

Here's how it works, take a dozen LPs to a dealer to compare two otherwise identical LP12s – one with a Lingo 3 and one with a Lingo 4. Play the first record on the LP12/Lingo 3 for a couple of minutes, replay the intro for 20 seconds or so, play it again on the LP12/Lingo 4. Take out the next LP, repeat the process going back from the Lingo 4 to the Lingo 3. Then wonder why you brought the other 10 albums.

Sonically, everything just gets that bit tauter and more focussed. 'It's All Right With Me' by Marty Paich Big Band [*The New York Scene*, Discovery LP] was a perfect example of this. The horn section was just more impactful, more upfront, and more exciting. All the while, the rhythm section suddenly became that bit more easy to define (not a simple task; bandleader Paich on the piano, Scott Ledaro on bass, and Mel Lewis on drums are very much 'in the pocket' and play as a unit, and being able to tease out and separate bass from left hand piano is no mean feat). That holds from beautifully recorded string quartets to thin sounding Rolling Stones albums; what was on the album was not changed tonally, but presented with pinpoint precision. I can imagine some of the analogue die-hards holding out on this digitally-precise encroachment on their analogue replay system… but only until they audition the Lingo 4. This doesn't fundamentally change the tone of the LP12, rather it extracts more from the records you play on the LP12; if you have spent the last decades not liking what the Linn Sondek does on ideological grounds, the Lingo 4 probably won't be the tipping point.

Turning 45 could be cause for concern. It would be easy for Linn to let the LP12 casually drift into its dotage, relying on past glories. But that's precisely what's not going on here. The Lingo 4 does for the LP12 in 2018 exactly what the LP12 did for turntables 45 years ago – it provides a more accurate platform from which to extract the music. And yes, making the turntable go round at 33⅓ rpm more accurately also makes the sound of the turntable better. Who would have guessed!

Recommendation is two-fold, but just as mandatory either way. If you have an existing Linn LP12 with anything apart from a Radikal, all roads lead to Lingo 4 and you need to book in a listening test. Granted, if you have an hour-long listening test, you'll spend ten minutes listening and the remaining 50 minutes begging the demonstrator to take your money, but it's worth doing the listening test just for that 'oh wow!' moment. The next is the 'from scratch' new LP12 owner. This is a done deal because if they are buying a Akurate-level turntable, it's going to use a Lingo 4 now. They just get a better overall package. In other words, that two-fold recommendation is as solid as they get. The Lingo 4 is the best LP12 power supply that still features an AC motor. Upgrading or buying anew, it's a real gem! +

Technical Specifications

Power supply for LP12, with on-board circuitry and external power supply
Supplied with new 12v AC motor for LP12
Speed management system checks speed on every rotation
Dual speed: 33/45 rpm
Price: £1,450 (excluding LP12, etc.)

Manufactured by: Linn Products Ltd
URL: linn.co.uk
Tel: 0800 001 5111 (UK only)
Tel: +44(0)141 307 7777

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CH Precision D1, C1, and A1 system

by Alan Sircom

This must rank as one of the most expensive one-make audio systems we've ever explored. CH Precision is based in Switzerland and it's designed and built by people who used to design and build Goldmund audio equipment. Each component is built like a brick outhouse, without even an implication of a suggestion of compromise. It's hyper-flexible, engineer's engineering. And the whole package costs well north of £60,000. Cor!

The system tested here is comprised of a D1 SACD/CD player, which becomes a transport to the C1 digital to analogue controller that in turn drives an A1 power amplifier. This last is perhaps the easiest way to define the 'hyper-flexible' nature of the system, because it's designed to be used as a lone 2× 100W amplifier, or with another A1 amp as a dual-mono, a passive or active bi-amplified system, or as a bridged design, delivering up to 350W per channel. All are equally good and valid ways to make sound, and all depend on what best suits your system. There is also an X1 power supply, designed to feed the D1 or C1, and this can be factory configured to feed one or two units. There is also an M1 reference two-channel amplifier. This has all the flexibility options of the A1, but doubles the power throughout. At twice the height and 75kg per chassis, it makes the 43kg A1 seem almost sylph-like. Like the X1, the M1 was not available at the time of review, in part because I wouldn't be able to get this into my room without having to resort to structural changes to the property.

There's a common theme to all CH Precision components in terms of design and overall look. They are share the same wave like front panel with centre display panel and all use the same chassis: large, heavy, and allowing the designs to be built on a common modular motherboard/card layout akin to a desktop PC. This not only means shared chassis components, but extends the working life of the design, by allowing up-coming changes to the design to be implemented by card additions and substitutions. The common chassis also allows a clever stacking arrangement, where decoupled screw-in bars fit in the place of the four feet, meaning the system becomes its own rack. Of course, this means whatever the three or four components rest on needs to be structurally sound, because it's taking a load that tips the scales at an impressive 99kg (142kg if you use two A1 amps) – that's almost 220lb in the developed world.

The 'no-quarter' build quality extends throughout. Take the D1 for example; it is a SACD/CD player based around a modified

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"Each CH Precision component is built like a brick outhouse, without even an implication of a suggestion of compromise."

Esoteric VMK-5 VRDS transport mechanism. CH Precision uses that big, weighty chassis to its advantage by mounting the VMK-5 on a 15kg steel plate and heavy steel rails, thereby conferring even more vibration immunity to the disc replay mechanism. You could do this on a smaller, lighter player, but run the risk of the steel plate buckling the chassis. If you take the top off the player (no mean feat in and of itself) you are met with a series of custom-made circuit boards, each one isolated from the others (which helps explain why all the CH Precision products come with a transit screws to lock things in place). Then, the modular layout underpins the flexibility of the system. There are five slots for daughter cards at the back of the player, allowing the D1 to be configured as a stereo player, a stereo transport, a dual-mono player (one dedicated output card per channel), a multichannel player, a multichannel transport (for a multichannel DAC), or a multichannel transport for multiple DACs. There's also a clock board for connection to an external clock, or synching to the D1. You can also control the D1 through Ethernet and update its firmware through USB. It's a potentially bewildering array of options, made no simpler by reading the manual, but is explicable by someone who understands the CH configuration options.

The C1 is no less flexible, and no less daunting in configuration. There are options for digital and analogue inputs, USB and Ethernet connections, and clock connections, as well as the aforementioned X1 power supply upgrade block. It's ultimately best to pick and choose what you need instead of just stacking the C1 up with extra features. There are fewer options on the A1 (as befits a Class AB power amplifier), although there is a USB input for software updates, Ethernet for remote control, and the mono buffer boards for dual mono use.

Card options aside, the CH Precision components can be neatly summed up as products made the way they should be made, to deliver their best. Where possible, discrete components abound. CH Precision developed its own 'CH Link' allowing PCM up to 32bit, 768kHz, and one bit DSD to 5.6448MHz, as well as asynchronous USB to 24/192 PCM and 2.8224MHz DSD and asynchronous Ethernet to 24/192 PCM and 5.6448MHz DSD.

There are superbly clever aspects to the design (small remote controls with magnetic bases that attach to one side of the cabinet), but with these come some frustrations. Until recently, the player and DAC controller were controlled by a series of menus on the AMOLED screen, driven by a dual concentric knob with a central push button. Functions change relative to what 'state' the device is in at the time you access these menus, and whether you tap the push button, or press it for two seconds (the former puts it into shortcut mode, the latter puts it into standby). The manuals describe the processes needed to access these menus accurately, but they are BIG manuals. The A1 has a more conventional array of five buttons, but these also allow you to adjust global feedback levels in 20% steps and precise adjustable gain control to match your loudspeakers in room.

Fortunately, at CES this year, CH Precision showed a handy app that took over these functions, as well as acting as the control point for a streaming solution. This means you no longer need to be a safecracker with an eidetic memory just to know how to fast forward.

The CH Precision system is pretty damn outstanding in its default settings, but if you don't delve through the manual, you may never know there are five PCM filter settings and four DSD settings, or that it allows you to synchronise the clock in the D1 to the C1, the clock in the C1 to the D1, synchronise both to an external clock, or simply ignore the clock options altogether, depending on your tastes and the rest of the system.

Although I received two A1s, my system (culminating in Wilson Duette Series 2)

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"...it's one of those systems that defies description, because the flexibility allows it to adapt to the demands of the loudspeaker so well, it becomes something of a shape-shifter."

needed just one. The second used in bridged mode didn't justify its inclusion. Your speakers and room may make different demands.

CH Precision's 'thing' is one of gradually winning over the listener. It's impressive by not being impressive, although there's some of the typically Goldmund 'writ large' presentation about the overall sound. But more importantly, it's one of those systems that defies description, because the flexibility allows it to adapt to the demands of the loudspeaker so well, it becomes something of a shape-shifter. It does the big, bold Wilson loudspeaker signature sound, but when you move from Wilson to Wilson-Benesch, it delivers the kind of tight, controlled, and authoritative sound you expect from Wilson-Benesch. And when you plug in a pair of loudspeakers that don't have the word 'Wilson' in their name, CH Precision adapts to them too.

If there is a 'house' sound for CH Precision, it's one of dry precision and infinite dynamic range. By 'dry' I'm talking more 'Martini' than 'Gobi desert', because the whole package is sophisticated, refined, elegant, and mature. I'm making this sound a little cool and distant, and that's not the way the CH Precision system sounds. Instead, it's so fundamentally correct that it makes other amplifiers and digital sources sound like they have some kind of overhang and bloat, and there's often no way back once you hear that.

Talking musical examples is invalid here. Everything is a musical example. If you find yourself thinking how good the backing vocals are on Funkadelic albums, you know that you are in the presence of audiophile royalty, and yet CH Precision wears the crown well. While it gives you insight into the music, it doesn't do so at the expense of the music. Of the three components tested, the D1 is the breakout star of the show. That's not an easy statement to make, because that show has one hell of a cast. But if the rest are Oscar winners, the D1 is Brando in *The Godfather*.

The CH Precision D1, C1, and A1 are in our Formula One; precision products, custom made for uncompromising users to deliver the ultimate performance. This top elite remain an ultimate, a goal towards which we should all strive, even if not all of us can reach it. And that's the thing; CH Precision is one of that select list of products we as audiophiles should try at least once in our lives. And for a lucky few (who not only have the financial clout, but are prepared to take time to learn how to really use the system), they get to live with one of the best systems ever. +

Technical Specifications

D1 Digital CD/SACD player/transport
Transport: TEAC VMK-5 VRDS-NEO
Formats supported: CD, CD-R/RW, SACD (single-layer, dual-layer, and hybrid)
D/A conversion: 1× Wolfson WM8742/ch
Digital filter: user selectable:
Connections: CH Link, AES/EBU, S/PDIF, Toslink, Clock input/output
Dimensions (W×H×D): 440 × 120 × 440mm
Weight: 32kg
Price: £22,800

C1 D/A Controller
Digital Inputs: CH Link (PCM to 32bit, 768kHz, DSD to 5.6448MHz), AES/EBU, S/PDIF, Toslink (all to 24bit, 192kHz)
Streaming inputs: USB (PCM to 24bit, 192kHz, DoP to 2.8224MHz), Ethernet (PCM to 24bit, 192kHz, DSD to 5.6448MHz)
Streaming formats supported:
PCM: WAV, AIFF, FLAC, ALAC, AAC, MP3,
DSD: DSF, DFF
Analogue inputs: 1× XLR pair, 1× RCA pair
Analogue outputs: 1× XLR pair, 1× RCA pair
DAC: 4× PCM1704 per channel
Dimensions (W×H×D): 440 × 120 × 440mm
Weight: 24kg
Price: £18,500

A1 power amplifier
Inputs: Balanced: 2× XLR
Single-ended: 2× RCA, 2× BNC
Power output: 2× 100W/eight ohms (stereo), 1× 350W/eight ohms (bridged)
Bandwidth: DC-450kHz (-3dB)/1W/8Ω
Dimensions (W×H×D): 440 × 120 × 440mm
Weight: 43kg
Price: £21,000

Manufactured by: CH Precision
URL: www.ch-precision.com

Distributed by: Wilson Benesch
URL: http://ch-precision-hifi.co.uk/contact-us.html
Tel: +44(0)1142 852656

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Hegel Music Systems Mohican CD player

by Alan Sircom

Even if it weren't a star player, the Hegel Mohican would get credit for having a delicious name. With a touch of wry Scandinavian humour, Hegel's ultimate CD player is named after that final leader of that part-fictional native American tribe in the title of James Fennimore Cooper's classic 19th Century novel, *The Last of the Mohicans*. Meaning this is the last – and best – CD player Hegel will ever make.

This is something of an about face for Hegel. The company has long been involved with digital audio and its CDP2A Mk 2 and CDP4A disc players are both highly respected and have been unchanged in the Hegel catalogue for many years. And that's part of the problem, or rather 'parts' of the problem. You see, a lot of the traditional high-performance components used in the best CD players of a few years ago are becoming very hard to find. Any product, for example, that relies on the near-legendary Philips CDM Pro series transport mechanisms is relying on a disc-spinning device that has not been in production for several years, and supplies are dwindling. The Mohican is Hegel's response, building a player from first principles, leveraging much of the technology and development that has gone into its current line of DACs and sourcing those last, best CD components.

This is resolutely CD in approach, though. The transport mechanism isn't a computer blu-ray writer press-ganged into CD use. It's not even a computer-based CD device or a CD/SACD player, it's a dedicated audio CD transport mechanism. This is coupled to Hegel's own servo control logic circuits, and a converter, filter, and output stage that bear a striking resemblance to Hegel's top HD30 converter with 32bit AKM DAC chips. But where the HD30 can process everything to DSD, the Mohican cruises in a low gear by playing 16-bit, 44.1kHz files as 16-bit, 44.1kHz files, so where the HD30 had low noise, the Mohican has extremely low phase noise, and even uses Hegel's patented SoundEngine output stage (which successfully attempts to move the crossover distortion of Class AB out of band without the attendant inefficiency and heat generation of Class A) to drive the transistors that manage the clock crystal, thereby reducing the potential for error in that stage still further. It's also, by 2016 standards, minimalist in the extreme. No upsampling, no digital inputs, no frills, no crazy overclocking, not even magic filters to alter the sound of the player's output. You have the choice of XLR or RCA stereo outputs and a solid 75-ohm BNC connector for digital output, should you be disturbed enough to want to try the Mohican with an off-board DAC.

The layout of the player is classic Hegel; a central mounted transport mechanism atop a medium sized blue LED read-out. Flanking this are two large dials, although in reality they are both three-way control buttons for opening and closing the CD drawer, play, and stop (to the right of the transport/display block) and track forward, track back, and power on (to the left). Play, track navigation (including FF and REW within a track) and a two-step repeat function are included on the supplied handset (which also controls the volume, source, and mute functions of a Hegel amplifier). Pause is actioned by pressing play while the track is playing. If you access 'repeat', the Mohican shifts from its regular track number and time display to 'RE P tr' (single track repeat) or 'RE P cd' (whole CD repeat) on the front panel LED screen every 10 seconds. As display dimming is a martyr to the cause of minimalism, this blinked away in my peripheral vision for a week or so of running in.

As ever with Hegel equipment, the casework is extremely solid, although the Mohican is not a heavyweight. It sits on three round feet with small hard rubber balls inset into them, and the power connector is set into the middle of the rear panel. The only possible concession to bling is the accessory box that comes with the Mohican, which houses the remote, its batteries, and the power cord. This is about the same size and looks similar to the box for an iPad mini. Factor in a friendly manual that really doesn't do deep 'informative' because there isn't much on

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the Mohican that requires 'information', and you have a player that does the right thing; it relies on its sound quality rather than peripheral aspects like a shiny front panel or a bewildering array of functions.

There is a depth and projection to the sound of CD through the Hegel Mohican that struggles to make it past the output stages of most players. 'Leave My Head Alone Brain' from the Wessletoft and Schwarz album Duo [Jazzland] is difficult to get right because the combination of piano and electronica sit in a 'treated' acoustic; the piano in a sometimes reverberant space, while the dry backbeat and basslines have never left the confines of the computer. This can sound like bad jazz meets bad house music, but the Mohican instead ties these disparate sounds together to bring out the interplay between instrument sounds perfectly. This is what jazz evolved into and it's exciting!

The Mohican also treads that thin line between being controlled and controlling, giving music played through the CD a natural sense of order, not imposed order. It has that distinctive slightly forward presentation common to Hegel electronics, but not in an imposing way. In fact, if anything, the Mohican's biggest strength is its ability to keep out of the way of the music and let the recording be its own strength or weakness. Bad recordings aren't given a free pass through the Mohican, but really good recordings on CD are truly sensational.

In fact, the interesting part of the Mohican's performance is just how much it challenges the need for high-resolution audio. That is fast becoming almost heresy among audiophiles, to the point where people even consider CD a low-fi format. Hegel's Mohican begs to differ, and can demonstrate just how good CD really can sound. There's a sense of cohesiveness and coherence to the sound of CD played through the Mohican, something that all too often gets lost in all the impressive detail and soundstaging properties of high-res. The Mohican has impressive detail and soundstaging, too, but it's not the kind of product that accents these (or any) parts of the performance. It's just a fundamentally honest sounding player.

There seems to be something of a Scandinavian theme emerging here, with like-minded brands making damn good, minimalist products that don't make you reach for the off-switch. In a financially unbalanced way, I found this source component sang along with the Aavic amplifier elsewhere in this issue far more than it has any right to. In a more sensible way, it's perfect for one of Hegel's integrated designs. In fact, the Mohican, the H160, a pair of Audiovector SR1 Avantgarde Arete standmount loudspeakers (and some Nordost cables) is one of those magic synergy systems that you can comfortably sit in front of for hours of extremely contented listening.

Lack of display control aside, the only downside to the Mohican I can see is I promised those shelves given over to CDs were going to be cleared and most of those discs put in the attic, and the Mohican is the kind of product that would make me renege on the deal. This will result in a high-frequency whine eminating from the wife's upper regions.

It would be in Hegel's interests to gently push those still playing CD to a file-based solution and point them in the direction of DACs like the HD30. Instead, the company has been both brutally honest with itself and shown just how much more can be squeezed out of the shiny polycarbonate disc. I guess there will be those who point to the Mohican's lack of SACD replay as a blot in its copybook, but I've only heard a handful of SACD players that really do a good job playing Red Book CD, and of those that are still in production, all of them cost considerably more than the Mohican. It seems, if you want to hear the best in CD, then only a dedicated CD-only player will do!

What I like about the Hegel Mohican CD player above all else is it doesn't care about its place in the audio chain of command; it just gets on with playing music. If it cared about its place, this would be a £15,000 player. OK, it would be a £15,000 player with a means whereby the display could be turned off, but if that's the sacrifices you need to make to get CD replay this good at this price, then so be it. To twist and paraphrase the last paragraph of The Last of the Mohicans, 'the time of the Red Book has come again!' Very highly recommended. +

Technical Specifications

Type: Red Book CD player
Analogue outputs: 1× unbalanced fixed RCA, 1× unbalanced fixed XLR (in pseudo-balanced output)
Digital output: 1× BNC 75ohm connection (S/PDIF)
Frequency Response: 0Hz-50kHz
Distortion: Less than 0.0015%
Available in: Black or Silver
Dimensions (H×W×D): 8 × 43 × 29cm
Weight: 10kg (shipping weight)
Price: £3,900

Manufactured by: Hegel Audio Systems
URL: www.hegel.com
Tel: +47 22 60 56 60

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Kalista Dreamplay and DAC

by Alan Sircom

Not perhaps the most exciting way to start a review of more than £70,000 worth of CD player, but taxonomy is important here. Métronome Technologie is a French company that makes digital players. Its top CD player/converter combination used to be known as the Kalista Reference CD player and Nausicaa DAC. There was a slimmed-down version called Calypso. Then Métronome Technologie brought out a line of more affordable players, such as LePlayer. The company patently didn't want the LePlayer line to be undermined by the very different looking high-end range, so the parent company Métronome Technologie split the two brands into entirely different entities; Métronome (making the more conventional looking players and DACs) and Kalista, which currently makes just two products – the Dreamplay transport mechanism, and the DAC. Both are still made by Métronome Technologie. Simple, ain't it?

All of this is important to know because the Kalista line of old helps shape the Kalista brand today. Actually, forget 'helps shape'... this is a full-scale begatting. Kalista Reference begat the Dreamplay and the Nausicaa begat the DAC. They have a huge amount in common, not least the distinctive three-point inches-thick clear acrylic styling that forms the suspension and isolation system of both head units (also like the previous Kalista/Nausicaa models, both devices are fed by a more conventional looking Elektra external power supply).

The Kalista Dreamplay is more 'chip off the old block' than its converting counterpart, in that it shares much with its predecessor. The top-loading mechanism is still a Philips CDM12 Pro transport, commonly considered to be the best dedicated CD transport mechanism ever made. Unfortunately, that is in the past tense, because Philips is out of the transport mechanism game and the only way you can get hold of new mechs today is to fire up the time machine. Métronome is one of the few companies with enough good sense to buy up as many as they could when Philips announced they were End Of Lifing it, and the company has enough transports stored to both continue to make and service new Kalista Dreamplay transports. Unless, of course, there is a sudden spike in CD-loving lottery winners.

That's not to say this is exactly the same player, though. The transport housing and puck have been subtly redesigned, with better sensors, the front panel display has moved from hard-buttons and an antiquated blue LED readout to an elegant black on light grey touchscreen (to match the DAC), and the hard-to-find upsampling switch has been removed because that's a job for the DAC. It sends a digital signal in pure, unadulterated 16/44 PCM in your choice of S/PDIF (coaxial and TOSlink) and AES/EBU.

The Kalista DAC accepts all of these, and asynchronous USB. Your choice of input is controlled from the touchscreen front panel. As is your choice of DAC, and your choice of valve or solid-state output. The DACs are a choice of PCM-friendly or DSD-chummy converter chip (not that straightforward, as DAC1 is the more conventional brickwalled PCM converter, while DAC2 is the more extended-frequency design made for DoP DSD replay from a computer. Of course, having these two DACs as options on the front panel invites experimentation. This is a radical departure for the Kalista DAC; previous versions allowed the listener to swap between valve and solid-state outputs, but the digital pathway was fixed. But, like the Nausicaa before it, there are balanced XLR and single-ended RCA analogue outputs.

The big part of the Kalista experience remains the interface itself. The 60mm thick methacrylate outriggers on the transport are echoed in the DAC, and the two are designed to sit one on top of the other, because the aluminium tubes at each corner are a lateral suspension system. Add to that the two aluminium central sections for the electronics, which both match and are beautifully finished, and the whole CD replay

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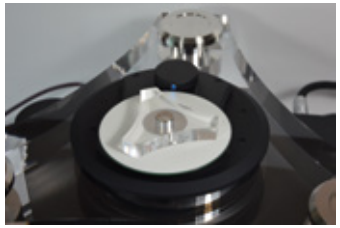
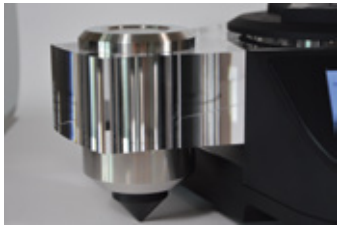
aspect takes on a degree of elegance no bluff box could hope to deliver.

Both transport and DAC are fed by their own separate external Elektra power supplies. These too look almost identical to their predecessors, but have been upgraded to support the new models with 12 stages of regulation per chassis. These power supplies look more conventional than the eye-catching transport and DAC, but are no less well-made, and remind you (and your back) of rack-mount power amplifiers in their own right. A newly beefed up remote handset completes the package.

Those who love vinyl for its rituals insinctually love the Kalista even before a disc is played. There is ritual here, too. The drive must be at chest height or above _ no scrabbling around on a lower shelf, your player takes pride of place, ideally with the DAC and Kalista's own three-pointed equipment stand making it a column of pure digital entertainment (I'm not laying it on thick here, that's the sort of thought processes that go on when experiencing this player first hand). You walk up to the player, press stop to make sure the last disc isnt going to spin off and fly across the room. You remove the clamp, place it on one of the towers for safe keeping, and carefully remove the last disc playing. Put that in its caddy. Then extract the next disc from its own caddy, place it carefully on the top of the Kalista Dreamplay, replace the clamp just as carefully, wait a few seconds while it spins up and the Dreamplay reads the table of contents of the CD, then press play. You aren't done yet, because you have

"The Kalista Dreamplay/DAC combo take the notion that CD is a dying medium and stomps all over it."





the option of walking through the different DAC options, and either valve or solid-state output, and these can help shape the sound of a particular disc. If you are really obsessive about this, note the choice of DAC and output on the front of each CD caddy. Some will look at this routine and think it pointless; this is not the player for them. Others will see this as something like the Tea Ceremony, for audio. And that's precisely what it is.

Far from being the stuff of frustration and annoyance, this disc changing ritual slows down the process of playing music just long enough to put you in the 'music appreciation' head-space. OK, I should add the word 'eventually' to that because the first few times you use the Kalista, CDs sit quietly doing nothing because you forgot to use the clamp. This is one of the changes from the Kalista Reference; there was no sensor on the transport and discs used to fly like ninja stars if you forget to clamp up. Once you are past that first knee of the learning curve, the slower, more contemplative approach to disc play really pays dividends.

There is a group of audio enthusiasts who question the need for a good CD transport. I used to think this a variant on the 'bits is bits' lowest common denominator argument, but I've softened my approach recently. There are many who might not have experience of what a good CD transport can do, having either not been around CD long enough, or simply never having heard a good CD transport. 10 minutes in the company of the Dreamplay will cure that!

There's a huge difference between what the Dreamplay can do and what mere mortal digital source components are capable of. That is perhaps to be expected given the price of admission to the Kalista Klub, but the difference still takes one by surprise. It's an organic, open sound and one that doesn't sound like anything we have been led to believe represents 'digital'. It still retains all the pitch and temporal precision of good digital, but adds a degree of dimensionality and inner detail to the overall performance that makes you think more of master tape than spinning bits of polycarbonate.

Then there is the DAC taken separately and fed a digital signal from elsewhere. The DAC is remarkably adaptable, in part because it's four DACs in one. This helps compensate for less than perfect PC inputs (DAC 2+valves) and poor CD rips (DAC 1+valves). Ultimately though, the DAC without the Dreamplay is like tick without tock.

It's as a whole player, then, that the Kalista comes into its own. Used with AES/EBU, the player as one unit really brought home just how much we are missing when we play our CDs on normal players, and just how wide remains the gulf between really well-sorted CD and streaming.

CD through the Kalista has a civilising element to digital. Not tame, not soft, and definitely not laid-back, just civilising. It's like it gives CD a touch of the My Fair Lady treatment and turns it from 1980s music carrier to refined transporter of digital music done right. Soundstage goes from being a notional idea (compered to vinyl) to a three-dimensional presentation of musical material. You don't play musical snippets here; music is to be revelled in or set aside. That's not simply because of that ritual aspect, but rather that you find yourself so engrossed in the music itself; drawing away is an effort.

Even when the music is sub-par, the Kalista combintion shows new insights. I've fallen in and out of love with 'Because he was a Bonny Lad' by the Unthanks [*Here's the Tender Coming*, Rabble Rouser] at times. The Kalista shows why: it highlights the limitations of the recording, showing up how the reverb sounds very artificial, but

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in the process does not undermine the meaning of the record itself. But when the recording is first rate, and the music has its groove on, the Kalista makes you relearn the music from first principles. 'The Ghetto' by Donny Hathaway for example [*Everything is Everything*, Atco] produces a sound so ultimately soulful and entertaining it leaves you wanting more. So, out comes the live album for the same track, and pretty soon you are singing along to one of about six tracks on the albums, and wishing you had a fraction of his talent (but not his schizophrenia). There is so much detail, so much dynamic range, and so much energy on offer in every track, that you want to walk up to the musicians and thank them personally.

There's a downside to all this. The dawning realisation that only a select few will ever hear precisely what CD is truly capable of, and of those, an even smaller set of music lovers will ever be able to own the means whereby digital music happens. Going back to mere mortal digital is impossible for a few days as you reacclimate to 'mainstream levels', even if that mainstream is extremely good in its own right. It's like getting used to cook-chill food after Michelin-starred dining. It takes time to adjust, and it's not a pleasant experience. Sadly, even with my most Editorial of Editor's hats on, trying my best magic price squeeze, this is still a remortgage, and digital at its best has to remain a memory.

The £72,000 question is "As a owner of the last generation of Kalista player, is the upgrade worth making?" And the simple answer is yes... and no. In the case of the DAC, it builds so heavily on the already fine performance of the Nausicaa, but adds strengths both as a PCM player and in replaying computer audio files. The argument for the Dreamplay is perhaps more nuanced. The removal of the built-in upsampler, the change from hard-buttons to touch-screen, and the slight change to the clamp all make for improvements in performance, but I am not convinced those increases are enough to justify trading up. If you have a Kalista Reference, you already have one of the best CD transports that was ever made, and while this betters its predecessor, it doesn't annihilate it. That being said, I reckon the number of people who will stay with the original transport after using the Dreamplay will be very low indeed. There is more than a touch of luxury element to the Kalista package and that touchscreen tips it over the edge.

The Kalista Dreamplay/DAC take the notion that CD is a dying medium and stomps all over it. If you listen to this player as a player then go back to the very best streaming can offer, you'll start to wonder if we've taken a wrong turn in sound quality. This might be perhaps the most elaborate way of spinning a polycarbonate disc in a time of absolute convenience, and the cost might cause even the most spendthrift and well-heeled of audiophiles to think twice, but it sounds fantastic and that is ultimately all that matters. +

Technical Specifications

Kalista Dreamplay Memory Player Transport

Type: Solid-state CD transport with memory playback
Disc Types: CD, DVD-ROM with WAV-encoded PCM digital audio files at up to 192/24 resolutions, or DoP-encoded DSD files (note: does not play DVDs, DVD-Audio discs, or SACD discs)
Internal storage: 64MB 'Digital Lens'
Digital outputs: TOSLink, coaxial S/PDIF, AES/EBU, and I2S
User interface: Kalista remote control plus on-board full-colour touchscreen controls
Dimensions (H×W×D): 10 × 42 × 36cm
Weight: Approximately 12.2 kg
Available finishes: Silver or black
Price: £35,000

Kalista DAC

Type: Solid-state PCM, DXD, and DSD-compatible DAC
Digital Inputs: Two I2S, coaxial S/PDIF, TOSLink optical, AES/EBU, USB, and Network bridge slot
Supported Formats: PCM: 44.1kHZ–192kHz, 16–24 bit. DSD: DSD64 and 128
Analogue Outputs: Single-ended (unbalanced) via stereo RCA connectors, balanced stereo analogue via dual 3-pin XLR connectors
Frequency response: 20Hz–20kHz ± 0.25dB
Distortion (THD + Noise @ 1kHz, full scale): < 0.03%
Output voltage: Two user selectable settings:
Low output setting: 1.41 Vrms (+5dBV)/3.15
High output setting: 2.81 Vrms (+8dBV)/5.3Vrms (+12dBV)
User Interface: Kalista remote control plus on-board full-colour touchscreen controls
Dimensions (H×W×D): 10 × 42 × 36cm
Weight: 13.5 kg
Available finishes: Silver or black
Price: £37,000

Manufacturer: Kalista
URL: kalista.com

UK Distributor: Absolute Sounds
Tel: +44(0)208 971 3909
URL: absolutesounds.com

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PS Audio DirectStream Memory Player

by Chris Martens

In an era of streaming network-attached digital music sources you might think the time for listening to music as played from spinning silver discs is past, but that isn't necessarily the case. In fact, if you have read between the lines of commentary from many of our reviewers you might have noticed a quiet trend; namely, a softly spoken preference for the sound quality of music played from discs as compared to the sound of the same music played from network-connected players or servers. It's hard to say what accounts for this preference, but one explanation may be that top-shelf disc players are able to harvest audio data from discs with very few read errors (and thus minimal intrusion from error detection and correction algorithms) and can likewise present that data in as jitter-free a manner as possible. If that's the case, then high-quality disc players may still enjoy a worthwhile performance edge vis-à-vis typical streaming solutions, meaning our prized disc collections might in turn have a new lease on life.

This review focuses on PS Audio's new DirectStream Memory Player, which is arguably one of the most flexible, capable, and forward-looking universal disc transports presently available. What is more, the versatility and performance potential of the DirectStream Memory Player are effectively multiplied when it is used in conjunction either with PS Audio's award-winning DirectStream DAC or DirectStream Junior DAC, for reasons I will explain below.

Naturally, the DirectStream Memory Player plays CDs, but it also happily handles many other disk types including HDCDs, SACDs, DVD-Audio discs, HRx discs, Blu-ray audio discs, and even user-created CD-R/RW, DVD±R/RW, DVD±R DL, and BD-R/RE discs. In addition to discs, the Memory Player can also play files directly from USB thumb drives via a convenient front panel-mounted USB port. To achieve this level of versatility, the DirectStream Memory Player is based on the time-tested Oppo universal disc player transport, but it is important to understand that it is not merely a re-badged or restyled Oppo. On the contrary, the Memory Player adds distinctive output features that distinguish it from the Oppo and most other transports on the market.

On the rear panel of the DirectStream Memory Player users will find an AES/EBU and three sets each of coaxial S/PDIF and 12S digital outputs. The purpose of this somewhat unusual mix of outputs is to allow the DirectStream Memory Player to play multichannel surround/sound discs, with the three grouped sets of S/PDIF or 12S outputs supporting front right/left channels, rear left/right channels, and centre and subwoofer channels. Of course the DirectStream Memory Player can be configured for stereo-specific applications, which is likely how most audiophile enthusiasts will use it, but it's nice to know the multichannel output option is there for those who need or want it.

Perhaps more importantly, the DirectStream Memory Player is – unsurprisingly – a 'memory' player; rather than outputting data read directly from discs it instead outputs data from a very low-jitter buffer system that PS Audio calls a "Digital Lens". However, the "Digital Lens" architecture used in the Direct Stream Memory Player is different to and better than the lens system found in the earlier Perfect Wave Transport. The old lens, says PS Audio, "relied on an intelligent RAM buffer to isolate digital data from the mechanical optical drive and laser mechanism" to output data "through a fixed low jitter clock to the DAC". The new lens architecture "solves timing, noise, and isolation problems through a unique combination of buffer memory and FPGA-based digital processing" with the upshot that the new Memory Player "has been able to shorten the memory requirements and improve the timing of digital audio data". In practical terms the DirectStream Memory Player moves from disc reading to ready-for-playback status faster than the original Perfect Wave Transport did and it sounds noticeably more sure-footed into the bargain.

One major benefit of the DirectStream Memory Player is that it can output DSD data

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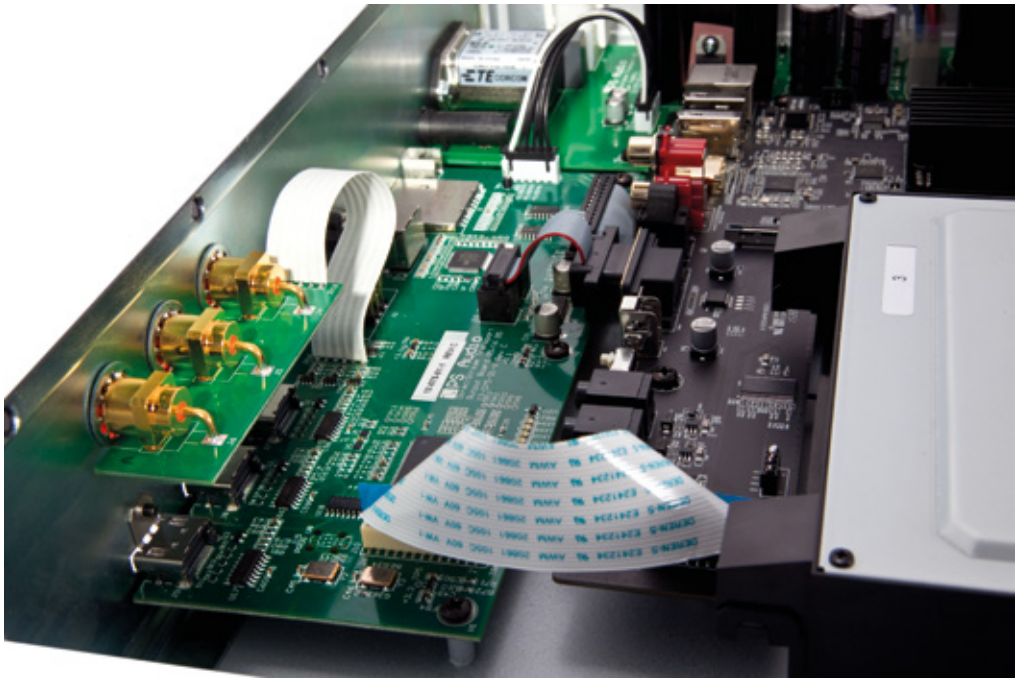
"Rather than outputting data read directly from discs it instead outputs data from a very low jitter buffer system."



from SACDs directly through its 12S outputs, provided they are connected either to PS Audio's DirectStream DAC or DirectStream Junior DAC (both DACs can accept DSD data through their 12S or USB inputs). No other player we know of offers this sort of DSD data transfer option, which is a boon for those who own (or might wish to own) large collections of SACDs.

Two other noteworthy features are DirectStream Memory Player's Ethernet interface, which lets the player seek out and display album cover art and metadata information for the disc in play, plus an all-new user interface that is simpler and more straightforward than the original Perfect Wave Transport UI. The DirectStream Memory Player also comes with PS Audio's next generation remote, which not only can control the DirectStream Memory Player, but also the firm's DirectStream-family DACs, BHK preamplifier, and NuWave phono preamplifier. The Memory Player uses the same beefy yet elegant die-cast metal chassis design common to all DirectStream components, whose layout allows PS components to 'nest' atop one another, provided users remove the feet of the top component in the stack.

For my tests I used the DirectStream Memory Player in my reference system, which includes a recently updated DirectStream DAC, an AURALiC ARIES wireless bridge with 2TB music library drive, and a variety of loudspeakers, including the GoldenEar Triton References, Totem Signature One monitors, and Dynaudio Special Forty monitors. This system allowed back-and-forth comparisons between the sounds of streamed content (from the ARIES) vs. the sounds of the same content played from discs. The results proved eye opening.

Let me begin by saying that sonic presentations of the ARIES and DirectStream Memory Player were competitive with one another and similar enough in broad strokes that casual listeners might have declared them to 'sound the same'. But more careful and critical listening reveals that in fact the two sources don't sound the same, with the DirectStream Memory offering a number of individually small and subtle but cumulatively significant and worthwhile sonic benefits. Let me expand on this point.

First, I found the Memory Player offered consistently superior low-frequency pitch definition and clarity. For example, when I listened closely to the pitch-bending tympani statements heard in the third (Adagio) movement of Bartók's Music for Strings, Percussion and Celesta [Reiner/Chicago, RCA Living Stereo, SACD], I found the Memory Player capture the attack, sustain, pitch shifts, and decay of the drums with greater clarity and more textural detail (such as the 'skins sounds' of the drum heads), significantly enhancing the overall sense of realism.

Second, the Memory Player enjoyed a notable edge in terms of capturing transient sounds of all kinds, such as the sounds of Chris Thile's delicately but precisely plucked mandolin notes as heard on 'Speak' from Nickelcreek's This Side [Sugarhill, SACD]. In particular, the Memory Player unlocked the mandolin's at once incisive but also sweet-tempered voice in a highly believable way. I observed similar benefits when listening to the Joe Wilder – Marshal Royal Quintet's rendition of 'Mood Indigo' from *Mostly Ellington* [BluePort Jazz/NuForce Media, DVD – 96/24]. On the expressive horn solos in 'Mood Indigo' the Memory Player let me hear small transient sounds such as the soft click of saxophone valves opening or closing, or tiny shifts in embouchure, that—in subtle ways—made the track feel much more vivid and alive (and less like mere 'hi-fi').

Third, the Memory Player did a better job of delivering both harmonic and reverberant information in the music, as in the percussion track 'Stank' from Jamey Haddad, Lenny White, and Mark Sherman's *Explorations in Space and Time* [Chesky, 16/44.1]. Small, filigreed details and harmonics from percussion instruments large and small

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"I found the Memory Player offered consistently superior low-frequency pitch definition and clarity."

were rendered with greater delicacy and a suave, self-assured sense of 'feel'. What is more, instrument harmonics remained wonderfully consistent with their underlying fundamentals, rather than being presented in a clinical, disembodied manner. Finally, the Memory Player let me hear small, low-level echoes and reverberant details that helped place the trio within a large and naturally reverberant recording space. This ability to render not only the musical performance but also the context in which it unfolds is one of the Memory Player's greatest strengths.

You might infer from the comments above that the Memory Player is all about harvesting and presenting more musical information, which it does well, but the Memory Player can also have the effect of smoothing and—in a subtle way—enriching presentations that can might otherwise sound bit edgy or raw. A good example would be the wonderful Hadden Sayers' track 'Back to the Blues' as performed by Ruthie Foster and Hadden Sayers on Foster's *Live At Antone's* [Blue Corn Music, 48/24]. When heard in a streamed context, Foster and Sayers' voices can sound somewhat rough-edged and raw, while Sayers' Fender Stratocaster can sometimes exude an overly ragged and almost 'zingy' quality. But, when the album DVD is played through the Memory Player Foster and Sayers' voices smooth out noticeably and sound richer, while the sound of the Stratocaster reverts back to its usual, soulful sonic character.

Finally, the Memory Player helps unlock the emotion in good recordings in ways that streaming sources can't always duplicate. A fine example would be Steve Strauss' 'Dead Man's Handle' from Strauss' *Just Like Love* [Stockfisch, SACD]. Günther Pauler of Pauler Acoustics produced this album and one of his techniques is to apply, selectively, varying degrees of echo and reverb to give extra emphasis to certain lines of phrases. Streaming sources can capture these details to a certain extent, but not with the laser-sharp focus and precision that the Memory Player affords. One such reverb-soaked line is Strauss crooning, "Lord, take me home/ to my baby", where the Memory Player lets you hear and feel the comingled weariness, longing, and desire in the singer's voice. For just that moment, Strauss' voice seems to expand, surrounding the listener, and filling the entire room. It is just this sort of musical moment that makes the Memory Player seem so worthwhile.

During my time with the DirectStream Memory Player I found it to be about 99.9% reliable, although it did exhibit a few command and control glitches when playing one or two DVD-Audio discs (e.g., *Buena Vista Social Club* [Nonesuch], where the Player had problems identifying track boundaries). Even so, the remote let me quickly sort our workarounds so that the disc could be played. However, with CDs, HDCDs, SACDs, DVDs, Blu-ray audio discs, and HRx discs the Player proved utterly trouble-free.

If you've bought into streaming source components in a big way, you may find PS Audio's DirectStream Memory Player will force you—in the nicest, gentlest, and most rewarding way—to reconsider the sonic merits of disc-based music playback. Streaming sources can be very, very good, but in many cases and in many ways, the DirectStream Memory Player often proves to be that extra 'Nth degree' better, in the process helping music to sound more vivid, emotionally rich, and alive. +

Technical Specifications

Type: Solid-state universal disc player/ transport with proprietary 'Digital Lens'
Disc Types: CD, HDCD, SACD, DVD-Audio, HRx, Blu-ray audio, and user-created CD-R/RW, DVD±R/RW, DVD±R DL, and BD-R/RE
Digital Outputs: One AES/EBU output (via XLR connector). Supports front left/right channels only. Supports PCM outputs from 44.1–192 kHz. Supports DSD via DSD over PCM protocol to 2.8Mhz (PCM 176.4 kHz). Three coaxial S/PDIF outputs (via RCA jacks). Supports front, rear, and centre/sub channels. Supports PCM outpus from 44.1–192 kHz. Supports DSD via DSD over PCM protocol to 2.8Mhz (PCM 176.4 kHz). Three I2S outputs (via HDMI Type A connectors, but not HDMI compatible). Supports front, rear, and centre/sub channels. Supports PCM outputs from 44.1–192 kHZ
Direct DSD output to 2.8Mhz
Other Connectivity: One USB input (front panel, for playing content from USB thumb drives), Ethernet (via RJ-45 connector) for album art and metadata look-up
Support File Formats: AAC, FLAC, OGG, ALAC, M4A, OGM, AVI, M4V, WAV, DFF, MP3, WMA, DSF, MP4
Accessories: PS Audio demo disc, PS Audio HDMI/I2S cable
Dimensions (H×W×D): 10 × 43 × 36 mm
Weight: 19 kg (31 lbs.)
Price: £6,000

Manufacturer: PS Audio
URL: psaudio.com

UK Distributor: Signature Audio Systems
Tel: +44 (0) 7738 007776
URL: http://www.signaturesystems.co.uk

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dCS Vivaldi 2.0 digital replay system

by Chris Thomas

The full four-box dCS Vivaldi system embodies what high-end digital audio should be all about. It is complex, beautifully made, endlessly functional through its myriad of connection options and of course, very expensive. Unlike so many high-end products though it is refreshingly free of bling, preferring to reflect what modern day dCS are all about through its different sculptured front panels, super in-house design, build quality, and of course its remarkable musical abilities.

It's been with us a few years now and I first reviewed it, over a couple of issues, just after its release. Those twin articles were really about its capabilities as a CD player and a digital hub. I moved up from a straight transport and DAC, before adding the clock and finally the Upsampler. This enabled me to stream files from external drives. Each additional box brought extreme improvements, though not necessarily of the kind I was expecting. Both the clock and the Upsampler built on the solid foundation of the DAC and transport, and what followed was a glorious and memorable period of musical involvement that had interesting repercussions for me as I learned that so many of those CDs I had thought of as being poor in sound quality, either recording, mastering, or transfer-wise, suddenly became musical revelations with a new life and relevance that took me completely by surprise.

Earlier this year Vivaldi was improved through a series of software updates and a hardware change to the Upsampler. I had never heard of any Vivaldi owners complaining about the existing performance, but when I got to hear what dCS had come up with I understood that, as far as CD replay was concerned at least, the company had moved the Vivaldi system onto an entirely new performance level. In fact, I soon realised that what they've actually done is launched the whole system into the stratosphere of digital playback. This is no minor update but rather, a new performance level entirely.

The hardware upgrades are within the upsampler and consist of completely new network and carrier boards. Sounds pretty straightforward doesn't it? Actually it is far more significant as these changes have really focussed the whole prospect of the Vivaldi 2.0 as a musically convincing digital hub. From a personal point of view, I have had doubts about what I had been hearing streamed from external drives for quite a while. Yes, I had heard some decent stuff but, if I had a stored file and the CD I would shrug

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"The Vivaldi 2.0 is so vibrant and dynamic that even the rather muted and small-sounding discs from the early days of CD are revealed as being far better than I had originally thought."

my shoulders and reach for the latter. Even with discs I had ripped myself, there was a downbeat edge to music, accompanied by a softening of dynamics and a real fall-off in colour and textures. The music was there but the magic had gone. I know that many people have been pretty satisfied with the state of play but all I can say was that these sources, with a few notable exceptions, always seemed second-rate to me. After getting that original Vivaldi at home and understanding the way it dealt with real musical issues, I was more convinced than ever that my listening future was going to be CD-based for the foreseeable future.

But, at a stroke dCS and the Vivaldi 2.0 system have completely changed my mind and my listening habits and that, to me, is no small thing.

Let's start with the software changes. The engineers at dCS have looked deep into their own RingDac and come up with two new 6MHz Mappers, a new DSD filter (filter 5) and implemented DSD128 on both USB and the Dual AES. They have also added a further pair of low level outputs of 0.2V and 0.6V though these are essentially for safety when using something like Spotify or Apple Airplay to avoid sudden volume occurrences. There is also improved RS232 integration and now, when utilising the variable volume output, the display is full screen for a few seconds.

The Upsampler has seen the aforementioned hardware upgrades that also add Tidal, Spotify, and the superb Roon software, plus the dual AES output options now support DSD/128 (DSDx2). The iPod input is no more but has been replaced by the ability to use Airplay instead. Again, the RS232 integration has been updated too and this has also been incorporated into the separate clock.

The Vivaldi always had four DSD filters but the new Filter 5 is much better with regards to out of band noise making it a lot more amplifier friendly particularly for those that choose to drive their power amplifier straight from the Vivaldi's analogue outputs. The transport now includes a third upsampling mode for CD playback in the shape of DSD×2 (1 bit / 5.644MHz) plus there are a couple of changes to the way the display operates.

One of the major changes has been to the algorithm mapping of the Ring DAC itself. The Ring DAC has been improved over the years but, until now, the mapping algorithm has remained constant. In the original Vivaldi there was only a single setting, but Vivaldi 2.0 offers Maps 1 through 3, selectable through the menu system. Map 1 is the new default setting, Map 2 is the same as the original Vivaldi (3MHz) but it has undergone what dCS describe as some 'housekeeping' so I hear it as being both quieter and cleaner, while Map 3 is an 'experimental' version, included as the boys at dCS liked it so much. Users will need to scroll through and decide their default setting. It is easy to hear the subtle changes in musical 'shape', perspectives, and emphases when listening to each and which you choose will likely depend on your system and taste. There's no right or wrong here. Choose the one you like the most is my advice and for the record, I am a Map 3 man myself, though I could, in certain circumstances, opt for Map 1.

All high-end equipment should be so musically engaging that it draws you in. Surely it must speak the language of music so eloquently that it encourages you to invest something of yourself in the performances and once you do that, how can you fail to become emotionally connected? Without this a system is really just a collection of very expensive boxes. This is what makes the Vivaldi 2.0 so special, because when number-crunching mathematics and music collide so spectacularly as this, then special things happen.

The Vivaldi 2.0 adds even more resolution. I think of the term as encapsulating everything about the music and the recording, from the rhythmic flow and movement, right through to the instrumental detail itself. This includes the playing techniques, phrasing, and of course the way this has been incorporated into the production. The Vivaldi 2.0 is so vibrant and dynamic that even the rather muted and small-sounding discs from the early days of CD are revealed as being far better than I had originally thought. The original Vivaldi excelled at this, but the new updates have taken things much further. Yes, even those old splashy and rather thin, bleached sounding Steely Dan discs can sound quite remarkable. I never thought I would write those words but it's an indication of what dCS have achieved musically here and the way that their undoubted prowess when it comes to evolving the Ring DAC has paved the way for the music lover.

Listening to the Little Tomato (Tomatito) and his wonderful orchestral *Sonanta Suite*

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(with Josep Pons) [DG], I am completely struck by the nuance of his style. Whereas most CD players make a bit of a hash of such dramatic and self-contained dynamics, the Vivaldi reveals the nature of the man and his expression within the beautiful physical relationship to his instrument. Against an orchestral and vocal backdrop, it is a fine balancing act but it never becomes swamped with the transients as his nails energise the strings or as the string itself smacks against the fret board. The Vivaldi's version of events is in many ways quieter and more considered but bristling with life and energy and the sense of focus is tremendous. There's colourful tone in his playing style. Warmth too and the Vivaldi's control over the guitar's undoubted percussive abilities leaves the recording open to more considered contemplation. There is no feeling of the system as moving out of its depth or struggling to cope and yet the speed and wonderful musical articulation gives the music new potential and flavour with simply tremendous bandwidth. For me, this is exactly what high-end equipment should do. It really must take you to the heart of the music; otherwise, what good is it?

Billy Cobham's interesting *Drum 'n Voice Expedition* [Sony] isn't the greatest recording but what the Vivaldi 2.0 draws off the disc is a feeling of musical mastery and rhythmic power that is quite brilliant. Cobham is the beat. He sits squarely on top of every song like the great player he is. He is the backbone that won't break and he lays down persuasive patterns that are never flash or over the top. He is always there, like a rock, and the flavour of the whole series of discs is dominated by not only his metronomic understanding of time and space itself, but through his feel for each piece and his understanding that less is more. It's a marvellous experience to just let him carry you through the albums and to hear the way that the accompanying musicians involve themselves within his rhythmic framework and constructions. I first discovered this album when I was using the original Vivaldi but I could scarcely believe how much more 'real' and expressive the Vivaldi 2.0 showed it to be. It offers greater instrumental separation, more dynamic independence, and a much more attractive picture of the music in the sense that the soundstage itself seems to have grown both in scale and three dimensional space plus tauter bass and a more extended and comfortable high frequency performance. The list goes on.

Of course, the fact that the transport can deal so well with SACD is a big plus too. I am late to the SACD party but those still invested in spinning discs are in for a real treat. The eastern markets, where dCS is so dominant are still very much interested in these discs, and comparing some of the classical SACD titles I have from the Esoteric label (sadly now out of production) have really shocked me. Take the Brahms violin concerto with the late and very great David Oistrakh and listen to the adagio. Forget the technical improvements and just listen to the way that Oistrakh plays the piece. His complete mastery of his violin in both space and tone through just about the most exquisite phrasing I have heard from a musician reach into you. They talk to you of yearning and beauty. I say talk because that's what I hear from his violin. His sense of phrasing is, to me, almost vocal. There is no need for excessive, quivering vibrato or over embellishment. The Vivaldi 2.0 takes you to the heart of what he is saying and his gift for 'shaping' a note is something I hear so rarely from violin players. There is a certain emotional nakedness about Oistrakh here, almost as if he is letting you into secrets he has discovered within the piece. It is as moving as it is memorable and is the finest I have ever heard this incredible piece of music played. I thought it sounded great through the original Vivaldi but it has been lifted to another level completely now.

But CD replay is only the beginning of the V2.0's talents as the new network card in the upsampler, combined with the other software upgrades, have made an enormous difference to the way the Vivaldi can be implemented. I can imagine a 3-box set-up, minus transport, for those who prefer their music streamed or those who like to listen through Tidal, Spotify, or similar software. I employed a Synology SS drive, ripped CDs through dB Poweramp onto a MacBook Pro and sent the files over the network to the drive. Playback is easily controlled through the latest version of the Vivaldi app and the results are quite simply the best I have heard from file storage. At a stroke I can now see this as an entirely viable way of increasing a musical library without thinking that the quality is a step-down from CD replay itself. This to me is enormously significant. Employing Tidal, the SS drive, and another small Toshiba drive pre-loaded with high-definition material bought me to Roon. This is surely the best way to access multi-sourced digital files with all the associated metadata, and AS and I will be taking a look at the whole Roon software and the way you can employ it in the near future.

The software updates are free to existing Vivaldi owners, while the Network board upgrades will require a factory or dealer return. So, more versatile, easier to operate, and now better able to function as a true digital hub, the Vivaldi has moved to a completely new level with the 2.0 updates. But, for me, the beauty of what dCS have achieved comes when you spend time listening to it because it is both addictive and musically immersive. Yes, it's expensive and supporting and cabling it at a high level means that it's a lucky person who can afford to go all the way. The pay-off though is in my experience without musical equal. Aural art at its finest. +

Price information:

dCS Vivaldi CD/SACD Transport: £27,250
dCS Vivaldi DAC: £21,750
dCS Vivaldi Master Clock: £10,700
dCS Vivaldi Upsampler Plus UPnP Renderer: £15,299

Manufactured by: Data Conversion Systems Ltd
URL: www.dcsltd.co.uk

Distributed by: Absolute Sounds
URL: www.absolutesounds.com
Tel: +44(0)208 971 3909

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Merging NADAC digital converter

by Alan Sircom

Merging might not be one of those names that trips off the audiophile tongue, but if you scratch the surface, this Swiss company has one heck of a pedigree. The company is extremely well known in the high-end pro audio world and Merging's Pyramix Virtual Studio suite is the gold standard in album publishing and mastering. Let's put it this way; unless your music collecting came to an abrupt end a few years ago, the chances are some of your best-loved recent albums were recorded or mastered using Merging's Digital Audio Workstations.

Perhaps more relevant given the NADAC tested here, the best studios around the globe often feature Merging's Horus or Hapi 'analogue sections' – robust, network-enabled multichannel DACs, designed for optimal conversion in monitoring and analogue applications in the sort of studios where they bandy around terms like 'mission critical'.

The networked Merging NADAC is close to a consumer version of the Horus and Hapi converters used in those studios, and as Pyramix is the DSD recording system (developing DXD in collaboration with Philips in the process) it's little wonder the NADAC is very DSD-friendly. Using the super-robust RAVENNA audio-over-IP networked audio in place of UPnP or USB/DoP, the NADAC is the closest you'll get to the sound of DSD in the place it was mastered, with phenomenal detail and soundstaging. NADAC even allows completely independent control of the built in headphone amplifier, even to playing entirely separate music files.

The domestic NADAC comes in two flavours – two and eight channels. The logical choice for a two-channel audiophile is not automatically the best one, especially as there's less than a grand between the two. In fact, the NADAC is built around the high-performance eight-channel ESS Sabre ES9008S D/A converter, and in the NADAC's eight-channel guise, these channels can be summed into respective left and right digital outputs from the menu. Summing eight-into-two should give slightly superior linearity, a greater dynamic range and a lower noise floor over the two-channel only version. We tested the eight-into-two configuration.

Because the NADAC runs genuinely balanced outputs, you can also use the eight channels to drive stereo balanced lines around the house, for example. Because it's very much a network-enabled DAC (actually, if we are being brutally honest, the NADAC is so linked to its network, the point where 'network-enabled DAC' ends and 'the best dirty great sound-card in history' begins is very blurred here), the single AES/EBU, and S/PDIF coaxial and optical inputs are very much on the 'legacy' side of things. It does, however, include a word clock input, which is again a nod to its studio heritage.

The clever thing about the NADAC's network robustness is it makes the converter hugely capable, flexible, and load tolerant. You can stream different music to the line-level outputs than to the headphone sockets, and you can configure the DAC as a network preamplifier, or assign full scale output to the line outs, but retain volume control over the headphone socket, all of which is software driven from the small, but surprisingly informative, front panel.

The downside to this call for network robustness – in fact, the sole downside to the NADAC in a domestic setting – is Merging takes a more belt-and-braces approach to digital system design than every other domestic DAC on the market. This is not deliberate obfuscation and the reasons for this uncompromised approach is predicated on good, solid digital engineering you need to perform when you are building converters for broadcasters who demand electronics that are not fazed by any environment. However, this means there's no USB port fitted to the NADAC because Merging suggests USB isn't as fault-tolerant under static electric discharge: the level of static discharge we're talking about here would effectively destroy most computers anyway,

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"Merging takes a more belt-and-braces approach to digital system design than every other domestic DAC on the market."

but in a studio environment the tools must survive.

Similarly, Merging eschews UPnP and DLNA protocols for networked audio, instead running under RAVENNA/AES67 Audio over Internet Protocol (AoIP) standards. RAVENNA is commonplace in the studio, and is designed for large scale, low latency, and highly stable audio transmission across Gigabit Ethernet LAN. This is fantastic news, because your audio replay is dropout-free, and used with a wireless router and any device with a web browser, fully remote controlled. However, RAVENNA demands a wired network, fixed IP addresses, and managed switches, which limits the number of options open to the end user and raises the typical cost of the audio Ethernet network itself. That being said, if you are spending more than £7,500 on a DAC, then spending £150 instead of £50 per network switch is no biggie, and Merging's website has a list of recommendations. Installing a RAVENNA-compatible network is entirely possible for those without a black belt in TCP/IP, but if you are more used to constructing ad hoc domestic networks, the uncompromising nature of that RAVENNA backbone is shifting up several gears. In a similar vein, the NADAC supports PCM (up to 24 bit/384kHz precision), DXD, and DSD 64, 128, and 256. That's it: it doesn't upsample, it doesn't over-sample, and it doesn't play MP3. In short, it's refreshingly resolute.

This shouldn't be considered a criticism of either RAVENNA or the NADAC. Our plug and play domestic network infrastructure perpetually hovers on the brink of falling over, and that network robustness can only be guaranteed by using a system that takes RAVENNA's belt-and-braces approach. And it comes from a place where 'have you tried turning it off and turning it on again' would involve three hours of powering down and rebooting a whole studio. If you want that kind of absolute reliability in your networked audio replay, RAVENNA isn't overkill – it's just the right and proper way to do things.

The 'pro' heritage also kicks in when you boot the device up (remembering that it's essentially a computer rather than a DAC, so it's best to power it down from the menu than use the pyramidal power button on the front panel). It takes a little less than a minute to start and the same to stop. And then, the amount of time it needs to get stable is… zero. As it boots up, it is ready to roll. OK, close scrutiny does suggest there are a few minutes of getting to optimum thermal operating temperature, but the improvements are minimal. The test NADAC arrived fully run in from several audio shows, so we cannot speak as to its need for 'running in', but judging by its no-nonsense demeanour in general, I'd imagine such concepts are alien to the NADAC. It just works!

Just as professionals use its rack-mounted brothers to act like a searchlight on the recording, so the NADAC acts on both their work and, although a significantly lesser extent, the system. The engineer puts a microphone out of place, or maybe goes a little too valvey-syrupy in the choice of microphone preamp (the words 'tube mic pre' are all the rage in the studio world right now) and you'll hear it. Maybe not with quite the stark surgical precision of a control room, but that comes down to our choice of partnering equipment. Nevertheless, what you get from the NADAC in your system is a level of musical focus and shading that is extremely rare in audio.

The chances are, in listening to this, you'll reach for a high-resolution recording, and very probably something out of 2L's excellent catalogue: it actually doesn't matter which 2L recording, they are all routinely excellent. However, with the NADAC in place, you hear why they are so good and how sophisticated Morten Lindberg's recording techniques are. Nothing is left to chance in the studio, and nothing is the slightest bit out of place. Once you begin to discover that Lindberg has a Merging DAC in his arsenal, and uses it to ensure nothing is left to chance, you begin to understand how good the NADAC is at communicating the intent of that engineer. Move slightly south to the Netherlands, and all those remarkable DSD recordings from The Spirit of Turtle and you get the same effect, for the same reasoning. It's not just classical music, it's not just DSD, and it's not just the latest output from European studios that benefits from using the NADAC: this converter is so transparent to source, you can hear deep into any recording you pass through its curvy case. Yes, there are DACs with a more easy presentation than the NADAC, but this usually comes at the expense of softened transients or a rolled off top-end. Only a tiny number of digital devices I've heard manage to combine all those virtues without a significant downside,

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"Only a tiny number of handful of digital devices I've heard manage to combine all those virtues without a significant downside."

and the NADAC is the most affordable DAC on that select list.

If I give the impression this is best used for Pyramix-made material, or that all that detail makes NADAC a converter of stark and barren honesty, that is far from the intention. You can – and will – point the NADAC at all kinds of musical genres and come away impressed at the results. At least, impressed by the mix if it's a good mix. The NADAC is extremely demanding of source material and doesn't suffer excess compression gladly. If a recording is bright or toppy it will let you know, and if a recording is made with thumpy, lumpy bass, you will hear thumpy, lumpy bass. Interestingly though, it's not so demanding that it will make these recordings unlistenable, and cuts through the mix well. Listening to less well-recorded music through the NADAC is more like writing a report card on the recording than limiting your listening.

When the recording is good and the music is great, though, the NADAC is a joy to listen to. The honesty of the Merging device simply makes it seem like it is playing music totally unconstrained by the electronics. 'Welcome To My World' by Depeche Mode [*Delta Machine*, Mute] is a perfect example of this, with its powerful and deep synth bass starting and stopping sharply in the verses it's a striking piece of demonstration-quality audio and that comes across perfectly here. However, with heavy string and choral sounds, and Gahan's large-scale bombastic vocals, this track can also turn into a loud mess during the crescendos, but on the NADAC remains on track and both enjoyable and dynamic.

There's one last box to tick – the headphone amplifier. This can be run as an entirely separate stream to what's playing through the rear panel outlets, and in set up you can assign fixed output to the rear panel feeds, and variable to the headphone amp (using the controller on the front panel as a volume knob). I also love the idea of having separate 3.5mm and ¼" jack sockets; they are identical in performance, but having both saves scrabbling round for an adaptor. The headphone amplifier itself is excellent, retaining all the precision, detail, and transparency of the line outputs. It isn't the most powerful of headphone amps, and those determined to drive torturous, no quarter given headphone loads might be better served using one pair of those eight XLR outputs to drive the custom-made dedicated headphone amp of their choice, but as a one-box solution, there aren't many devices that will better it. Once again, Merging's pro roots are showing here, as it makes a fine partner to detail-orientated headphones.

Technical Specifications

Type: Open-Standard Network Attached DAC
Digital inputs: Ethernet (RAVENNA/AES67) on RJ45 connector, AES/EBU XLR, S/PDIF Toslink and RCA Phono, word clock input on BNC connector
Analogue outputs: 2/8 XLR outputs, 2/8 RCA outputs, ¼" and mini-jack headphone sockets
Precision: S/PDIF to 24 bit/96kHz PCM; AES/EBU to 24 bit/192 kHz PCM; Ethernet to 24 bit/384kHz PCM, DXD and DSD 256 maximum
Formats supported: PCM, DXD, DSD
Impedance: 40Ω (XLR and headphone output), 20Ω (RCA)
Max. output level: 6.1Vrms (XLR), 2.1Vrms (RCA), 4Vrms (headphones)
THD+N: 0.00022% (multichannel XLR and RCA), 0.00016% (stereo XLR), 0.0002% (stereo RCA), 0.00028% (headphones)
Dynamic range: 124dB(A) multichannel XLR, 130dB(A) stereo XLR, 120dB(A) stereo XLR, 123dB(A) stereo RCA and headphones
Dimensions (W×D×H): 43.5 × 43.5 × 9.5cm
Weight: 11kg
Price: £7,640 (2ch), £8,400 (8ch)

Manufactured by: Merging
URL: www.nadac.merging.com

Distributed in the UK by: Emerging
URL: www.emerginguk.com
Tel: +44(0)118 402 5090

The NADAC shows its true colours in the headphone space in a way. Not because of sound quality or drive potential, but by virtue of how close to the NADAC you will likely be when using headphones. Although it is also browser controlled, its navigable on-screen menu system is shown in an inch-square front panel in tiny legends, that only the eagle eyed could see beyond arm's length. If you are using the control surfaces and display on the NADAC, you need to be very close to the DAC. Headphone close.

The Merging NADAC has an important tale to tell audiophiles – it shows us that what the pros really work with is really good quality equipment, after all. Moreover, it makes a good case for saying RAVENNA should be more common in domestic audio. If it were, the NADAC is the kind of DAC I could seriously envisage using as a reference point. The Merging NADAC is about the most accurate and precise digital listening tool I can think of. Very highly recommended. +

GUIDE TO AUDIO SOURCE COMPONENTS 2018: DIGITAL REVIEWS HI-FI+

Moon Evolution 780D digital converter/streamer

by Alan Sircom

We keep beginning these reviews of state-of-the-art digital products with variations on the theme of 'how the digital world is changing' for a reason: it IS changing. Moon's prestigious Evolution range is perfectly indicative of that change. The digital top spot in Moon's top range used to be held by the 750D CD player, but this year that was ousted by the Evolution 780D, a combined digital converter and network streamer.

CD players – essentially DACs with CD transport mechanisms – remain in the Moon catalogue, but it's possible these players are the last of their line and subsequent generations of Moon digital products will evolve from the 780D (well, an 'Evolution' pun was irresistible). In fact, it's already happening; products that have a direct link to the 780D design brief have already begun to appear in Moon's more affordable NEO range.

Viewed on a surface level, the Evolution 780D is a nine-input digital converter, already next-gen ready thanks to its USB, Ethernet, Wi-Fi, and aptX Bluetooth connections, alongside the optical and coaxial S/PDIF and AES/EBU inputs. It's a dual-differential DAC layout where each of the two ESS9018S Sabre DAC chips sports essentially 16 unique DAC circuits per channel that can support PCM to 24-bit, 384kHz and DSD to quad-speed/256. In other words, it can support bleeding-edge formats, for which there are but a handful of tracks. Nevertheless, the logic behind this is if it can process at this resolution, 24/192 and DSD 64 should be a breeze. While I'm not wholly convinced of the need for this endless specification arms race given the paucity of music available in astronomic-resolution, there doesn't seem to be much sign of a ceasefire yet. Irrespective of file format, the Evolution 780D also features a Femtosecond-grade internal clock, to show jitter who's boss.

Moon has started a move to a new Hybrid Power (MHP) supply in the 780D, a high performance universal Power Supply using conductive polymer parts, high speed digital switching, and analogue linear regulators post stages designed to smooth the DC output. With an increasing number of DAC designs going switch-mode only, which works well for digital stages, it's great to see a digital device take its analogue side just as seriously.

The net result of all this taking power seriously does have its downside – acronyms! The dozen stages of DC voltage regulation include two M-LoVo (Moon Low Voltage Regulation) stages and four I2DCf (Independent Inductive DC filtering) stages.

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"Music flows from musical theme to theme with such passion and grace on the 780D that it's hard not to be impressed."

All connected with SimLink comms. And probably a PIAPT (Partridge In A Pear Tree) somewhere, too.

Elsewhere, the 780D is all aircraft-grade aluminium, super-thick PCBs, isolating corners, and the kind of last-a-lifetime, you could drive a tank over it build we have come to expect from Moon's top Evolution range. It also has Moon's trademark huge red LED front panel readout. It features balanced and single-ended analogue outputs; we preferred single-ended, but not by much.

Integral to the 780D is MiND, or Moon intelligent Network Device. Originally a standalone box, designed to allow more conventional DAC devices to talk to local and internet networked audio, MiND is now becoming integrated into the company's latest digital products. MiND was one of the first ways of streaming DSD files over Ethernet, and many still consider it the best in terms of flexibility. In particular, MiND and the accompanying app integrate with network streaming service TIDAL in a way few other hardware companies have achieved. This redefines the term 'seamless' when it comes to integration of local and online music services. The 780D's open-ended design suggests that should the need arise to upgrade the DAC or the MiND stages, upgrades and updates will be made available (and Moon does have some 'form' in providing such updates, so the idea of future updates is not idle speculation).

On the subject of improvements, several of the top tier products in Moon's Evolution range can be upgraded using the company's external 820S power supply. The 780D is no exception, but we didn't have this to hand. Neither, at the time of test, did we have a Moon amplifier to try out the SimLink communications hook-up between the two devices. However, on past experience, this is a wonderfully integrated connection between linked devices, with control surfaces, functionality, equalised level LED dimming, even cascaded power up and power down routines, passed perfectly and effortlessly from product to product. I have no reason to believe the 780D would behave out of the ordinary here. For Moon devices, that is.

That throwaway end of the last paragraph is actually a pivotal function of Moon's equipment. Taken alone or together, they work in the way you would expect audio components to work. You don't need an electronics degree to switch the device on, and you don't need to pray for a miracle that when you turn it on, it hasn't permanently locked you out of three-quarters of its functionality. The 780D is an undeniably complex, multifunction piece of electronics engineering, so it's never going to be as easy to use as a toaster. It requires some installation skills and some understanding of how to create a home network to operate it at its best. If you can't do that personally, ask your dealer, who will then get his 13 year old son (who can do this kind of stuff in his sleep) to configure and create a network for you. Ultimately, you will end up with some kind of network attached storage, to which you will rip some of your CD collection, before giving up on the whole project and signing up to TIDAL, which you can also do through the network and on the Moon app.

Installation is not – by modern standards – complex, and once your MiND network is up and running, you'll begin to look at those CD-spinning days with incredulity, rather than nostalgia. It quickly becomes a 'did I used to do that?' mindset. I've recently started listening to CD anew thanks to the dCS Rossini, and the 780D makes a very fine DAC in and of itself, but it also makes a fine argument for putting CD back in its jewel case and stowing it away because the 780D delivers some of the finest streamed sounds I have ever experienced. CD is still great, and still sounds great, but the 780D extracts the musical marrow from all file types!

Like the 750D CD player before it, the 780D makes music with great authority. The 780D begins with its spatial properties, establishing a fine soundstage of great width and precision. It doesn't matter what music you are playing here, if it has any kind of stage, the 780D will present it well. I played 'She Talks To Angels' by The Black Crowes [*Shake Your Money Maker*, American], which isn't the first choice for portraying deep soundstage (the guitar and vocals are close mic'd and the rest of the band seems to appear as a thin layer of musicians in the chorus), but the 780D created a surprising sense of dimensionality and solidity to the sound in the room. When you moved over to music with true soundstaging (yes, it's an audiophile cliché, but Cannonball Adderley's *Somethin' Else* [Blue Note] is a perfect album to play here), you could place yourself in the studio with the musicians, such is the size and precision of the 780D's staging properties.

The great thing about the 780D is that it doesn't have that thin, stark, and forward sound so common to 'next-gen' audio equipment at this time. The sound digital produces is extremely detailed, highly coherent, and very articulate, but somewhere in the transition from disc-based to file-based music we seem to have forgotten that music is more than shots; it's there to be drunk deep. Not here though. The 780D has music wired into its DNA: you don't listen to minute long 'Classical Moods' here – you play Beethoven's Ninth Symphony [von Karajan, Berlin Phil, DG] from beginning to end, because you are at ease with the music it plays.

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"Check back next year and those early adopter 780D users will be absolutely blissed out. Over the Moon, in fact!"

There was a word that kept coming back on the notepad with the 780D. The word was 'graceful'. It's not used much in audio today because most music replay devices have forgotten its importance, but music flows from musical theme to theme with such passion and grace on the 780D that it's hard not to be impressed. It's almost analogue in intent, although this is the wrong term: it's not trying to be vinyl, and it's definitely a digital player, just that it has that sense of musical grace (that word again) you hear immediately on vinyl and is oh so rare on digital.

I can see there will be some who like their music with great gusto, who will find this more majestic, graceful presentation not 'edgy' enough. On the other hand, there are also those who find a singular obsession with music's pulse too limiting and crass, and for them the Moon 780D's abilities to balance tonal, timbral, and rhythmic elements with great evenness hard to resist.

Part of the Moon's ability to move beyond the rhythmic end of the spectrum is because the next most common word on my note pad was 'confident'. This is a big, and bold sound, at once comfortable with huge-scale orchestral works and breathy girl-with-guitar songs, and all points between. Dynamics are effortless (to the point where you stop becoming aware of a thing called dynamic range and just listen to the music) and this dynamism, and a good natural sense of melody (without accenting the beat) combined with that graceful overall presentation, makes this an easy digital device to love.

In a way, although the hardware is the power behind the throne, the one element that ultimately makes or breaks a product today are the programs and apps used to interface and control the device. The best sounding DAC with a poor app will fail to thrive. And that's where MiND really comes into its own – the app is so good here, I could almost imagine someone buying the 780D because of the app. The best way I can describe the app is it works the way you would expect a music playing app to work, and it just happens to connect with and control one of the best sounding digital devices you can get. In fact, the Moon does come with a really nice handset with squidgy touch buttons that glow every time you pick it up (it has an accelerometer inside), and eight touch buttons on the front panel, but the moment you power up the app, those elements become redundant.

In fact, the only real limitation to the 780D is that well documented running in period that applies universally to all Moon devices. If you get a demonstration, make sure the store has given the 780D plenty of time to get its act together. That includes not leaving it unpowered for any significant time. When you get it home, it will sound pretty good out of the box. Weeks later, you'll suddenly relax into the 780D's performance more than you have before, and at that point it's about half way there. I've had a few 'wow!' moments along the way with the 780D and – from experience with Moon products – I'm about a third of the way through the whole warming up process. Check back next year, and those early adopter 780D users will be absolutely blissed out. Over the Moon, in fact!

The Moon Evolution 780D is something to get excited about, even if you might never get close to being able to afford one. It deserves that excitement not just because it sounds damn good, not just because it works so well, but also because it shows us all the right way to do audio in 2015. It's a complete digital solution in a world of half-finished audio jigsaw puzzles. It's a template for engineers to create a new generation of products that actually work as they should work, and it's a call to arms for enthusiasts to demand this level of professionalism from the manufacturers, whether you are spending £100 or £100,000. And to those other brands, let's make this abundantly clear: Moon got things very right with the 780D – why can't you do the same? The 780D comes very highly recommended! +

Technical Specifications

Type: Network streaming DAC
Digital Inputs: 1× AES/EBU XLR, 3× S/PDIF (1× BNC, 2× RCA), 1× Toslink S/PDIF, 1× USB Type B, RJ45 Ethernet, Wi-Fi/ Bluetooth aerial
Inputs: RS232, 12v trigger in/out. SimLink in/out mini-jack
Analogue outputs: RCA stereo, XLR stereo, 2.0V rms
Output impedance: 100 Ω
Formats supported: PCM to 32bit, 384kHz, DSD 64, DSD 128 and DSD 256, DXD supported
Frequency Response: 2Hz–100kHz (+0db/-3dB)
THD: 0.0001% (@1kHz, 0dBFS)
Intermodulation Distortion: 0.0001%
Dynamic range: 124dB
Signal to noise ratio: 124dB (full output 120dB)
Jitter: 150 femtoseconds
Finish: All black, all silver, silver with black, custom finish to order
Dimensions (W×H×D): 47.6 × 10.2 × 42.7cm
Weight: 16kg
Price: £10,500

Made by: Moon
URL: www.simaudio.com

Distributed in the UK by: Renaissance Audio
URL: www.renaissanceaudio.co.uk
Tel: 44 (0)131 555 3922

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Nagra HD DAC

by Alan Sircom

There's still a buzz about Nagra. Even those who have racked up a lot of miles on their audio clock get a little worked up over a Nagra product, and when that product is the first of the company's new cost-no-object range, the long-awaited HD DAC, it's hard to keep your feet on the ground.

Let's get the aesthetics bit out of the way first: you have to be some kind of cold-hearted anti-geek not to love Nagra's industrial styling. With the large recessed dials, switches, and that famous 'modulometer' on the front of both DAC and MPS power supply, the HD DAC has the classic look of a product made back when 'built to last' meant something. And yet, it's not simply retro styling for its own sake; everything is there for a purpose. But regardless, it's hard not to be impressed by the look and feel of these solid pieces of audio architecture.

However, it's also important not to let the whole 'it's a Nagra' element swamp the sophistication of what's going on beneath that solid alloy case. This is a 'back to the source' digital project, leveraging years of professional digital audio engineering to basically start again with digital to analogue conversion. The professional audio side becomes apparent at the point of contact for a datastream; all the HD DAC's digital inputs are filtered before being passed to a multiplexer circuit. This means the AES/EBU input on XLR and the S / PDIF inputs on BNC and RCA connectors each has its own individual transformer. This might seem like overkill to most digital companies because a digital datastream is not influenced by the impedance and level of the signal. However, the same does not apply to the electronics that process the datastream, and using the kind of best-in-the-business grade of transformers that Nagra can get for the task means the datastreams from each input are 'presented' to the digital processing section in the best possible condition.

The audiophile intent begins after these balancing operations, however. As suggested previously, the company went right back to first principles. Nagra sees the quantization noise of 16-bit/44.1kHz digital audio, and the methods used to quell that noise, as one of the big problems of the CD age. Crude brickwall filters that block out any noise above 22.1kHz can undermine phase above 10kHz, the company suggests, while conventional oversampling and interpolation methods are a cure that Nagra believes is often worse than the disease.

Nagra instead concentrated on the goals of getting the extraction and converting of data absolutely right, without resorting to 'cheating' (oversampling). Ultimately, this led to Direct Stream Digital, and Nagra

(in association with DSD pioneer Andreas Koch) developed its own Sigma-Delta DSD processing, on a custom 72-bit Field Programmable Gate Array. Add to that a custom time-correction algorithm, in place of the usual demands for atomic clocks at this grade, to keep this DAC temporally precise, and the result is the removal of that quantization noise up to so far beyond the audio band, its impact is effectively completely eliminated.

This conversion schema is a very clever one indeed. Normally, DACs process DSD by passing the datastream through a low-pass filter and then to the same PCM converter used for 16-bit or 24-bit digital words; a simple, but effective way of decoding these signals for more real-world audio systems. When you ascend to the high end, typically DSD and PCM are routed through entirely different processors, each suited for the task in hand. This works well, but when one

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DAC is in use, the other sits there gently propagating self-noise through the system, and steps (typically heavy, expensive steps) have to be taken to manage this. Nagra does it differently, turning PCM into DSD, running at 5.64MHz. That's a rare pathway (in hardware, EMM and Meitner follow the same route, and you can run JRiver that way in software, if you have a hard-as-nails computer up for the task), but that means off-the-shelf digital conversion is simply not available.

Bizarrely, one of the things that is frequently overlooked in DACs is the 'to analogue' part. Perhaps it's not so bizarre; digital engineers think in the digital domain, and can sometimes view the analogue section as something of a 'done deal', but it can mean a very good DAC in the digital domain can have a relatively 'blah' analogue output stage. The Nagra HD DAC is not one of those devices; the thoroughness applied to its digital processing applies just as much to the analogue domain. This is perhaps understandable given Nagra's heritage in professional recording, because the company retains, "a culture of total intransigence when it comes to respecting the integrity of sound."

There are two key points to this intransigence. First up, the analogue section is designed to be 'phase perfect' throughout. This should be a given – we spend an inordinate amount of time and energy ensuring the digital input from a digital source is 'bit perfect', why shouldn't the same apply to what happens inside the DAC? However, once you include any kind of complex filtering in the input stage, phase integrity is 'difficult' ('difficult' being the polite form of 'damn near impossible'). Moving from a PCM to a DSD-based architecture allows Nagra to eliminate that input stage filtration, and the company instead invested considerable R&D time into group propagation delay. The result is a DAC with the reactions of a ninja cheetah, even under significant dynamic swings.

But then, we return to transformers. Where most DACs rely on voltage gain from active electronics, Nagra uses custom-wound, custom-designed interstage transformers, which took the company months to perfect. Fed by ultra-rapid drivers, these transformers mean a lower impedance signal path, making this the perfect internal environment for the valve output stage. The use of a single JAN 5963 double triode (essentially a 'super' ECC82, with beefed up anodes to give it almost solid-state bandwidth and signal-to-noise ratio) in so sophisticated a device may seem odd, but it was selected because Nagra claims it found no way of making a solid-state output stage with the same degree of harmonic integrity.

As ever with high-end devices, the individual components come in for some special attention. Which is why you'll see coupling capacitors with some very distinctive materials (such as a beeswax dielectric) inside, all selected for their performance in that particular section of the DAC. Also common to high-end devices, close attention has been paid to the power supplies, and the HD DAC features 25 separate power supplies, driven by two separate external power supplies as standard. I suspect most people who have gone as far as the HD DAC, will go the extra mile for the optional battery MPS supply, and that was how the HD DAC was supplied. The comparison in size was interesting here; the MPS is in the standard Nagra small alloy box, and while Nagra has retained similar height and width, it had to make the HD DAC considerably deeper.

"…Nagra treats digital audio like an obsessive compulsive equerry might treat the Queen – with great respect, but also with absolutely no conception of 'good enough'."

Essentially, the way to think about this DAC is Nagra treats digital audio like an obsessive-compulsive equerry might treat the Queen – with great respect, but also with absolutely no conception of 'good enough'. Nothing is 'good enough' on the Nagra HD DAC. Other DACs do 'good enough'. Nagra shows that 'good enough' isn't 'good enough,' after all! Of course, that implies your approach to the digital input the Nagra receives is equally uncompromising, but this is less 'fussiness' on the HD DACs part and more that music (and especially music played through the Nagra) commands respect, and this is the way respect should be shown. That means the right transport, the right computer, the right program, the right music files, even the right cables.

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My sample arrived fully run in, from the late 2014/early 2015 show circuit. So the only waiting I had to deal with was the 30-second warm-up/diagnostic cycle the HD DAC takes to power up, and the 15 minutes or so it takes to come on song after that. Then, you had a full evening's magic before the battery pack began to need charging, and the rest of the evening in a state of near-Nirvana. The quality drop from battery to mains power is relatively small, but is like reaching for a Château Lafleur, after drinking a Petrus.

There's a meme floating round the internet that digital audio is the great leveller; that it closes the gap between the best and worst digital devices. Bits is bits, after all. In truth, the meme is not without some justification; the difference between a £100 turntable and a £10,000 turntable is fairly easy to identify, and very easy to justify, but the gap between digital audio devices at the same prices are not quite as significant. The Nagra HD DAC takes that meme apart.

Digital played through this DAC doesn't sound like all the others, and it doesn't sound 'digital'. It has a richer, more harmonically organised, and just 'organic' sound compared to most other digital sources. This makes most digital replay sound as if it were taking the music apart, where this portrays it as a contiguous, flowing 'whole'. That said, it's still deeply analytical, and with the kind of systems a DAC of this calibre is likely to work with, can highlight the structure of the music, the quality of the musicianship, and the sensitivity of the recording engineers. However, it does this analysis in that 'lean forward' manner one gets at a really good concert, rather than a mechanical, 'air crash investigator' approach.

The natural partners for the HD DAC are well-recorded jazz and classical, because the sense of musical 'flow' the Nagra creates is easier to find in these genres. But that doesn't mean it's somehow soft-edged and too legato for anything amplified or electric. I have a suspicion this might be the one and only time this music is played through this DAC, but it sounds great playing 'Endorphin' by Burial [*Untrue*, Hyperdub], as it plays those crackly electronic sounds, the sampled voices, and the huge bass with a sense of insight and focus that is often skipped over. But where it works truly remarkably is on slower, more contemplative pieces, and especially those slow-build works where it starts *ppp* and ends *fff*, such as 'Mars' from Holst's Planets Suite [Zubin Mehta, LA Phil, Decca] or at the other end of the spectrum, the achingly beautiful 'Lift Your Skinny Fists Like Antennas to Heaven', from the album of the same name by Godspeed You! Black Emperor [Kranky, CD]. If your system and ears can handle it, the Nagra HD DAC has dynamic range enough to spare, and that 'harmonic integrity' the company discussed in making a tube output stage shines through. It's one of those rare devices that demand your full attention; turning the music off or even 'down' becomes an affront to music, and anything that breaks the spell is apt to get shouted at.

As a consequence of this 'holistic' approach to digital music making, the listener is drawn deep into the piece playing, in the manner of good analogue systems. This is more than just soundstage or detail, and is a lot more than the tonal balance or frequency response. For the want of a better term, this is about 'mojo'; the Nagra HD DAC has lots of mojo. Mojo in this respect is the difference between The Beatles and The Bootleg Beatles; no matter how close the alternative gets, you just know when you are listening to the real deal. And the Nagra HD DAC sounds like the real deal.

Walk this back to 'surface' observations. The Nagra HD DAC has excellent coherence from the deep, powerful bass to the unforced, grain-free treble. It has sublime detail and you'll hear things in your music you didn't know were on the recording. Vocal articulation is first rate, drawn out of a wide dynamic range, top-to-toe coherence, and an absence of background noise. The DAC is transparent, melodically, harmonically, and temporally spot on, and has the kind of flat frequency response that makes the Bonneville Salt Flats look like the Rockies. And all of that applies just as much to the powerful, servo-controlled, capacitor-free headphone socket as it does to the rest of the outputs; my HiFiMAN HE-500s, the oBravo HAMT-1, and even the Ultrasone Edition 5 have never sounded so right!

We are duty bound to find a downside to any product, but in concluding the review of the Nagra HD DAC, I simply couldn't find one. It represents a leap in digital audio performance that doesn't happen that often. It extracts a lot from existing 16-bit, 44.1kHz files, and even shows to a high-resolution sceptic what DSD is capable of. OK, if there is a shortcoming, it's that price tag. It's not overpriced – if anything, once you've heard what the HD DAC can do, the price becomes irrelevant – it's just that, for me, that price tag means I have to put it back in its boxes soon. And I'll miss it greatly. Highly Recommended! +

Technical Specifications

Digital inputs: 1× RCA S/PDIF,
1× BNC S/PDIF,
2× XLR AES/EBU, 1× TOSlink Optical,
1× Audio USB (mode 2), 1× I2S (Nagra format)
Signal handling: 5.6MHz/6.2MHz, 72 bits
Analogue outputs: 1× RCA stereo,
1× XLR stereo (optional balancing transformers)
Output level: 1.3 or 2V RMS (for a digital signal at 0dB FS)
Noise: -128 dBr linear (without filter)
Distortion: < 0.02% @ -20 dB FS
Harmonic Distortion: < 0.03% @ 192 kHz
Bandwidth: 5 to 40 kHz, +0/-1 dB
Diaphonics: 99 dB (at 1 kHz)
Dimensions (W×D×H): 280 × 350 × 76mm
Weight: 5 kg (without power supplies)
Price: £17,950 (as tested, including MPS)

Manufactured by: Audio Technology Switzerland SA
URL: www.nagraaudio.com

Distributed by: Padood
URL: www.padood.com
Tel: +44 (0)1223 653199

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AURALiC VEGA G2 streaming DAC/preamplifier

by Chris Martens

At the Munich High-End show 2017 AURALiC held a press conference in which the firm announced that it had all new G2 versions of it popular VEGA Digital Audio Processor and ARIES wireless streaming bridge under development along with a new master clock called the Leo G2 and an upsampling processor called the Sirius G2. Of its next-generation VEGA AURALiC said, "with a completely redesigned internal architecture focused on advanced isolation techniques and a novel approach to clocking, the VEGA G2 is breaking new ground in the world of premium digital processing." Going further still, AURALiC promised the VEGA G2 would incorporate "engineering innovations that set a new standard for sound quality." Obviously these are bold claims, but past experience has taught us that AURALiC typically does not make such statements lightly. Therefore, we were eager to hear the new G2 models in action and were pleased when, late last year, we received a sample of the VEGA G2 that is the subject of this review.

For those not yet familiar with AURALiC, the firm is a Hong Kong-based high-end audio electronics company co-founded in 2008 by President and CEO Xuanqian Wang and his business partner Yuan Wang. Xuanqian Wang has had formal training as an electrical and audio recording engineer and is an accomplished classical pianist, while Yuan Wang has a background in sociology and management science. The partners-to-be met at the 2008 Festival of Waldbühne Berlin and discovered they shared a passion for music and sound quality. Not long thereafter they launched AURALiC Ltd. and the rest is history.

The VEGA G2 streaming DAC offers expanded features as compared to the original VEGA and is configured so that it can function as a DAC, a digital/analogue preamplifier, a streamer, and a headphone amplifier. Much like the original VEGA, the VEGA G2 emphasises cutting-edge digital audio design features, but also takes an almost old-school, purist's approach when it comes to its carefully voiced, pure Class A analogue output circuitry. A review of some the features and technologies found in the G2 will show what I mean.

The VEGA G2 DAC section can process PCM files with sampling rates ranging from 44.1 to 384kHz and with bit depths up to 32 bits; it can also handle DSD files ranging from DSD64 to DSD512. There are total of six available digital audio inputs: one AES/EBU, one Toslink, one coaxial S/PDIF, a Gigabit Ethernet streaming input, a proprietary AURALiC L-Link (Lightning Link) input, and a USB input. The L-Link input uses an I^2S-like connector and is designed to enable high-bandwidth/low-noise data exchanges between AURALiC G2-series components that incorporate L-Link interfaces.

Where Ethernet connections to shared music files or music servers are available, the VEGA G2 supports OpenHome and RoonReady streaming protocols and is designed to work with OpenHome-compatible control software packages (e.g., BubbleUPnP, BubbleDS, Linn Kazoo, and Lumin) or with Roon—where a Roon server must be present on the network in order for Roon to be used. (Note that while the VEGA G2 serves as a RoonReady endpoint and can be configured under Roon as a zone or an output, it cannot act as a Roon Core or a Roon server.) Alternatively, the VEGA G2 also works well with AURALiC's own control software packages: Lightning DS for iOS or Lightning DS for Web. Streaming digital audio file types supported by the VEGA G2 include both lossy formats (such as AAC, MP3, MQA, and WMA) and lossless formats (such as AIFF, ALAC, APE, DIFF, DSF, FLAC, OGG, WAV, and WV).

Digital audio processing is handled by what the manufacturer calls the AURALiC Tesla Platform, which is based on a "Quad-Core A9 chip, with 1GB DDR3 memory and 4GB of storage" and that provides a jaw-dropping 25,000 MIPS (Millions of Instructions Per Second) of data-crunching power. The G2 processor is some 25 times more powerful than the one used in the original VEGA and this allows, says AURALiC, the "introduction of more sophisticated filter algorithms and oversampling techniques than ever before."

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The G2 offers four menu selectable digital filter modes labeled Precise, Dynamic, Balance, and Smooth. AURALiC points out that these four filter modes employ "five digital filters optimised for corresponding sampling rates," where the filter schemes were developed using a combination of "objective data models and subjective testing."

AURALiC describes Precise mode as a "traditional filter design using a single filter algorithm for all sampling rates," which is said to provide the most exacting representation of the source material. Meanwhile, Dynamic mode offers "the same pass-band and stop-band performance as Precise mode," with less group delay, with Dynamic mode offering an "ideal balance between measurable precision and subjective quality." Balance mode is "designed to achieve minimum pre-echo and ringing effects," while "slow roll-off filters show moderate pass-band and stop-band performance," with minimal group delay. Finally, Smooth mode features filters that are all minimum phase types with "no pre-echo at all" and they are also designed with "very small group delay" to help eliminate ringing. Of the four, Smooth mode scored highest on AURALiC's subjective tests during development.

The VEGA G2 promises jitter-free operation thanks to a scheme where, instead of trying to lock on the input signal's frequency, the G2 instead buffers a large quantity of inbound digital audio data (the amount is configurable via a menu setting) and then re-clocks the data using one the G2's two, hyper-accurate, low-noise 72 femtosecond Femto Master Clocks. One clock handles samples in multiples of 44.1kHz while the other handles samples in multiples of 48kHz. AURALiC claims this design makes the VEGA G2 "the industry's first signal independent 'Master DAC'."

Noise minimisation (and isolation) is a consistent theme in the VEGA G2 design, which makes extensive use of digital audio galvanic isolation throughout. AURALiC designed a "high speed galvanic isolator that's configured between primary circuits in the VEGA G2." This means the D/A converter, Femto Clocks, and analogue audio circuits are all isolated from the central processing circuit in an effort to eliminate EMI noise.

In a similarly vein the G2 benefits from a very low noise, high-performance, low power, fully passive volume control. The volume control uses an R-2R resistor ladder network driven by a set of "eight coil-latch relays" that, once set, draw no current and hence produce no EMI noise. AURALiC concedes that this volume control is "an expensive solution to construct,' but argues that its sonic benefits more than justify the added costs.

Finally, the VEGA G2 features a pair of the firm's signature Purer-Power linear power supplies. One supply feeds the G2's processing circuit, network interface, and LCD front-panel display, while the other supply powers the G2's D/A converter, Femto clocks, and analogue audio sections. The dual Purer-Power supplies help isolate noisier circuitry from noise-sensitive circuitry, in part because the two supplies are—you guessed it—galvanically isolated from one another.

"AURALiC promised the VEGA G2 would incorporate 'engineering innovations that set a new standard for sound quality'."

While much of the VEGA G2 is new, one area where it harks back to the design of the original VEGA is in its analogue audio section, which is once again based upon a pair of AURALiC's signature ORFEO Class-A output modules. To my mind this a good thing, since both the design and voicing of the ORFEO modules was inspired by the circuitry of the classic Neve 8078 analogue recording console, which is justly famous for a sound that combines high levels of sonic transparency with an elusive quality of natural, organic warmth.

Finally, the VEGA G2 enjoys AURALiC's new milled-from-solid-billet-aluminium Unity chassis, which is designed to shield the circuitry within from EMI while damping out (for absorbing) unwanted vibration. The Unity chassis, which will be shared by all G2-series models, is extremely handsome and robustly made. Rear panel connections are protected by thick aluminium flanges, while the gently curved faceplate sports a centrally-positioned four-inch high-res LCD screen flanked by a large rotary encoder knob/selector switch that falls readily to hand. The entire chassis is treated to a tasteful satin black finish with the AURALiC logo cut into its top plate. Compared to the original VEGA, the VEGA G2 has a much more solid, purposeful, and upscale appearance.

For my listening tests I used the VEGA G2 in a system that included Rega's Osiris integrated amplifier; a first-generation AURALiC ARIES wireless streaming bridge (because the next-gen ARIES G2 was not quite ready for review yet); a 2TB music library drive loaded with standard and high-res PCM, DXD, and DSD digital audio files; a PS Audio DirectStream DAC and Memory Player disc transport; Magnepan 3.7i loudspeakers; interconnect,

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"In short, the G2 offered up a sound that was at once invigourating, elegant, refined, and realistic."

speaker, and power cables plus power conditioning equipment from Furutech; digital cables from AudioQuest; audio racks from Solid Tech; and room acoustic treatments from Auralex, RPG, and Vicoustics.

It was instantly apparent that the VEGA G2 was in a whole different (and much higher) performance league from the original VEGA (and I say this with all due respect to the VEGA, which was and is a solid performer in its own right). The four biggest differences I noted were the G2's significantly lower noise, it's markedly superior rendering of low-level sonic information, it's clean and clear but never hard or etched-sounding handling of transient sounds, and its downright astonishing three-dimensionality. Put all these factors together and the listener is treated to what Wizard of Oz fans might term a major "we're not in Kansas anymore!" moment.

Perhaps not surprisingly the VEGA G2's sonic strengths are particularly effective on well-made live recordings, such as Dead Can Dance's powerful yet also ethereal song 'Anabasis' from *Dead Can Dance – In Concert* [PIAS America, 16/44.1]. The track combines a delicious mix of high and low-pitched acoustic percussion instruments, synthesizer washes, and soaring, middle-Eastern inflected vocals. The G2 makes child's play of differentiating acoustic from electric instruments and reveals a wonderful touch of delicacy and elegance in capturing the shimmering, evanescent sounds of the high-pitched percussion figure that is repeated throughout the song. But more than anything, the G2 deftly renders subtle hall and crowd sounds, giving the presentation the sort of expansive, you-are-there feel of a live event. With help from the Magnepans, the VEGA G2 created an enormous, three-dimensional soundstage, yet with plenty of imaging specificity in terms of accurate instrument placement on stage. The Magnepans don't always yield such coherent 3D soundstages, but with the VEGA G2 in play they certainly did.

The VEGA G2 is equally effective on tightly focused and purely acoustic material such as the track 'Le Boulet Rieur' from Joël Grare's *Grare: Paris – Instanbul – Shanghai* [Alpha, 16/44.1]. Grare leads a remarkable percussion ensemble whose talents and multi-coloured instrumental voices are highlighted in the jaunty, syncopated 'Le Boulet Rieur'. As the track played through the VEGA G2, three things caught my ear: the brilliant purity and richness of the tonal colours of each of the instruments in play, the dead-accurate rendering of the dynamic envelopes of the instruments (and especially of their distinctive attack and decay characteristics), and—once again—the striking three-dimensionality of the overall presentation. In short, the G2 offered up a sound that was at once invigourating, elegant, refined, and realistic.

Some readers will no doubt want to know how the VEGA G2 fared in comparison with the PS Audio DirectStream DAC, which is widely regarded as a performance leader in this general class. My answer would be to say that AURALiC's VEGA G2 is at the least sonically competitive with its PS Audio counterpart, but that the G2 enjoys a 'secret weapon', sonically; namely, its versatile Flexible Filter modes. Where the DirectStream DAC basically speaks with one voice, the VEGA G2 effectively offers four subtly different 'voices' in the form of its four filter modes. This is a compelling sonic benefit that works strongly in the VEGA G2's favour.

AURALiC's VEGA G2 represents a big sonic step forward from the firm's well-respected VEGA Digital Audio Processor and it also is one of the most beautiful sounding and accomplished DACs I've ever had the pleasure of using in my reference system. For this reason and more, the VEGA G2 is thoughtfully and enthusiastically recommended. +

Technical Specifications

Type: Digital-to-Analogue-Converter/ preamplifier/headphone amplifier
Digital Inputs: One AES/EBU, one Coaxial S/PDIF, one Toslink, one USB, one AURALiC Lightning Link, and one Gigabit Ethernet streaming input.
Analogue Inputs: One stereo single-ended (via RCA jacks)
Analogue Outputs: One stereo single-ended (via RCA jacks), one stereo balanced (via XLR connectors), two sets of faceplate-mounted 6.35mm headphone jacks
Frequency response: 20Hz–20kHz, ± 0.1dB
THD+N: < 0.00012% (XLR); < 0.00015% (RCA)
Dynamic Range: >130dB
Supported Digital Formats: All PCM from 44.1KS/s to 384KS/s with word lengths up to 32-bit, DSD files from DSD64 to DSD512
User Interface: AURALiC's Smart-IR system allows VEGA G2 control inputs to be mapped onto 3rd-party IR remote controls
Display: 4-inch full-colour LCD display
Dimensions (H×W×D): 8 × 34 × 32cm
Weight: 7.8kg
Price: £5,499 UK or $5,699 US

Manufacturer: AURALiC LIMITED
URL: www.auralic.com/en/

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Chord Electronics DAVE DAC

by Alan Sircom

In this review, I'm going to take the unusual step of starting with the negatives first: Dear Chord Electronics, you called it DAVE? Really? Is there some kind of kid's TV thing going on here – "Today children, Timmy the transport and Dave the DAC meet up with Andy the amplifier to allow Lenny the loudspeaker to make some noise." OK, so there's a backronym involved ('Digital to Analogue Veritas in Extremis'), which goes some way toward providing mitigating circumstances. Even so… DAVE the DAC: That's up there with Postman Pat and Captain Snort from Pippin Fort.

But really, that's it. That's about the only bad thing I get to say about the Chord DAVE DAC. Everything else is, quite simply, some kind of magnificent. In a way, it's so good that the review effectively channels the late science-fiction author Sir Arthur C. Clarke, because the DAVE lives up to his maxim that, "Any sufficiently advanced technology is indistinguishable from magic."

Calling the DAVE a DAC is doing it a disservice, as it is more of a decoding computer in the truest sense. The relevant digital decoding and filtering algorithm is stored in memory until the choice of PCM or DSD datastream is chosen, at which point the DAVE virtually reboots itself with the right DAC options for the music preloaded into its large FPGA (Field Programmable Gate Array). Contrast this with the rest of the digital audio replay world and you are met with good devices that share the same silicon for PCM and DSD replay, or the better models that run entirely separate digital pathways for the two. The Chord way is uncontentiously the best for sound quality terms, as there is no digital transcoding, and no quiescent digital processing subsystems on the same processor board. OK, so those who like to switch instantaneously from PCM to DSD and back again may baulk at several seconds of downtime while one DAC is expunged and replaced by another in the FPGA, but their impatience costs them dearly in the aural stakes.

This ability to store and deploy the right DAC for the task not only sets the DAVE apart from its rivals, it sets it apart from digital's history. This wouldn't have been possible even a few years ago, because the large LX75 variant of the Xilinx Spartan 6 FPGA used in the DAVE didn't exist, and nothing that went before had the capacity to cope with such a sizeable amount of code being written and overwritten. Put simply in Chord-language, the latest FPGA has around 10x the capacity of the previous QBD76 flagship from the company.

If this were DAVE's sole 'plus', it would already set it above the competition, but the rewritable DAC is merely one part of the DAVE's portfolio of ground-breaking tech. There's also Rob Watts' innovative WTA interpolation filter, which uses 166 separate DSP cores and an unprecedented 164,000 taps. The flexibility of the architecture extends to the operation of the DAC. If you want to configure the DAVE to prioritise PCM over DSD or vice versa, engage different styles of filter, specify which inputs to use and in which order of priority, adjust phase, use the DAVE as a digital hub or simply a DAC, or use one of Chord's innovative Crossfeed DSP settings to drive headphones, all are possible and addressable using the menu system in the central 'eye' of the DAVE. You can also determine output level, adjust the display for complex or 'granny' modes, menu colour scheme… the full enchilada. What's more, far from giving the DAVE a clunky, overblown interface, four buttons and a central knob control the whole device and, with a series of multi-colour LEDs to denote the nature of the digital input received. The only minor niggle here is because of that flexibility of set-up, these five hard buttons are not marked; this is understandable because one button will do myriad different things depending on whether you are in set-up or play mode, but those who insist every button be labelled don't get their hands held.

The easiest way of thinking of the DAVE interface is to use the display, which is always divided into three sections. The uppermost two display digital input and file type on the left and volume level or line output on the right. The lower section displays information

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"What is so important about the Chord DAVE is that it represents a raising of the bar of what can be had from a digital device. It's one of those rare products that throws down a gauntlet both sonically and technologically."

regarding the mode in which the DAVE is working; preamplifier, DAC, or headphone amp/DAC. The thing to note, both in the front panel display and the array of LEDs that surround that central display, is just how powerful the processing power of the DAVE can be. It supports PCM files to 32bit, 768kHz, DXD, and up to DSD256 (we need to place the term 'allegedly' after this; not that we suspect Chord of being incapable of living up to its specifications, but because the only thing recorded at 32/768 PCM at the moment is the sound of unicorns). While these astonishingly large bit depths and sampling frequencies are – for the moment at least – academic, it does suggest the Chord DAVE's abilities at processing the kind of files you can buy or stream are state of the art.

As ever with Chord products, the build quality is off the charts. The elegant aluminium or black anodised finish is rich and deep, the product looks like it was constructed to withstand the rigours of deep space, and the control surfaces have a positive feel. It's also extremely well specified in terms of inputs and outputs; HDMI and FireWire (remember FireWire?) are missing, and this is not a streamer so don't expect an Ethernet connection, but it sports a ¼" TRS headphone jack, four BNC-based coaxial digital inputs, USB, two toslink connectors and an AES/EBU balanced input. Then there are the quartet of 'DX' digital connections also using BNC connectors that fit into a 'watch this space' line of reasoning.

The DAVE fires up within 20 seconds (that's how long it takes to load up the decoder of choice and then run checks and balances to confirm status, and general housekeeping), but sounds at its best when the player is warm to the touch. However, the performance difference between 'stone cold start' and 'warm to the touch' is minimal in comparison to other designs. Essentially, 20 seconds into turning the DAVE on for the first time, you are at about 90%-95% of what it can do, and the rest just piles in from there… fast!

But what can it do? Put simply, it does it all. This, perhaps more than any DAC, is digital done right. It has the same 'wow!' factor performance that sets the Mojo and Hugo apart from their respective competitors, but taken to a new level. If you are in the market for a DAC at this price and beyond ('beyond' extending up to about 10× the DAVE's price) here's how the demonstration goes: it is plugged in, you wait 20 seconds, listen for about 10 seconds more, and reach for the credit card. If you do this, have someone waiting with a camera or smartphone to record your facial expression during those 10 seconds, because you go from 'WTF' to 'OMG' and then 'LOL'.

Everything – literally everything – you can throw at the DAVE musically is returned as best as you have ever heard it. OK, it doesn't suffer musical fools gladly, and compressed recordings remain compressed, but even here the sheer amount of information the DAVE is extracting will make you reevaluate your music anew. Reviewers (unconsciously or otherwise) have a series of tick boxes they list when listening to a device: dynamics… tick, microdynamics… tick, vocal articulation… tick, detail… tick, and so on. Normally, these elements are rated on a scale and how they combine dictates both absolute performance and recommendation in terms of 'fit' into a system and the tastes of a listener. Good bass and fast transients might, for example, put a device into a 'pacy, rhythmic' system, where excellent imagery, good detail, and midband transparency would put it in a 'traditional audiophile' setting. The DAVE is that rare beast; a device that performs equally well in all these aspects of performance, and by 'equally well' we mean it does an outstanding, class-leading job in all parameters.

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"…DAVE is amongst the best DACs money can buy. You might get 'different', you might even get 'equal', but I don't think you can get 'better'…"

This makes reviewing the DAVE both easy and incredibly difficult. Easy because the review just defaults to a series of superlatives; boring to read, but easy to create. Difficult because trying to categorise any aspect of performance is merely pointing out the faults in other devices. While I'm fairly sure Chord would like that, when you are working with something as advanced as the DAVE it feels a little like *schadenfreude*. But the fact remains that the DAVE is the best DAC I can think of at this or any other price. Yes, I can see people listening to the DAVE and ultimately choosing another DAC because they prefer how its set of compromises fit into their tastes or their system, but I can't see someone dismissing it out of hand.

I guess if I have to pick one area where the DAVE shines it is in its sense of dynamic scale and shading. Not because the DAC accents this, but because it shows so clean a set of heels to its rivals, this sheer energy coupled with outstanding subtlety makes the DAVE simply shine. Whether that's a bangin' bass line from a ZZ Top record or the full *sturm und drang* of the conclusion of Mahler's Eighth Symphony, or even the delicate interplay of musicians in a smokin' jazz recording from the late 1950s, the DAVE sets its flag in the ground in amongst the best DACs money can buy. You might get 'different', you might even get 'equal', but I don't think you can get 'better', whatever the price. That's how good DAVE is.

The headphone amplifier is similarly excellent, and extremely powerful and quiet. It doesn't struggle with even the most difficult headphones and is extremely quiet with sensitive models. Crossfeed is an interesting concept for headphone users. Or perhaps more accurately, Crossfeed is an excellent concept for traditional stereo users adopting the headphone revolution. As the name suggests, Crossfeed introduces a small amount of 'blend' information (left channel information included in the right channel, and vice versa) to replicate live sound in the room, studio, or concert hall. Crossfeed has three settings, and you could almost consider these are made for 'in ear', 'closed back' and 'open back' designs in descending order of intensity. Curiously, although normally such DSP settings are best used 'off', I found this did give more of a sense of music being outside the head rather than thoroughly lateralised and in-head. While I've learned to enjoy that lateralised sound, it's actually very refreshing to hear a soundstage that appears to sound like it's coming from outside my own cranium from time to time. This might not be as exotic as the Smyth Realiser, but the Crossfeed concept is more than just a gimmick.

Technical Specifications

Type: DAC, with built-in headphone amplifier
Inputs: USB B-style: 44 kHz to 768 kHz – DXD and Quad DSD, 2× optical: 44kHz to 192kHz , 1 × AES: 44kHz to 192kHz , 4 × Coax: 44kHz to 384kHz, 2× BNC 'DX' inputs
Outputs digital: 2× ultra-high-speed coax 768kHz dual-data mode for use with future-unannounced Chord Electronics products
Outputs analogue: 2× RCA, 2× XLR, ¼" TRS headphone socket
Dual-data mode available
Maximum output voltage: 6 volts RMS
THD and noise at 2.5 volts: RMS 0.000015 %
THD and noise at 2.5 volts: 127dBA Awt (124dBA into 33 ohms)
Dynamic range: at -60 dBFS 1kHz -127 dBA A wt (No measurable noise floor modulation, no a harmonic distortion) (Analogue distortion characteristic: no distortion for small signals)
Power requirements: mains power 80 volts to 260 volts; AC 20 watts
Available: in black or silver
Dimensions: (W×H×D): 34 × 6 × 15cm
Weight: 7kg
Price: £7,950

Manufactured by: Chord Electronics
URL: www.chordelectronics.co.uk
Tel: +44 (0)1622 721444

As I've said, there are rival products, some of which turn in a different sound, and some of those sounds you might prefer over the DAVE. And there are some digital converters that come so close to the DAVE's performance that you'd struggle to hear the difference in some settings. But the DAVE will likely show its hand sooner or later. It may be in dealing with a format, or outputting to a super insightful system or headphone, but the DAVE is a tough act to better all round.

Perhaps beyond all other aspects of performance, what is so important about the Chord DAVE is that it represents a raising of the bar of what can be had from a digital device. It's one of those rare products that throws down the gauntlet, both sonically and technologically. Yes, you can do a lot with an off-the-shelf variation on a theme of the application board that is supplied to digital engineers by the chip companies, but that only goes so far. Chord Electronics' DAVE is one of the few devices that challenges that concept head on. And for that, I can put up with the electromorphising name. The DAVE gets the strongest recommendation we can muster! +

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Hegel Röst network integrated amplifier

by Alan Sircom

Hegel Music Systems has come up against the Law of Unintended Consequences with its new Röst integrated amplifier. The flexible, easily networkable, white-fronted integrated amplifier came as a result of direct requests from the iChummy North Americans and style-conscious Danes, and it has sold extremely well everywhere in the world… except for North America and Denmark! Give people what they want, it seems, and they always want something else.

Those two countries dismissing Röst (pronounced somewhere between 'roost' and 'rust' for non-Scandi ears) are missing a trick, because this is a truly outstanding one box, does-almost-everything device. How much of an 'everything' largely depends on you. If you have a Control4 multiroom system, Röst is one IP address away from seamlessly joining in a two-way conversation with your home. If you have Apple devices, you can connect using AirPlay, or you can use Röst with any sort of network storage, even Sonos Connect.

The 75W per channel Röst is also a distillation of all the best bits of Hegel's recent highlights; it has the latest version of the company's SoundEngine localised feed-forward amplifier design from the H360, and applying that to something very close to the popular H80 amplifier chassis and circuit and running with it. This meets what is basically the DAC and headphone amp stage of the H160, and then mixes its own special sauce into the recipe for connectivity to Ethernet connection for all those next-generation audio sources.

Röst has two potential 'bonuses', which can go either way on the 'bonus' continuum. Living so much of its life through Ethernet, Röst has no need of any kind of wireless connectivity, as it's expected that wireless access occurs upstream at the Wi-Fi router point. By not including its own wireless connectivity, Röst is preventing possible wireless clashes on a network. That all being said, the inclusion of some kind of Bluetooth receiver would be useful, for those short-range signals that won't be transmitted across a network, but are mandatory for all teenagers.

Next, Hegel's built-in digital converters support 24-bit, 192kHz PCM audio files through coaxial, optical, and Ethernet connections, and only 24/94 through its USB input. Unlike the company's standalone HD12 and HD30 DACs, Röst and the other Hegel integrated amps do not support DSD. This, however, fits well into an Ethernet view of the world, as the ability to stream DSD

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files across a LAN is not entirely robust. The fact USB is capped at 96kHz probably also fits in with the intended customer base for Röst: this is an audiophile-grade product for people who would never consider themselves audiophiles, rather than those who are prepared to faff around with dedicated drivers for higher resolution audio. In other words, it's the high-performance sounding amplifier for system integrators and the multiroom systems they provide, and it's the one visible box in a more comprehensive system hidden away in a plant room somewhere. That is not to say Röst cannot be used in a more conventional audio setting, but those self-evident strengths are as much about its ease of integration into a larger network as they are as a great sounding amplifier.

Hegel doesn't use what it refers to as 'asynchronous upsampling' in any of its digital processing. Everyone else calls this 'SRC' or 'Sample Rate Conversion'. Hegel avoids this because it folds jitter errors into the 'to analogue' part of a DAC. Instead, Hegel developed its 'syncroDAC' system that works in lock-step with the master clock.

Nevertheless, there are going to be people who view products as a simple numbers game, and will skip over Röst because they see figures like '24/96' and '75W'. This is perhaps something Hegel has always had to deal with, however; as those who listen, not those who obsess over numbers, buy the H80. I can already see the comments section of our website boiling over with the self-righteous purchase avoiders puffing up their chests to tell the world, "No DSD… I'm out!" once again. But here's the thing: even if Röst did support DSD, they would still be 'out' because it wouldn't be the right grade of DSD, it doesn't support MQA, isn't Roon Ready, on any one of a rolling series of 'next gen' options that help them limit the field to precisely no products on the market. Yes, in fairness, I would like to see Röst have some kind of Roon and TIDAL integration, and maybe have the option of greater than 24/96 through its USB input. But I'm the kind of audio nerd that Röst is only tangentially aimed toward.

Physically, the two big differences between Röst and previous integrated amps by Hegel are the display and the finish. The display is an OLED design and an order of magnitude more sophisticated than the big blue LED read-out of previous Hegel designs (in fairness, previous Hegel designs didn't need as sophisticated a display, as source and volume were all that was needed).

The white finish was tougher to implement than it looks. Hegel wanted Röst to have a modern and elegant appeal, but not something that will quickly turn to that kind of dirty yellow when white plastic meets heat, sun, and age. It also wanted to create something that didn't have the texture of old orange peel. Ultimately, Hegel went ol' school and used thick white paint over the aluminium and steel chassis. This created its own set of idiosyncrasies to resolve, but resolved they were, and the overall look is actually really sophisticated and a world away from the black or silver finishes common to most audio electronics. I'm not going to play the 'battle of the sexes' card here, but it's fair to say that the relatively limited set of amp colour options available to most amp makers does make a lot of audio electronics hidden from view, and Röst is one of the rare exceptions.

"The Hegel Röst fits that 'MacGyver' concept well, although fortunately it's mercifully free from the late-1980s fashion sense of the original."

This could be a review of two amplifiers in one. The first is the conventional audio amplifier. The second is the amplifier designed to sit at the sharp end of a network connected and possibly multi-room concept designed by system integrators. But, in reality, the integration part extends well into Röst's core, and as a result, it behaves like a Hegel amplifier, with benefits.

In fact, it behaves like a Hegel amplifier with all the latest technology in place. This is more profound than you might first think, because it makes plugging an Ethernet-connected audio system no more threatening than hooking up a CD player. The advantage – to real-world users and system integrators alike – is it's not the kind of network-connected device that requires a lot of cross-referencing of the manual. Control4 installers simply look to the website for the relevant IP control codes for toggling power, operating source control, volume level, mute, and – if need be – resetting Röst. There is also a YouTube video showing how to connect it into a Control4 network. It can be controlled with the supplied remote, runs on conventional IR codes for those wanting a more customised one-controller system… and in all other ways acts like an amplifier with a DAC. Like the best in consumer electronics, Röst can never be 'future proofed' (because we don't know what the future will bring – smart lawns and interactive e-socks notwithstanding), but it is about as 'now-proofed' as it's possible to get.

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"The joy of Röst is that it is exceptionally forgiving of signal, yet doesn't do this at the expense of excellent performance…"

All this would be as nothing for the audiophile if it didn't sound good, but fortunately Hegel has a reputation for making fine-sounding amplifiers, and Röst does not undermine that reputation. In fact, if anything, Röst is currently the best sounding of all Hegel amps, unless you need the power of the H360 and beyond. More to the point, the knee-jerk need for extra power might not be as important as you think, unless you use a specifically current-hungry loudspeaker design, because I have heard Röst effortlessly drive loudspeakers it has absolutely no right being able to drive, like Magicos. And it drives them well. Of course, more real-world system partners exist (Hegel often demonstrates with KEF, and anything from LS50 to Blade 2 would be a fine combination). I went with the more extreme test and used Röst with the Wilson Audio Duette Series 2; a speaker worth roughly 10× the cost of the amplifier. While I wouldn't recommend such a combination on price-balance grounds, in terms of performance it sang sweetly. I also used Hegel's own excellent Mohican CD player, Airplay, and connected it to my Naim UnitiServe-fronted UPnP network: nothing phased Röst at all.

The joy of Röst – and perhaps what marks it out best as a 'now-proofed' product – is that it is exceptionally forgiving of signal, yet doesn't do this at the expense of excellent performance; it all comes down to the file quality. Airplay is the great arbiter, here – the 'Mastered for iTunes' version of the title track of Rennen by producer Christopher Taylor's alter band ego SOHN [4AD] is fairly typical of the kind of material this might play – because it can so easily sound thin, nasal, bright, and reedy. But through Röst, these elements are held at bay to let the music out.

When it comes to playing fine recordings – say, the ripped-to-WAV CD of Joni Mitchell's 'Court And Spark', played by Herbie Hancock and Norah Jones on Hancock's 2007 album *River: The Joni Letters* [Verve] – Röst gives the music its chance to shine, with outstandingly open dynamics and imaging, and a tonality that is entirely free from artifice.

Hegel's signature detailed, slightly forward presentation, with very tight, deep, and ordered bass is still in full effect, but placed side-by-side with the H80, there is slightly more refinement and order to the sound. Not a massive step forward – the H80 already scores highly on the 'refinement' and 'order' stakes – but there is a small, but distinct improvement upon what came before. Again staying with the good recordings, playing several Contrapunctus by J.S. Bach from *Bach: The Art of Fugue* played by the Emerson Quartet [DG] through CD, there is a greater authority and sense of 'in the room' presence through Röst, which – like the H80 before it – accounts for the 'fighting above its weight class' performance.

There's one last aspect of Hegel's Röst that deserves a lot of credit: that headphone socket is no afterthought. It's a fine expression of the Hegel sound, remastered for in-head use. It drives surprisingly difficult loads extremely well, doesn't scream 'leading edge detail' at the listener, is refined, sophisticated, and makes a sound that you might expect from a more esoteric dedicated headphone amplifier. Granted, if you are a true headphonista, the filigree resolution and absolute detail you get from a top-class standalone system out-performs Röst, but for the long game of just sitting down and listening to music, the overall balance of the Hegel's headphone output is easier to live with.

I confess I was struggling to find a way of describing Hegel's Röst without using the 'audio Swiss Army Knife' phrase already well in circulation. Jet lag helped and I found the answer at about 4am as I jolted awake in a hotel room in Las Vegas: MacGyver! And I apologise profusely to the people in the adjacent room for shouting 'MacGyver!' out loud at 4am (I think they might have thought it was my safe word). But, the Hegel Röst fits that 'MacGyver' concept well, although fortunately it's mercifully free from the late-1980s fashon sense of the original. It really is a 'do anything' kind of amplifier that – armed with little more than the tools it comes with out of the box – can work easily with absolutely any music source, and integrates with surprisingly sophisticated home network or home automation systems with equally surprising ease. If you think audio deserves to break free of the Man Cave, or even if you don't and simply want a damn good amplifier with network benefits, the Hegel Röst is highly recommended. +

Technical Specifications

Type: Integrated amplifier with network connected DAC
Power output: 2 × 75 W into 8 Ohms
Minimum load: 2 Ohms
Analog inputs: 1 × balanced (XLR), 2 × unbalanced (RCA)
Digital inputs: 1 × coaxial S/PDIF, 3× optical S/PDIF, 1 × USB, 1 × Network
Line level output: 1 × unbalanced variable (RCA)
Frequency response: 5 Hz–100 kHz
Signal-to-noise ratio: More than 100 dB
Crosstalk: Less than -100 dB
Distortion: Less than 0.01% @ 50 W 8 Ohms 1kHz
Intermodulation: Less than 0.01% (19 kHz + 20 kHz)
Damping factor: More than 2000 (main power output stage)
Dimensions (H×W×D): 8cm (10cm w/feet) × 43cm × 31cm
Weight: 12kg
Price: £2,200

Manufactured by: Hegel Music Systems
URL: www.hegel.com
Tel: +47 22 60 56 60

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Moon Neo ACE integrated streaming amplifier

by Alan Sircom. Pictures: Simon Marsh

I'm not even going to resist temptation here. The Moon Neo ACE is audio's Swiss Army Knife – even though it's made in Canada. This all-in-one amplifier-meets-media player is on the very cutting edge of 'now' technology, a product that would have been impossible 10 years ago, and unthinkable 10 years before that. Yet it's a product with legs long enough to think it still a going concern 10 years from now, and that's not easy to suggest in today's fast-moving digital audio world.

The ACE is part of Moon's Neo range, the slimline ones with all black or 'panda' silver-black chassis. The name is an acronym meaning 'A Complete Experience' and that seems like a fair assessment. It's a 50W per channel integrated amplifier with a moving magnet phono stage, a couple of rear-mounted line level RCA inputs and a front mounted stereo mini-jack for DAP, tablet, or smartphone users, and a surprisingly competent headphone stage. There are also eight digital inputs, including aptX Bluetooth, USB, Wi-Fi, and Ethernet, alongside the older Toslink and coaxial digital. There's a neat little OLED screen in the middle of the front panel.

The core to the digital side of things is Moon's own MiND (Moon intelligent Network Device) system, and a MiND module is fitted inside the ACE. All you need to do is hook this to a computer network (wired or wirelessly – it doesn't really matter unless you are attempting to squirt some really high-res files through Wi-Fi, in which case wired is probably your best bet – this is more to do with the robustness of your domestic Wi-Fi infrastructure than any weak links in the ACE), and then run the whole caboodle from a tablet or smartphone – preferably a tablet – working on the same network. Complexity of installation largely depends on whether you have to enter a network password. Basically, unless you are having this sentence explained to you by your carer, the actions of reading and parsing this page are about as complex as getting the Moon up and running. MiND will locate, support, and play any audio files it finds on that network that aren't protected, and integrates with TIDAL quicker than Taylor Swift finds new boyfriends. Fortunately, if you feel that nagging fear of being overwhelmed by technology, the ACE makes all this simple.

ACE needs to do all this because we are at the tail end of the biggest migration of audio replay since the 1980s. There's a statistic commonly bandied round the music business that suggests most people start collecting music in or around the time they turn teenage, and that crucial period

"MiND will locate, support, and play any non-protected audio files it finds on the network and integrates with TIDAL quicker than Taylor Swift finds new boyfriends."

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between 13-28 is when we lay down musical roots that resonate through the rest of our lives. And if you are celebrating your 28th birthday this year, you came of age musically in the time of Napster. Chances are, you never needed to start a CD collection, because online services fed that addiction (in fact, paradoxically, a 28 year old music lover is more likely to own a collection of LPs rather than CDs, and their digital music will have always been entirely file-based rather than physical). However, many of us with a few more years on the odometer are likely to have a collection of music on CD, either ripped to a server or still being played through a CD player. So the ACE needs to accommodate listeners who have all their music on polycarbonate (no CD player in the ACE, but it does have digital and analogue connections for players) or even vinyl disc, those who have music stored on home computers and servers, and those who have abandoned local storage for online content delivery. Phew!

Five years hence, one or more of these options might have dried up or all-but dried up. Maybe the need for Toslink will seem vestigial, or perhaps USB will be on the wane. It could be the vinyl bubble finally burst, or even Ethernet in 2021 will seem like using a dial-up modem. Fortunately, this Moon device being the Swiss-Canadian Army Knife, it has a lot of ACEs up its sleeve! It covers all the present bases, so even if it's out of step with the day after tomorrow, it's still got enough firepower in reserve to support new technology with (hopefully) minimal kludge-connections. I'm not a big fan of 'future-proofing' because the technology world moves too fast to guarantee what is relevant today has staying power: perhaps a more useful – if not as elegant – term would be 'fully now compliant'. The more flexibility included on a device at the time of launch, the longer that device remains relevant in the real world. And the ACE is perhaps the most flexible single device currently available in audio.

Moon has a deserved reputation for its products taking extraordinary amounts of time to come on song. They usually sound good out of the box, but it can take weeks or months for the true performance of the device to be realised. The Neo ACE seems to be an exception to the rule. Yes, the ACE gets better over time, but it's more like letting a good bottle of wine breathe for an hour or so than laying it down to age for half a year. However, despite cracking the 'warm up' nut, the ACE retains all the characteristic Moon Neo performance parameters: a deeply unfatiguing yet remarkably satisfying sound, with an extremely large, walk-in-and-make-yourself-comfortable soundstage, excellent precision of dynamic range, image placement, detail, and timing, and that sense of musical 'structure' rising out of a very dark background.

The easiest way of describing the ACE's sound is it's inherently neutral in approach. Nothing is out of place; it doesn't put undue emphasis on one aspect of the performance (either the musical performance being played or aspects of that performance from an audiophile perspective), and a sense of ordered – although not sterile or boring – calm comes across. It can rock out with the best of them, getting into the inner detail of the recording in the process, yet never losing sight of the inherent fun in rock music (my wife, for reasons that seem slightly weird even to her, suddenly got into 1970s 'driving' rock recently and began playing '(Don't Fear) The Reaper' by Blue Öyster Cult through the ACE… which led to a lot of 'More Cowbell' moments).

"The ACE's unfussy ability to work diplomatically and sympathetically with other devices takes some of the pressure off the buyer."

I put a lot of music through its paces on the ACE, and the Moon product never once disappointed. The MiND app is easy to navigate and integrates well with local and online streamed music, so it is effectively open to all the music you will probably ever need. This, combined with the ACE's even-handedness, makes for some very interesting musical ping-pong through the evening. Jazz turns to blues turns to classical, then back to jazz again, before diving into opera, turning left through world music, then to rock through Scandinavian death metal, and so on. Any audio product that lets you jump from Horowitz playing Scriabin's etudes [Sony Classical] to 'Swansong for a Raven' by Cradle of Filth [Nymphetimine, Roadrunner] in two moves is doing something very right indeed. Why? Because it has the subtlety and grace to cope with the structurally dense piano work of Horowitz playing the ultimate late Romantic works, and the balls-out energy to cope with the extreme metal onslaught, without overplaying one or understating the other. Unless you have a very catholic set of tastes, it's often hard to

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hear this, because one will seem 'boring', the other a 'cacophony'.

The joy of the ACE is that it gets out of your musical way better than many of its rivals. You really can play anything through it and it doesn't colour the sound or undermine one musical style or another too much in the process. As described above, it has a Moon-esque 'shape' to the sound, but as that shape is inherently one that doesn't add to or subtract from the performance and simply lets the music out to play, it's that precise and ultimately listenable.

There's something that jumps out with the ACE. It's a true one-stop-shop for audio enthusiasts, effectively becoming a 'just add speakers' approach to audio. If you have a turntable, it has an excellent MM phono stage. If you use headphones, the built in amp drives all bar the really gnarly ones well. If you have a CD player or tuner, the line stages are excellent, the DAC is outstanding, the streamer is easy and flexible, and the app is intuitive and works seamlessly. In short, all the things you need from your audio electronics today are in the ACE, and the sound it makes is inherently neutral, meaning it just lets your loudspeakers be themselves. The ACE takes a lot of the system matching problems out of the equation as a result, and much of that task revolves around matching the right speakers to the room, knowing that the ACE is flexible enough to be accommodating. Yes, there will always be some synergy issues where some matches are better or worse, but in the main, the ACE's unfussy ability to work diplomatically and sympathetically with other devices takes some of the pressure off the buyer.

While we don't do comparison reviews in *Hi-Fi+*, there are two noticeable rivals to the ACE that cannot be ignored here. The first is the Hegel H160, which we know well. The Hegel is more powerful, but is essentially an amp with a DAC. Both have their 'house' sounds – the Moon more 'effortless' in approach, the Hegel more 'authoritative' – but the two are very similar in outlook, and unless you were using a difficult load or playing in a very large room, I'd go with the greater flexibility of ACE. A possibly more narrow comparison is between the ACE and one of the most popular integrated system amps in the UK for the last few years, the Naim SuperUniti. Again, I know that product's performance, too. The mix of features is tighter here, although the ACE still has the upper-hand in terms of phono stage and range of digital options. And I have to say that here, the Moon ACE is the better all-rounder sonically, too. The Naim SuperUniti is a fun, exciting, and powerful-sounding amplifier, very much like the classic Nait line from the brand, but the ACE is a more balanced performer overall. In comparison, the Naim's 'excitement' factor is like adding grain to a digital photograph to make it look like film, where the ACE just is more like the unsullied original. And the ACE is a whole grand cheaper! I still have time for all three, but nevertheless the ACE edges its rivals out.

The limiting factor to the ACE is fairly obvious. Strip away all the features and it's a 50W amplifier. It's a really good 50W amplifier, capable of punching above its weight, and hangs on to its sonic character for a lot longer than most 50W integrated amplifiers, but that still imposes certain limits on what speakers you can use with the ACE. I don't suppose anyone in their right mind would use the ACE with a punishing £100,000 behemoth loudspeaker with the impedance load of a small asteroid, but this highlights the ACE's performance in positive terms. You wouldn't partner these two because of the price differential, but in performance terms, the ACE is a more tempting proposition, thanks to its outstanding sound quality. If you are going for some really high-grade loudspeakers, it might be best looking at a separates approach – very possibly from the same brand.

I think the ACE is something of a game-changer for audio, and Moon itself. It's a complete solution in a box at a price where it sees off challenges from separates pre/powers, rival standalone solutions, and pick 'n' mix streamer/DAC/amp systems. Its intrinsic performance is neutral enough to represent a complete 'just add speakers' approach to high-end audio, at a price that many high-end audiophiles might spend on a power cord. The Moon Neo ACE gets our highest recommendation. +

Technical Specifications

Type: Integrated amplifier with streaming DAC
Power output: 50 Watts per channel (8 ohms)
Input Sensitivity: 370mV
Input Impedance: 22.1kohms
Gain: 37dB
S/N ratio: 100dB full power
Frequency response: 10Hz-80kHz +0/-3dB
Crosstalk: -100dB
THD (1w/50w): 0.02%/0.02%
Intermod: 0.005%
PCM Bit-depth/sample rate: 16-32bits/44.1-384kHz
DSD sample rates: DSD64, DSD128, DSD256
Finishes: all black, black and silver
Dimensions (W×D×H): 42.9 × 8.9 × 36.6cm
Weight: 11kgs
Price: £2,800

Manufactured by: Moon by Simaudio:
URL: www.simaudio.com

Distributed by: Renaissance Audio
URL: www.renaissanceaudio.co.uk
Tel: +44(0)131 555 3922

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Innuos ZENith SE MkII server

by Jason Kennedy

Noise. That's what's wrong with digital audio reproduction. Yet how could this be? CD introduced the silent background, the hiss free 'inky blackness' that allowed the music to stand out. But it didn't... it just seemed to; digital audio appears to have very low noise, yet when you hear a system with far, far less noise it's a revelation. I know this for sure because I have heard it and it is not a subtle thing. This digital audio server makes it blindingly clear that noise is the biggest problem in digital audio. We know that the source is king – and in analogue this idea is well established – yet with digital audio we have been upsampling, filtering, and trying numerous other ideas to make things better and progress has been at best incremental. That's because these technologies do not address the fundamental problem, which is that noise (even at very low levels) undermines the potential of the medium. By dropping the noise so dramatically, the ZENith SE Mk II has made more progress in the quest for high fidelity in digital audio than all upsampling and high-resolution formats combined. But first the product.

Usually the SE suffix means a few tweaks here and there that refine a product without making any significant changes to its construction. Innuos has decided to go down the decidedly British route of understatement for its SE, and given that this ZENith SE MK II looks pretty much the same as its standard form stable-mate, you'd be forgiven for thinking that not much has changed except the colour of the faceplate. But you'd be wrong; this Special Edition is very special indeed.

However, what it is might need to be explained. The ZENith SE Mk II is a network server: essentially a NAS drive, but one that's been developed specifically for the purpose of serving up audio files to a streamer or DAC. It has connections for USB and Ethernet and its operating system is related to the one behind the Squeezebox network streamers that started this whole malarkey off. There are a few competitors in the audio server market place, but nowhere near as many as there are network streamers; it's a product type whose worth has yet to gain full recognition, a state of affairs that this Innuos will change.

A regular ZENith MkII can be purchased with 2TB of SSD drive capacity for £2,899 (or £2,299 with 1TB); the SE version is one whole pound under five grand for 2TB so where's the extra cost coming from? There are a number of differences, but the one that Innuos emphasises is the power supply, which was designed by Sean Jacobs who runs the misleadingly titled Custom HiFi Cables, a company that appears to specialise in power supply upgrades. Sean has a background in robotics and defence electronics, but clearly has a very good grasp of what matters in audio if the SE is anything to go by.

Other differences to the regular ZENith include three anti-vibration feet arranged underneath key components within the box. It looks a bit odd when you turn it over, but if this helps then the occasional tip when you lean on the wrong corner is a small price to pay. Innuos have also upgraded the internal wiring and improved the protection against EMI (electromagnetic interference).

Most of the set up options for Innuos servers are accessed via your web browser: just go to my.innuos.com and it will find the server on your network and give you a dashboard where you can choose to import files from various sources, select ripping format – that slot on the front is for this purpose – and even choose between fast and noisy or slow and quiet ripping modes. This is also where you can configure streaming accounts with a choice of Tidal, Qobuz, and Spotify Connect, a feature I've not seen on other servers to date, but whose function is limited to USB connections where you are pushing data direct to a DAC. Another feature that is even rarer is full Roon Core compatibility; few audio components have the computing

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"The ZENith SE has such low distortion that you can turn the system up as far as you like. It's so effortlessly relaxed."

power to run Roon in full effect and as a result often require an external PC for the purpose, but the ZENith SE Mk II does not. Other choices include whether to transcode DSD onboard or send a native signal to the DAC, and the option to use low latency with USB.

When using the ZENith's USB output you can control it with an app called iPeng that was developed for Squeezebox devices. It's a nice app, too; not free but inexpensive and better than many on the market. The Tidal/Qobuz interfaces aren't the slickest but they sound good coming from the ZENith SE, more open than I'm used to with network streamers.

The connections on the back consist of Ethernet for network and DAC and USB for back-up and DAC. Through the network connection, the ZENith acts as a switch, meaning one less (electrically) noisy computer peripheral in the room polluting the mains with its switched mode supply.

The ZENith SE Mk II's OS is not entirely idiot-proof when it comes to loading files. It uses three basic methods for file loading: direct from an attached USB drive, importing from a NAS, or by using the 'Auto-import' folder on the desktop. The latter seems the most straightforward until you try it on a wirelessly connected laptop and discover that it's painfully slow. This is because the data has to go through the PC between the source drive and the ZENith. The NAS import system is better because it bypasses that route but you need to know the precise path name of the NAS to keep it happy. This shouldn't be difficult and I succeeded when transferring from a Naim Unitiserve, but was less successful with a Melco N1A. The degree of ease seems to depend on the server software on the host drive.

The import process itself is a bit of a control freak. It goes through every file with a fine tooth comb to establish it's exact nature, which should be good for the state of the resulting library but results in numerous albums being rejected and put in the 'Unsorted' folder. You then have to figure out what's amiss with them and put them back into 'Auto-import' and hope that they pass next time. All library programs have foibles, but this one is the fussiest I have yet encountered.

This inconvenience is more than compensated by the results. Listening commenced with a USB connection to the mighty CAD 1543 MkII DAC, which revealed subtlety, precision, and a real sense of high resolution with CD quality material. The phrasing of brass was superb as was the sense of swing in the music; then I noticed involuntary movement of my fingers and realised that the 'air piano' playing had kicked in. It's a bad habit, I know, and one that I thought I had under control, usually with familiar material it's not an issue, but this told me something was different, something rather good was coming out of the system. Having found in the past that Ethernet is generally more musical than USB, I switched to an AURALiC VEGA G2 streamer/DAC and hooked up the Ethernet to the ZENith. The first thing that became apparent was just how quiet the background was on Anouar Brahem's *Blue Maqams*. This isn't noise per se; it's a reduction in the noise floor, something you can't hear directly, but it's clear when it goes down. This means you can hear more of the room acoustic and the quietest parts of the music, which while they may not be significant in themselves are what creates a sense of realism. They allow the recording environment to be brought into your room where a virtual live music event takes place; that is what happened with the ZENith/VEGA combination. The improvement was not directly attributable to the VEGA G2 itself, which I had used with my regular server for some time beforehand, but rather was due to the ZENith. Plainly the VEGA G2 had previously been held back by the source.

The more great performances I played the stronger this impression became, 'La Canción de Sofia' by Corea, Clarke, and White [*Forever* Concorde Records] is a live performance highlighting Stanley Clarke's double bass skills, in which the preamble to the solo does not draw attention. Here the atmosphere was electric and it was impossible not to be drawn in, so that when the solo came along the sense of presence was uncannily palpable, and it felt like being there in the audience. This degree of realism is not easy to achieve

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"It seems that the path to digital audio nirvana has lain within the grasp of a canny engineer for some time."

whatever the source, and frankly speaking digital audio would not be my choice when attempting it. Yet it prompted me to think: 'so this is what this system is capable of!'

The ZENith SE has such low distortion that you can turn the system up as far as you like. It's so effortlessly relaxed that it brings to mind reel to reel tape, but without hiss. Yes, it's that good. It also makes it clear that the order of importance with digital audio is not what we thought; if you can make 16/44.1 sound this good then sample rate isn't the issue; noise is the problem. It's insidious and cannot be removed from the music by merely doubling sample rate; only by removing it as far back in the chain as possible can we achieve genuine high fidelity. It comes back to the old adage that source is king, the server is in effect the turntable and arm while the streamer is the cartridge and the DAC the phono stage. They all matter but if the first part is distorted or just plain noisy then nothing later in the chain can make up for it.

Back to the music, and switching up a gear in resolution terms in the process, I gave some DSD a spin and was faced by a whole wall of music courtesy of Mozart's 'Violin concerto in D major' [Marianne Thorsen, *TrondheimSolistene*], 2L]. This encouraged an attempt at realistic concert hall volume in my listening room, something that proved a little bit much for the system/room combination. The laws of physics cannot be bent when it comes to physical scale it seems, which is why smaller ensembles and live performances work so much better. A larger live experience is to be found on an audience recording of Ryan Adams and the Cardinals performing 'Hallelujah' [*Live at Das Haus*, archive.org] where audience noise combines with a quiet song to produce a lump-in-the-throat experience that's very powerful indeed. All it takes is to close your eyes and you're in the auditorium, soaking up the energy in such a convincing way that it's hard to think of ways in which the sound could be bettered. Captivating is not a sufficient word to describe what this device is capable of. 'Gobsmacking' gets closer.

It seems that the path to digital audio nirvana has lain within the grasp of a canny engineer for some time. None of the elements employed within the ZENith SE Mk II are new but Innuos is the first, to my knowledge, to have put them together, to take the server that seriously. The company is a server specialist, but not the only one. The closest competition I've heard is the CAD CAT (computer audio transport), which is in the same league but dedicated to USB operation (CAD has an Ethernet connection but it doesn't do what the Innuos does). With a run limited to 100 units I suspect that the ZENith SE MkII will be pretty scarce within a few months; hopefully it will be resurrected if demand is sufficient, but there's no guarantee. If you really want to know just how good audio reproduction in the home can be I strongly recommend that you audition this server at the earliest opportunity. Just remember to turn it up and close your eyes. They say that the only magic left is art. This product makes a strong case for that statement where music is concerned and I want one! +

Technical Specifications

Type: Solid-state music server with SSD storage and CD ripper
Storage: 2TB Samsung EVO SSD
Network connection: RJ45 Ethernet
Digital Outputs: RJ45 Ethernet direct, USB 2.0
Back up connection: USB
Formats supported: WAV, AIFF, FLAC, ALAC, OGG Vorbis, AAC, MP3, DoP (DSD over PCM)
CD rip format: FLAC (zero compression)
Streaming services supported: Qobuz, Tidal, Spotify Premium, Roon
User Interface: Web browser, third party control applications
Other Features: UPnP server, DLNA device compatible.
Dimensions (H×W×D): 70 × 420 × 320mm
Weight: 11kg
Price: £4,999

Manufacturer: Innuos
Tel: +44(0) 1793 384048
URL: www.innuos.com

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Linn Klimax DS network music player

by Alan Sircom

Back in 2007, Linn Products launched a game-changing product called the Klimax DS. It was the first post-physical digital streaming player to really take music seriously. It underwent a couple of changes in the intervening years, but the basic package remained essentially unchanged for one very obvious reason – it sounded bloody good. 2007 in streamer years is ancient, but the Klimax DS has stayed the course, and any Klimax player can be brought up to date to the latest 'DS/2' standard.

But now there's the Linn Klimax DS (the so-called 'DS/3'), and everything has changed. And, of course, what changed with the DS also applies to the DSM, which adds HDMI and line-level preamp functionality to the standard DS streamer. As both of these products feature the Exakt RJ45 links for fully digital active (aktiv, in Linn-speak) connections to many Linn, B&W, KEF, and Kudos speakers, the preamp is superfluous unless you are adding a line-level source.

The core (kore?) of the latest upgrade is what Linn calls its Katalyst DAC architecture. In many digital systems, digital conversion takes place under fairly tightly constrained digital architectural limitations: the circuit itself is often a variation on a theme of the application notes or application board sent out by the chip designer. In fairness to some makers, there are not a lot of options open to an audio engineer faced with a chip that has very tightly specified demands, but this leads to the somewhat erroneous but understandable concept that any digital product essentially 'sounds like its chips'.

Those who know their way around digital design don't follow so narrow a path. Some – like Chord Electronics and dCS – go as far as to design their own DAC from scratch. Linn went instead with the Katalyst architecture, and just as the Exakt system launched to the pithy 'the source is in the speaker' sound-byte, so Katalyst and Klimax is all about 'a DAC is more than just a chip'. Katalyst involved scanning all the chip catalogues on the planet in search of devices flexible enough to accept not just a single voltage, but multiple power supply feeds – two for modulation and three for the conversion stage – all fed from an extremely stable and fully isolated voltage source. This is perhaps not unexpected from a company like Linn, which has a long history in making stable voltage power supplies for devices like the Radikal for the LP12 turntable, but the process required looking beyond the usual suspects for DAC chips, all of which accept a limited voltage input to the chip, despite that power feeding a range of different sub-systems within the DAC.

Power feed alone makes a big difference to the performance of the DAC, but that's only part of the Katalyst architecture. The signal is fed through a data optimization process (a 16x, 768kHz upsampler working at 35 bit precision, then to a 8x, 6.144MHz modulator) before being passed to an array of bitstream DACs, and finally passed to a new analogue output driver. The whole digital signal path from upsampler to the main conversion of the DAC array, is governed by a high precision master clock.

This data optimization system largely obviates the need for super high-resolution files and DSD, because the upsampling process raises 16/44 to 24/192 PCM files up to such a high performance level internally. Given Linn has been able to track what digital streaming users actually listen to (not individual listeners in some kind of Big Brother tracking, but the Linn DS users as a cohort), it seems that we are moving away from local collections of manicured super high-resolution files and toward online services like TIDAL. As a result, the company sees no need to break its own rules about 'open, commonly used' formats. Moreover, Linn's Studio Master recordings are sold as 24/192 FLAC files, but are also sold as SACD discs, so I guess they would have a good track on what is and isn't important in high resolution audio. This is at odds with the

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"If you want, your existing Klimax gets the full DS/3 treatment, and you get your old DS/2 back in a basic 'Renew DS' box."

somewhat enforced DSD/MQA 'acronym arms race', and I respect Linn's stance on this.

Linn Klimax DS fits in the standard Klimax chassis from 2007 (very early Klimax cases need some internal surgery to fit), and the solid aluminium chassis with internal chambering to physically separate digital, analogue, logic, and power supply is still a very good way of making a digital device. Linn retained the chassis, and designed the latest DS/3 architecture to be an almost direct replacement for the existing internals of the predecessor. From a manufacturing standing, that means no retooling or reworking the casework, which given the sophistication of the case is no bad thing. It also allows existing Klimax users to upgrade without losing out.

Linn retains a loyal following, for good reason. And the Klimax demonstrates a major part of that good reason. If you are the owner of an existing Klimax, you don't end up consigning that expensive streamer to trade-in or eBay hell. Instead, if you want, your existing Klimax gets the full DS/3 treatment, and you get your old Klimax DS/2 back in a basic 'Renew DS' box. And now it's time to call on the hackneyed car analogy, because that's like driving your one or two generation old Mercedes S-Class into the showroom, asking the salesperson if they could turn your old S-Class into a new S-Class, then give you back the original drivetrain, electronics, safety features, and interior of that older S-Class, in a new C-Class body. What you do with your Renew DS is up to you: an initial comparison is obvious, but then you could use it to extend your system to another room, adding amp and speakers along the way, you could hand it down to a family member or friend (+500 brownie points guaranteed), or you will get very good money for it if you choose to sell it on. Whatever you choose to do, Linn's 'leave no Klimaxer behind' plan seems eminently sensible to me.

Because this was a very hush-hush review, with strict embargos and non-disclosure agreements that explained in graphic detail what would happen to my technical area if I even breathed a word about this product before the middle of September, I listened to the DS/3 in a top-spec Linn system in Scotland, and I used a Klimax DS/2 as comparison. This, however, is a decent place to start because the DS/2 is already among the best digital streamers out there, and many DS/2s will be used in this system context. I had expected the comparison process to be a protracted, nuanced affair, trying to define subtle differences between products that really weren't that different. So, out came 'Son of a Preacher Man' from Dusty Springfield's justly famous *Dusty In Memphis* album [Phillips], which sounded extremely good on the DS/2. Two bars into the same track on the DS/3 and it sounded like she was singing with a band, where the DS/2 now sounded like she was singing to a backing track. It was as if a group of better and better-rehearsed musicians had turned up. In truth, it took longer to acclimate myself to the conditions than it did to parse the differences between the DS/2 and DS/3. In the context of a system you know, if you already have a Linn Klimax DS or DS/2 the amount of time you will need to audition the DS/3 before realising you have to buy a DS/3 is about twice as long as it will take you to read this sentence.

Naturally, this hot Linn-on-Linn comparison action came with several Studio Master albums from the Linn Label. Perhaps the most significant was the Largo from Beethoven's Piano Concerto No. 3 [Scottish Chamber Orchestra, Linn Records]. This is a wonderful piece of music, played beautifully at the best of times, and on the DS/2, listening was a therapeutic experience, as it felt as if your heart rate and blood pressure calmed in the listening. But the new DS/3 took this to new levels. It felt like Beethoven was working on you at a synaptic level. This felt like a serotonin burst… I probably wasn't smarter or a nicer person for the playing of this track, but I felt a burning desire to work some differential calculus while rescuing a kitten. 'Get Lucky' from Random Access Memories by Daft Punk [Columbia] sounded like 'Get Lucky' on the DS/2, but on the DS/3, it sounded like 'Get Lucky' on cocaine, in gold lamé hot pants, and with glitter sprinkles.

Then there's the whole finding new music aspect, which comes as a result of that effortless TIDAL connectivity. 'String Trio – Continuity Theory' by the Janaki String Trio on their Debut album [Yarlung] is not something I would normally play, but I happened upon it almost at random and found it profound and powerful.

'Profound' is the watchword, here. The DS/3 simply makes music more profound. That sounds trite, but it holds throughout. Although the comparison between DS/2 and DS/3 is an instant one, the difference also has more staying power. With less 'filter' in the way of the music, the Klimax DS/3 opens the listener up to so much greater depth

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"The new DS/3 took this to new levels. It felt like Beethoven was working on you at a synaptic level. This felt like a serotonin burst."

to their music, and as a result sessions get protracted. I sat and listened to all of Zappa's *Joe's Garage* [Zappa Records], smirking along with all the crass jokes, as well as just enjoying the music and the musicianship.

Like the best LP replay systems, you can follow every line of the music, without losing sight of the composition and intent of the music. This was possible with the Klimax DS/2, because of that streamer's unfatiguing delivery and inherently 'undigital' treble, but the level of musical insight the DS/3 brings to the music just makes the whole process a lot more organic, in the way you might turn your attention from one musician to another, or from melody to harmony, when listening to live music.

It's not just audiophile-approved pieces of music that have this kind of effect through the DS/3. 'The Hunter' by bizarre Icleandic space pixie Bjork, 'Because' by the Beatles, 'God Only Knows' by the Beach Boys, even 'Satellite' by Nine Inch Nails: all captivate, all drag you into the music. This is music replay as orgiastic tribal stuff. The last time it got this atavistic, I'm sure there was a big black monolith and a thigh bone involved.

The strange thing about the Klimax DS/3 sound is you don't tend to talk about the sound, more about how the sound has an influence on you. It is, obviously, extremely detailed, very tonally accurate, dynamic, coherent, and possessed of the sort of ringing-free, effortless treble that makes a lot of digital audio sound, well, digital. But, where many other products focus on these aspects of performance, this does that rare holistic thing that makes you reach deeper into your musical collection, whether locally streamed or on TIDAL or Qobuz. If you have spent any time with the Klimax DS or DS/2, you'll know what I am on about here, and what the Klimax DS does, the Klimax DS/3 does an order of magnitude better.

In fact, the first three words I wrote on my note pad sum up the Klimax DS/3 effect better than all the other 1997 or so words written here. And I wrote them in capitals and underlined them twice for good measure: Holy. Living. F**k. That's the ten-second later comment, and it was still relevant at the time I put away the note-pad.

I've not heard every single digital device, but I've heard a lot of them, and Klimax DS/3 is the best of the ones I've heard, or at least the best I've heard that don't cost as much as a decent luxury car. And even at the super-lofty end of high-end digital, the Klimax DS/3 stands with the best of them, and even shows a clean pair of heels to some of audio's upper echelon with ease. It might even be the best of all of them, and therefore comes profoundly recommended. +

Technical Specifications

KLIMAX DS/DSM

Type: Network music player (DSM with preamp functions)
Analogue inputs (DSM only): 1× Balanced XLR pair
Digital input: Ethernet RJ45 (DSM adds 3× HDMI Type A, 1× S/PDIF RCA also configurable as output, 2× Toslink)
Analogue output: 1× Balanced XLR pair, 1× unbalanced RCA pair
Digital output: 2× RJ45 Exakt link (DSM adds 1× HDMI Type A)
Supported file types: FLAC, Apple Lossless (ALAC), WAV, MP3, WMA (except lossless), AIFF, AAC, OGG
Audio sample rates: 7.35 k, 8 k, 11.025 k, 12 k, 14.7 k, 16 k, 22.05 k, 24 k, 29.4 k, 32 k, 44.1 k, 48 k, 88.2 k, 96 k, 176.4 k, 192 k
Word Depths: 16-24bits
Control Protocol: Compatible with UPnP™ media servers, UPnP™ AV 1.0 control points, OpenHome.org compatible
THD+N (line output): THD+N <0.0007 %
Dynamic range: >110dB
Gain range: -80dB to +20dB, 1dB steps
Finish: Black or silver
Dimensions (W×H×D): 35 × 6 × 35.5cm
Weight: 8.6kg
Price: Klimax DS £15,800, DSM £18,900
Klimax DS upgrade £3,850,
Klimax DSM upgrade £4,200

Manufactured by: Linn Products Ltd
URL: www.linn.co.uk
Tel: +44 141 307 7777
Tel (UK Freephone Only): 0800 001 5111

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Naim Audio Uniti Nova integrated streaming amplifier and Uniti Core music server

by Alan Sircom

This was a LONG time coming! Naim Audio announced the new versions of the Uniti products in the middle of 2016, with a view to rolling out the first products in October or November. And that's precisely what happened, except no-one asked Naim precisely which October or November. Reviewers who had bought products from the previous Uniti line were first in the queue for reviews (so my UnitiServe pushed *Hi-Fi+* up to the head of the line), but even so, we were asking after our Naim products at the Bristol Show in February, Munich High-End in May, and all points between.

Such is the power of Naim in the UK, there have been droves of people who have adopted an "It's OK… I'll wait" stance, when lining up for their new integrated streaming amplifier or server. Although a number of brands (most notably Hegel and Moon) have taken advantage of the Naim-shaped hole in the market for such products, Naim's faithful have remained wholly true to the cause, quite possibly because the products looked as if they were worth the wait.

Oh boy, were they worth the wait!

We received two products from Naim's Salisbury HQ; both in essence direct replacements of what went before. The Naim Uniti Core is a disc-ripping networked music server, directly replacing the UnitiServe that has been providing sterling service in that task for several years in my system, regardless of DAC or streamer. The Naim Uniti Nova is the top of three one-box streamer/amplifiers from the brand: the Atom is the half-sized pocket rocket integrated (replacing the UnitiQute 2), the Star is the full-sized does-it-all device, complete with ripping or live-play CD drive (which replaces the Uniti 2), and the Nova is the big kahuna SuperUniti replacement. Those who obsess over the Naim catalogue will note the UnitiLite one-box player is not being replaced and has been quietly dropped.

The whole Uniti range has now moved from the traditional matt black livery with green lettering, to the more modern-looking brushed black with the logo laser cut into white back-lit clear acrylic. In the Nova and the other players, it also moves the volume control from the front panel to the top plate. These styling cues are part of a direction that works so well at the super high-end (Naim's Signature amplifiers) and at the entry point (the two Mu-so models). Only time will tell whether a similar stylistic change takes place in the Classic line. Personally, I think it's extraordinarily elegant and brings Naim's designs bang up to date, where arguably green on black is a bit '1990s' in approach.

If the Uniti products were merely reboxed versions of the older designs, gift-wrapped, and given some 2017-era production control techniques, the review could end here and many would still be happy. The legacy Uniti products still perform perfectly well and are as entertaining today as they were half a decade or more ago. But Naim took its time to make the new Uniti so much more.

Starting with the Core, this is a completely new design across the board. Hardware, operating system, ripping software, even the app used to drive it has changed. Any music server is essentially a single-task computer, but in fairness the UnitiServe was slightly more like a computer, albeit one that was built as bomb-proof as possible to survive spending years running in the background. The new player doesn't rely on a laptop power supply, for example, and it doesn't run on Windows! Instead, Naim spent years writing custom code for a Linux-based thin-client that can now support up to 12 streams, play anything up to 32-bit, 384kHz PCM files across UPnP, or act as a transport mechanism with a memory. It also comes diskless as standard, but includes a caddy and rear panel for fitting your hard disk of choice (Naim has a list of recommendations for both HDD and SSD options). It now runs from the standard Naim app, and no longer requires a separate n-Serve app. It even has a sleep mode!

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The Core is a fine replacement to its predecessor in its own right, but used in tandem with products like the Uniti Nova it begins to offer significantly better functionality. Which leads us on to the Nova itself.

The three new Uniti amplifiers are the result of a four-and-a-half year project to substantially revise and improve upon the original Uniti platform. That says just how good the original Uniti platform was in that it still stands up as a viable 2017 service despite the first models appearing eight years ago. However, it's worth bearing in mind that high-resolution to the original Uniti was 16-bit, 48kHz and (if you could get them) 24-bit, 96kHz PCM files. Today, we are looking at up to 32-bit, 384kHz PCM and multiples of DSD. In addition, streaming was what you did with a bad head-cold, not a legitimate way of accessing high-resolution audio from an online music provider. Uniti appeared before the iPad and the system was essentially ported to the world of tablets and as a result the more text-led navigation of the older system gives way to a more up-to-date GUI. The new Uniti platform is built to live in an app-dominated world. This change also brought new formats into the Naim fold, including Apple AirPlay, Google Chromcast, and improved Wi-Fi connectivity.

This is relatively easy to write out, but the reality is a complete back to the blank page approach from Naim to ensure this latest Uniti platform is as robust and long-lasting as its predecessor. And that means everything right down to developing their own digital signal processing. Normally, that means writing a bit of code to augment the digital filtration of a particular DAC, in this case it meant writing their own unique digital filter.

Nova, however, stands out from the Uniti range as a showcase for the amplifier platform and the changes that can be brought to Naim's old centre of excellence. This 80W Class AB amplifier is very much in line with Naim's traditional power amplifier design, but the platform's front-end is a radical departure because it operates in the digital domain, converting the two analogue inputs into the digital domain, and 'D/A-ing' the preamp outputs. Whether this is a presage for future developments in the Classic line, or simply the best way of handling analogue inputs amid all that digital domain, only time will tell.

The change to the Nova is also a philosophical one. The latest generation of Uniti products play to a very different audience than Naim's classic line, and the physical differences only serve to highlight this. These are not products designed for the Top Trumps player, where every specification is poured over and used to score points off fellow enthusiasts. Indeed, you have to dig deep on Naim's website to even find the specifications of the Nova. Instead, this speaks to a new generation of music lover who enjoys a damn good sound, but doesn't need all the audiophile baggage that so often comes with that sound.

I used the Nova against the SuperUniti on a range of loudspeakers, from the charmingly musical Neat Iota Alpha right up to the Wilson Audio Duette II (more on that later),

and at every turn I kept coming back to the Nova. There are a few of us in the *Hi-Fi+* offices who have used the SuperUniti extensively, and now I have to tell them that it's time for an upgrade. The SuperUniti was and is a great amplifier, but the Nova means you have to add a suffix: …of its time. The day you compare a bedded-in Nova to the SuperUniti is the day you trade in your SuperUniti. It's almost that simple. The digitised line inputs hold a smoothness and softness that is not matched by the networked or digital audio platforms, but if you use it as a one-stop-shop, it's outstanding!

Used as a DAC/amplifier or better still as a streaming amplifier design, the Uniti Nova is the coming together of the best version of the Naim streaming platform with an amplifier that seems to think itself a miniaturised version of the Statement, or at least a NAC-N272/NAP-200 DR combination. Sonically though, there are elements of Statement in the performance and the way it opens up the soundstage more than many Naim amplifiers do, with the same clean, fast, and tactile bass and a suprisingly lithe and natural midrange. I say 'surprisingly' not because it's a Naim amp "and they just do Pace, Rhythm and Timing, don't they?",

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but this midrange was surprising from any integrated amplifier that isn't three times the size and four times the price.

I keep coming back to the SuperUniti because for so many listeners, it's an old friend. And for so many of those 'so many listeners' it is their one-stop-shop. They don't hook it to a turntable or a CD player – it's just the amplifier, a network storage device, and speakers. And those listeners are going to find the Nova more exciting sounding, more dynamic, more detailed, more fluid, more natural, with a bigger, deeper, and wider soundstage, and conveying more of a sense of musical intent by the performers. It doesn't matter one jot whether those performers are singing plainsong or indulging in some Norwegian death metal, it is just so much fun to listen to, and so much fun to be around.

Now back to the Duette II. This is the very model of a 'mullet' system, where the loudspeakers cost several times the price of the amplifier. Sometimes this works surprisingly well, sometimes not so well. It works extremely well with the SuperUniti, but the Nova takes it to a new level. This is one of those combinations that makes you question the need to take things further. Yes, inserting tens or even hundreds of thousands more on a system will improve it, but the joy of the Nova is it will not 'better' it.

In fact, the biggest downside I can think of is the mildly textured solid aluminium top plate of the previous generation of Uniti model ran almost perfectly warm enough for one of my two cats to spend most of the day neatly curled up asleep. The shiny brushed surface, the control interface and the groove running through the middle of the top-plate gives him less sleeping comfort, and he now spends much of the day giving me that "I blame you" look that cats perfected in Ancient Egypt. When the main negative is feline disapproval, you are on to a winner! Actually, it gets better.

As we went to press on this, Naim served up a beta version of its Roon ready software for testing. This adds an order of magnitude more 'awesome' to an already bursting bag of superlatives. Part of the reason Naim's servers are so robust is the file system is a rigid hierarchy, which you don't futz around with because it works so well. However, for those who don't think in quite the same linear way, it can be frustrating (I've been told – the truth is once you have used Naim's hierarchy for as long as I have, other systems seem convoluted and disorganised). Roon allows you to remove such file structures to the 'forget about it' part of your brain, and integrate your music into Roon's music-led jaunt through the catalogue, seamlessly blending TIDAL with your own collection in almost any way you can think of, should you so desire.

This isn't simply some rebadged product from the last generation. This is a true revolution in performance from Naim, and both come with the highest recommendation possible. If this is the future, it looks and sounds great! Very highly recommended. +

Technical Specifications

Naim Uniti Core

Type: App-controlled network music server
Audio Inputs: CD-ripper, 2× USB A (front/rear)
Audio Outputs: 1× BNC S/PDIF
CD formats supported: Audio CD (Red Book, including CD-R)
Digital formats supported: WAV – up to 32bits/384kHz, FLAC and AIFF – up to 24bit/384kHz, ALAC (Apple Lossless) – up to 24bit/384kHz, MP3 – up to 48kHz, 320kbit (16 bit), AAC – up to 48kHz, 320kbit (16 bit), OGG and WMA – up to 48kHz (16 bit), DSD – 64 and 128Fs
Network connection: Ethernet (10/100/1000Mbps)
Storage: Up to 100,000 tracks to internal or external Network Attached Storage
Choice of internal HDD or SSD hard drive (up to 8TB)
Network output: Serve up to 12 network-connected players via UPnP™
Dimensions (H×W×D): 95 × 214 × 265mm
Weight: 7kg
Price: £1,899

Naim Uniti Nova

Type: Integrated Network Streaming Amplifier
Power output: 80W per channel into 8 ohms
Digital Inputs: 2× Optical TOSLink (up to 24bit/96kHz), 2× Coaxial RCA (up to 24bit/192kHz, DoP 64Fs), 1× BNC (up to 192kHz, DoP 64Fs), 1× HDMI, 2× Type A USB sockets (one on front panel)
Analogue inputs: 1× RCA pair, 1× DIN
Network inputs: Ethernet (10/100Mbps), WiFi (802.11 b/g/n/ac with internal antenna), Bluetooth (AptX HD), Internet Radio, UPnP™ (hi-res streaming)
Analogue outputs: 1× stereo power amplifier output, 1× RCA sub/pre output, 1× 3.5mm headphone jack
Internet Radio: vTuner premium 5
Streaming options: Chromecast Built-In, Apple AirPlay, TIDAL, Spotify® Connect, Supported audio formats: WAV – up to 32bits/384kHz, FLAC and AIFF – up to 24bit/384kHz, ALAC (Apple Lossless) – up to 24bit/384kHz, MP3 – up to 48kHz, 320kbit (16 bit), AAC – up to 48kHz, 320kbit (16 bit), OGG and WMA – up to 48kHz (16 bit), DSD – 64 and 128Fs, Gapless playback supported on all formats. All formats to 384kHz maximum over wireless network.
Dimensions (H×W×D): 95 × 432 × 265mm
Weight: 13kg
Price: £4,199

Manufactured by: Naim Audio
URL: naimaudio.com
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Roon Nucleus+ music server

by Chris Thomas

Streamed music always seemed to me like a great idea, but one that, over the years, I have had begun to have serious doubts about. I know that, in many households, music has been somewhat relegated to commodity-level these days, but the systems I was hearing had left me unimpressed, despite the hype. As I began to dip my toe into the world of high-end streaming I was encouraged by the process but still generally disappointed with the overall quality I was hearing. Would it take years before we had the necessary equipment and software to really explore its potential and depths? Compact Disc was like that and we all blamed the early discs for their rather thin and indifferent sound. It took a long time for me to both accept it as a main listening source and even longer to understand that there was a lot more music on those early discs than I had ever thought. I hoped that digital file storage and streamed music wasn't going to take so long to reach maturity because when digitally encoded music for the home first came to prominence in the early 1980's, it absolutely stank.

The dream that streaming has always promised the music-lover is the world of high-quality music at your fingertips. Through lossless streaming from companies like Tidal, this dream has notionally become reality, or at least has been on the cusp of real success. In fact I have had several set-ups at home that have come close(ish) to high-end CD replay but the quality has always been 'consistently inconsistent'. As the software improved so did the music, but a great sounding album could always be followed by flat and rather anaemic disappointment. Add to this a certain clunkiness in the operating systems requiring all-too-frequent reboots and I have often found it a rather unfulfilling experience. But, as far as sound quality goes, streaming and its electronics have moved on enormously over the past year or so and easy access to an enormous library is, in no small way, thanks to my choice of Tidal, and Roon's software with its superb detail and implementation acting as Tidal's able wingman.

Where home audio is concerned, there was a time when our musical horizons were defined by our libraries. How many CD's or albums had you accumulated? Along with the occasional foray into the world of FM radio, that was your musical world, as seen from the comfort of your listening chair. Then along came iTunes and then Spotify, and the amount of music at your fingertips grew enormously. But there was always the sound-quality to consider if you aspired in that direction. You could plug into all sorts of music and even rip the contents of your CD collection onto any number of storage systems with a few clicks of the mouse. That was fine, but the sound certainly wasn't. It was often excruciatingly bad. In fact, the sheer amount of material available and the various ways of storing the associated files was always going to require some creative software to bring it all together. If you've ever stood before your CD collection wondering what to play or hunted for an elusive disc, you'll know what I mean. Some companies were ahead of the game here and supplied software providing this gateway and the hand-held tablet was quite obviously the most convenient way of actually seeing what was available to listen to. Throw in some metadata like the album artwork and other details, incorporate this into the mix alongside the world of recorded music and it's not hard to see the scope for some serious software innovations. This is where Roon comes in.

Imagine a situation where you have a subscription-based account with a company

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"What has been needed is a separate and dedicated computer for running the Roon core."

like Tidal, NAS drives crammed full of your ripped CDs, some downloaded files, perhaps a memory stick or two, and a drive crammed full of hi-def files. That's a hell of a lot of music you can access, and you'll want to achieve that quickly along with some cover art and relevant information. You may just want to browse your music for inspiration, or even have suggestions made for you. Often there is a cascading effect where one piece suggests another, and this is the way great and memorable listening sessions come about for me. Roon is your friend here and is the richest and most rewarding of its type that I have tried. But, as a fan of great sound, I was never going to get too excited until the quality to rival a top CD player was achieved. For me it's all about the total experience and not just the sheer convenience.

I had been using the Roon software, alongside Tidal for over a year now and one of the issues has been that running it requires a decent amount of processing power. A tablet won't do it, so I have been using a MacBook. It works well enough but means that the computer is essentially out of bounds while the music is playing. What has been needed is a separate and dedicated computer for running the Roon core, linked to the network to assemble and collate the metadata as well as providing an extensive view of the library through your tablet. Utilising the Mac also led to some occasionally clunky and irritating reboot moments, which did little to enhance the whole experience into an immersive listening session. The Nucleus is Roon's first hardware product; a dedicated server with a built-in processor that runs Roon autonomously. Two versions are available: the entry-level Nucleus (see Specifications box, below) and the higher performance Nucleus+ version reviewed here. The Nucleus+ is built around an Intel NUC i7 processor, 8GB of RAM, and a 128 GB OS SSD for the operating system with the option to also add an SSD or HDD hard drive to provide an extensive internal library. There are connections for external NAS storage and an output that supports an HDMI connection. Roon also has drivers available now that enable integration with automated systems like Crestron.

Nucleus and Nucleus+ are entirely compatible with any of the growing list of devices on the market that are Roon-ready and there are also an increasing number of products that are able to run a dedicated core too. Roon themselves are a very open company in so far as they make recommendations as to what to buy and how to configure it should you want to build your own server system based around the NUC. You could certainly achieve identical technical results and save some money by doing it yourself. The Nucleus+ is really a self-contained version that brings everything together in a pre-configured, small, finned box with a dedicated custom power supply and no irritating fan noise for those who just want a ready-made single-box solution. Its sole purpose is to power the software and bring you music from all connected digital sources and arrange it into a coherent and comprehensive format that enables you to listen to what you want and as importantly, to explore new musical avenues. It does these things supremely well. But, obviously at a price, especially when you factor in the costs for Roon itself.

Just plug the Nucleus+ into your network through the router, hook up your hard drives and access everything through the Roon app (Mac OS, Windows, iOS and Android are all supported). Straightforward installation and lightning boot up are both exemplary aspects of the Nucleus+ and its simplicity of operation, operational stability and the clean, uncluttered appearance of the app are hallmarks of a great design. It is also a multi-room compatible platform that provides DSD and PCM upsampling as well as multi-channel playback.

It's impossible to talk about the Nucleus+ without describing what Roon itself brings to the home-listening experience and the success of the whole Roon platform depends ultimately not only on how it looks and functions but also on how it sounds. As I mentioned earlier, for years it has been possible to utilise computing power to access music from the net but it's only recently that it has begun to sound like anything other than

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"It's impossible to talk about the Nucleus+ without describing what Roon itself brings to the home-listening experience."

a second quality source. Roon has certainly helped in changing all that and it takes a while to fully appreciate just what it can do. A fully charged Nucleus-based system will have access to music through a subscription-based service, like Tidal in my case and perhaps an entire CD collection ripped onto a NAS. It also opens the world of hi-def downloads like never before and despite always being somewhat underwhelmed by these in the past, I have to say that, after recent experiences, I see them as the future of high-end sound. I was granted access to a portable hard drive crammed full of them and the audio quality of the music has been really very impressive. Music that I have on standard CD that I have been able to compare with some of the same albums in a hi-def format has left me shocked, in a good way. I can't detect any unpleasant digital artefacts or tonal nasties. But what has surprised me most is the sense of solidity, integrity, and instrumental qualities and character that I have been hearing. At long, long last, the whole streaming experience is now fulfilling the musical potential we always hoped it would.

If you run Roon – and you should seriously consider it if you intend on using stored files and a service like Tidal – the Nucleus+ (or Nucleus) is but one option, but what an option! Roon will change the way you listen to music in that it will serve you up musical options and link them together. Search for an artist, an album or a song and it presents you with the answers by looking at everything you have within your musical library and everything it can find within Tidal, depending on the parameters you set. It will download rich metadata for all your music, including those ripped files and continually look for ways to enhance and expand that. It provides many musical reviews, ratings, and links which will enable you to look at an artist in far greater depth by listing all of their albums or by just clicking the producer or any of the mentioned musicians. This opens up a new vista of possibilities as this aspect of Roon is developing all the time. In this way you discover new music on a daily basis and I cannot tell you how often this has led me towards albums and artists that I doubt I would ever have heard of without the Roon/Tidal axis. It will, as Alan Sircom said to me, release your inner musicologist. It looks good too and has many subtleties that you discover on your journey. It enables you to focus your searches and bring songs or albums together in personal playlists.

For those who are happy to maintain their CD collection in hard form and who have no intention of ripping it onto a storage medium, but just like having a musical asset like Tidal, perhaps Roon is less necessary and there are other 3rd party apps that work well. But, as your library grows, Roon comes into its own and I wouldn't want to be without it now as I envisage myself exploring the world of hi-def music much more intensely than ever before from now on. It has fantastic potential and depth.

So, if you are smitten with Roon and its abilities, the Nucleus is easily recommendable as it's small, easy to accommodate and simply allows the software to work at its optimum. Your personal library just keeps growing and growing and it is just too easy to lose yourself for hours while listening to music you have never heard before. This just has to be one of the main reasons for owning a decent system. In the next issue I will be incorporating the Nucleus-powered Roon software into a high-end home system built around a dCS Rossini so I will be able to take a closer look at sound quality and formats. If you like Roon, there's no doubt you'll love the Nucleus. It does precisely what it says on the tin. Tidal's wingman? In fact, the Nucleus is audio's Top Gun! +

Technical Specifications

Type: Music server/Core for Roon software
Variants: Nucleus – Intel NUC i3 processor, 4GB RAM, 64GB OS SSD
Nucleus + - Intel NUC i7 processor, 8GB RAM, 128 GB OS SSD
Storage: Supports libraries up to 12,000 albums (120,000 tracks)
Supports multi-room systems up to 5 zones
Connections: 2 × USB 3 ports, Thunderbolt 3, internal 2.5" HDD/SSD bay
Dimensions: 7.5 × 22 × 15.5 cm (H×W×D)
Price: Nucleus £1,499, Nucleus + £2,499

Manufactured by: Roon Labs
URL: roonlabs.com
UK Distributor: Henley Audio
Phone: +44 (0)1235 511166
URL: henleyaudio.co.uk

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How to be your own turntable guru

by Michael Trei

After many years when only the hard-core vinyl enthusiasts were showing much interest, playing records and using turntables has suddenly become hot again. But this renewed interest brings with it a sticky problem. Thirty years ago, records were the music source of choice, and every audio retailer had an analogue setup guy, someone who could get your new rig tweaked and ready to go. Today most of those turntable gurus have moved on (or, sadly, passed on), and many new turntables are now sold through online outlets, leaving the end user to fend for him or herself.

The good news is that several turntable manufacturers have recognized this knowledge gap, so they ship lower cost models complete with a pre-installed cartridge and simple enough instructions to get the rest of the job done. But, if you have any plans to step up above the entry level, you may find that you'll need to screw some of the bits together yourself.

Get yourself situated

Setting up a turntable requires a good amount of attention and focus, so pick a comfortable and well-lit spot to do the work. Some exotic turntables can only be assembled in their final location, but whenever it's possible, I like to work at a large sturdy surface such as a kitchen table. Just be sure to pick a time when the kids aren't going to be running around creating havoc.

Most of what we call turntable setup, is really centred around installing and adjusting the cartridge in the tonearm. Sorting out the rest of the turntable is typically quite straightforward. Just follow the instructions for your particular model showing how to attach the belt, install the platter and mat, and loosen any transit screws. With some designs you'll need to add oil to the main platter bearing, while with others you may have to insert the tonearm into its mounting collar. If you're resurrecting an old forgotten record player from the attic, check to see if you can find a scan of the original manual at Vinyl Engine, a great information resource for all things turntable related.

The one key tweak that applies to almost every turntable, is the importance of getting everything level. Put your spirit level directly on the platter, and adjust the feet

Right: Everything a smart-dressed turntable needs to be a dashing platter-around-town, including the complete Professional Analogue Toolkit from Clearaudio.

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or underlying shelf so that it reads perfectly true in every direction. An out of level turntable platter will create added friction and noise which will mask low level detail, and that's exactly what we're trying to dig from those grooves.

Once the basics are done, you can get down to the challenging, er, fun part, which involves installing and adjusting the phono cartridge. Nothing will spoil your new vinyl experience more quickly than trashing a brand new cartridge that you scrimped and saved for several weeks to afford, so give yourself plenty of time to proceed deliberately and carefully.

To help allay that fear, most new cartridges come with some kind of protective cover for the stylus assembly, and it makes sense to use this whenever possible during the setup. There will be a few points in the process where you'll need to have the stylus naked and exposed, but at other times it's a good idea to keep it covered up.

Making the connection

I always find that it's easier to make the electrical connections first before physically mounting the cartridge on the tonearm, but others insist that you should do it the other way around. You can make your own call.

At the back of the cartridge you'll find four pins where you need to attach the four colour-coded wires that exit from the business end of the tonearm. Normally the cartridge pins have some kind of colour coding that corresponds to the wire colours, although some manufacturers like to make it a bit more cryptic by marking the pins with R+, R-, L+, and L-. Basically, the standard colours for the left channel are white for the positive connection, and blue for the negative, while the right channel uses red for the positive and green for the negative. Some arm manufacturers like to complicate things by throwing a black or yellow wire into the mix, so check the manual if there's any doubt.

Personally, I prefer to attach the wires without using any tools, by grasping the end of the wire between my bare fingers and pushing it directly onto the pin. I find that I can get a better feel for what's happening, and when I try using needle nose pliers or tweezers there's always a greater danger of bending the clip over. The pins themselves are supposed to be a standard diameter, but it seems that some cartridge manufacturers missed the pin size memo, so you may need to carefully adjust the tightness of the clip to get a good firm connection. If it's too loose, try using needle nose pliers to very gently squeeze the clip together. Opening up an overly tight clip is a bit trickier, but pushing a toothpick into the clip – or opening it with a jeweller's screwdriver – can help.

Mounting it up

Once your wires are snugly attached, you need to physically mount the cartridge on the arm. Almost every cartridge manufacturer now uses M2.5 metric thread mounting screws, and most manufacturers supply suitable screws with the cartridge. Many cartridges have blind threaded screw holes, making it a doddle to run the screws down from the top through the headshell and into the top of the cartridge. If you're not so lucky and need to use separate nuts, it's often simpler to run the screws up from underneath the cartridge, with the nuts positioned on the top of the headshell. Once you've figured out the best way, position the cartridge so it's near the mid point of the slots in the headshell, then tighten up the screws until they are just barely starting to get snug.

Now you're ready to fine tune the alignment. But before you whip out your alignment protractor, you need to get the tracking force roughed in.

A weighty subject

Many tonearms have a built-in stylus pressure scale, and the most common type uses a small freely rotating ring on the front of the counterweight, with markings for the stylus pressure in grams. To use this properly, first you need to calibrate the position of the ring on the weight, then add the stylus pressure you want by rotating the entire weight. With the anti-skating set to zero, place the cartridge end of the arm just off the right of the edge of the platter, then rotate the counterweight until you find the point where the arm will 'float' at around the same height as a record sitting on the platter. At this point the cartridge would be applying zero grams of pressure if it was on the record, so you can calibrate the counterweight by turning just the little numbered ring, while keeping the weight itself still, so that the '0' is at the top. Now apply the tracking force you want by turning the entire weight anti-clockwise until the required stylus pressure is showing at the top of the dial. Most cartridges come with a recommended tracking force, or a range that you want to be in. With new cartridges the best performance is often found near the top of the recommended range, but you may find that as the cartridge suspension beds in with use it helps to dial it back a bit.

If you need to use an external scale, the simple but excellent Shure SFG-2 has been getting the job done for decades. More recently it has been joined by various digital strain gauge scales, ranging from cheap Chinese made eBay specials that sell for just a few pounds, to purpose made devices like the Ortofon DS-1. Most of these digital gauges give very accurate readings, although you should avoid those where the measuring platform is at a significantly different height than a record sitting on the platter.

Covering all the angles

Now that the stylus pressure is in a safe range, it's time to set the overhang and horizontal tracking angle, a.k.a. zenith. People have written books on the subject of overhang alignment, but for most users, the differences between the thoughts of guys like Mr. Baerwald, Mr. Loefgren and Mr. Stevenson really aren't all that important. I normally recommend using the protractor and alignment that came with your arm whenever possible.

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Universal protractors that will work with any arm typically come in two types. For many years, almost everyone used what's known as a two point protractor, where you adjust the cartridge until you find the point where it will line up squarely on two different grids on a flat plate. While a two point protractor can be perfectly accurate, it's accuracy depends on how precisely you can judge a tiny amount of visual misalignment. That's often a tough call, so for many years the gold standard was a protractor called the Dennesen Soundtracktor. This used a gantry with a point that you would align with the pivot point of that arm, resulting in perfect alignment using a single point. Unfortunately Dennesen stopped making Soundtracktors decades ago, but more recently some of Mr. Dennesen's patents have expired, and we now have a new flood of Dennesen-like devices such as the Feickert Analog NG, The Pro-Ject Align It, and for the truly obsessed, the costly Acoustical Systems SMARTractor. These all do a great job, with far greater precision than a basic two point plate protractor.

Vertical tracking angle or more accurately stylus rake angle, is another subject that can get analogue junkies worked up into a frenzy. This involves getting the tall and narrow stylus footprint on the sides of the groove wall to match the way the record was originally cut. Think of the vibrations embedded in the record as being like folds in a curtain, and the stylus is like a tall rod that you want to move across the curtain to read the folds. If the angle of the rod doesn't perfectly match the folds, you're going to get a less precise read of how the curtain looks. Most manufacturers design their cartridges so that when the arm is parallel with the record, the stylus rake angle will be correct, but that doesn't mean that a little careful tweaking won't yield an improvement. Some arms allow you to raise of lower the back of the arm to make subtle changes to VTA; others, most notably Rega, feel that the added rigidity of a nonadjustable mounting outweighs any possible benefit.

Azimuth adjustment is very similar to the stylus rake angle, only in this case you want the V shape of the stylus to fit the groove squarely when viewed from head on. A tool like the Musical Surroundings Fozgometer lets you adjust this by balancing the channel to channel crosstalk, but again, getting the cartridge so it's perfectly square on the record is 95% of the battle. Most tonearms don't allow for this adjustment at all.

Skating away

Anti-skate is the final thing you need to set, and it's also perhaps the most contentious. This is an outward force applied by the tonearm, to counteract the inward skating force created by the friction of the stylus riding in the groove. Anti skating is always a compromise, as it will vary depending on how deep of a cut the record is, whether it's a quiet passage or a loud one, and even whether you're at the start or the end of the side. Peter Ledermann who has rebuilt thousands of cartridges for SoundSmith, says that most of the well-used stylii he sees show greater wear on the outside than on the inside, and this tells him that most people are using too much anti-skate. He suggests using a blank record, and setting the anti-skate so that the cartridge moves slowly inward as it rides on the blank surface.

This covers all of the points of a basic turntable setup, but some of these adjustments can affect each other. Therefore it's always a good idea to go back and recheck your stylus pressure and other settings before snugging down all of the various fasteners and calling it a job well done.

Finding the sweet spot

Once your turntable is aligned to perfection, you need to find a suitable spot to locate it in your system. Far more than with other components, what you put your turntable on can make or break the performance you achieve. The turntable is trying to read the tiny little squiggles that form the groove in the record, so any unwanted external vibration getting into the system can mask the subtle low-level information that you're trying to hear. There have been many schools of thought about what makes good turntable support, but everyone agrees that you need to keep the turntable away from sources of vibration. Don't put the turntable in the same bookcase as your speakers, and certainly don't do what I saw a few times back when I was a college student, and plonk it on top of the nice flat top surface of one of your speakers. If playing records makes you want to dance around the room, then a wall mounted shelf is often the best solution to avoid the dreaded skipping record.

While most audio components are pretty much plug and play today, a turntable requires a little more care and expertise to deliver a great analogue music experience. Analogue setup pros are pretty thin on the ground these days, but with just a little handy work you should be able to get your own rig back in the groove. +

Useful Resources

Acoustical Systems
URL: www.arche-headshell.de
Analogue Seduction
URL: www.analogueseduction.net
Clearaudio
URL: www.clearaudio.de
Dr. Feickert
URL: www.feickert.de
Musical Surroundings
URL: www.musicalsurroundings.com
Ortofon
URL: ortofon.com
Pro-Ject
URL: www.project-audio.com
Shure
URL: www.shure.co.uk
Vinyl Engine
URL: www.vinylengine.com
(free registration required)

GUIDE TO AUDIO SOURCE COMPONENTS 2018: TURNTABLE SETUP HI-FI+

Roon – A software component for your digital music system

by Eric Neff

Over the last year or so many articles have been written that include something like "Roon Ready" or "Roon compatible" If you are a new or even an experienced audiophile you may be wondering what that actually means. Put simply, 'Roon Ready' means the DAC or other device being certified complies with all Roon Labs requirements to fully allow for all Roon's considerable functionality. That invites a deeper question of course – what is Roon?

Roon is a software ***component*** for your digital audio system designed by Roon Labs. We buy amps, DACs, and speakers to put together our rig. Roon should be looked at as one more part of that system. Roon puts a digital front-end on your entire music collection no matter where in your system it may be stored, and allows you to source your listening from your computer or via a tablet to one or multiple output devices located throughout your home. Its peerless music curation function allows you to have your own favourite and personalised radio station made up of Roon selected tracks based on as little as one song selected by you to begin your listening session. More on that later.

For example, many of us have music files from iTunes on our Mac or PC. We may have downloaded purchased hi-res files from HD Tracks. We may also have an extensive library of CD ripped files as we have begun to store away our physical libraries. In many cases, mine for example, those files can be spread over many storage devices. Roon seeks them out across your home network upon install and integrates them seamlessly within Roon's media management front end. OK, you say, I have other software that can do that, so what? Roon also provides an extensive library of Metadata to sort and categorise your files. You can add to it manually too to further customise your collection. Other software can do this as well you say? Roon also licences extensive artist information to further flesh out your collection. In fact, Roon will continue to review and add liner notes, photos, and additional versions of music as it manages your collection. I don't know anything else that is so proactive with my library.

"It turns out that this automated station-building is a central aspect of the Roon design ethos: freedom from the tyranny of choice!"

Roon also integrates with TIDAL allowing an extraordinary expansion of songs, albums, and versions to your collection. It can output via Airplay or to a Bluetooth device or both simultaneously. You can select a variety of different output devices in your home and tie them together for multi room output. Pass the iPad around to everyone at the party and let the playlist construction begin. The variety of functions is an integral part of why Roon was created in the first place. It's designers (the brains behind Sooloos) envisioned a way to bring a more active and engaging aesthetic to the listening experience. I certainly have found it to be very engaging. My first day with Roon I entered a search for a guilty pleasure, The Eagles 'Hotel California'. I know… What a cliché`! Whatever, I love the song and the album. No apologies. However, once the song was over the next song up was Fleetwood Mac's 'Rhiannon'. Another old favorite, then Jackson Brown followed and so on, for hours. A single song selection led to my own personal 1970's soft rock station!

It turns out this automated station-building is a central aspect of the Roon design ethos: freedom from the tyranny of choice! I know I have had many days when I have stared at my library of nearly 40,000 songs and could not make up my mind what I should listen to next. The Roon designers had the same

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"I have enjoyed many afternoons with Roon, discovering more about a band than I had known before because of these liner notes and reviews."

experience prior to creating Roon. Their integrated curation function is extraordinary in offering up choice music that I had not initially considered or was not aware of. This is a great boon for the classical music buff with so many great artists, orchestras, and conductors who have recorded the same composer, but each presenting it in their own way. Perhaps you are an old audio dog like me and want to get a sense of newer genre's. Ask your kids for a favorite artist and play a song they like and then let Roon expand your musical horizons. Occasionally a song will pop up that is just not your thing. That is what the forward button is for.

Another aspect of the engagement I have touched on somewhat is the more active information around the songs and artists that you find in a typical music management software. iTunes and other music organization software offers up a two-dimensional spreadsheet look to your song choices. You can view in album mode but either way it is a static seeming presentation. Roon offers up the full "Hold the album in your hands" experience, including music reviews by industry professionals. This is an aspect of the actively managed metadata and data sets licensed by the Roon team. They want to provide that sense of ownership without the storage space. I have enjoyed many afternoons with Roon, discovering more about a band than I had known before because of these liner notes and reviews. They are well written and researched adding a nice dimension to the otherwise music only delivery of digital.

This is not inexpensive, though. Perhaps the biggest complaint regarding Roon is that it costs $119 per year or $499 for a lifetime subscription price. Why so much? Two factors drive the price. The first is Roon's elaborate metadata and its associated licensing costs. Clean interesting data and information needs to be continually updated and that means decisions on what information should be included, how often is it updated, what types of ancillary information is interesting, and how is it sourced. Updating the software is the other large expense. One of the designer's, Enno Vandermeer, started off in Pro Audio as a software engineer. Roon is engineered to those professional standards. Enno told me consumers have not been accustomed to the price tag for pro audio software. Many times, the software expense is buried in the hardware costs (i.e. iTunes comes pre-installed on a Mac). Well written dependable pro software is not inexpensive. The expense of maintaining and enhancing that software over time is real. We all spend significant amounts on our hardware and expect it to perform at a high level for years. But with software we have an expectation of it being current with prevailing technologies. Should a new feature or format arrive the software must be able to stay relevant to emerging tech. To that end, MQA is now active in Roon 1.3, released last month. You paid for relevance as a subscriber and Roon delivered. Subscribers will notice that Roon's updates are generally universal. The Mac and PC upgrades are simultaneous. There may be minor functional difference between Roon certified devices based on component functionality though.

What about audio packages like JRiver, Amarra, and Audirvana+? I own all three and each does an excellent job orf improving sound quality vs a straight mp3. Roon also has their approach to this. However, boosting sound quality per se is not Roon's primary role, so that you may find alternatives whose sonic qualities you prefer over Roon. Such is choice. None of them do in total what Roon does though and so it is more of an apples vs. oranges conversation. As I look at my Mac desktop I see icons for all of these packages. However, since installing Roon, I rarely open them as Roon's functionality and curation abilities have won me over. I described Roon as a software audio component. It is very much a component. When I want to play a shiny disc, I place it in my PS Audio DirectStream Memory Player. If I have an album in mind, I place it on my VPI Scout 1.1 turntable. Both devices I expect to serve me well in their specific capacities for many years. Frequent software updates and curation enhancements has me looking at Roon in the exact same way for my digital audio collection. With Roon, I can listen to DSD, mp3, and PCM files one after another, with my virtual album cover in hand (or on my monitor), and with my own private radio station queuing up song after song just for me. Highly Recommended. +

Technical Specifications

A digital software audio component offering a musical curation software package that creates a searchable and surfable magazine about your music.

Download installation software from: roonlabs.com
MAC and PC versions available, Linux installation available for higher end NAS installation
Price: $119 USD per year or $499 USD Lifetime subscription.
Support available at: https://community.roonlabs.com

GUIDE TO AUDIO SOURCE COMPONENTS 2018: ROON OVERVIEW HI-FI+

ENCYCLOPAEDIA ANALOGIA

VINYL REPLAY TERMINOLOGY EXPLAINED, *Hi-Fi+* Staff

As in other disciplines within high-end audio, the world of analogue audio has spawned terminologies that at times can seem obscure or mysterious, even to the best of us, whether newbie or veteran. This article is an attempt to define and demystify some of the acronyms, words, and phrases you may be apt to encounter as you investigate the art and science of vinyl playback.

Just the (Analogue) Basics

- LPs/Records/'Vinyl'/'Vinyls'
- Critically Important LP/Record Factoids
- Record Players
- Turntables
- Phono Cartridges
- Tonearms

More Advanced Analogue Terminology

- Anti-Skating Systems/Skating Forces
- Arm Lengths/Stylus-to-Pivot Lengths
- Azimuth
- Cartridge Overhang & Alignment/ Cartridge Adjustment Protractors
- Cartridge Suspension/Dampening Systems
- Cartridge Types
- Counterweights
- Headshells
- Motors
- Platters/Sub-Platters/ Main Bearings/Spindles
- Plinths
- Record Clamps and Vacuum Hold-Down Systems
- RIAA (and other phono EQ curves)
- Rumble
- Speed Controls
- Stylus Profiles
- Stylus Rake Angle
- Turntables with Suspensions vs. Mass-loaded Turntables
- Tonearm Types
- Tonearm Bearing Systems
- Tonearm wands/tubes, etc.
- Tracking Force
- Turntable Drive Systems
- Vertical Tracking Angle (VTA)
- Wow and Flutter

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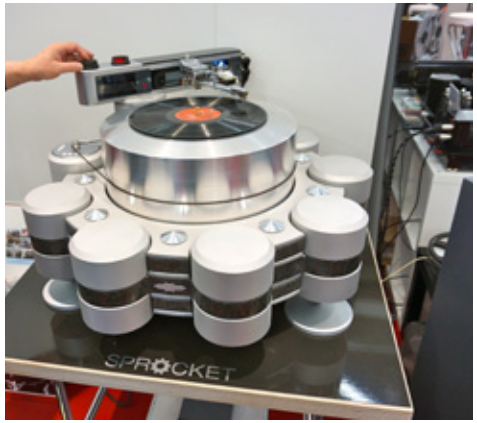
Just the (Analogue) Basics

This brief section is intended for those who have little or no experience with analogue audio and are eager to learn the basics. Treat this information as a set of foundational building blocks you can build upon later on.

LPs/Records/'Vinyl'/'Vinyls':

The whole idea behind analogue audio is to achieve musically satisfying playback of vinyl phonograph records. Records are sometimes also called LPs (for 'long play records') or called 'vinyl' by the older generation or 'vinyls' by the younger buyers (as in, "I picked up some great new vinyls at the record shop today.").

Vinyl LP records are relatively thin, flat vinyl discs, almost exactly 12-inches in diameter, with music—captured in the form of undulating grooves—pressed into their front and back sides. Traditionally, LPs rotated at 33 ⅓ RPM, although an increasing number of audiophile pressings now include multiple 45 RPM records, treating the LP as if it were a collection of 12" singles.



Right: As the exotic and costly Tone Tools Sprocket turntable and Derenneville DTT-02 radial-tracking tonearm demonstrate, analogue lovers sometimes go to extreme lengths to maximize the performance of their vinyl playback systems

In contrast, the single has commonly spun at 45 RPM and was often sold as either a 7" or 12" record. A small number of 10" extended play ('EP') records have also been produced, but – like the single – are rarely pressed today.

By convention, the spiraling grooves in the record surface start at the outer rim of the record and move inward toward the record's centre. When the last piece of music on the record side is complete, the groove—no longer containing music—spirals inwards a bit further to a so-called 'run-out groove' where the stylus of the phonograph cartridge quietly rests, waiting to be lifted from the groove when the listener is ready either to turn the record over or to shut off the playback system.

Critically Important LP/Record Factoids

Staying within the (Straight) Lines: Masters lacquers for vinyl records are made on record cutting lathes where the lathe's cutting head travels in a straight line from the outer rim toward the centre of the master disc. In an ideal world, we would want the styli of our phono cartridges to follow this exact same straight line during playback, so that the phono cartridge/stylus would remain perfectly tangent to the record grooves at all times. In practice, though, it is rarely possible to achieve true straight-line motion or perfect stylus-to-record-groove tangency at all times, so that engineers must create compromise solutions that position the phono cartridge stylus so that it remains nearly tangent to the record groove, most of the time.

Spacing Out: The spacing between record grooves is not constant, as some suppose. If you think about it, quieter musical passages require only very low amplitude modulations in the record grove, whereas loud and dynamic passages require groove modulations so high in amplitude that they are sometimes visible to the naked eye! Given this, record-cutting lathes can vary groove-to-groove spacing to allow for the dynamic swings that inevitably occur in music. This means that as the tonearm, phono cartridge, and stylus play the record from the outer edge to the innermost groove, their lateral motion is not absolutely constant, but rather varies in response to groove spacing variations.

Record Players:

Some listeners (especially newcomers) sometimes use the informal term **RecordPlayer** to describe a complete record playback system, including a turntable, tonearm, and phono cartridge. However, audiophiles almost always discuss these playback components individually, as each has a separate role to play.

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Turntables:

Turntables are the devices we use to play or "spin" vinyl records. The turntable's job is to both support and rotate the record at a precise speed (typically either 33 ⅓ RPM or 45 RPM) during playback, while contributing as little noise and as few speed fluctuations as possible. (The human ear is extremely sensitive to speed fluctuations, because they translate directly into musical pitch fluctuations.)

Some people use the word "turntable" to mean the whole record player assembly, but most serious audiophiles use the term to refer only to that part of the record player that is responsible for spinning the record.

Phono Cartridges:

Phono Cartridges are the devices tasked with 'reading' or tracking the grooves in the spinning record and then converting the physical movements involved in tracking the grooves into electrical signals that can be amplified for playback in our hi-fi systems. Phono cartridges have three basic elements: a stylus, a cantilever, and a motor (or signal generator mechanism) of some type.

The stylus is the part of the cartridge that makes physical contact with the record groove and tracks the undulations in the grooves. Styli (the plural of stylus) are almost invariably made of extremely small, precisely shaped, and finely polished diamonds.

The cantilever is a miniature rod or tube that forms a connection between the stylus and whatever type of electrical signal generator

Ortofon's MC Anna is a quintessential top-tier moving coil phono cartridge

or motor the cartridge happens to use. The cantilever is typically supported by a flexible suspension system that serves double duty as both a 'spring' that supports the cartridge and as a damper to help control the motion of the stylus/cantilever mechanism.

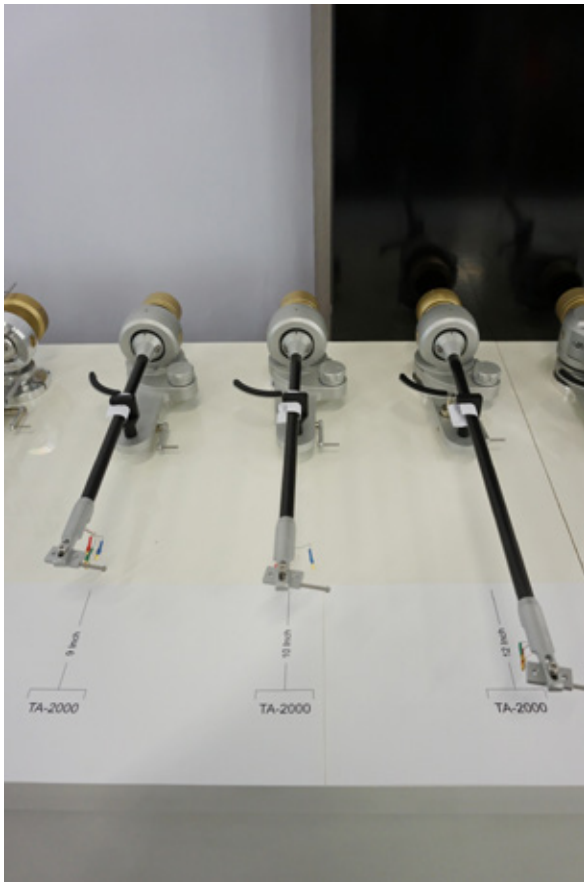
The motor of the phone cartridge translates the movements of the stylus in the record groove into an electrical signal that is analogous and proportional to the music encoded in the record grooves.

Tonearms:

The tonearm's job is to position the cartridge over the surface of the record and to hold the cartridge in place while the stylus is tracking the record grooves. This description sounds straightforward enough until you consider that the tonearm's design brief can at times seem like a contradiction in terms.

For example, we want the tonearm to hold the cartridge's body (or outer shell) almost perfectly still as the stylus, cantilever, and signal generating mechanism rapidly move in response to the groove modulations in the record. But at the same time, the tonearm cannot and must not hold the cartridge body in a rigidly fixed position; on the contrary, the tonearm must allow the cartridge freedom of movement in both the vertical (up and down) and horizontal (left and right) axes. These degrees of freedom of movement are necessary for three reasons.

First, tonearms must allow the phono cartridge to move so as to stay centred directly above the inwardly spiraling record grooves. Second, tonearms must allow cartridges to deal with the fact that many records are at least slightly eccentric, meaning the inward spiral of the groove is not necessarily smooth and continuous. Sometimes, listeners encounter records that require the tonearm to swivel back and forth (from left to right) as the record rotates, even if only very slightly. Third, many records are at least slightly warped, meaning the tonearm must allow the cartridge to move up and down to maintain a stable position relative to the surface of the record—a surface that, when viewed from the side, may at times appear to be 'bobbing' up and down as the record rotates.



Tonearms are offered in a variety sizes, shapes, and lengths, as this collection from Acoustic Signature illustrates

Stated simply, the mission of the tonearm is to hold the cartridge in a stable position relative to record groove, while at the same time allowing the cartridge freedom of movement where necessary. +

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More Advanced Analogue Terminology

Anti-Skating Systems/ Skating Forces

The majority of tonearms on the market today are pivoted, non-tangential designs and the geometry of such arms makes for a condition where the cartridge stylus tends to be pulled inward toward the centre of the record. This inward pull is called skating and its result is that there is more stylus pressure on one side of the record groove than the other.

Ideally, we would want equal pressure on both sides of the record groove and to achieve this result many tonearms feature so-called anti-skating mechanisms that apply a compensatory force that is intended to offset skating forces.

Note that skating forces can and do vary with the amount of tracking force applied to the stylus, and also vary from one stylus shape to another (because styli of different shapes may have more or less 'drag' within the record groove). For these and other reasons, setting anti-skating forces is not an exact science and in fact some manufacturers advise against applying any anti-skating forces at all. In any event, adjustments to anti-skating force should—as with everything else in high-end audio—be verified by ear.

Arm Lengths/Stylus-to-Pivot Lengths

Phono cartridges mounted in pivoted tonearms move in an arc over the record and by following an arc the cartridge/stylus can achieve true tangency to the record groove at two points per record side. But at all other points the cartridge/stylus assembly will experience some degree of tracing error, meaning the stylus will be just slightly askew to the ideal tangent-to-the-groove position.

This is where tradeoffs come into play and tonearm length looms large as a design variable. Generally speaking, the greater the length of a pivoted tonearm the lower its geometric tracing error will be—provided other length-induced design tradeoffs can be properly managed. However, increasing tone arm length is not a panacea, because longer tonearms may have potential problems with structural rigidity, unwanted resonance, cumbersome size, and excess mass.

These days the most common tonearm length is in the range of 9-inches from the pivot point to the stylus—a length that offers a good set of compromises in terms of structural rigidity, relative freedom from resonance, manageable mass, ease of handling, and reasonable physical size. At the same time, designers and listeners recognise that longer tonearms can and do reduce tracing error (because their arc-shaped travel paths more closely approximate the theoretically ideal straight lines). For this reason, the analogue world has in the past several years seen a resurgence of interest in 10-inch and 12-inch tonearms, with at least one manufacturer offering a turntable fitted with a 14-inch tone arm!

Well Tempered's Royale 400 turntable sports a 14-inch tonearm

Azimuth

Azimuth refers to the degree of left/right tilt of the phono cartridge stylus as it rests in the record groove, where the ideal is for the stylus to be positioned exactly vertically in the record groove as viewed from the front.

One tricky factor, however, is that there is no guarantee that the stylus is perfectly aligned relative to the phono cartridge body, meaning that technically correct azimuth alignment might in fact require the cartridge body to be tilted just slightly to the left or right.

Not all tonearms (and especially not many inexpensive tonearms) offer provisions for making azimuth adjustments, but many mid- and upper-tier tonearms do. Many enthusiasts have discovered that a very useful and simple tool for setting azimuth is a device called the Fozgometer (named for the veteran audio designer Jim Fosgate), which can used in conjunction with a set of recommended test records to check, revise, and adjust azimuth settings. It is also possible to use a test record and an oscilloscope for precision adjustment of azimuth, although this requires a considerably higher degree of user expertise... and the purchase of a test record and an oscilloscope!

Are the benefits of proper azimuth alignment audible? In high-resolution systems they most certainly are, making for a heightened sense of focus, clarity, and freedom from mistracking on complicated musical passages.

Cartridge Overhang & Alignment/ Cartridge Adjustment Protractors

As stated above, the theoretical ideal would be for the phono cartridge stylus to move across the record surface following the same straight-line path followed by the record

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cutting head when the original master lacquer for the record was made.

The majority of turntables are fitted with pivoted tonearms that cause the phono cartridge/stylus to swing in an arc across the record, rather than following a true straight-line path. Since an arc can only intersect a straight line at two points, the stylus can only achieve perfect stylus-to-groove tangency at two point on the record, meaning it will be slightly out of tangency at all other points on the record. To achieve best results with pivoted arms, two adjustments are critical: cartridge overhang (the exact distance from the arm pivot to the stylus) and cartridge alignment (the left-to-right angle of the cartridge relative to the tonearm and the record).

The Arche tonearm headshell from Acoustical Systems offers special provisions for adjusting azimuth, stylus rake, cartridge overhang and alignment

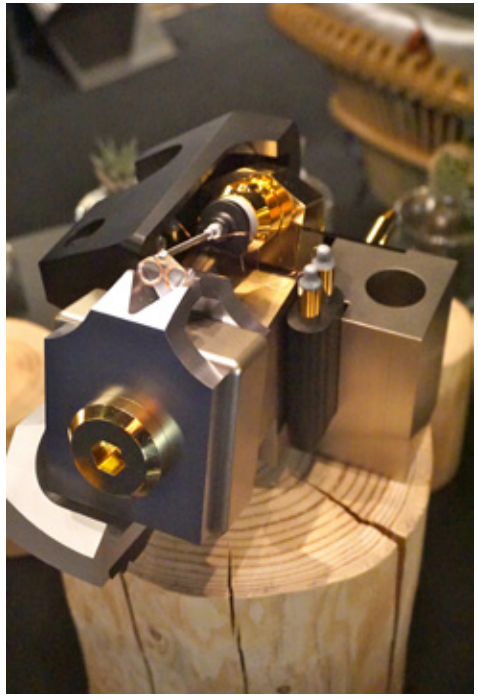
To help users adjust these two variables, many manufacturers offer cartridge alignment protractors, which are designed to slip over the turntable spindle and to rest temporarily on the turntable platter. Protractors provide markings that show where the stylus should be positioned in terms of overhang (X marks the spot) and that show how the cartridge/stylus should be aligned.

To use such protractors, listeners first loosen the fixing screws for their cartridges, then gently and carefully move the cartridges fore and aft and from from left to right, following a gradual trial-and-error process until the desired overhang and alignment positions are achieved. Once the cartridge is correctly positioned, the fixing screws can be tightened to lock the cartridge in its properly aligned position.

Note that so-called straight-line or tangential-tracking tonearms also require overhang and alignment adjustments, but with the important difference that, once properly adjusted, they maintain perfect stylus-to-groove tangency across the entire record surface.

Cartridge Suspension/Dampening Systems

As noted above, the stylus/cantilever/motor assemblies used in all phono cartridges require some sort of suspension system, which in most cases will also double as a dampening system or 'shock absorber' of sorts. Many designs use either an



This oversize, cutaway model of Audio-Technica's new AT-ART1000 moving-coil cartridge makes it easy to see the black elastomeric support system that serves as the suspension for the cartridge's stylus/cantilever assembly

elastomer ring or suspension block for this purpose, and as you may surmise the exact dimensions and compositions of these suspension/dampening elements are critical to performance.

If the suspension of the cartridge is too stiff or over damped, compliance will be reduced and resonance problems may be introduced. On the other hand, if the suspension is too soft or under damped, compliance will be too high, and other types of resonance problems may arise (not to mention the potential problems of increased fragility and possible cartridge collapse). For obvious reasons, then, the idea is to achieve a carefully judged blend of appropriate compliance levels and damping characteristics that best suit the intended playback application.

It is worth noting that, in some moving coil cartridges, designers sometimes add a supplementary suspension/damping 'tie-wire' at the rear of the cantilever assembly to provide additional support and resonance control.

Cartridge Types

Phono cartridges tend to be classified by the types of signal-generation systems or 'motor' mechanisms they employ.

Moving iron & moving magnet: Moving iron and moving magnet cartridges are conceptually similar. In both cases, either a small magnet (moving magnet) or small ferrous metal tip with adjacent stationary magnets (moving iron) is fitted to the cartridge cantilever and positioned near a set of stationary coils of wire. As the stylus tracks the groove, the magnet or ferrous metal tip (acting as an induced magnet) is set in motion and generates a voltage in the cartridge's signal coils. In most but not all cases, moving magnet and moving iron cartridges are considered high output

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designs and therefore should be used with phono stages that have a standard gain, moving magnet ("MM") phono input.

As a general rule, moving iron cartridges are thought to offer better transient response than moving magnet designs, because their ferrous metal tips are lower in mass than equivalently sized magnets.

Moving coil: As their name suggests, moving coil cartridges feature cantilevers typically fitted with tiny cruciform frames around which are wound coils of wire positioned near sets of stationary magnets. As the stylus tracks the groove, the cruciform frame and coils are set in motion (within a fixed magnetic field), thus generating an audio signal. In the majority of cases, moving coil cartridges are considered low or mid-level output designs and therefore should be used with phono stages that have a high(er) gain moving coil "MC" input.

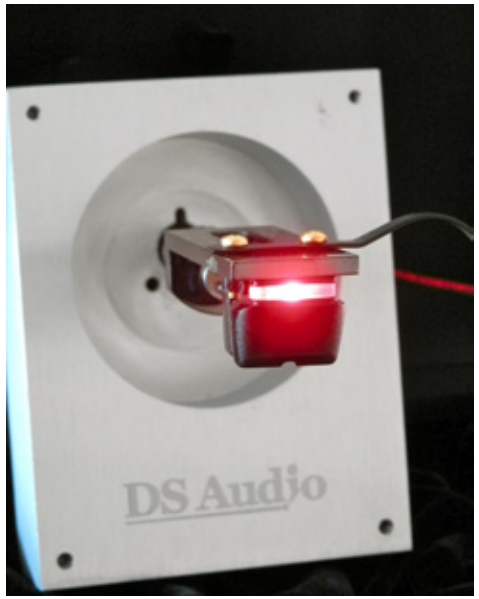
As a general rule, moving coil cartridges are thought to offer superior transient speeds and higher levels of detail than moving iron/magnet cartridges, because their moving coils of signal wire are considerably lower in mass than moving magnet or moving iron signal generators. However, this theoretically superior performance comes at a price.

Generally speaking, moving coil models are more complicated to build and more costly to make and to buy than moving magnet/iron equivalents. Some moving coil models are prone to high-frequency resonances,

Kuzma's CAR 30 is representative of an entire class of highly accomplished moving coil cartridges

which means designers must pay extra attention to damping schemes to mitigate potential problems. Finally, moving coil models typically require more costly high-gain/low-noise phono stages. With all this said, however, the majority of today's top-tier phono cartridges are moving coil designs.

Optical: Optical phono cartridges use an opto-electronic mechanism to modulate a voltage supplied from an external power supply/equalization box. In typical optical designs, which at this point are comparatively rare, the cartridge cantilever is fitted with a tiny light-permeable screen. When the stylus moves in the record grooves, the screen moves in response. An LED illuminates the screen, while an opto-electronic photodiode sensor located behind the screen 'reads' the light (as modulated by the moving screen) to produce an output signal.



DS Audio offers an optical phono cartridge that is drawing considerable attention of late

Two theoretical advantages of optical cartridges is that their moving mechanisms are very low in mass, making for excellent clarity and transient speed, and they can in principle be very low in noise. One potentially significant drawback, however, is that they must be used with their own companion power supply/equalisation boxes, which also serve in lieu of traditional phono stages.

Strain Gauge: Strain gauge-type cartridges are based—you guessed it—on strain gauges, which are flexible materials whose resistance to current flow changes as the materials expand and contract. In a stereo strain gauge cartridge, then, the cantilever is connected to two such strain gauges, with the strain gauges typically serving as both the suspension for the cantilever/stylus assembly and as the signal modulation mechanism.

Like optical cartridges, strain gauges require an external power supply box, but interestingly they do not require traditional RIAA equalisation; this is because—unlike moving magnet, iron, or coil designs—strain gauges are not velocity-sensitive transducers (where the signal depends upon how fast the stylus is moving), but rather are displacement-sensitive transducers (where the signal depends upon how far the stylus moves).

Advantages of strain gauges include the fact that their moving mechanisms are very low in mass and that their stylus/cantilever assemblies are directly and mechanically connected to the strain gauges that modulate their output signals. Three possible drawbacks are that strain gauge cartridges are costly to manufacture and to buy, are thought to be comparatively fragile, and they require use of a dedicated external power supply box.

Counterweights

Moveable counterweights are used at the back ends of tonearms, primarily to balance the arms once phono cartridges are installed, but also—in some but not all designs—to apply tracking force on the stylus. Also, for some unipivot tonearms, counterweights

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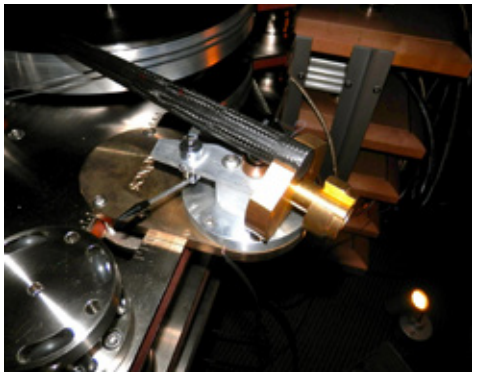
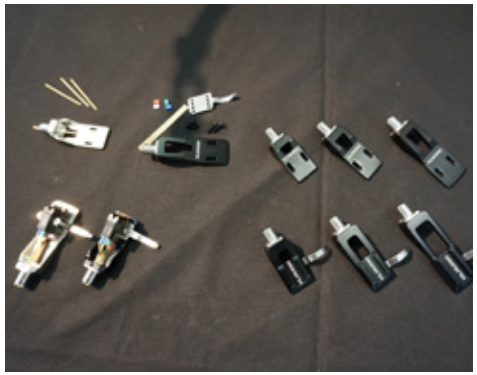


Shown here is the massive and beautifully made counterweight system of a Theriault unipivot tonearm as mounted on a Kronos turntable



KL Audio offers precision-made phono cartridge headshells to fit various applications

are deliberately eccentric in shape, so that the weights not only can move fore and aft, but also can rotate side to side for purposes of making azimuth adjustments. Typically, counterweights are made of relatively dense materials such as brass or, in some instances, even tungsten.

Headshells

The headshell is that element of the tonearm to which the phono cartridge is affixed and which traditionally would provide a finger lift, if one happens to be used on the tonearm in question. Headshells may range from ultra-minimalist on through to quite elaborate designs that, in some instances, provide within-the-headshell adjustments for azimuth and for stylus rake angle.

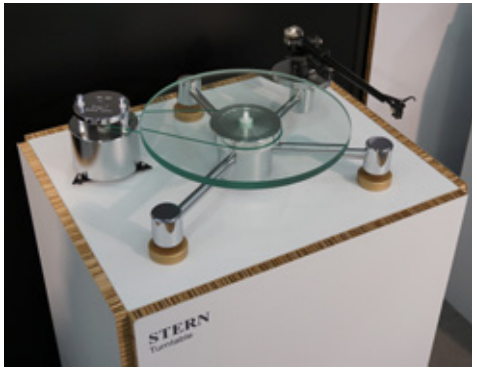
Headshell designs can either be fixed (that is, permanently attached to the tonearm wand or perhaps even fashioned as an integral part of the wand) or detachable—usually via a locking collar of some kind. Proponents of fixed headshells cite their potentially superior strength, rigidity, structural integrity, and freedom from resonance, where proponents of detachable headshells emphasise the fact that detachable headshells facilitate cartridge swapping (because users are free to mount spare cartridges in separate headshells, thus making it possible to switch cartridges with a minimum of set-up hassles).

Motors

A wide variety of motors can be found in turntables, but some of the more common types are AC synchronous motors (motors that are in essence locked to the frequency of the mains), low-noise DC motors, and so-called 'Hall Effect' direct-drive motors (where in essence, the platter serves double-duty as the 'armature' of the motor). Each type of motor has its ardent proponents and each can, if well executed, give sonically superb results. The main points to grasp are that motors need to drive their associated platters at precise, unvarying speeds with as little noise as possible and with virtually no tendency to show speed fluctuations (not even extremely minor ones) in the presence of large or small-scale dynamic variations in the music.

Platters/Sub-Platters/Main Bearings/Spindles

Platters: Platters are the relatively heavy, disc-like elements upon which records rest and rotate while in play. Ideally, we would want platters to be perfectly flat, perfectly round, and to be fitted with spindles that are perfectly centred in the platter's top surface (the spindle is a round vertical post used to centre the record upon the platter). Further, we would want platters to offer sufficient mass that, once in rotation, they would have enough inertia to be able to resist speed fluctuations—even when playing records where timing accuracy is hyper-critical (e.g., certain piano passages) or where there are wild dynamic variances over time (think of Tchaikovsky's classic 1812 Overture). Finally, we would want platters made of materials that offer good internal damping and provide a solid, neutral sounding support surface for the record. It is common to see platters made of machined aluminium, glass, brass, copper, composite materials or combinations of the above.



This Klimo Audio Stern turntable features a glass platter, which enables viewers to see the aluminium sub-platter below

Sub-Platters: Depending on the design brief being followed, some turntable designs feature platters that rest upon smaller sub-platters to which the turntable drive mechanism is connected and to which the main bearing of the turntable is attached.

Main Bearings: Main bearings must support the weight of the platter while allowing it to rotate as smoothly and quietly as possible. It is important to bear in mind that any noise—even seemingly very low-level noise—from the main bearing can be passed upward through the platter and the record, to be picked up by the phono cartridge. For this reason, precision-made main bearings are an absolute must for optimal sonic results to be achieved. It takes a great deal of expertise to design and to manufacture top-class main bearings, but the effort pays huge dividends in terms of sound quality. Indeed, one of the biggest differences between good vs. great turntables lies in the quality of the main bearings used.

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Some common main bearing types include shaft and bushing designs (with or without continuous recirculating oil baths and with or without inverted bearing shafts), shaft and ball designs, air bearings (where the weight of the platter is borne upon a cushion of pressurised air), and opposed magnet supported bearings, where sets of opposing magnets are used to partially 'levitate' the platter thus relieving physical pressure on the bearing assembly. Bearings can be made of hardened tool steel with or without jeweled contact surfaces or balls, sintered bronze, other exotic metal alloys, ceramics, composites, specialised plastics/polymers, and other man-made materials.

Spindles: Spindles are precision-made circular posts, typically made of metal, that protrude from the top centre surface of the platter. Spindles are made to an industry standard diameter and their primary purpose is to act as a centring-pin for records, when records are placed on the platter for playback (and yes, there is a corresponding, industry standard, spindle-sized hole in the centre of all LP records). But one other purpose for the spindle is to provide a gripping surface to which optional record clamps, if any, may attach.

Plinths

Plinths are the externally visible housings or structural frames for turntables. In some design, the plinth is essentially an outer shell to which various sub-frames or assembles (for example, motor mounts) are attached—or from which they are suspended.

In other designs, however, the plinth basically is the frame of the turntable, to which the turntable's tonearm, main bearing/platter assembly, and in some cases even the drive mechanism or motor is attached.

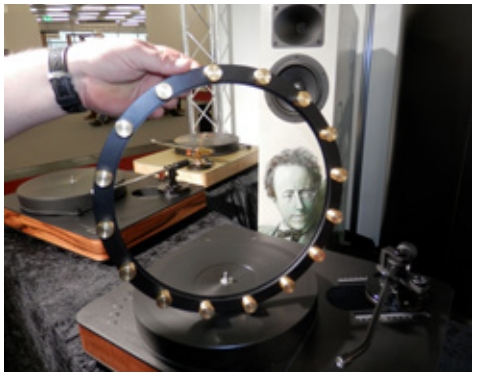
Can plinths affect sound? Recent *Hi-Fi+* reviews of aftermarket plinths for popular turntables such as the Linn LP12 suggest that plinths can have a surprising high level of impact on the turntable's overall sonic presentation.

For this reason, it is important to respect plinths as significant elements of turntable design and not as an afterthought.

Record Clamps and Vacuum Hold-Down Systems

Many analogue audio experts think that it is desirable to clamp records firmly to the platters upon which they rest during playback and for this reason a number of turntable makers and aftermarket accessory manufacturers offer specialised record clamps, which typically are attached via the platter's spindle.

Others go even further, suggesting that, since many records are very slightly warped, it is desirable not only to clamp records at their centres, but also around their outer perimeters (so that the records will lie perfectly flat upon the platter's top surface). Accordingly, a handful of manufacturers offer ring-shaped clamps, typically made of metal, that slip over the outer edges of the record and turntable platter, thus coupling the record firmly to the platter, flattening out any warps in the record surface as a result.



This Dr Feickert Analogue perimeter ring clamp is designed to hold records flat against the platter surface, while also adding a desirable degree of inertial mass to the platter

Finally, it is worth noting that not all analogue experts are devotees of record clamps, mostly out of concern that clamps might put undue pressure on the platter main bearing while potentially creating unwanted stresses in the record surface.

One way of achieving the benefits of clamping systems, but without actually using clamps, is to build turntables that incorporate vacuum-powered record hold-down systems. Turntable manufacturers such as SOTA and TechDAS have done just this, with very good results. The only drawbacks to the vacuum hold-down approach involve complexity, costs, and the need to manage the noise produced by the requisite vacuum pumps.

Many Airforce-series turntables from TechDAS, including the Airforce 1 model shown here, employ both air bearings and vacuum-powered record hold-down systems

RIAA (and other phono EQ curves)

A fact little know among laymen is that records as pressed do not have flat frequency response. On the contrary, during the record mastering process specific equalisation curves are applied—curves that reduce the amplitude of bass frequencies and boost high frequencies. The typical EQ curve used is called the RIAA curve, where the acronym stands for Recording Industry Association of America. There are also other phono EQ curves that provide similar functions, although they are far less common than the RIAA curve. Alternate phono EQ curves include those from CCIR/Teldec, Columbia, DMM, and Decca/EMI. Arguments continue to rage today as to whether record companies switched wholesale to the RIAA curve when stereo arrived in 1958, or whether recordings cut in the 1960s or later used the alternate EQs derived in the monophonic era.

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Why is phono equalisation necessary? The answer is that bass content, if cut into the record with flat frequency response, would require record groove modulations so extreme that it is doubtful that even the finest phono cartridges could properly track them. What is more, the modulations would be so large in amplitude that they would force unfeasibly wide spacing between record grooves, which would severely limit the amount of content that could be included on each record side. At the other end of the audio spectrum, high frequency material, if cut into the record with flat frequency response, would potentially be so low in amplitude that it might get masked by naturally occurring groove noise.

Thus phono equalisation, complete with boosted highs and trimmed-back low frequencies, is always applied during the record mastering process. However, in order to restore flat frequency response when playing vinyl records, inverse phono equalisation is applied during the playback process via a specific type of preamplifier called a phono stage. All phono stages provide inverse RIAA equalization, but some of today's more elaborate, upper-tier phono stages may also provide six or more specialised phono EQ curves, as mentioned above.

Rumble

Rumble is a measure of the detectable noise generated by turntables as they rotate, so that you could think of rumble as being the turntable world's equivalent of the signal-to-noise-ratio in conventional audio electronics. Rumble is typically quoted as a negative dB figure (for example, -64dB) where—as with signal-to-noise ratios—the higher the negative number of dB, the quieter the turntable will be.

As with audio electronics, lower rumble in turntables may not necessarily be perceived as 'lower noise' (although it is just that), but rather as 'enhanced low-level detail' in the music.

Speed Controls

It is impossible to overstate the importance of proper speed control in turntables since even very minor speed fluctuations can, under the right circumstance, be painfully audible (long, sustained piano chords are extremely revealing in this respect). For this reason, many designers have developed precision outboard power supply/speed control regulation boxes that serve to tighten up the speed accuracy of their associated turntables.

Speed control boxes such as this unit from Pear Audio Analogue help tighten up speed regulation for their associated turntables, significantly improving sonic performance in term of PRaT (Pace, Rhythm, and Timing)

Is this just an example of 'gilding the lily'? No. Proper speed control can make all the difference between a good turntable and a great one.

Stylus Profiles

The exact shape and dimensions of the phono cartridge stylus have much to do with how well the phono cartridge will track the record grooves. Some common stylus shapes you will encounter are the following.

Conical/Spherical: As the name suggests, conical styli are cone-shaped, but with rounded, hemispherical tips. Conical/spherical styli are the easiest to make and are the least finicky about set-up, but they have performance limitations in that they are comparatively high in mass, have relatively large tips with respect to the dimensions of the record grooves, and also provide relatively small 'contact surfaces' (analogous to the 'contact patches' of automotive tyres) between the stylus and the groove.

Elliptical: An elliptical stylus represents an improvement over the conical/spherical because, rather than having a large round tip, the elliptical stylus offers a tip with an elliptical profile whose narrower edges face to the sides and directly contact the record groove. Two benefits accrue. First, the elliptical stylus is lower in mass than an equivalent conical stylus would be, and second, the elliptical stylus' narrower but more elongated contact surface offers a better fit for purposes of tracking the undulating contours of the record groove (those narrow-radius contact points can much more readily track high-frequency details, for example). Elliptical styli require somewhat more attention to set-up, but are still relatively forgiving.

Shibata: The Shibata stylus, named after its inventor, represents an even more radical step forward from the elliptical stylus in that it has an even narrower tip shape that, under a microscope, looks somewhat like the blade of a garden trowel turned so that the flatter side of the blade is facing the viewer. The side-radius of the Shibata tip is even smaller than that of an elliptical stylus so that the contact surface is not merely a somewhat elongated ellipse (as with typical elliptical styli), but rather is a much taller and narrower ellipse that almost resembles a vertical line. Relative to elliptical styli, Shibata styli offer three compelling advantages: significantly lower tip-mass, even narrower side-radius dimensions for superior tracking of high frequencies, and—somewhat unexpectedly—an increase in contact area with the record groove (meaning that even if higher tracking forces are used there is still less stylus pressure per square centimetre than with an elliptical design). Because the side-profile of the Shibata stylus is narrower and more blade-like than with elliptical designs, greater care must be taken to make sure that the stylus rake angle is properly adjusted.

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Line Contact/Fine Line: Line contact/fine line styli, often attributed to the designers A.J. van den Hul and Fritz Geiger, represent an even further advancement along the same lines that inspired the Shibata stylus. The general idea is to pare away yet more stylus tip mass while narrowing the side-radius of the stylus tip, so that the stylus contact area becomes an extremely narrow and elongated 'fine line'. But don't let the shape and dimensions of that fine line mislead you; the fine line/line contact shape still offers plenty of stylus-to-groove contact area, so that stylus pressure per square centimetre still remains reasonable. Once again, improvements are noted in high-frequency tracking and in overall ability to trace fine, small details in the record grooves. More so than other stylus types, line contact/fine line styli are sensitive to set-up and to stylus rake angle adjustments.

Stylus Rake Angle

Stylus rake angle (SRA) refers to the front-to-back tilt angle of the phono cartridge stylus vis-à-vis the record grooves (whereas azimuth is the side-to-side tilt angle of the stylus in the groove). Unlike azimuth, however, the optimal stylus rake angle is not dead vertical (90 degrees), but rather is thought to be in the range of 91.5 – 92 degrees (depending upon which experts you consult), with the stylus tipped back just a bit, as if 'scooping' into the oncoming groove by 1.5 – 2 degrees.

Why is this very slight tilt back desirable? The answer is that the cutting head used to produce the lacquer master for the record also had a similar degree of tilt back. As always, for best sonic results the ideal is for the phono cartridge stylus to come as close as possible to following both the horizontal path and the vertical 'angle of attack' of the original cutting head.

It is possible to adjust SRA by ear, but an even more foolproof method is to use a USB microscope to observe and adjust the stylus rake angle as the stylus is resting upon the record.

Note that not all tonearms make provisions for SRA adjustments and note too that many audiophiles and even some experts tend to use the terms 'stylus rake angle' and 'vertical tracking angle' (VTA) interchangeably—even though they aren't precisely the same thing. Sonically speaking, though, SRA is the adjustment you want to get right.

Turntables with Suspensions vs. Mass-loaded Turntables

Almost all turntable manufacturers seek to isolate key elements of their playback systems from both mechanical and airborne vibration, but there is much divergence of opinion as to how best to achieve that result.

Some designers believe in using mass loading to prevent (or at least suppress) transmission of unwanted vibrations and their designs typically use fixed, solid plinths to which the turntable platter and tonearm assemblies are firmly affixed (though turntable motors/drive units may, in such designs, be mounted in separate housings or 'pods' that stand apart from the main plinth). In such mass-loaded designs, there usually is no suspension at all, apart from feet that may, in some instance, provide built-in elastomeric or spring-loaded suspension elements.

The VPI Prime is a mass-loaded turntable with isolation feet and a standalone motor 'pod' as shown

Other designers, however, strongly believe that it is best to have the turntable platter and tonearm mounted on sturdy sub-chassis that is suspended and—to a degree—isolated from its surrounding plinth. For even greater noise isolation, such designs very often attach the motor to the turntable plinth and then use an elastic belt-drive system to transfer power from the motor to the platter.

As a general rule, mass-loaded turntables are sometimes more prone to mechanically-induced noise and vibration transferred via audio furniture or the floor, while suspended turntables tend to offer somewhat better vibration isolation, but at the expense of considerably more elaborate initial set-up procedures and a certain tendency to drift out of adjustment over time.

The classic Linn Sondek LP-12 turntable is a suspended chassis design that has continued to evolve from the 1970s to the present day (the sample shown is from the mid-1980s and is still in use today)

Tonearm Types

In broad strokes, there are three main types of tonearms you might encounter, although pivoted tonearms are by far the most common types. The other two types of arms are radial-tracking/straight-line tonearms and tangential-tracking tonearms.

Pivoted Tonearms: Pivoted tonearms may feature straight or curved tonearm wands with either fixed or detachable cartridge headshells at the front end, a bearing assembly toward the rear, and a counterweight at the back end. In a pivoted arm, the cartridge/stylus always moves in an arc across the record surface, though tracing errors can be mitigated by careful adjustment of cartridge overhang and alignment angles.

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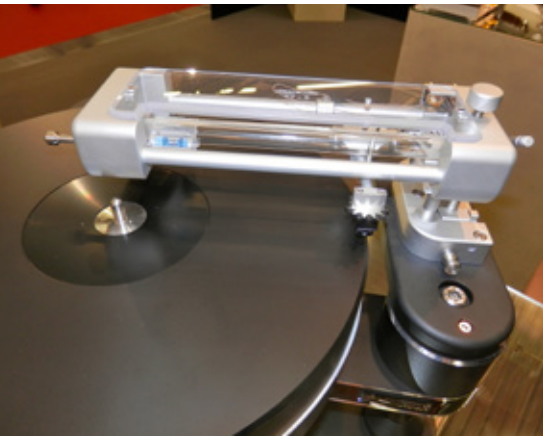

Clearaudio's TT-3 is considered a classic radial-tracking tonearm design. Note how the arm's bearing carrier allows the arm assembly to move straight sideways over the record

Radial-tracking or 'Straight-line' Tonearms: Radial-tracking or straight-line tone arms almost invariably feature comparatively short, straight tonearm wands with either fixed or detachable cartridge headshells at the front end, a bearing/arm carrier assembly toward the rear, and a counterweight at the back end. What sets straight-line tonearms apart, though, are their distinctive bearing/arm-carrier assemblies, which significantly allow the tonearms to move straight sideways—not swinging in an arc as pivoted arms do. In this way, the arms realise the ideal goal of having the stylus move in a perfectly straight line across the record, always maintaining perfect tangency to the record grooves. The downside of straight-line tonearms however, is that they are complicated to design and build, costly, and can in some instances prove difficult to set-up and to keep in proper adjustment.

Tangential-tracking Tonearms: Tangential-tracking tonearms are conceptually a cross between pivoted tonearms and radial-tacking tonearms. On one hand, tangential-tracking tonearms are pivoting designs, but with one crucial difference: their cartridge headshells are not locked in a fixed position on the tonearm wand, but rather are position on an articulated mount that—get this—allows the cartridge alignment angle to be continuously adjusted during playback to maintain stylus-to-groove tangency all the way across the record. To achieve this desirable result, most tangential-tracking tonearm are built with a main tone arm wand and a secondary control arm that rides beside the main wand and that is responsible for making continuous

The Swiss-made Thales Simplicity is a fine example of a tangential-tracking tone arm. Note how a control arm allows continuous, on-the-fly adjustment of cartridge alignment via the tonearm's articulated, pivoting headshell

alignment adjustments as needed. When viewed from above, tangential-tracking tonearms and their associated, articulated headshells look something like slender, elongated trapeziums. For obvious reasons, tangential-tracking tonearms must be crafted with extremely tight-tolerance bearings for the arms' several articulated joints.

Tonearm Bearing Systems

As mentioned above, it is very important for tonearms to offer nearly friction-free movement, while preserving tonearm/cartridge/stylus geometry with great precision. To this end, designers have devoted a lot of attention to the types of bearings used. Some type commonly encountered are as shown below.

Air bearings: Air bearings are typically shaft-and-sleeve bearings where the sleeve is fed pressurised air from an external source so that the shaft never makes metal-to-metal contact with the sleeve, but rather rides on a virtually friction-free cushion of air. This type of bearing is used in a number of straight-line tone arm designs. Examples would include the Bergmann Magne, Kuzma Air Line, or Walker Proscenium Back Diamond V tonearms.

Ball/Gimbal bearings: Precision-made ball bearings are popular for use in tonearms, often via gimbal-type mounts where one pair of bearings handles horizontal axis motion and the other pair handles vertical axis motion. Ball bearings are often graded using ABEC (Annular Bearing Engineering Committee) ratings where the higher the

Bergmann's Magne is a classic, air-bearing equipped radial-tracking tonearm

ABEC number the tighter the bearing tolerances are.

Knife-edge bearings: Some tonearm designs have used so-called knife-edge bearings for vertical axis applications. A knife-edge bearing consists of a knife-like blade that rides within a corresponding, precision machined V-shaped trough.

Multi-point/Kinematic bearings: Multi-point or kinematic-type bearings, as used by a handful of manufacturers, combine the precision of ball/gimbal-type bearings but offer the promise of even lower friction and

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The Kuzma 4 Point tonearm shown here uses a multi-point bearing system

Well Tempered's Symmetrix LTD tonearm uses a thread-type bearing, as this close-up reveals

The Wand from Design Build Listen is an elegantly simple, minimalist unipivot tone arm sporting a carbon fibre tonearm tube

VPI's innovative JMW Memorial 3D tonearm was the first to use a 3D-printed tonearm wand

essentially zero 'free-play' in the bearings. The general idea is to precisely locate the centre of motion typically using just three or four contact points. Examples would include the Kuzma 4 Point and Wilson-Benesh ACT-series tonearms.

Thread-type bearings: Some tone arms forego traditional, metal rotational bearings and use threads not only to suspend the tonearm but also to afford it both horizontal and vertical motion. Examples would include the Well Tempered tonearms or the Funk Firm F6 tonearm.

Unipivot bearings: As their name suggests, unipivot bearing feature just a single point of contact—an idea appealing in its simplicity. Such bearings typically feature a spike (with or without jeweled tip) that rests in a cup (again, with out without jeweled contact surfaces). One point to note, though, is that arms fitted with unipivot bearings must be balanced from side-to-side in order to achieve proper azimuth alignment.

Tonearm wands/tubes, etc.

As mentioned above, tonearm must position phono cartridges precisely without introducing resonance problems. For this reason, arm wands/tubes must be strong, rigid, well damped, and as resonance-free as possible.

Most tonearm wands are constructed as tubes that can be made of metal, plastics, composites, or hybrid combinations of materials. Many manufacturers enhance tubular tonearm designs either by adding internal stiffeners or by adding dampening materials, or both.

Lately, several manufacturers have begun to experiment with 3D-printing techniques for arm wands, some using plastic-type materials and other using metal materials. 3D printing allows complex shapes/designs that could not be made via traditional machining techniques.

Tracking Force

Tracking force is the amount of downward pressure applied to the phono cartridge stylus and that is necessary in order for the stylus cleanly to track demanding material encoded in the record grooves. Above all, the intent behind using the proper amount of tracking force is to make sure the stylus remains in contact with the walls of the record grooves at all times, yet without applying so much pressure that the groove walls are damaged or subject to undue wear.

When a stylus does break contact with the record groove, even if only to a slight

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degree, that condition is called mistracking, which is audible, unpleasant-sounding, and hard on the record grooves. Typical tracking forces for most modern phono cartridges will range from the mid-one gram range to the mid-two gram range, in accordance with published specifications for the cartridge. The general idea is to use sufficient force to eliminate mistracking, but not more force than is necessary.

Contrary to popular assumptions it is preferable to use slightly too much tracking force than not enough. While heightened tracking force does increase record wear to a degree it also tends to help prevent mistracking, which can be even more damaging to one's record grooves.

Turntable Drive Systems

Turntables are often classified by the drive mechanisms they use. Some common drive mechanism types are described below.

Belt drive: In belt drive turntables the motor stands separate from the platter assembly, while a precision-made belt (typically, but not always made of elastomeric materials) transfers power from the motor drive pulley to the turntable platter (or to a sub-platter beneath the main platter). Some designs use thread or magnetic tape in lieu of an elastomeric belt. The belt is thought to decouple the platter from the motor, keeping motor noise from being transferred into the platter where it could be detected by the phono cartridge.

VPI's new belt-driven Avenger turntable uses multiple drive belts to share the platter-spinning workload

Direct drive: In a true direct drive turntable the 'armature' of a Hall-effect motor is embedded within the platter, while other parts of the motor are contained in the turntable plinth. In other words, the platter is essentially its own motor. If properly designed, direct drive turntables can be extremely quiet as their motors, by definition, rotate at platter speed and thus do not introduce higher-frequency vibrations. Also, direct drive tables—again, if properly designed—also allow extremely tight speed control.

Technics' new SL-1200GAE represents both a reissue of and a substantial technical update to one of the most iconic (and best loved) direct drive turntables in the analogue world

Early generation direct drive turntables sometimes got unfavourable reviews because their designs allowed some degree of audible motor 'cogging' and because their speed control mechanisms sometimes introduced noise and micro-variations in speed. More contemporary designs typically address and solve both problems.

Idler-wheel drive: Idler wheel drive, sometime confusingly called 'direct drive', involves a motor with a drive wheel and an idler wheel that transfers motor power to the platter. Almost the opposite of belt drive designs, idler wheel designs forge a direct coupling between the motor and the platter, so that it is imperative to base such designs on extremely low-noise motors (typically very high quality DC motors). Proponents of idler-wheel drive praise their dynamic

The Italian-made Audio Silente Blackstone SE turntable uses an idler-wheel drive mechanism inspired, in part, by much earlier generation idler-wheel-driven turntables from Thorens

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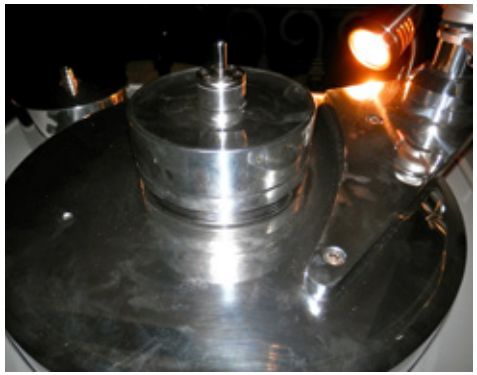
The JR Transrotor Fat Bob Reference 80 TMD turntable uses a belt-driven Transrotor Magnetic Drive bearing assembly to spin its massive, 80 mm thick, solid aluminium platter

immediacy and solidity as well as their freedom from such micro-variations in speed as can be introduced by elastic drive belts.

Magnetic drive: Magnetic drive offers another method for transmitting power to the platter while at the same time physically decoupling the motor, per se, from the platter. In this system, the motor typically drives a substantial sub-platter, which is magnetically coupled to a physically isolated platter positioned directly above the magnetic coupler. When the sub-platter rotates, its magnets attract those in the platter above, causing the platter to rotate.

Vertical Tracking Angle (VTA)

Many audiophiles and experts use the term vertical tracking angle to describe what should properly be called stylus rake angle (SRA). See above.



JR Transrotor's magnetic drive turntables feature a belt-driven, magnetic-drive subsection (the lower cylinder seen here) with an adjacent, magnetically sensitive sub-platter/bearing assembly above (the upper cylinder/spindle assembly seen in this photo)

Wow and Flutter

The terms 'Wow' and 'Flutter' refer to two undesirable types of speed variation in turntables. Wow is a slow, gradual fluctuation that might yield a slow "Wow" sound as speed gradually increases and then decreases. Flutter is a more rapid speed fluctuation with would produce vibrato or tremolo-like sounds as speed rapidly increases or decreases. For obvious reasons, it is desirable to have turntables that produce as little wow or flutter as possible, though of the two types of speed variation flutter is arguably the more noticeable. +

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ENCYCLOPAEDIA DIGITONIA

DIGITAL TERMINOLOGY EXPLAINED, *Hi-Fi+* Staff

Perhaps no single category in all of high-end audio has spawned a more convoluted 'alphabet soup' of technical terms and abbreviations than digital audio. Indeed, the topic has given rise to so many TLAs (three-letter acronyms) that at times it seems almost impossible to keep them straight in one's mind. We present here a minimalist glossary that, whilst by no means exhaustive, covers at least a few of the more common acronyms and terms you are apt to encounter when you go shopping for digital audio components.

- AAC
- ADC
- AIFF
- ALAC (and ALE)
- Bit
- Bit-rate
- Byte
- CD
- Clock
- Codec
- Compression
- DAC
- DSD
- DSP
- Dynamic Range
- FLAC
- Jitter
- kbps and Mbps
- Metadata
- MP3
- Network Audio/Network Streaming
- PCM (and LPCM)
- Resolution
- Servers
- Streamers
- UPnP/DLNA
- WMA
- WAV (or WAVE)

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AAC
This acronym stands for 'Advanced Audio Coding', which is one of several coding standards for lossy digital audio compression (see 'Compression' in this glossary for more details). AAC was originally developed as the successor of MP3, which is another form of lossy compression. AAC is generally thought to deliver somewhat better sound quality than MP3 for any given bit rate.

AAC comes up often in product specifications sheets because it is the default audio format for such popular products and services as: YouTube, iPhone, iPod, iPad, iTunes, and the Sony PlayStation 3.

ADC
The acronym ADC (sometimes also shown as 'A/D') is shorthand for 'Analogue-to-Digital Converter'. Realistically, not many audiophiles own, or would have any reason to own ADCs, but it is worth bearing in mind that recording studios and production houses use ADCs in order to create the digital audio music files that most of us enjoy.

ADCs receive analogue audio signals, sample those signals at very high frequencies (under the control of extremely accurate **clocks**) and then generate digital bit-streams (that is, multi-bit words of digital audio data) that represent the sampled analogue audio signals as accurately as possible. As with any other type of audio equipment, ADCs are not created equal and some have audibly superior performance capabilities to others.

AIFF
This acronym stands for 'Audio Interchange File Format', which is a digital audio file format developed by Apple. AIFF stores audio data in uncompressed pulse-code modulation (PCM) format and is therefore lossless. Because they are both uncompressed and lossless, AIFF files require more data storage space than compressed audio files would do, but the trade off—one that many audiophiles happily embrace—is that AIFF introduces no sonically deleterious 'compression artefacts' of any kind.

ALAC (and ALE)
The acronym ALAC stands for 'Apple Lossless Audio Codec', which is sometimes alternatively called ALE (for 'Apple Lossless Encoding'). In short, ALAC is a method for compressing digital audio data in a completely lossless manner (meaning all of the original audio data is preserved).

ALAC was initially a proprietary Apple standard, but as of 2011 Apple made the codec available as open source and royalty-free software. Both iTunes and iOS devices support ALAC (whereas Apple systems and devices typically do not support other lossless standards), so that ALAC has become the de facto lossless compression standard for audiophiles who use Apple computers and/or iOS devices.

Note that AIFF and ALAC are not the same things. AIFF digital audio data is not compressed at all and therefore is inherently lossless; ALAC digital audio data is compressed, but can be decoded for playback in a lossless manner. ALAC digital audio files are roughly one half the size of equivalent uncompressed files.

Bit
One unit of digital data, typically represented by voltages either above or below a clear-cut threshold and by convention held to represent a '1' or a '0' as used in binary numbers. Typically abbreviated as a lower-case 'b' – as in, "My DAC can handle PCM digital audio files at resolutions up to 32-bit/384kHz."

Bit-rate
The speed, expressed in number of bits per second, at which digital audio data is processed or transferred from one device to another or playback. For example, one of the better sounding and more popular forms of MP3 transfers data at 320kbps (kilobits per second).

Byte
An 8-bit 'word' of digital data, abbreviated with a capital 'B' – as in, "I store my digital music library on a 2TB drive" (where 2TB means '2 Terabyte'). The digital word lengths used in digital audio are typically multiples of 8-bits: hence, 16-bit, 24-bit, or 32-bit words are frequently discussed.

CD
The acronym stands for 'Compact Disc', a physical storage format for digital audio commercially launched in the early 1980s by Philips and Sony. CDs are polycarbonate discs that incorporate a highly reflective metallic layer upon which 'pits' can be etched along with shiny spaces in between the pits, known as 'lands'. The pits and lands effectively represent the '1s' and '0s' inherent in digital audio data.

By convention, CD standards are set forth in the so-called Red Book, which calls for

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the digital audio data to be stored in 16-bit words of data sampled at a rate of 44.1 kHz. When writers talk about 'CD resolution' digital audio files, they will often refer to them as '16/44.1' files. While CDs are arguably the most popular digital audio format on the planet, other storage formats are now on the rise, many of them offering resolutions (and, in principle, sound quality) much higher than that of CDs.

Clock

Digital clocks are extremely important in digital audio, both when encoding and decoding or playing back digital audio files. Since clocks govern the precise time intervals at which digital audio files are captured, and then later played back, it is critically important for clocks to be stable and accurate so that the intervals between clock beats are maintained with extreme precision.

The human ear is remarkably sensitive to clock timing errors, so that errors occurring down at the picosecond lever are thought to be audible. The more accurate, stable, and precise a clock is, the better the sound of the component will be (all other things being equal). Some very high-end components use extremely exotic Rubidium (or 'atomic') clocks to achieve the 'nth' degree of sound quality.

Codec

A codec is a software or firmware program that can encode or decode a digital audio stream. The term 'codec' represents a condensation of the more cumbersome phrase 'encoder-decoder'. Some popular codecs you may have heard of include MP3, MP4, ALAC, FLAC, Ogg Vorbis, and many more.

Compression

Compression is a data manipulation process where digital audio files are condensed in order to conserve data storage space. It is useful to think of compression, as it applies to digital audio, as a two-part process. First, digital audio files are compressed to reduce them to a more compact and manageable size for storage; then, later on, the compressed files are decoded or de-compressed for playback. There are many types of audio compression algorithms, but they generally fall into two categories: lossy compression and lossless compression.

Lossy compression algorithms do the most efficient job of compressing data, but with the trade off that—when it comes time to decode the lossy files—only part of the original digital audio data is restored, while some is irretrievably lost (hence the name 'lossy'). Two of the more popular lossy compression codecs are AAC and MP3.

Lossless compression algorithms are less efficient than lossy algorithms in terms of conserving storage space, but they have the benefit that—when it comes time to decode the files—fully 100% of the original digital audio data is restored. Most audiophiles perceive lossless compression to offer audible performance benefits vs. lossy compression (although there is some debate on this topic).

As broadband internet speeds continue to increase and very high capacity storage devices have become less expensive and more commonly available (even in small, portable, handheld devices) there is less pressure on audiophiles to conserve storage space, so that over time lossless compression algorithms have become increasingly popular. Two of the more popular lossless compression codecs are ALAC and FLAC.

DAC

This acronym stands for 'Digital-to-Analogue-Converter', with the DAC serving as an essential ingredient in any digital audio playback device. In simple terms, the job of the DAC is to receive digital audio data at extremely precisely clocked intervals and to convert that data into an analogue output that mirrors (or is proportionate to) the numerical values of the digital audio data received.

DACs can be, and often are, condensed to fit on single integrated circuit chips, with popular DAC makers including firms such as Burr-Brown, ESS, Texas Instruments, Wolfson, and many more. However, it is possible to create DACs from individual, discrete parts—an approach some audio component manufacturers have pursued pursue in the interest of superior sound quality.

Either way, it is important to understand that the DAC devices used in a given component do not necessarily define or determine the component's characteristic sound (other circuit elements also play a major role in determining sound quality).

DSD

The acronym stands for 'Direct Stream Digital', which is a digital audio encoding and decoding system developed by Philips and Sony as the format of choice for use in their higher-than-CD-resolution Super Audio CD discs (commonly called SACDs).

Unlike, PCM (pulse code modulation) formats, which store digital audio data in the form

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of 16, 24, or even 32-bit words sampled or clocked at rates ranging from 44.1 to 384 kHz, DSD is a single-bit, delta-sigma modulated encoding process, but with extremely high sampling rates of 2.8224 MHz (known as DSD64) or 5.6448 MHz (known as DSD128). In principle, DSD files are extremely easy to decode for analogue playback, requiring only a basic low-pass filter. Some critics argue that DSD files have high frequency noise issues to contend with and that the delta-sigma process has some inherent errors that are difficult to overcome. Proponents of DSD, however, argue the DSD achieves a smooth, free-flowing, analogue-like sound that is often difficult for PCM to achieve.

While SACD discs have never achieved the popularity of conventional Red Book CDs, their underlying DSD file format has won widespread popularity in recent years, since many music lovers now prefer listening to files downloaded or streamed from the Internet (or a local network). DSD files can be streamed or downloaded via a transfer process called 'DoP', which stands for 'DSD over PCM'. This process does not convert DSD files to PCM format, but rather temporarily stores DSD data in PCM 'data containers' in order to simplify file transfers.

DSP

The acronym stands for 'Digital Signal Processing', a topic that comes up often in discussion of digital audio. One of the beauties of digital audio is the fact that, once analogue signals are converted into digital formats, they can be processed in ways that would be difficult if not impossible to achieve solely through analogue means. For example, DSP can be used to implement complex digital filtering systems that can shape the sonic character of the ultimate playback presentation in extremely subtle and potentially desirable ways. Likewise, DSP makes possible certain elaborate equalisation (EQ) systems that would be very difficult to execute with a purely analogue EQ system. Finally, DSP allows designers greater control over various sonic variables including noise, transient response, resolution, etc. as well as greater control over various processing/playback artefacts.

Dynamic Range

In audio, dynamic range is the difference between the smallest and the largest usable signal that can be passed through a transmission or playback system; this difference is expressed as a ratio and typically is quoted in dB (decibels). The human ear is said to have about 140dB of dynamic range (which is also, in rough terms, about the same dynamic range as some of today's best microphones).

Since digital audio inherently involves creating digital representations of analogue sound waves, one question that arises is this: "Does the digital system have more or less dynamic range than the analogue signals it is attempting to represent?" All other things being equal, digital components with greater dynamic range often offer superior sound, in part because they do not lose low-level signals in noise, nor do they overload on very high-level signals.

Part of today's emphasis on higher-than-CD-resolution digital audio files involves the fact that 24-bit files offer dramatically higher dynamic range than do the 16-bit files found in CDs.

FLAC

The acronym stands for 'Free Lossless Audio Codec'. FLAC is one of the most popular and widely supported lossless audio codecs in use today, in part because it is an open-source, royalty-free software package, but also because FLAC readily supports metadata tagging, complete with storage of album cover art and the like.

Jitter

As mentioned under 'Clocks', above, timing is absolutely crucial in digital audio with particular emphasis on maintaining absolutely identical time intervals between clock pulses. Unfortunately, nothing is perfect so that small variations or errors between intervals can and do occur—errors called 'jitter', which will usually be quoted as worst case timing variations (for example: 'Jitter: </= 9 picoseconds').

As mentioned elsewhere in this glossary, the ear is extraordinarily sensitive to timing errors and thus can readily differentiate between clocks with errors measured in the parts per million vs. clocks with errors measure in the parts per billion. The point is that, all other things being equal, the digital playback system with the lowest jitter almost invariably sounds best.

kbps and Mbps

The former acronym stands for 'kilobits per second' and the latter for 'megabits per second'; both terms are used to express data transfer speeds. 'kbps' figures often come up in discussion of lossy compression codecs as a means of comparing the net amount of audio data one codec can supply vs. another codec (typically, the higher the data rate, the better the lossy codec's sonic performance will be).

You might, for example, see digital downloads offered in two types of lossy formats: 'MP3 (CBR at 128 kbps) or MP3 (VBR at 320kbps)'—

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where CBR stands for 'constant bit rate' and VBR is short for 'variable bit rate'. In this case, the MP3 128kbps digital audio file would take up less storage space, but the MP3 320kbps digital audio file would offer markedly superior sound quality.

One small tip: In talking or reading about acronyms like these bear in mind that a lower case 'b' denotes 'bits', while a capital 'B' denotes 'Bytes'.

Metadata

Literally 'beyond data', metadata is information about the data itself. For example, in an audio file, this might mean the title track, the artist, the composer, the genre, date of recording, date of composition, the album cover, band members, and more. This information about the music is generally 'embedded' within the file itself, to be read and displayed by media players and music servers alike. Metadata is enormously useful for listeners, simply because 'Good Vibrations' is a more memorable file name than 'a156e03c' to humans. Older file formats (such as WAV) are less robust in preserving metadata than their more modern counterparts.

MP3

MP3 is one of the oldest and most widely supported lossy digital audio compression codecs in the world. Over time MP3, which was created by the Fraunhofer Institute in the early 1990s, has emerged as a free ISO (International Organisation for Standardisation) standard that has also been incorporated by the MPEG (Motion Picture Experts Group) as part of both the MPEG-1 and MPEG-2 Audio Layer III standard.

MP3 was instrumental in the explosive growth that personal digital audio device have enjoyed over the last 15 years or so, because it offered a means of substantially compressing large digital audio files so that even fairly large music libraries could be condensed to fit in devices with limited storage capacity (for example, early generation iPods).

MP3 also served, for many listeners, as an introduction to 'perceptual coding', where the general idea is to reduce the amount of data used to represent aspects of sound thought to beyond the perceptual resolution of most listeners, while devoting data to the aspects of sound most readily heard and perceived. The concept was to reduce dramatically the amount of data that needed to be stored while still appearing to deliver full fidelity sound for most listeners, most of the time. Naturally, the idea of throwing out potentially useful sonic data did not sit well with most audiophiles and has been a topic of controversy and heated debate ever since.

Networked Audio/Network Streaming

Music stored on a computer can be removed to devices distributed across a home network (more accurately, a LAN or Local Area Network). This typically involves storing music on a computer or network attached storage device, which also runs some form of music server program to store and order these music files. The music itself is played through a 'media renderer' in your audio system that is also attached to the same computer network.

Functionally similar to internet streaming, networked audio distributes your own music library within the local network, instead of relying on online providers to stream their own music. While the popularity of personal libraries stored locally looks set to wane as online services proliferate, the networked audio system is a great way to store all your existing music collection in one easily accessible place.

PCM (and LPCM)

The former acronym stands for 'Pulse-code modulation', while the latter stands for 'Linear pulse-code modulation'; both are means of representing analogue audio signals in a digital format. Many audiophiles use the terms PCM and LPCM interchangeably, though in fact the terms do not mean the same thing. PCM/LPCM is by far the most popular digital audio encoding format in use today.

Both PCM and LPCM sample the amplitude of analogue signals at precise and identical timing intervals. When each sample is taken, the amplitude of the signal is quantized and recorded as a multi-bit digital word. The difference between PCM and LPCM involves the manner in which signal amplitude is quantized; in PCM, samples are quantized to the nearest value within a range of possible digital steps, whereas in LPCM, samples are quantized to steps that are uniform in level.

The quality of PCM and LPCM encoding is largely controlled by two factors: the sampling rate (that is, the rate at which samples are taken) and the bit-depth of the samples taken (that is, the length in bits of the digital words used to represent each sample). As a general rule, all other things being equal, higher sampling rates and greater bit depths equate to better sound quality. Thus, a 24-bit/384kHz file of a song would likely sound superior to a 16-bit/44.1kHz file of the same song, assuming the master recording captured high levels of sonic detail and nuance in the first place.

Resolution

In simple terms, 'Resolution' is the catchall phrase most audiophiles use to describe the amount of digital audio data used to represent analogue audio signals. As a

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general rule, the less data used the lower the resolution (and sound quality) will be, while the greater the amount of data used the greater the resolution (and sound quality) will be—up to a level where a perceived 'point of diminishing returns' is reached.

Generally speaking, lossy compression codecs yield what are considered low-resolution digital audio files. CD files, captured at 16-bits/44.1kHz are considered the standard, and files with higher-than-CD bit-depths and/or sampling rates are considered to be high-resolution files.

Can listeners hear the difference? In a word, yes. The only area where there is room for discussion involves the question, 'When is high resolution high enough?'

Servers

This term is the shortened form of the term 'music server'. Typically, music servers provide a means of storing large quantities of digital audio files along with user interfaces that facilitate loading, organising, and playing digital audio files. As a general rule, servers are typically thought to be self-contained units that not only store digital audio files, but also can deliver them for playback on demand.

Streamers

By definition, streamers are network-attached devices that may offer Ethernet, Internet, Wi-Fi, and/or Bluetooth connectivity, or any combination of the above. As a rule, streamers do not have storage of their own (apart from perhaps a relatively small amount of on-board buffer memory), but rather are capable of detecting, accessing, and playing (or 'streaming') digital audio content from other network-attached resources, such as PCs or Macs, smartphones, tablets, or the Internet. Like servers, streamers have user interfaces to allow their owners to view, choose, and play audio content from the available network resources at hand.

UPnP/DLNA

UPnP (Universal Plug and Play) and DLNA (Digital Living Network Alliance) are similar sets of interoperability guidelines, allowing digital media devices to work together with little or no need for complex 'handshaking' protocols. Devices that fall under one (or more usually, both) standards are designed to be compatible with one another as standard, and fall into three broad categories for audio systems: control point (which might be an app on a tablet), media renderer (the network-attached DAC or streamer), and media server (that might be a computer or NAS drive).

WMA

This acronym stands for 'Windows Media Audio' a family of audio data compression codecs developed by Microsoft that together are part of the Windows Media framework or 'ecosystem'.

The are four WMA codecs:

- The original WMA codec is a lossy compression algorithm comparable to MP3.
- The WMA PRO codec supports multi-channel or surround sound files (with up to eight discrete channels) and supports 'high resolution audio' (at up to 24-bit/96kHz levels).
- The WMA Lossless codec is a lossless compression algorithm.
- The WMA Voice codec is a low bit-rate, lossy compression algorithm focussed specifically on conversational voice content.

WAV (or WAVE)

This acronym stands for 'Waveform Audio File Format', which was developed by Microsoft and IBM and which is an uncompressed and therefore lossless file format that typically uses LPCM encoding. In theory, WAV supports compressed audio as well, though this is rarely seen in actual practice.

WAV and AIFF files are compatible with Windows, Macintosh, and Linux operating systems.

In simple terms, WAV—much like AIFF—is all about preserving maximum sound quality while eliminating compression artefacts of any kind. Two drawbacks are that WAV files take up considerably more storage space than files encoded by lossless compression codecs and that WAV files do not lend themselves to storage of album/song-related metadata. Recognising the sonic potential of WAV, many manufacturers of ripping and/or music server software have come up with workarounds to allow WAV files to be stored with associated metadata. +

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