HI-FI+ GUIDE TO CABLES

Sponsored by CRYSTAL CABLE and SILTECH

Crystal Cable®

SILTECH

Absolute Dream

by

Crystal Cable®

Crystal Cable's Monocrystal Silver Conductor - the Gold Star for signal transmission.

"an abundance of detail..."

"[the Absolute Dream] can fill the space of your room, from wall to wall to wall, with the sound of the studio or hall in which the recording was made,"
Jonathan Valin, The Absolute Sound, January 2013

"Rewiring your whole system with Absolute Dream is so far ahead of the pack, I'm not sure you can find a way back to the 'ordinary' world."
Alan Sircom, Hifi+, Issue 96

"..this cable offers the smooth, creamy lushness of the warmer-sounding cables and yet combines this with a spaciousness and the sparkle of the livelier sounding cables. Absolute Dream USB is well-named."
Paul,Miller, Hifi News, June 2013

2012 the absolute sound PRODUCT OF THE YEAR AWARDS

hi-finews OUTSTANDING PRODUCT

2014 the absolute sound Editors' Choice Awards

GOLDEN EAR the absolute sound 2013 AWARDS

hi-finews EDITOR'S CHOICE

Absolute Dream – Because Music Matters

Each Absolute Dream interconnect or speaker cable employs four of our unique mono-crystal silver conductors (with dedicated designs for digital and power applications) for the best possible signal transmission and lowest possible resistance.
This ground-breaking construction has resulted in a totally new level of audio cable and audio system performance.
For more information about Crystal Cable's Absolute Dream and all other products visit **www.crystalcable.com** or follow us on **www.facebook.com/CrystalCable.IAH.**

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Energy transforming equipment

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Audio Destination ... (Devon) ... www.audiodestination.co.uk ... 01884 243584

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Lotus HiFi ... (London) ... www.lotus340r.net ... 07887 852513

Martins HiFi ... (Norfolk) ... www.martinshifi.co.uk ... 01603 627010

Rayleigh Hifi ... (Essex) ... www.rayleighhifi.com ... 01268 779762

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Sonic Synergy ... (Swansea) ... www.sonicsynergy.co.uk ... 07971 849474

Studio AV ... (Berkshire) ... www.studioav.co.uk ... 01753 863300

OptimUs

Nature is the best constructor ! That's why at Entreq we try to build in the same way . The result is a natural sound and a flow in the music that is seldom heard . With this ethos in mind Entreq set out to develop a unique cable optimizer, OptimUs , which would burn in and optimise all of Entreq's signal cables (with the exception of the mains cables) . You can also apply this unique process to any brand of cable. For more information on optimising your cables performance please contact Entreq UK or one of our Stockists .

www.entreq.co.uk info@entreq.co.uk 01234 924242 07545 681680

Entreq

Energy transforming equipment

www.entreq.co.uk info@entreq.co.uk 01234 924242 07545 681680

Entreq Grounding

Innovation

Entreq have been pioneering signal grounding since 1999 . Over the past 16 years they have established an understanding and a level of knowledge in this unique field that up until recently no other audio or electronics manufacturer had either taken time to explore , understand or even deem worthy of research . This puts Entreq in the enviable position , certainly in the audio industry , of being the leader rather than the follower in this arena .

Ground Box

Something to establish is that Entreq's use of the term Ground does not directly relate to or mean 'Primary Earth' i.e. what you would understand as your 'Protective Earth' for your mains electricity . Entreq Ground Boxes are not designed to substitute or replace the protective ground found in your home . The function of the Entreq Ground Box is to present itself as an attractive destination for high frequency noise , stray voltages and the various issues induced by magnetic field effects . This pollution is littered across the system and is always present . Different systems attract , generate and produce different levels and types of noise ! **This is why Entreq offer a selection of Ground Boxes to suit every system and budget .**

Get Connected

You now need to connect your Ground Box to your equipment !

Establishing a connection to your hifi system with an Entreq Grounding Box couldn't be simpler . Entreq make a range of Ground Cables called Ertha Cables that attach to any free and available connection on any product connected to your system . Connections currently catered for include : RCA , XLR , USB , BNC and RJ45 . On the other end of the Ertha Cable is a spade termination that attaches to the Ground Box itself . As per the Ground Boxes these Ertha cables come in a range of levels ; offering the end user the ability to closely match the right combination of both Ground Box and Ertha Cable to obtain optimal performance .

Generally the key component to Ground first is often the product at the centre or hub of your system , whether that is your Pre-amplifier, Integrated amplifier or Dac/pre . Next you should consider a source component ; either your CD player / DAC , Streamer , Phono stage etc .

Once connected to your system the improvements are usually noticeable within minutes however the grounding process will continue to evolve . After approximately 24 hours you will in most cases have obtained the optimal result . It is not uncommon to hear continual Improvements up to and beyond 72 hours !

Please feel free to visit : www.entreq.com for further information on Entreq .

Please find a list of experienced UK Dealers : http://www.entreq.co.uk/dealers.html

This is not Voodoo or Black Magic it is primarily an in depth understanding of Physics , magnetic field technology and the experience of combining these disciplines .

In service to the music - Entreq

hi-fi+

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WELCOME to the ***Hi-Fi+ Guide to High-End Audio Cables***. Many consumers believe that 'wire is just wire' when it comes to connecting audio component in hi-fi systems, but hundreds of thousands of audiophiles worldwide have learned through firsthand experience that the design and construction of audio cables can and does have significant real-world impact on sound quality. We at *Hi-Fi+* are firmly in the camp that holds that cables do make a difference—sometimes a very big difference—in terms of enhancing our enjoyment of the music we love.

In this Guide we attempt to do several things. First, we provide two sections designed to address the question: **What's Next in High-End Audio Cables?** (One section focuses on cables for traditional loudspeaker-based audio systems while the other addresses cables for personal audio applications.)

Next, ***Hi-Fi+* interviews fourteen of the best and brightest leading-edge designers in the cable industry** to gather their thoughts on a variety of cable-related questions and to learn more about their respective design philosophies.

Then we offer a pair of cable-specific **feature articles** to stimulate your thinking on how best to plan your own cable upgrades. The first article asks, **'Do Single-Brand Cable Looms Make Sense?'** The second article talks about Using the **Right Cables in the Right Ways.**

To help cable shoppers derive maximum benefit from our print magazine, we provide an extensive ***Hi-Fi+* Cable Review Index** (ranging from 2012 to the present time). Going even further we offer ***Hi-Fi+* Editors' Choice Recommendations** for speaker cables, interconnects, digital cables, and mains cables.

Last but certainly not least, we include our **Encyclopaedia Cablexicon**, which is a glossary of commonly used cable lingo and terminology explained in layman's terms. Ultimately, our hope is that this Guide will provide food for thought, stimulating discussions, and useful input for music lovers looking to improve their audio systems through cable upgrade. As we suggested above, finding the right cables for your system can really help set your favourite music free.

We wish you happy listening.

Chris Martens
Publisher, *Hi-Fi+*

The hard reality is that audio cables can only do damage: they can blur or smear information, distort phase relationships, destroy detail and add colouration.
Bad cables can – and all too often do – ruin the best of systems.

To make the best cables, the ones that do the least damage, takes years of experience and accumulated knowledge, the development of new techniques and proprietary technology – and a willingness still to learn…

In performance terms, that's when evolution sparks revolution.

Siltech - years of excellence are no accident.

SILTECH

Explorer Series

Classic Anniversary Series

Royal Signature Series

Triple Crown Series

"Never think you're finished. Keep comparing. Keep innovating. In high-end audio, there is no limit to quality." Edwin Rijnveld

www.siltechcables.com

WHAT'S NEXT?

HIGH-END AUDIO CABLES

PERSONAL AUDIO CABLES

SEE WHAT'S NEW FROM TODAY'S MOST TALENTED CABLE MAKERS

Ansuz X-series from Ansuz Acoustics

The new Ansuz X-series includes high-end power cables, speaker cables, USB digital cables, and balanced and single-ended interconnects – all designed only with materials of high quality. The main focus is on capacitance, inductance, resonance, and grounding.

The X-series is designed to perform at a high level, in terms of sonic performance and aesthetics. The 'full-bodied' experience you get from listening to the X-series is distinct from other cables and very clearly a part of the Ansuz family. Despite the modest price of the new X-series, the highest musical experience can be expected. Skilled professionals in Denmark assemble all Ansuz Acoustics' cables, including the X-series.

The Ansuz X-series is available worldwide: e.g., X-series 1 meter power cable at £420

www.ansuz-acoustics.com

Atlas Cables Asimi Ultra stereo interconnects

The range-topping Atlas Asimi Ultra analogue interconnect uses the very latest cable manufacturing technology combined with hand crafted workmanship. Manufactured in Scotland, each Asimi Ultra consists of OCC (Ohno Continuous Cast) solid silver conductors covered with microporous PTFE (Teflon), then covered again and stabilised using a protective FPE (Flexible PolyEthylene) dielectric, maintaining the required geometry of the conductor, Atlas has developed a new system using two internal symmetrical drain wires that connects the screen effectively and provides 360° screening from harmful external RF interference. Asimi Ultra also employs newly developed Atlas solder-free, self-cleaning RCA connectors, which consist of an internal non-conductive sleeve matched to the dielectric properties delivering total consistency from socket to socket. Available now, priced from £2,750.00/1m.

www.atlascables.com

Audience OHNO-series cables

Audience has broken through all existing barriers to entry-level high-end audio cables with its new line of OHNO cables. The name is after Dr. Atsumi Ohno who invented the process of making "OHNO" continuous cast wire, also known as mono crystal wire. The new Audience OHNO cables are made with 6Ns mono crystal copper and insulated with the highest achievable quality of XLPE (cross linked polypropylene). At US$199 for a pair of 1m RCA interconnects and US$229 for a 2m pair of speaker cables, no other cable comes close to this value let alone being a true high performance cable. OHNO is also offered in XLR and S/PDIF.

www.audience-av.com/cables/

AudioQuest Bridges & Falls, Rivers, and Elements-series interconnects

AudioQuest's Bridges & Falls-series analogue interconnects targeted primarily for personal audio applications requiring shorter cable runs and 3.5mm plugs typically are required (although RCA terminations are optional).

AQ's mid-level Rivers and top-tier Elements-series interconnects are geared for use in high-performance audio systems, where longer cables runs or balanced (XLR) connections may be required.

Elements-series cables use triple solid PSC+ copper or PSS silver conductors, each in Air-Tubes. Elements models use AQ's carbon-based Noise-Dissipation System (NDS) and control the direction of conductive elements (signal, shield, DBS) for optimised noise filtering. The 72V Dielectric-Bias System (DBS) helps minimize insulation-induced phase smearing. RCA and XLR plugs are made of extreme-purity red copper with thick silver plating. Available now. Elements prices start at US$450/pair.

www.audioquest.com

Black Rhodium Thunder loudspeaker cables

Black Rhodium cables are all about music, about conveying the magic of the musicians' art from the recording to the listener. We have researched the laws of physics to identify how the cable can change the sound of music, and then applied carefully designed engineering solutions to cut audible distortion to the music to an absolute minimum. Every time we apply our engineering solutions we remove a layer of audible distortion and bring ourselves closer to the musicians. Black Rhodium Thunder loudspeaker cable has just been launched with the special feature of eight Vibration Stabilisers designed by Graham Nalty specifically to reduce the distortion due to mechanical vibrations. We are extremely pleased by the sound of Thunder.

www.blackrhodium.co.uk

Bocchino Audio Mayflower interconnect cables

The Mayflower™ interconnect cable design derives from the hand made cables, which have been the mainstay of the Bocchino Audio portfolio for over 10 years. Porting the hand made design into the Mayflower structure has resulted in many new advantages. The ultra pure copper wire strands are >99.99%+ pure copper and drawn through diamond dies in a vacuum to deliver a flawless circular profile. All Mayflower cables are terminated with Bocchino Audio-Designed pure copper connectors. These have identical metallurgy and purity as the copper wires of the Mayflower. The Mayflower is the music lovers' cable!

www.bocchtech.com/bocchinoaudio/mayflower.html

Bybee Technologies Quantum Signal Enhancer

Bybee Technologies offers its new Quantum Signal Enhancer (QSE) with propietary Chrystal Technology. The QSE is small and passive. It is designed to be placed under/over components, speaker wire, cables, interconnects and power cords. The QSE aligns the electrons to enhance the flow and purity of the signal. It can be used even on the best audio systems regardless of shielding. Improvements include bass frequencies that are faster and more impactful, and high frequencies that are more extended, open and natural, and without edginess. The critical midrange sounds become more musical, more liquid, and less "electronic." The overall presentation of imaging and soundstaging becomes both more precise and more enveloping. They are available now at US$119 each.

www.bybeetech.com

Cardas Clear Reflection-series cables

Cardas Clear Reflection cables combine the technology found in all Clear-series cables, with the warmth and musicality for which Cardas is known. Clear Reflection Speaker uses the geometry of our legendary Golden Reference cables, adding Matched Propagation conductors and forged billet connectors. Clear Reflection Interconnect uses Matched Propagation conductors similar to those found in our flagship Clear Interconnect, surrounded by air-tube suspension and carbon-impregnated PTFE dielectric. Both cables convey the extended detail and imaging characteristic of the Clear range, along with the traditional Cardas sound.

Clear cables are jacket in black and use copper-trimmed connectors for a look as stunning as their performance. Available now: Interconnect starts at US$1,450/1.5m pair; Speaker starts at US$2,100/1.5m pair.

www.cardas.com/reflection

Clearer Audio

Clearer Audio are delighted to announce the launch of the Silver-line Power Cable M1 designed specifically for use with the Naim NAP 500 Power Amplifier. The cable features 7 × 4mm² Silver-plated Ohno Continuous Cast (OCC) conductors insulated in polyethylene dielectric for optimal power transfer. To further maximise performance, the conductors are cold-welded to the silver-plated machined copper pins under high pressure without the use of solder. Customers can audition the product without risk with our 60-Day Money Back Guarantee. Available now the product ships worldwide direct from our workshop, with prices starting from £1,250 (inc. UK VAT) for a 1.25m length.

http://www.cleareraudio.com/collections/power-cables

Crystal Cable Absolute Dream-series cables

Absolute Dream-series cables are Crystal Cable's top products. Their first-in-the-world, unique, 100% mono-crystal metallurgy allows the cables to reduce further the already very low micro distortion achieved by Crystal Cable's silver-gold metallurgy.

The pure mono-crystal silver core conductors are covered with Dupont's Kapton and PEEK as dielectric materials, plus two shielding layers, one of silver-plated mono-crystal copper and one of gold-plated mono-crystal silver. The braid is covered by a transparent sleeve giving the cable a distinctive appearance. Each interconnect or speaker cable employs four of our unique mono-crystal silver conductors for the best possible signal transmission and lowest possible resistance.

With Absolute Dream, Crystal Cable has created the perfect synergy between High Tech, design and music.

www.crystalcable.com

GUIDE TO CABLES: WHAT'S NEXT IN HIGH-END AUDIO CABLES? HI-FI+

DNM Stereo Interconnect 3 cables

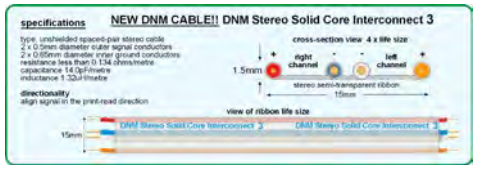
In 1984, DNM Design made an audio cable to optimise the interface for amplifiers using negative feedback. Key characteristics like distributed inductance, low capacitance, resistance were defined using round conductors spaced in a precision-made ribbon, offering a designed magnetic performance.

In 2007, DNM developed a stereo ribbon cable with 4 conductors, designed to be easily divided into two 2-conductor ribbons. The unique DNM stereo ribbon halves the number of separate cables needed for stereo, improving magnetic performance and clarity where the channels need to run side-by-side.

In 2015, DNM introduced three Stereo Solid-Core cable models: one interconnect (called Interconnect 3) and two speaker cables, priced £24.00-£33.00/stereo metre, covering most audio applications.

For specifications and further details, see the link below.

www.dnm.co.uk/links/



Dynamique Audio Zenith 2, Celestial 2, Infinite 2, and Magellan 2 cables

Dynamique Audio Ltd. proudly announces its updated V2 reference cable range. Zenith 2, Celestial 2, Infinite 2 & Magellen 2 respectively comprise Dynamique's flagship interconnect, loudspeaker, power, and digital cable ranges. We introduce exciting new innovations such as our 'multicore' technology, which combines the best of solid-core and multistrand for the most neutral tonal balance, and our MK2 Resonance filters, which dramatically reduce electrical and mechanical noise. All designs utilise super-pure 5N solid silver wire suspended in a PTFE Teflon air-dielectric, and complex noise-cancelling geometries.

Available widely from Q1, 2016, prices are as follows: Zenith 2 interconnect: £1,775, Celestial 2 loudspeaker: £5,150, Infinite 2 power: £1,795, Magellen 2 digital: £610.

www.dynamiqueaudio.com

Ensemble INCANTO, DALVIVO, and SUPREMO cables

The pictured INCANTO™ interconnect with ALLINO™ RCAs (high conductivity copper contacts) is part of Ensemble's latest cable creations, along with the DALVIVO™ power and speaker cables, and the SUPREMO 75™ digital transmission cable. They rest on a 30-year design experience.

The design fundamentals:

- Optimal electrical values, thereby providing the widest positive compatibility – and implicitly a very balanced, artefact-free, uncolored sound.
- Total immunity from omnipresent interference, thereby providing the lowest possible noise floor – and consequently extended dynamics as well as tangible details otherwise lost.
- An extremely careful choice of materials (e.g., for the lowest possible dissipation factor).
- Multi-conductor and -shielding topology that allows application-adapted, optimized configuration and routing.

Pricing: 1m pair, £ 690 (€970, US$1,050).

www.ensembleaudio.com

Fono Acustica Virtuoso Cables

Fono Acustica's flagship Virtuoso cables combine proven materials with a hands-on, empirical approach to cable design that is refreshingly free of techno-babble. As with all Fono Acustica products, the Virtuoso is based on an essentially simple premise: if it sounds better, it IS better. Employing proprietary silver-gold, solid-core conductors, loosely housed in over-sized Teflon tubes, the Virtuoso cables pay special attention to both electrical and mechanical considerations, with hand-wrapped carbon filaments employed to dissipate energy in high-microphony applications. Extensive use of natural materials compliment the beautiful cast copper housings of the plug bodies, creating a complete range of digital, analogue and power cables that offer a remarkable sense of natural warmth, weight and musical power. Prices start at €12,000.

www.fono-acustica.com

Furutech Nanoflux power cable

The Nanoflux is Furutech's top-of-range power cable. It features an ultra-high performance conductor, the Alpha Nano-OCC that, after undergoing a patented two-step cryogenic freeze and demagnetization process for superior signal transfer, is treated with Furutech's new finely tuned transmission enhancer, Nano Liquid. Nano Liquid features a precise ratio of tiny gold and silver particles (approximately 8/1,000,000th of a millimeter in diameter), which finely coat the conductor and smooth out any microscopic concave-convex areas, providing a greater contact surface.

Advanced double-layer insulation, combined with a complex outer shield, damping layer and EMI-absorbing modules, rejects external vibration and electromagnetic radiation to ensure clean power flow. Furutech's top-of-range FI-50 connectors provide finishing touches.

Available now, priced at £2,750.

www.furutech.com/2015/04/17/10766

GamuT Audio New 'Reference'-series cables

The Danish audio brand GamuT is pleased to announce its new 'Reference' line of high-performance hi-fi cables. Each of the conductors' 38 strands is constructed from extremely high grade Matched Crystal OFC with a dense and very pure silver coating of varying thicknesses. Insulation between core and shielding is PTFE (Teflon), an excellent insulator – but with one drawback: it can build up static charge, resulting in noise and smearing of fine detail. GamuT therefore sourced a special fabric containing microscopic carbon fibres, which is tightly sewn around the conductor to effectively remove static and dampen micro resonances. The GamuT Reference line is available as single and bi-wire speaker cables (from £2,590), interconnect cables and power cables (both from £1,990).

http://www.gamutaudio.com/en-GB/Products/Cables-and-Interconnects/Speaker-cables/The-Wormhole-Signature-Speaker-cables.aspx

GutWire Uno-S interconnects

GutWire Uno-S interconnects feature high-grade copper conductors with state-of-the-art multi-layer shielding (via use of propriety protocols and natural minerals) to provide isolation from all forms of electro-magnetic radiation. Even further isolation is achieved through use of separate sheathes for positive, negative, and ground conductors. Cold soldering used in the cable terminations does not detract from the purity of the cables and results in a grain-free presentation without brightness. The GutWire Uno-S features low distortion and background noise with accurate soundstaging to give a realistic, faithful and natural presentation. Our flagship Balanced Uno-S interconnects are priced at £3,350/pair.

www.gutwire.com

HighEnd Cables representing Audience OHNO-series cables

Audience OHNO cables achieve the very highest level of performance at an entry level price. OHNO cables are named after Dr. Atsumi Ohno who invented the method of manufacturing mono-crystal wire, which eliminates the crystalline barriers found in all conventional wire. Whereas copper typically exhibits thousands of crystals per meter, as audio signals move through this maze, energy is lost at every crystalline juncture. OHNO copper is a single crystal providing an unobstructed path for transmission of the purest audio signal. OHNO cables are made with XLPE (cross linked polyethylene), one of the very best insulations for high-end audio cables. The price/performance is second to none.

Starting prices: OHNO RCA interconnects, £169.99/1m; speaker cables, £183.99/2m, and digital S/PDIF cables, £99.99.

www.audience-av.com

www.highendcable.co.uk

In-akustik Referenz NF-2404 interconnects

The absolutely unique Air Helix structure requires only air as insulation material (second-best after vacuum), resulting in an incredibly low capacitance of 10pF/m. The specially designed clips hold the conductors floating in the air at a precisely measured distance to the shield. The conductors themselves of course also play a major role. The NF-2404 is made of 32 high-purity copper wires braided on a PE core. This results in an extreme reduction of the skin effect. An exceedingly thin coating layer on the wires prevents eddy currents inside this super high-speed waveguide. The sound is very natural, detailed, precise, and dynamic. This cable is entirely made in Germany and is available now. Price for 1m set with RCA plugs: £1,148.

www.in-akustik.de/en/

IsoTek 'EVO3 Optimum' high-performance power cable

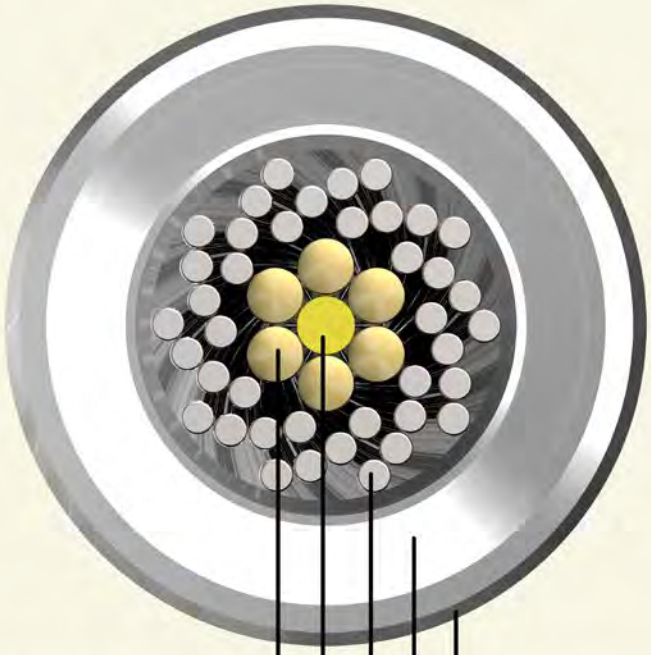
At the Optimum's core are three silver-plated OCC copper conductors, offering significantly higher purity than traditional OFC copper. Each of the three 3.0sqmm conductors features an innovative square-shaped configuration of 40 strands, each strand also being of square cross-section, designed to provide an enlarged contact surface with enhanced electrical conductivity. Superior insulation and maximum rejection of RFI and EMI interference are achieved in several carefully constructed layers: a high quality Teflon FEP dielectric, cotton filler, Mylar wrap, and an active OFC copper shield, all encased in a durable, heat-resistant PVC outer jacket with excellent flexibility and mechanical strength. Finally, the EVO3 Optimum is terminated using IsoTek's bespoke audiophile grade 24-carat gold plated connectors.

Available now, priced at £595.

www.isoteksystems.com/products/get-connected/evo3-optimum/

Crystal Cable®
next »

Taking High-End Sound Along with You



High purity silver-gold conductors

Aramid fiber core for ultimate strength

Silver plated monocrystal copper shield

Anti-allergic, skin friendly, ultra flexible

Biocompatible transparant sleeve

Crystal Cable Next sets new standards for the next generation of headphone and earphone products. The superb conductivity, shielding and high-tech insulation materials used by Crystal Cable are perfect for the low-signal level, low-power applications typical in portable audio systems.
Crystal Cable Next is available exclusively through Astell & Kern: www.astellnkern.com
For all other Crystal Cable products visit **www.crystalcable.com** or follow us on **www.facebook.com/CrystalCable.IAH.**

Jade Audio Reference Gold/ Platinum interconnect

Jade's top-of-the-line Reference Gold/ Platinum interconnects use 100% pure solid gold strands to make up the positive conductor and both 100% pure solid gold and 100% pure solid platinum strands in the return conductor. These strands are sleeved in unbleached cotton to form a nearly perfect dielectric and absorb micro vibration as specified in our patented design.

The midrange of this cable is exceptionally liquid, luscious, and compellingly natural. The highs are shimmering, open and fully extended and the bass is tight, solid, and deep. Tempo and speed is effortlessly quick creating excellent dynamics and subtleties.

The RCA interconnect uses Bocchino B-11 silver plated solid copper connectors and the XLR uses the Furutech premium rhodium connector.

Pricing: US$3,050/pr. RCA, US$4,400/pr. XLR.

www.jadeaudio.com

Jena Labs Aurora interconnects

Jena Labs is proud to announce its new Aurora-series interconnects. For a quarter of a century there has been a large price gap between our more affordable collection and our statement collection; Aurora fills that gap. Like our other interconnects, Aurora is fabricated with our Ultra-Wire, using linear crystal copper of better than 6-nines purity. It is available in rhodium or gold RCA, and silver or gold XLR. Like our entire range of interconnects, speaker cables, AC cords, USB cords, headphone harnesses, AC power conditioners, and upcoming pre-amps and equalizers, all component parts and wire are Immersion Cryo processed in liquid nitrogen in our own Cryo lab.

Available now. Pricing: US$2,000, first 3 feet: US$160, each additional foot.

www.jenalabs.com

JPS Labs Superconductor V Phonograph cables

As the latest addition to JPS Labs' Superconductor V lifestyle series hi-fi cables, including interconnects and loudspeaker cables, this new phonograph cable sports custom rhodium plated RCA and DIN connectors. Very flexible design, dual ground leads on the laser engraved RCA version (pictured) allows fine-tuning to minimize noise. The cable's soft jacket is engineered to absorb vibration, preventing microphonics from interfering with your music. JPS Labs' proprietary Alumiloy wire offers up music quite clearly from the surface of the record with stunning, lifelike musicality and a wide sense of space.

Pricing: £1,150 for a 1.0 meter set, with RCA or XLR balanced connectors to fit your amplifier, and straight or right angle DIN to the turntable. Hand made in USA.

www.jps-labs.com

Kimber Kable NΩHM loudspeaker cables

The Russ Andrews/Kimber Kable co-designed range of NΩHM (pronounced nohm) loudspeaker cables leverage the inherent noise rejection capabilities of Kimber braided designs. The goals of pure, clean, and fast sound, with greatly enhanced noise reduction, are accomplished with both simple and complex designs and manufacture. There is a complex arrangement of non-ferrite and non-inductive passive components housed in wooden pods at either end of the cable. Four-axis machined hardwood-finished pods in hand-rubbed oil are matched to three-axis precision-machined end caps. To manufacture one pair of cables requires at least 30 hours. This is a truly bespoke product, in design, manufacture, and materials!

Typical NΩHM speaker cable prices, per pair, in USD: Nohm LS Cu 2.5m, US$31,602; Nohm LS Ag 2.5m, US$64,848.

www.kimber.com

www.russandrews.com

LessLoss Audio DFPC-Series Skin-filtering power cables

Skin-filtering is our solution to the problem of HF noise. It is a proprietary technology developed by LessLoss, fundamental to the performance of any audio equipment. It makes perfect use of the laws governing the behavior of alternating electrical signals traveling down a wire, joining the principle of attenuation over distance with the high frequency skin effect first described mathematically in 1883. Specifically, by treating the wire surface where noise resides, we render it conductive only to the necessary low frequencies, but not to high ones, thus suppressing these noisy high frequencies to levels so low that they are effectively eliminated as a source of noise pollution. Available factory direct, from US$535 to US$1,824.

www.lessloss.com/dfpc-series-p-213.html

MCRU Pinnacle mains power lead

The MCRU Pinnacle mains power cord benefits from our 30+ years of experience with hi-fi mains connections.

Each component—from the cable, to the filtration, fuse, earthing, mains plug, and IEC connector as well as the termination of internal wires—has been tweaked to be the best they can be.

The Pinnacle can be used to power mains conditioners, balanced mains units, mains blocks, and individual components. The Pinnacle also incorporates mains filtering to further enhance performance. We have specified the very latest triple C copper cable designed for hi-fi use, plus Furutech mains plugs and IEC connectors, meaning the unit functions as a superb mains power lead.

The Pinnacle is launched in December 2015; the retail price is £1,650.

www.mcru.co.uk

MIT Articulation Control Consoles

MIT Articulation Control Consoles: "toward a visceral response" is the new direction MIT is heading with the release of this new line. Priced between US$49,000 and US$80,000 there are three versions in this series, each outfitted with three articulation controls on each channel dashboard, plus a unique "2C3D" switch. Articulation control is now possible over three sections of the bandwidth, which allows the listener to adjust for challenging room conditions, equipment changes, and sometimes software choices. The 2C3D switch engages more circuits to produce or "throw" more energy out into the room, which helps to continue the suspension of disbelief that a live performance is within reach.

Available now. For more information on Multipole Technology and 2C3D, visit our website.

www.mitcables.com

Monster® Silver Advanced Performance Fiber Optic Audio Cable

The Monster Silver Advanced Performance Fiber Optic Audio Cable is designed to deliver the most accurate audio reproduction.

Ordinary fiber optic cable can degrade your sound. Audio systems aren't immune to digital jitter and ordinary fibre optic cables can actually increase jitter. This is because their low-grade fiber limits the amount of signal transferred down the light path. In turn, time domain errors in the digital signal can, during the digital-to-analogue conversion process, produce audible imperfections: phase distortion, higher noise floors, and loss of audio clarity. Monster's InsuLight inner jacket reduces digital jitter and time distortion for more accurate audio as well as heavy-duty strain relief thanks to the cable's duraflex protective jacket.

Currently available, starting at US$39.95 for 4 feet.

www.monsterproducts.com/Cables/Audio_Cables/id-7220/Silver_Advanced_Performance_Fiber_Optic_Audio_Cable

Naim Audio Super Lumina-series cables

Designed in parallel with Naim's Statement amplification components, our Super Lumina range of cables is hand-built with absolute precision at Naim in Salisbury, England from high-calibre materials carefully selected through listening tests.

Consisting of audio interconnects and speaker cables, the Super Lumina range meets the demands of Statement systems, but is equally at home in other Naim 500 and Classic-series systems.

Super Lumina cables are designed to minimise the effect of external and internal interference sources and preserve maximum signal fidelity. The fundamental cable design consists of several individually insulated, multi-strand, silver-plated copper conductors of varying diameters enclosed in a tin-plated copper shield. This is all enclosed in a soft outer jacket, which facilitates easy installation whilst minimising microphonic interference.

www.naimaudio.com/product/range/super-lumina

Nordost Heimdall 2 Ethernet Cable

Nordost's new Heimdall 2 Ethernet Cable is the perfect solution for digitally driven hi-fi enthusiasts, supporting frequencies of 1000 MHz and transmission speeds up to 40Gbits/second.

This groundbreaking cable allows NAS devices and music streamers to be fully integrated into a hi-fi system, while improving its sonic performance! The Heimdall 2 Ethernet Cable consists of eight 23 AWG polymer insulated conductors, arranged in four individually shielded, twisted pairs, which are then wrapped in braided, silver-plated copper shielding, and encased within high-density polymer insulation before being cut to a mechanically tuned length. The cable is terminated with a completely shielded and ruggedized 8P8C/RJ45 connector designed to further resist EMI and Electro Static Discharge.

Available January 2016; MSRP: 1-meter length—US$699.99

www.nordost.com

Purist Audio Design Neptune speaker cable

Released this year, Purist's Neptune speaker cable possesses a romantic sound and 3D sound stage. We crafted the Neptune using ultra high quality SCC (Single Crystal Copper) strands with a P.E. dielectric, and treated the full cable with our proprietary Triple Cryomag© process. The resulting design gives a very low resistance of 0.000999Ω/ft. To further enhance the sound, the cables are designed with an isolated positive and isolated negative per channel. Quality materials and expert construction combined with fluid dampening reduces EMI and mechanical vibrations. Our custom interchangeable connectors improve ease of use. Order yours today, in spade, banana, or most custom connectors.

Available now; MSR: 1.5 m Neptune Speaker, US$2,545, then US$360 for each additional 0.5m.

www.puristaudiodesign.com

Russ Andrews representing Kimber Select USB cables

With the KS-2400 series, Kimber has really broken the mould. To overcome the performance limitations of the mass production techniques commonly used on USB cables, Kimber's expert technicians handcraft each cable. The cables are manufactured from the finest materials and finished with bespoke USB plugs.

Like all Kimber Kable products, Select USB cables utilise Kimber's famous Braided Cable Geometry and VariStrand conductors. Dual layer frequency optimised shielding ensures accurate data transmission.

Available in three variants, the KS-2416 Cu, KS-2426 HB and KS-2436 Ag, which feature copper, copper and silver hybrid, and pure silver conductors respectively, the cables provide the ultimate in performance for serious computer audio systems.

Pricing: KS-2416 Cu, £371, 0.5m; KS-2426 HB, £499, 0.5m; KS-2436 Ag, £1,344, 0.5m.

www.kimber.com

www.russandrews.com

The Perfect Connector

should have…

Complete continuity of conductor material
Consistent geometry irrespective of socket size or tolerance
Massive mechanical stability but low mass
Consistent contact pressure across all connections
Easy insertion but complete security of connection
Enhanced grounding integrity

It should be strong, silent AND good looking!

Meet the Triple Crown Connector family - innovative, self-centering, variable geometry, lockable designs exactingly engineered with mono-crystal silver contacts and precision machined, low-mass bodies, designed to meet the termination demands of our finest ever cables.

Siltech Triple Crown
Creating Cable Royalty

SILTECH

TRIPLE CROWN

www.siltechcables.com

Shunyata Research VENOM-series cables

Shunyata Research's VENOM-series signal cables were designed to signify an obvious counterpoint to the market's trend toward obscenely priced audiophile cables. To make an unequivocal statement of value and performance Shunyata applied its 15-year history of custom parts development to create cables that express the finest in performance without the exorbitant price.

The VENOM speaker cables (US$595)/ interconnects (US$295) feature true technical advantages including: single crystal OHNO conductors and VTX (virtual tube hollow-core) geometries. Completing the package is Shunyata Research's own STIS (interchangeable speaker terminals) and superior copper XLR and RCA connectors.

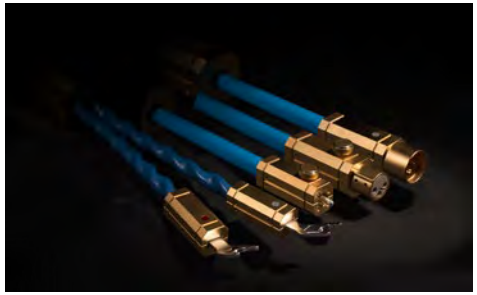
To find this level of material quality and customization in expensive products is no certainty. To find these expensive features in reasonably priced cables is truly unique!

www.shunyata.us

Siltech Triple Crown-series cables

Siltech's Triple Crown series sets a new benchmark for interconnect and speaker cable performance. A new topology, the Air Cradle Construction, combines massive mono-crystal silver conductors with ultra low-density insulation created from a complex Teflon matrix, to deliver incredibly low inductance, resistance, and capacitance. This ensures absolute geometrical and mechanical consistency, no matter how the cable is curved. But it's not just a mechanical and electrical optimization of the cable; the radical new Triple Crown connectors are just as innovative. Their solid mono-crystal silver contacts provide perfect material continuity through the cable and connector, while the revolutionary two-part asymmetrical design of both the XLR and RCA self-centres and mechanically clamps the contacts—all resulting in a vanishingly low-loss cable performance.

www.siltechcables.com



Studio Connections Platinum Series Cables

Studio Connections has taken a fresh approach to cable design with its recently launched Platinum Series of cables. The engineering of these cables has been steered primarily by research into the perception of stereo imagery, especially concentrating on the timing spectrum of up to 800kHz, which is critical to our ability to interpret spatial awareness and to hearing clear stereo.

The result is that each of the balanced and single-ended 'Platinum Series' digital and analogue cable types has a specific combination of conductors and nitrogen foamed dielectric components. Each cable is then trimmed for optimal electrical parameters in delivering accurate timing and spatial information.

The digital interconnect starts at £1,350 and a set of Stereo interconnects starts at £2,000.

www.studioconnections.co.uk

Synergistic Research Atmosphere AC Cords

Introducing a new line of AC Power Cords from Synergistic Research, Atmosphere Level 1, Level 2 and Level 3 features the world's first use of graphene in an AC power product. With the highest current density of any known material, graphene is a near "superconductor" at room temperature. Graphene imparts performance characteristics not found in other power cables. Atmosphere Level 2 and 3 include integrated UEF filters with internal power supplies for "Active Shielding"; there are no external power supplies to mess with—simply plug and play as with conventional passive cords. Thanks to graphene, Atmosphere power cables are thinner and more flexible than the models they replace. Starting at US$995 to US$3,395. Available Now.

www.synergisticresearch.com/new-atmosphere-series-ac-power-cords/

The Chord Company ChordMusic cable range

ChordMusic is a new flagship cable system from The Chord Company, featuring Chord's Super ARAY conductor technology and a revolutionary new insulation material called Taylon®. ChordMusic cables are the only range of audio cables to use this unique and revolutionary dielectric material. With a lower dielectric value than PTFE, Taylon® is also a phase stable insulation material. What does this mean? That big collection of CDs that every music lover has: well, they sound a lot, lot better than you think they do—and so does your system. ChordMusic Super ARAY configuration Taylon® insulated interconnects are one of the most profound steps forward in performance that has happened in twenty-five years. Welcome to a new musical landscape.

www.chord.co.uk

Van den Hul Carbon Nano Tube technology

Our CNT technology is based on 19 pure graphene 15-micron carbon-tube strands twisted together to make each conductor in our balanced configuration. The atomic structure of graphene is so perfect that there is no space left for any boundary or impurity. Sonically this results in the most stable electrical conductivity ever. Also here, many electrons are used for linking and less for conductivity. This boundary free structure is, so far, the most ideal material for audio products. Worldwide,ours is the first and thus far the only company using graphene based CNT for this purpose. There is no conductor material with the same superior sonic qualities. The CNT interconnect is available now and prices start at £3,500.

www.vandenhul.com/cable-technologies/carbon-nano-tube-cnt

Vertere Pulse HB Absolute Reference cable range

Ensuring absolute integrity of signal transmission, Vertere Pulse-HB utilises various bespoke internal conductor designs to provide unsurpassed reference performance. Pulse-HB's proprietary conductors are constructed from scratch using highest purity copper of various diameters with each strand silver or tin plated as required. These bare conductors, some of which are a fraction of the thickness of a human hair, are then made into the individual insulated internal conductors. Finally, the internal conductors are combined with a unique configuration and twist, shield wrapped, shield braided, and coated with a special outer covering meticulously hand assembled, then put through extensive QC checks and final listening tests.

The Pulse-HB range includes; USB, Ethernet, AES/EBU, coaxial, and analogue interconnects, plus loudspeaker and mains power cables.

www.vertereacoustics.com

www.vertereacoustics.com/vertere-pulse-hb-hand-built-cable-system/

Vertex AQ HiRez Solfonn analogue interconnects

The Vertex AQ HiRez Solfonn analogue interconnects have recently undergone a significant revision. Part of a broader range of cables including mains leads, speaker leads, and digital interconnects, the HiRez Solfonn's design change has resulted in a doubling-up on the acoustic module count, from two to four, revised acoustic labyrinth construction within the modules, and further enhancements to EMI and RFI reduction. Conductors are solid-core silver with unbleached cotton insulation with our proprietary EMI absorption sheath, which, unlike conventional screening, prevents external noise entering and absorbs high frequency hash carried by the conductors themselves. Prices start from £2,200.

Available now from all Vertex AQ dealers.

vertexaq.com

Wireworld Cable Technology Helicon 16 speaker cables

Wireworld's Helicon 16 is a new compact speaker cable designed for internal wiring and DIY applications. These highly flexible cables consist of two flat conductors that are twisted and bonded together. This bonded helical structure stabilizes the conductors without an external jacket. It also provides the uniquely lifelike sound quality of Wireworld's patented DNA Helix conductor geometry.

Inside the two flat insulated conductors are sixteen parallel copper strands arranged as eight pairs. The gaps between those pairs are essential, because they channel electromagnetic signal energy to provide audible and measurable improvements in fidelity. Helicon 16 is also very easy to strip and connect to internal or external speaker terminals. Cable will be available with OFC or OCC-7N copper conductors.

www.wireworldcable.com

WyWires Diamond-series cables

Diamond is the newest cable in the WyWires lineup, the luxury aesthetic line of cables using our proprietary Litz wire design. Diamond cables contain a complex combination of different conductor and dielectric materials, optimized to provide a neutral and well-balanced tone, along with detail retrieval that goes beyond what we've been able to do in the past. Additionally, we have achieved a superior level of transparency, dynamics, and a startlingly low noise floor for the ultimate music enjoyment experience. Diamond cables feature black jackets with a subtle sheen, carbon fiber tubing at both ends, and a WyWires medallion that can slide along the cable and out of sight. Prices start at US$4,495 for interconnect cables, US$7,995 for speaker cables.

www.wywires.com

XLO Electric Reference-3™-series cables

XLO International, Inc. is pleased to announce its newly designed Reference-3™ Series cables comprising single-ended and balanced interconnects, 75-Ohm and AES/EBU cables, loudspeaker cables, and AC power cables.

Reference-3 cables address three key issues: high conductivity, low capacitance, and extreme noise resistance. Conductors are made from solid core, high-purity continuous cast copper. Dielectrics consist of proprietary low-constant, high dump rate insulation in a Litz-variant configuration, which increases positive and negative equivalent SFDR by eliminating one source of capacitive discharge artefacts. Noise is managed through the "integrated field" winding geometry with a jacketless, non-shielded design for balancing electrostatic and electromagnetic fields.

Reference-3 cables are all custom terminated. Interconnect prices start at US$480/1m pair; speaker cables start at US$1,760/8-ft. pair.

www.xloelectric.com

NORDOST

MAKING THE CONNECTION

BRING YOUR MUSIC TO LEIF

Distributed by Atacama Audio: T. 01455 283251 E. post@atacama-audio.co.uk www.nordost-cables.co.uk Made in USA

ALO Audio SXC 8-series personal audio cables

ALO Audio (Audio Line Out, LLC.) presents its SXC-8 cable line of headphone cables, earphone cables, and interconnects. Silver-plated high purity copper wire is at the heart of each of the eight fine-stranded 24-awg conductors. Each conductor is custom annealed to an extra soft temper. The cable is jacketed with durable FEP for exceptional resistance to discoloration. The SXC-8 is braided in house using a stereo symmetrical design with opposing currents. The cable has a supple feel that is unlike other silver-plated or pure silver cables.

Headphone/Earphone cables starts at US$349, interconnects at US$199. Available now.

www.aloaudio.com/sxc-8

Alpha Design Labs (ADL) iHP-35 headphone cables

ADL's iHP headphone cable features silver-plated OCC conductors engineered using parent company Furutech's proprietary 'Alpha' process. Designed to keep metal parts in a perfect stress-free, stable, and highly conductive state and hence significantly improve audio performance, this two-step technology follows a deep cryogenic freeze with a patented ring demagnetizing process. Top grade insulation is provided by an inner PTFE dielectric and outer flexible PVC sheath. The iHP-35 is available with various high-quality Furutech terminations designed to connect with most major audiophile-grade headphone brands; the iHP-35Hx for the Sennheiser HD800 features state-of-the-art rhodium-plated non-magnetic stainless steel and carbon fibre connectors plus an additional woven cable-damping sheath. Available now, priced from £75 to £445, depending on cable length/connectors.

www.adl-av.vom/products/cables/headphone

Atlas Cables Zeno upgrade headphone cable

With the Zeno headphone cable, Atlas Cables set out to bring its own engineering-driven vision of cable design to the fastest growing category of audio products. Ohno Continuous Cast (OCC) copper conductors are covered in FEP (fluorinated ethylene propylene) low temperature deposition dielectric wrapped within a protective soft PVC inner liner and finished with a fabric outer jacket. Developed for Zeno, Atlas' Metik non-solder crimp plugs provide signal consistency from socket to socket. Available in 2.5mm, 3.5mm, 6.3mm and 4-pin XLR mini for the headphone end and 3.5mm, 6.3mm and 4-pin XLR for the amplifier end, Metik plugs provide a direct, airtight metal to metal contact for minimal losses and maximum fidelity. Available now, prices range from £145.

www.atlascables.com

AudioQuest Lightning USB Cables: Forest, Cinnamon, Carbon, and Diamond

Digital audio files of many types—including files from Tidal's premium streaming service, lesser streaming services, Internet radio, a friend's MP3s, or 24/96 files stored on one's iPhone—benefit from using superior USB cables, ones that preserve signal integrity and allow better processing.

Four Audioquest USB models are available with Apple's® Lightning™ connector (all recent iOS devices) on one end. All AudioQuest USB cables use premium metal solid conductors (from Long-Grain Copper to increasing percentages of silver-plating, to solid PSS Silver), in order to optimize signal transfer, reduce noise, and eliminate strand interaction.

Higher-end models use more sophisticated versions of AudioQuest's Noise-Dissipation System (NDS) and, finally, AQ's 72V Dielectric-Bias System for additional performance.

Available now, starting at US$39.

www.audioquest.com

Cardas Audio headphone cables

Cardas offers three levels of headphone upgrade cables: Cross Headphone, Clear Light Headphone, and Clear Headphone.

Cross Headphone was among the first headphone upgrade cables on the market. George Cardas designed it for his daughter, Angela (who now manages Cardas Audio), when she was in radio, and was constantly wearing out stock cables. Cross offers increased detail and enhanced durability.

Clear Light Headphone brings Matched Propagation technology to headphones and is the cable used on our EM5813 Ear Speakers.

Clear Headphone's conductor geometry is exactly like a miniature pair of Clear Speaker cables, with a separate cable for each channel. Clear brings unprecedented detail and imaging to high-end headphones.

Cardas headphone cables, like all Cardas cables, have a lifetime warranty.

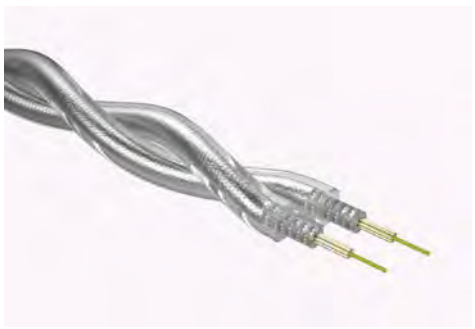
http://www.cardas.com/headphone_cable.php

Crystal Cable Next-series personal audio cables

Headphone and portable applications place unique demands on cable design and construction. Not only do they present extreme mechanical challenges, in terms of noise performance, mechanical stability, and longevity, but also the emergence of portable high-resolution file replay systems combined with rapidly advancing headphone performance has created one of the most sonically exacting markets. It's a field in which cable performance has become a critical limiting factor.

The superb conductivity, shielding, and high-tech insulation materials used by Crystal Cable are perfect for the low-signal level, low-power applications typical in portable audio systems. They make the most of every last little bit of signal, while dedicated designs combine their inherent flexibility with skin-friendly outer sheathing to set new standards for unobtrusive comfort.

www.crystalcable.com/portable/



Dynamique Audio Cyclone and Halo headphone cables

Dynamique Audio Ltd. recently released a new line of headphone cables designed to complement the finest designs from Sennheiser, HIFIMAN, Audeze and others. Cyclone is a silver-plated copper and FEP Teflon design, featuring four multistranded conductors in a star-quad cable geometry. Halo brings pure silver conductors, air-dielectric, multicore, and resonance damper technologies into one design that will suit the finest headphone designs.

Cyclone and Halo are available now worldwide, prices starting at £160 for Cyclone and £500 for Halo in 1.5m lengths.

www.dynamiqueaudio.com

Kimber Kable AXIOS high-resolution headphone cable

The first products that Kimber Kable designed were the braided 8-wire (4PR) and 16-wire (8PR) speaker cables. The AXIOS headphone cable follows this classic Kimber Kable braided design, revisited for high-resolution headphones. The cable utilizes a very flexible OFHC copper wire braid comprised of 16 FEP insulated 24 gauge stranded conductors. We developed a new precision hand-braided process, which allows the conductors to seamlessly separate from 16 wires to 8 wires within the transition, eliminating the need for a solder joint. Each connector is finished with hand-polished hardwoods to match the beauty of your headphones. Price for a 1.2 meter is US$698. Additional lengths and connector termination options will be available upon request beginning in January, 2016.

www.kimber.com

MIT Vero-series personal audio interface cables

Vero headphone cables are MIT's first entry into the personal audio space and they leverage MIT's patented Multipole Technology, featured in MIT Cables' legendary audio interface cables. Using MIT's Multipole Technology, Vero is able to create a lifelike immersive listening experience.

Vero means "true" in Italian and it is the essence of our latest designs aiming at "truth in music". With this new headphone interface installed, you find yourself suspended in a giant three-dimensional space where the background is black, silent, and void of walls. Natural timbre and textures will flow like water, providing a spacious sound, setting the stage for the closest thing yet to truth in music.

Shipments start in January 2016; MSRP is about US$995.

mitcables-buyersclub.com/collections/vero

Moon Audio Dragon-series cables

Moon Audio's Dragon Cables are now Apple® MFI Certified and made for your iPod, iPhone and iPad.

Adding to Moon Audio's broad variety of audio connection choices, we now offer Apple® Lightning™ and 30 pin connection options. Dragon MFI certified cables can link your iDevices to your MFI certified Home, Car, and Portable headphone systems.

Need a way to connect to your non-MFI audio systems? We can help here too.

In most cases, you will link your Apple® iDevice to a DAC via a USB connection. Our Silver and Black Dragon Lightning USB cables are the highest grade of USB cables today at a remarkable price and provide the most detailed, undistorted sound signal for your digital to analog transfer applications.

www.moon-audio.com

Nordost Blue Heaven headphone cable

Nordost's newest personal audio product is the Blue Heaven headphone cable. Combining Nordost's proprietary Micro Mono-Filament technology, Litz construction, and an Aramid fiber strength member, Blue Heaven makes for a profound improvement over the sub-standard, detachable wire provided with many headphones. The Blue Heaven headphone cable not only increases transmission speeds, eliminates triboelectric noise, and improves upon mechanical damping, but also addresses the added demands of pliability and durability necessary of a high quality headphone cable. The Blue Heaven headphone cable is terminated with a 3.5mm stereo mini plug and is provided with a threaded 3.5mm to 6.3mm (1/4") stereo phono adapter that easily and securely screws onto the original termination.

Available January 2016; MSRP: 1meter length, US$399.99.

www.nordost.com

Purist Audio Design Impresa headphone cable

Go mobile with Purist's Impresa headphone cable. Its braided shielding protects your listening experience from the types of outside interference you'll encounter on the go. Braided shielding and a proprietary PTFE dielectric gives the Impresa a mere 0.0233 Ω/m resistance and a capacitance of 23 pF/FT. Lower capacitance and better dielectric means a quicker release and a more transparent and true, airy sound. Oxygen-free copper conductors ensure the purest sound possible. The Impresa, like many of our high-end cables, receives a proprietary, triple Cyromag© treatment for breath-taking sonic performance.

Available now; MSRP: 1.5m pair, starting at US$680.

www.puristaudiodesign.com

Synergistic Research Atmosphere-series headphone cables

New from Synergistic Research are the high definition Atmosphere-series headphone cables with graphene. Atmosphere-series headphone cables feature UEF Technology combined with silver alloy conductors and graphene in an air-string geometry so they are light and flexible. Graphene has the highest current density of any known material and is a near "superconductor" at room temperature for performance not found in other headphone cables. Developed with custom connections for the Sennheiser HD 800 and Audeze LCD-X, LCD-3, and LCD-4 headphones. Available fitted with TRS ¼", 4-pin XLR, and 2-connector XLR terminations.

Available now; prices start at US$695.

www.synergisticresearch.com/new-atmosphere-series-headphone-cables/

Vertere Pulse D-Fi Total Connectivity cable range

Pulse D-Fi has been expertly developed and engineered to offer unsurpassed performance from headphones, mobile devices, home computers, and Hi-Fi and AV systems. D-Fi is derived from our reference Pulse range of cables utilising highest purity copper conductors of varying diameters. Each element is silver or tin plated with Teflon or PVC coating. Every internal conductor of the cable is made on state of the art equipment to our exacting standards. Finally these bespoke internal conductors are specifically twisted, double shield wrapped, and overall coated to make D-Fi the cable it is: A true gateway to high-end audio.

D-Fi has an extensive range, which includes; USB, AES/EBU, detachable headphone, analogue interconnect, and loudspeaker cables to enable total connectivity.

www.vertereacoustics.com

www.vertereacoustics.com/vertere-pulse-d-fi-cable-system/

Powerful Connections

IsoTek®

An ordinary 'kettle lead' like those supplied free with hi-fi components contains only rudimentary conductors and connectors – the bare minimum to ensure the item works. Cables like these act as aerials to EMI/RFI, which affects the performance of audio equipment. IsoTek produce an award winning range of cables starting at just under £100 to £600 as featured below.

"Is there any audiophile who still doubts that power cables make a difference?"
Hi-Fi Choice

"IsoTek gets power, so it's logical that IsoTek is the go-to company for power cords"
Hi-Fi+

EVO3 PREMIER

- IsoTek's entry-level power cable – high performance, low cost
- 3 x 2sqmm silver-plated 99.9999% OFC conductors
- Teflon FEP dielectric extruded over each conductor
- Solid copper, 24ct gold plated connectors

EVO3 SEQUEL

- Upgraded version of EVO3 Premier
- 3 x 2sqmm silver-plated 99.9999% OFC conductors
- Enhanced strand geometry and sheilding
- Teflon FEP dielectric extruded over each conductor
- Solid copper, 24ct gold plated connectors

EVO3 ELITE

- IsoTek's mid-level power cable – uncompromising audiophile performance
- 7 x 1.25sqmm silver-plated 99.9999% OFC conductors
- Enhanced strand geometry and sheilding
- Teflon FEP dielectric
- Solid copper, 24ct gold plated connectors

EVO3 OPTIMUM

- IsoTek's top-level power cable – unparalleled performance for high-end audio systems
- 3 x 3sqmm silver-plated ultra-pure OCC (Ohno Continuous Cast) copper conductors
- Teflon FEP dielectric and sheilding
- Solid copper, 24ct gold plated connectors

sound foundations

info@soundfowndations.co.uk
www.soundfowndations.co.uk
0118 9814238

@IsoTekSystems /IsoTekSystems YouTube /IsoTekSystems isoteksystems.com

Wireworld Cable Technology Nano-series headphone/portable audio cables

Wireworld Cable Technology is now shipping the ultra-light and flexible Nano series cables for headphones and portable devices. Patented DNA Helix® geometry features eight signal conductors—four times the number used in standard cables—channeling electromagnetic energy more efficiently and providing greater detail and dynamics. All models utilize Composilex® 2 insulation which minimizes triboelectric noise for lifelike tone quality. Four models include Pulse™, featuring molded plugs and OFC conductors @ $40(1.5m), reference level Nano-Eclipse with OCC-7N copper @ $200(1.5m), Nano-Silver Eclipse with OCC-7N silver-clad copper @ $275(1.5m), and Nano-Platinum Eclipse with carbon-fiber plugs and OCC-7N solid silver @ $600(1.5m). Nano cables are available with mini jacks and the most popular headphone terminals in a variety of standard and custom lengths.

www.wireworldcable.com

WyWires Red-series headphone/personal audio cables

WyWires' Red-series is our line for the personal listening market, including headphones cables, extension cables and adaptors. Red cables are compatible with virtually any headphone that features a detachable cable. Amplifier options are limitless. We configured a new Litz wire formula specifically for personal listening; the cable is designed to be flexible, lightweight, durable, and non-microphonic. Red is also our thinnest cable line to date, in keeping with our less-is-more philosophy. Red cables are identified by a red body, with white pigtails that connect to the headphone.

www.wywires.com

The hard reality is that audio cables can only do damage: they can blur or smear information, distort phase relationships, destroy detail and add colouration.
Bad cables can – and all too often do – ruin the best of systems.

To make the best cables, the ones that do the least damage, takes years of experience and accumulated knowledge, the development of new techniques and proprietary technology – and a willingness still to learn…

In performance terms, that's when evolution sparks revolution.

Siltech - years of excellence are no accident.

SILTECH

Explorer Series

Classic Anniversary Series

Royal Signature Series

Triple Crown Series

"Never think you're finished. Keep comparing. Keep innovating. In high-end audio, there is no limit to quality." Edwin Rijnveld

www.siltechcables.com

MASTER DESIGNERS: HIGH-END AUDIO CABLES

HI-FI+ TALKS WITH FOURTEEN LEADING-EDGE CABLE DESIGNERS

GUIDE TO CABLES: *HI-FI+* TALKS WITH FOURTEEN LEADING-EDGE CABLE DESIGNERS HI-FI+

Bruce Brisson of MIT (Music Interface Technologies)

_Hi-Fi+_: When, how, and why did you start making audio cables?

BB: Back in the 70's I heard differences (in sound) as I introduced various interconnect cables I had been buying. This occurred as I was adding new equipment to my system. After this initial discovery, I went about buying and twisting various conductors in different configurations. I finished them off by heat-shrinking the assemblies to keep the separate conductors in place. In no time at all I was conducting tests to determine that many differences could be heard, and duplicated.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

I would say "all three", but I would say that geometry is first in terms of importance.

How have your cable designs evolved over the years?

Commercially, it started with Monster Cable's Interlink Reference and the MIT MI-330, which are both multi-bandwidth designs. Shortly after Monster, we moved on to develop what is known as Multipole Technology, which provides multipole "poles of articulation" along a wider bandwidth than "just cable".

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?

Each interface plays a significant part in the chain of custody, but I would have to say speaker cables are the most influential. This is due to the need to playback music from one instrument at a low current level, while playing another instrument at a high current level at the same time at the same frequency.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?

We would recommend SP/DIF, because we have so much control over the integrity of the signal in this connection.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?

First, there is no music until something vibrates, electrically or acoustically. Second, in terms of cables, a digital cable "pulses" off and on quickly. If the cable does not vibrate in sync with the music signal, there will be errors.

GUIDE TO CABLES: MASTER DESIGNERS: BRUCE BRISSON HI-FI+

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?
Well, I didn't see this one coming! Yes, at MIT we use "boxes" as enclosures to house and protect our unique technology. We have found that there is only so much control you can have over a signal by changing the metallurgy, winding geometry, or dielectric. With Multipole technology we can deliver low frequency, middle frequencies and high frequency energy (without preference) over the widest bandwidth of any non-networked cable.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?
Personally, I feel that banana plugs deliver better bass energy but the design lends itself to fatigue over time, resulting in noise or intermittent signals. For this reason, I prefer spades.

Do you recommend bi-wiring for loudspeakers? Why or why not?
Yes, a bi-wired speaker is capable of delivering more instantaneous current to the drivers. Current is key to optimizing driver performance.

What is the reasoning behind cable lifters or risers? Do you recommend using them?
While there is a difference when we raise and decouple magnetic fields from the floor, I do not bother with this additional step; I plan to stay married.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
We could work well with both, as long as the component impedances do not get too high. When the impedances get high, the bandwidth gets narrower.

Has the vinyl revival meant developing new tonearm cables for the modern world?
Yes, everybody is making better phono stages, quieter motors, and better cartridges. We like to think we have a role in this revival with our Multipole phono cables.

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?
Yes, we are in the final phases of developing the Vero Personal Audio series of headphone interfaces. The most difficult obstacle was developing Multipole technology for a miniature enclosure that goes unnoticed on a headphone cable, until you listen to one! The word Vero means "truth" in Italian so we thought that it provided a nice moniker for the project since the sound is so effortless and controlled in its purity, or honesty.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?
We solved this problem when we introduced our "impedance matching technology" that allows you to "dial in" the correct impedance settings for any component. Nobody else can do this but MIT.

If you are at liberty to say, what new cable development projects will you tackle next?
You can look forward to much more on the Personal Audio front; we are just getting started with Vero and so far it has been fabulous! +

GUIDE TO CABLES: MASTER DESIGNERS: BRUCE BRISSON HI-FI+

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George Cardas of Cardas Audio

***Hi-Fi+*: When, how, and why did you start making audio cables?**

GC: I started making audio cables experimentally in the early 1980's. At that time I was living in Ontario California and working the 'graveyard shift' for a large general telephone company, surrounded by cables and testing equipment.

My first attempt to produce a commercial cable was in 1984.

I was an avid audiophile seeking musicality in my audio system. At the time, I knew a group of struggling musicians that needed work, so I put them to work building cables.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

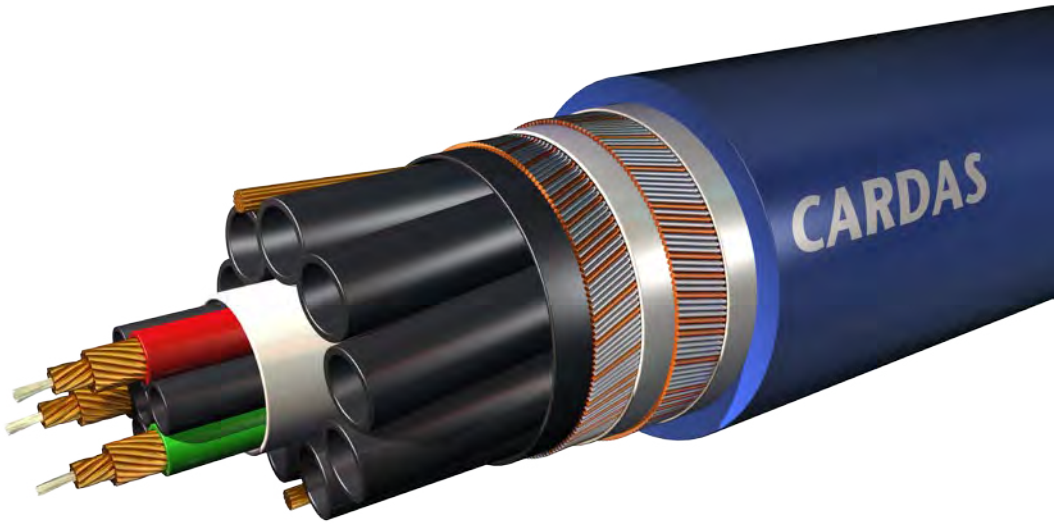
Conductor geometry is the most important improvement that can be made in a cable; after that, mechanical construction and materials follow in line. Cables have been made for over 100 years and telephone cables addressed the basics of materials and mechanical construction long ago. The "magnifying glass" of telephone transmission lines made differences of this nature (differences in construction, geometry, and materials) painfully obvious. Conductor geometry is the only way to match charge and current propagation in "real time".

GUIDE TO CABLES: MASTER DESIGNERS: GEORGE CARDAS HI-FI+

How have your cable designs evolved over the years?
In the early days of digital audio and solid-state electronics, accentuated leading edges were the rule. The design at the time was largely empirical because, after all, it was my systems' musicality that was the driving force. As decades passed the equipment evolved more towards sonic neutrality and my cable design tracked with those equipment changes, hopefully adding the final touch that brings the music into focus.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?
The answer is system dependent. The difference that power cords can make relates to power system and equipment isolation variables and is not predictable across the board. With that said, power cords might well make the biggest difference.

Speaker cables and interconnects are also equipment dependent. Long interconnects



can help to isolate sensitive front end components from the speakers and are often the most critical link, particularly if the driving device does not match cable impedance properly.

Speakers vary wildly in their current needs and impedance swings (a poorly damped speaker cable can be a disaster). Lets say are many ways to go wrong with speaker cables.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?
This is clocking and noise related. In short lengths under 15ft a proper USB cable works best, in long lengths Ethernet or glass fiber. In general with digital you must be able to either buffer, or totally control source feed. In a buffered system, the difference in signal integrity and clocking is more equipment dependent and power and noise isolation is more important. In an un-buffered system the cable is very critical because cable jitter (caused by mismatch of charge and current propagation in cable) is transferred to analogue sound.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?
(Laughs) No argument there—you would not be talking to an audiophile. The fact is that digital audio is 'all ones zeros' and time. In digital cables, clocking and time arrival integrity is crucial to musicality. When the timing aspects of digital cables are right, the sonic differences should be (and are) obvious, so if you can't hear a difference, don't buy the cable.

GUIDE TO CABLES: MASTER DESIGNERS: GEORGE CARDAS HI-FI+

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?
No boxes on signal cables. Attempting to correct signal flow at intervals (like inductors and Pupin coils on phone lines) is unnecessary if you balance/current charge propagation using conductor geometry.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?
Given that the connectors are copper or silver (this is rarely the case with bananas) there is little difference with forged connections. In the real world, spades win.

Do you recommend bi-wiring for loudspeakers? Why or why not?
I will leave that to the speaker manufacturers, as crossover design can make bi-wiring necessary at times. I think there can be an advantage in a design that does not load the high path with the low frequency crossover.

But sure, I think everyone should buy twin sets of speaker cables. (Cardas smiles…)

What is the reasoning behind cable lifters or risers? Do you recommend using them?
We go to a lot of trouble selecting the appropriate materials for cable construction, but for some reason carpet and flooring materials manufacturers don't consult with us, so I prefer not involving their materials in the equation.

With that said cable risers often makes an improvement in the sound of the system for several reasons (remember Enid Lumley and her spray bottles?). That works! Electrical charge is a hard thing to see at times.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
All else being equal I prefer balanced because cables work better if the signal is mirrored.

Has the vinyl revival meant developing new tonearm cables for the modern world?
Emphatically yes!

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?
Of course.

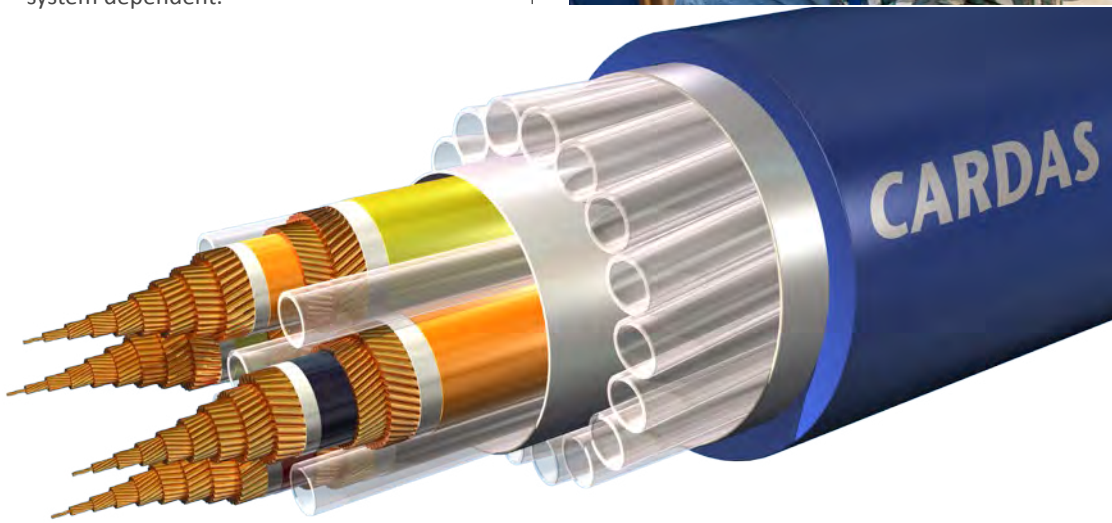
Making a cable that is light and flexible as well as electromechanically stable with an organic texture and feel—and that is non-tangling, that's a challenge!

Another problem is simply making enough of the tiny little stuff.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?
There is a step towards musical truth in cables that are designed properly, but with that said, not all components are designed with that kind of musical honesty in mind. If a component has a severely rolled leading edge or a profound overshoot then these are things that must be compensated for in some way, though not necessarily with my cables. For instance, I am not willing to make a cable that accentuates the leading edges of signals.

So, within a certain window of system quality, Cardas can provide an integrated musical solution. But, outside that window of quality, the answer to this question becomes system dependent.

If you are at liberty to say, what new cable development projects will you tackle next?
The majority of my focus is on taking care of new manufacturers so I will roll with their needs as best I can. Personal audio is demanding at the moment. +



GUIDE TO CABLES: MASTER DESIGNERS: GEORGE CARDAS HI-FI+

Ted Denney of Synergistic Research

***Hi-Fi+*: When, how, and why did you start making audio cables?**

TD: I started experimenting with cables back in the late 80's. Then as now I was an audiophile seeking for ways to improve the sound of my system.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

High performance audio is a lot like Formula 1 and if you ask any F1 boss what's most important to winning, brakes, engine, aerodynamics, cooling and so on you're likely to get the answer, "It's all important". With that said, breakthrough technology and new ways of doing things can create significant advantages that make other considerations somewhat less important. Take the past two F1 seasons for example. Mercedes has had a tremendous advantage with their engine but without downforce from aerodynamics, reliable braking and overall reliability, the mighty MBZ Silver Arrows could not compete on their engine power alone.

High resolution audio is the same and cables play a critical role in overall system performance along with competent circuit and speaker designs, synergy between different components, mechanical isolation of components within the system, AC purity, and of course, acoustics. It is the synergistic interaction between all these various elements that creates a winning music system. Applying a holistic approach to the individual elements that go into cable design—that is, dielectric and conductor materials, conductor gauge count and composition, geometry, shielding, grounding, connectors, and post process cable conditioning all contribute significantly to the final sound of a cable.

The fact is no one element is unimportant but some play a greater role especially in lower cost cables where all options cannot be fully developed due to budgetary constraints. For example, ultra exotic/expensive connectors can add that last touch when voicing a state-of-the-art cable design, but money invested on exotic connectors will be better spent on other elements within a lower cost cable's design. In cost-constrained designs I think better shielding and conductor materials both help deliver a better sounding product than if the majority of a cable build is budgeted for jewelry like connectors.

How have your cable designs evolved over the years?

My earliest interconnect designs circa 1992 dealt with altering a cable's shielding through grounding cables attached to a cable's shield. These ground cables could be combined in different ways to effect changes

to the cable's overall sound or balance by terminating them to the then common phono ground post found on nearly all pre-amps of the day. We originally offered four different interconnect designs, all at the same price point: Mark I through Mark IV. Each interconnect was engineered to compliment different components and system types with an emphasis on system synergy. People would audition all four interconnect models to compare at home in their systems. They had 30-days to make up their minds with no obligation to keep the cables. My first speaker cables were offered in three different models, Mark 1 through Mark III, all at the same price point, but engineered for different speakers and amplifiers. As with our interconnect cables, people would try the speaker cables at home for 30-days.

Early on during my original 3-year development program sometime in the late 1980's I landed on alloy conductors as a better way to capture the subjective benefits of different conductor materials like copper or silver without surrendering to their sonic shortcomings, a practice that is still followed at SR today. Another early development that has stuck with Synergistic Research cable designs is the use of multiple cable geometries running in parallel. Just as no single conductor material can be deemed perfect for all applications, so too do different cable geometries compliment different systems and by combining multiple geometries in parallel we found we could make cables that compliment the widest possible variety of systems.

In 1994 I engineered the world's first commercially successful high performance AC power cord, the Synergistic Research AC Master Coupler, which went on to sell over 10,000 units worldwide.

In 1995 I began research looking for a way to dramatically improve cable performance through improved shielding. To this end I started experimenting with the application of a DC bias to the shield of the cable with the hope that we could open up the sound of our cables by actively biasing a cable's dielectric and reduce the additional ground wires. At first we began experiments that biased a cable by tying the positive cathode of a battery to the cable's shield and an unterminated wire tied to the batteries negative anode. This did change the sound of our test cables but in an uneven fashion. While this battery bias opened up the top end it did nothing for a cable's perceived mid-range, yielding a somewhat thin and bright sounding cable that lacked body, fullness, and low frequency impact. It also made the cables measurably noisier especially on long interconnect runs as the wire terminated to the batteries anode was not grounded and so acted as an antenna.

Ironically there are commercially available cables today that use our initial DC bias experiment. We then started working with Active DC bias supplied by a transformer. This allowed us to run not only DC through the cable shield, but also current as we completed the circuit with resistance and inductance between the cable's shield and the power supply. This created a far quieter cable then was possible with battery bias and led to our first generation Active Shielded Cables in 1998. Active Shielding then was refined in eight successive generations of cables between 1998 and 2014: Synergistic Research Active, X Series, (X2), Tesla, Tesla LE, Galileo System, Element and Galileo LE.

Up until 2007 Synergistic Research was strictly a cable company, we only made interconnects, speaker cables, power cords and digital cables. Then in 2006 I got the idea for an electromagnetic cell as a new means of filtering AC or signal without limiting current. This led to my first patent and our PowerCell power conditioners and later, Tranquility Base EM platforms. We then refined and applied EM cell technology to the flagship Galileo System cables and later Galileo LE cables.

In 2007 I began experiments with sympathetic resonance as an alternative way of treating room acoustics, which led to our Acoustic ART room treatments. Looking for ways to shrink the form factor of the Acoustic ART System led to UEF Technology first implemented in our HFT room treatments. I then applied UEF technology to the internal EM Cells as a means of amplifying its effectiveness, which improved the performance of our PowerCell line conditioners and Tranquility Base EM component isolation platforms. With the advent of patent-pending UEF Tech and the patented EM Cell we were in a position to dramatically improve cable technology while making our cables far less complex for end users by eliminating the power supplies found in all upper-end Synergistic Research cables dating back to October 1998.

By applying UEF directly to the shields of interconnects and speaker cables combined with EM Cells infused with UEF we were able to leapfrog their performance far beyond what was possible through Active Shielding alone, and without the complexity and clutter of multiple wall transformers and wires. I then revisited my first use of tying a cables shield directly to ground at a star ground and thereby bypassing the common practice of tying a cables shield to a component's ground, which shields the signal from noise, but still transfers that noise to a components power supply or a speaker's crossover. By running a very thin ground cable from the shield of an interconnect or speaker cable to a star ground point I was able to build the quietest cables in our history and thanks to UEF technology applied directly to the shield of our newest cables, and in some models an additional UEF EM Cell, we could surpass the open dimensionality of Active Shielding by a significant margin.

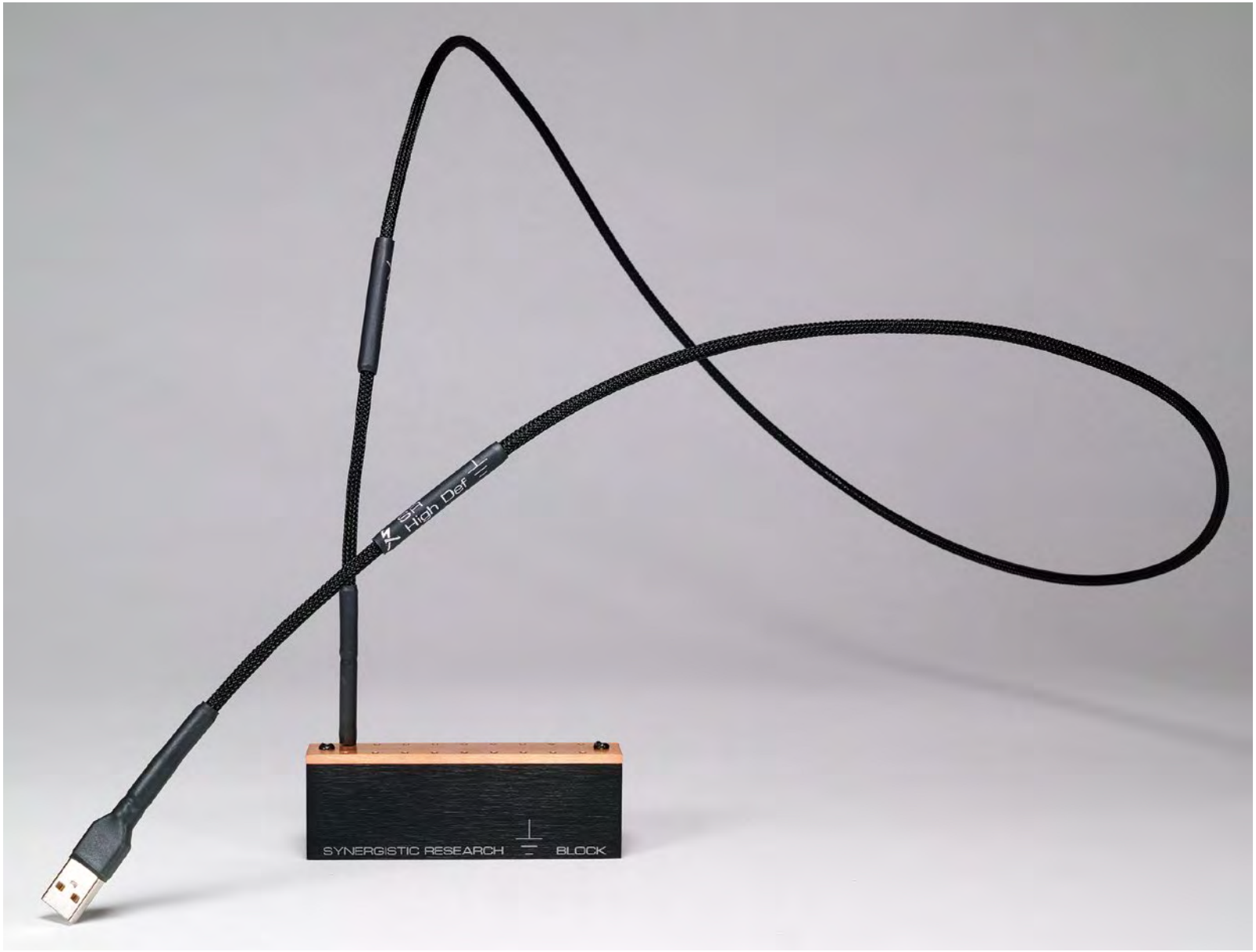
These innovations are found in our current Atmosphere-series interconnects, speaker cables, and power cords. For Atmosphere-series AC cable, in addition to the tech found in their interconnect and speaker cable counterparts, we utilize DC as a bias for the cables shield with an internal power supply built into a carbon fiber enclosure on the

GUIDE TO CABLES: MASTER DESIGNERS: TED DENNEY HI-FI+

power cord—so, no additional transformers or wires. DC in close proximity to AC acts like a linear power conditioner without limiting current on demand in our new Atmosphere-series power cords and is an adaptation of our patented EM Cell technology found in our PowerCell line conditioners. To make Atmosphere-series cables compatible with nearly any system we employ a variation of our UEF technology. Removable UEF filters change the resonance of the cable, which affects the sound or balance, but with the filters totally outside the signal path. One needs to only listen with and then without the removable EM Filter to find the balance that best compliments their system and personal taste.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?

Again let me use the Formula 1 analogy. Which is most important for overall automotive performance—the suspension, the engine, the braking system, or the aerodynamics? The answer is, all of the above. All factors being equal and barring any technological advantage to one system over all others, then all systems are important and must be in balance if you want to take the Driver's Championship and the Constructor's Cup. The same is true of the cables in your system. All must be in balance with your system and one another. This is why we build different families of cables, each designed to work together so that you can create balance, and not overspend in one area at the expense of the others.



GUIDE TO CABLES: MASTER DESIGNERS: TED DENNEY HI-FI+

For example let's say you just love speaker cables so you overspend on this one area at the expense of your interconnects and power cords. In most cases you would have had a much better sounding system had you balanced your expenditures with all cables designed to work together. This is why we created our CORE UEF-series of cables with the core of Synergistic Research technology at the lowest possible price; when used together, CORE UEF cables create a whole that exceeds the sum of their parts.

There are only a few reasons I can think of where a person might be better off investing more in one type of cable vs. another. The first example would be power cords. Most people think of a turntable or a digital device as their system's front end, but I do not. The original signal that gets converted and then amplified throughout the chain of a system is not the musical signal but rather the AC first entering a system. AC is the original source, which starts at a single frequency and voltage and is then converted into complex frequencies and voltages until it is converted into mechanical energy by our speakers and then is interpreted as music in our brains.

For this reason if someone wanted to use one of my higher performance power cords to feed, say, their digital-to-analog converter or preamplifier, and to use lesser interconnects, speaker cables, and power cords elsewhere, they might get better performance than if they had equally shared their budget between all the cable in their system. The other reason I can see where someone may want to spend less on one area of cables vs. another would be if they intend to change a component in their system and therefore want to hold off on buying the best cables they can afford and that matches their system. In this case it would make sense to first cable their system with a level of cable that matches the performance of their system while holding off on the cables for the component they are going to change.

In this scenario you would use entry-level Core UEF cables for the component you are going to change out while cabling the rest of your system with higher-level Atmosphere or Galileo-series cables. Then, when you are ready to upgrade your component you would upgrade your Core UEF to Atmosphere (or Galileo LE) cables and take advantage of our Lifetime Passport Protection Plan which gives you a 70% lifetime trade in allowance for whatever Synergistic Research cable or product you wish to upgrade into. Since there is a common thread in all Synergistic Research cables you can mix and match different levels of SR cables until you are ready to maximize system performance. We actually have people trading in my original Mark I interconnects toward current models and getting 70% of their original 1992 retail price.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?

Simply stated, the best result for digital audio is whichever option works best for a given component. Obviously if your DAC and computer or hard drive has only a USB option then that's going to be your best option. Ideally, you would like to choose the option that takes advantage of the highest common data transfer rate between the two components you are trying to bridge so if your components both support options of USB 3.0 or FireWire, you would choose USB 3.0. For more traditional options like RCA vs. XLR, either pick the common option or if you have both RCA and XLR options try both to see if one has an inherent advantage over the other.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?

I don't argue this point. All cables affect the final sound of a system so if they don't understand this, it's obvious they have not listened or can't overcome their negative expectation bias. Amusingly there is no such thing as a "one" or a "zero" where digital transfer through a cable is concerned. There is only an analogue signal, which is "interpreted" as a one or a zero, so there really is no difference between why analogue cables effect sound vs digital cables effecting sound. All cables affect sound in a system.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?

Some of our cables have EM Cells which are based on the interaction between two close proximity fields, so technically they are not in the signal path, but they do play a significant role on the way the cable sounds and performs. They are used to improve the fidelity of our cables.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?

Both spade and banana work very well. We do actually prefer banana plugs because they maximize surface contact while reducing the mass of the connector and are more convenient, but honestly the differences are not great enough to worry about.

Do you recommend bi-wiring for loudspeakers? Why or why not?

For speakers that are bi-wire-capable we recommend bi-wiring only if you are bi-amping. For a non-bi-amp connection between amplifiers and speakers we developed a solution called Integrated Frequency Transmission, or IFT bi-wire for short. IFT bi-wire improves dampening response between the amplifier and speakers compared to traditional dual speaker cable runs for bi-wiring and allows for the highest resolution speaker cable design to be used in common between the two terminal posts on your speakers. It also significantly outperforms the solid metal jumpers that come with most bi-wire speakers.

GUIDE TO CABLES: MASTER DESIGNERS: TED DENNEY HI-FI+

What is the reasoning behind cable lifters or risers? Do you recommend using them?
For people wanting to take the performance of their systems as far as possible and for whom cable risers are not an eyesore we do recommend their use, but only if your system is well sorted enough to appreciate or hear their benefit. For systems that have addressed AC through conditioning and power cords, have high quality cables, tuned acoustics, and isolation of mechanical resonance of components in the system, raising speaker cables off the floor accomplishes two things. First, it can reduce the capacitance of the cable, which opens up the sound especially in the high frequencies. Second, it allows the speaker cable to resonate by removing the dampening effect of laying the cable on the floor.

The benefits of this are similar to removing a blanket from a resonating piano. The net effects of cable risers can be subtle, non existent, or profound. It just depends on what other factors you have addressed and to what degree your system is performing optimally so that you can hear the benefit, or being held back by other factors therefore obscuring any benefits of cable risers.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
We have won numerous 'Best Sound at Show' awards with both single-ended and balanced systems. The choice boils down to which option will enable your particular system to perform best. There are many components on the market with "XLR" connections that do not have truly balanced circuits, so there will be little benefit if any from running balanced cables. There are systems that have a mix of components some with balanced circuits and some with non-balanced circuits, but with XLR outs. These systems are tricky and actually can sound best if RCA cables are used. For truly balanced systems with true dual differential balanced circuits throughout the system, XLR will be the clear choice. McIntosh Electronics are an example of true balanced circuits that sound far better with XLR balance cables than with RCA single-ended cables. The reverse is also true, some systems sound best when cabled with single ended RCA cables.

Has the vinyl revival meant developing new tonearm cables for the modern world?
Yes. As components, speakers, and turntables, everything really, gain in resolution and become more refined in their frequency presentation, it requires that cables not only keep pace, but that they be voiced on today's higher resolution turntables (and speakers and electronics).

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?
We just completed the development of the world's highest resolution headphone cables for Sennheiser and Audeze headphones. Our Tranquility Base UEF platforms are also transformative when paired with headphone amplifiers and digital front ends. Currently we are in development of a micro parallel filter for highly portable headphones to be used with iPhones and Androids as well as portable headphone amplifiers.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?
In our experience mixing and matching different cables from different manufactures, all of which were never designed to work together, is little different than placing four different tires from four different manufacturers on a Ferrari. At SR we refer to this as 'cable stew'. We do not recommend it as it creates a system sound that is incoherent.

If you are at liberty to say, what new cable development projects will you tackle next?
The name 'Synergistic Research' means just that; we are a company focused on research in synergy as it applies to the reproduction of sound and we reinvest over a third of our company profit into research and development on an annual basis. We are continually in development of new technology and while it's not always cable technology, there are many instances where a new technology developed for a certain application finds new uses in different applications. Take, for example, our new SR Ground Block, which employs a UEF Ground filter originally intended as a star ground point for the shields of our new Atmosphere-series cables. We then adapted our UEF Shield technology from Atmosphere-series cables to build High Definition Ground Cables that attach to unused USB ports on hard drives and XLR and RCA connectors on components to lower their noise floor. This has turned out to be one of our most significant new products in years, and it came about as an evolution of various SR Technologies. +

GUIDE TO CABLES: MASTER DESIGNERS: TED DENNEY HI-FI+

Nigel Finn of The Chord Company

***Hi-Fi+*: When, how, and why did you start making audio cables?**

NF: I joined The Chord Company in 1989; prior to then most of my time was spent either listening to or playing music. My first real introduction to hi-fi came when Sally took me to a Naim/Linn evening in Brighton; I clearly remember being so shocked by what I heard I didn't touch my home system for about three days afterwards. What fascinated me about the cables was the fact that the differences I could hear were fundamentally musical differences; they made listening to music more involving and more enjoyable. It helped that Sally gave me an enormous amount of freedom to experiment and it helped that I got to speak to and go and see some of the best hi-fi dealers there were. Music had been an obsession since early childhood and working for Chord gave me a chance to explore it in a completely different way.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

They are all important. Over the years we've learnt that when you focus on all aspects of a design and build, then seemingly small performance improvements add together to produce a sum far greater than its parts.

We have obsessed about high frequency interference since the late nineties, when we began to realise the problems it was causing and that led towards experimentation with high frequency effective shielding. It also meant that we had to investigate conductor configurations and gain a deeper understanding of the relationship between conductor and insulation materials.

We think that the relationship between conductor and dielectric material is a critical element. It can have a massive influence on the tonal colourations that cables can produce and in turn, these will ultimately affect the coherence of the system they are used in. RCA plug design is another area where we were able to improve overall performance, particularly by developing non-compression strain relief designs. So in answer to the question: everything is important.

How have your cable designs evolved over the years?

Our first designs were straightforward coaxial configuration cables, where a central conductor carried the signal and the shield the return. From there, we moved towards pseudo-balanced designs where the signal and the return are carried by identical sets of conductors, and in many ways, the move towards pseudo balanced designs allowed us to start experimenting with high frequency shielding—something that is pivotal to the products that we produce today.

Our first interconnects used oxygen free copper but as we learnt more about conductors—and particularly about the relationship between conductor and dielectric—we moved towards using silver-plated conductors. Much of our current range features silver-plated conductors.

From pseudo-balanced cable designs, we were able to experiment with tri-conductor cable configurations and this ultimately led to the development of Chord's ARAY, Tuned ARAY and Super ARAY conductor structures.

There is constant and ongoing research and as our designs become more transparent, so we are able to understand more about the importance of particular areas and apply what we've learnt to other cables throughout our range. This constant research has also led to the introduction of Taylon®, a completely new dielectric material, which when applied to audio cables has produced the most neutral and transparent interconnects and speaker cables that we have yet designed and produced.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?

I wish there was an easy answer. Theoretically, one would say start with power cords, especially given the degree of electrical pollution that exists today. However, often it's understanding and replacing the cable that is creating a bottleneck within the system that brings the most profound improvement. This could be either digital or analogue interconnects, or speaker cable. Reviewers and manufacturers well know the importance of power cables but there is still a degree of customer antipathy towards them. What we find from talking to customers is that very often, power cables are the last things to be investigated—generally when they have got to a point where they are happy with all the other cables in their system. At this point, it's often easier to hear and understand the benefits of power cords. So in answer to the question 'Which is more important?' it comes down to the components within the system.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?

This is hugely dependent on the system. From a cable specialist's view, I suspect all of us resent the miniaturisation of connectors; certainly they can severely limit the choice of cable designs. On top of this, choice of system often dictates the choice of interconnect and the type of connections. There used to be a fairly simple choice between optical and coaxial connections and it was easy then to say that generally the coaxial was the best option. However, with systems that use a computer as a source it often means that the choice of connection is limited to USB or, on occasion, optical and there are streaming systems where an Ethernet cable is the only means of connection. We are also beginning to come across I^2S and have experimented with both HDMI and DIN versions. The first Tuned

ARAY cable we developed was intended for implementation with digital cables. So we've experimented with and developed Tuned ARAY configurations in all digital formats. Somewhere lurking in a dark cupboard there is even a prototype Tuned ARAY HDMI! We have components that allow us to play with all these options and from this it's honestly very difficult to say that one particular type is better than the other.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?

Sit down and have a listen! Any digital cable (with the exception of optical cables) in a hi-fi system is carrying an electrical signal. That signal is as subject to interference and mechanical noise as any analogue cable is. We've already mentioned how critical we think the relationship between conductor and dielectric material is and if anything, this is more so when it comes to digital cables. For the same reason, the quality of shielding and the ability of that shielding to work at high frequencies are also critical. One of the areas of musical performance that digital cables seem to have a profound effect on is the coherence with which music is presented. Producing cables that are able to carry a musical signal coherently is, we think, fundamental to every cable design.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?

Not at the moment. We are not fundamentally opposed to the idea of networks designed to filter particular frequencies of interference and in the past have used exactly this to produce some of our HDMI cable designs. This was partly due to the limitations that the HDMI connector places on cable design. With conventional digital and analogue cables, we tend towards a 'less is more' design principle and are able to deal with a lot of the issues that networks are designed to deal with, with a combination of high quality shielding and conductor configuration.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?

Over the years we've carried out many experiments with the many types and designs of speaker cable terminations available and the reason that we fit the barrel and spring banana plug to our cables is that currently it is the best speaker connection we have found. One of the reasons we particularly like this design is that it allows a very high-pressure contact point between the plug and socket. One of the problems with alternative connectors is that they do not always produce this high-pressure connection. The other problem is that as a design, it is relatively common and the quality is very variable. We got around this by having our own version machined and then gold-plated in the UK. We do terminate

speaker cable with spade connectors if required. If we have any problem with spade connectors it would be that over a period of time they can work loose and this will affect sound quality.

Do you recommend bi-wiring for loudspeakers? Why or why not?

We stopped producing bi-wired speaker cables some years ago now. The reason for this was that whilst we could see that bi-wiring a speaker could often produce an increase in perceived levels of detail, it often did so at the expense of coherence. So, given a particular budget, we felt that spending that budget on a better single, rather than a bi-wire, speaker cable could obtain better results. We did experiment with bi-amp systems and although it wasn't a night and day difference, we did prefer to use two separate sets of cable rather than a bi-wire cable terminated for use with a bi-amped system.

What is the reasoning behind cable lifters or risers? Do you recommend using them?

We have used several types of cable lifter and they have all been beneficial to some degree. I did try using them at home and they proved irresistible to my daughter—they stack rather nicely. We do think that vibration—mechanical noise—may well be one of the reasons that they work and we have also considered static as well. Interestingly, whilst our Dem Room is carpeted and my home has wooden flooring, the results produced with cable lifters on both types of flooring were very similar. It should also be said that whilst my friends have come to appreciate the music that my system produces, the cable risers induced serious fits of sniggering.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?

'Not an easy choice and we have no clear answer. It depends very much on how the balanced outputs and inputs have been implemented. There are many components that sound more coherent and enjoyable via the single-ended connection and equally there are those where the balanced connection is very superior indeed. The advice we would give customers who have both options available is to listen to both and decide for themselves. In terms of cable design, our XLR cables are adaptations of our analogue cables, usually involving the addition of an extra conductor(s).

Has the vinyl revival meant developing new tonearm cables for the modern world?

Yes, all the previous comments about high frequency shielding apply to tonearm cables and also power cords as well. Tonearm cables make certain demands on cable designs, especially those turntables with suspension systems. The challenge has been to build a tonearm cable with the same degree of shielding as we apply to other cables, whilst ensuring that it does not affect the suspension movement of the turntable. We love the glorious mix of engineering, tradition, myth, and magic that belongs to turntables.

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?

One of the particular problems we have is that all the research, design, and development since our first trials with high frequency screening has led to a range of cables that are completely impractical for use with headphones. The challenge is designing a cable using proven principles that will be flexible enough to use with headphones. We are currently working on this and our very basic experiments so far show that there is a serious potential for improving performance. Our latest digital cable, the Chord Clearway, was developed in such a way that we can fit a minijack to the cable. There are now several portable DACs that accept a coaxial input via a minijack socket.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?

There is a strong degree of logic in using a cable loom from one manufacturer. There is a good chance that the same design principles will have been applied to all the cables in that range. The other thing to consider is that different manufacturers may well have very different design philosophies that will influence the way their cables affect sound quality. There will be combinations of brands of cables that will clash and this is another good reason for using a coherent loom. However, for all of that, it is perfectly possible to assemble an extremely good cable loom using different brands of cable throughout. We certainly have examples of customers who have done so. There are two ways of achieving this. The first is to do with more luck than judgement; the second is being prepared to put in an awful lot of experimentation and listening. So again, a single-brand loom will take a lot of the guesswork out of the equation.

If you are at liberty to say, what new cable development projects will you tackle next?

In many ways, this is one of the most exciting times I have experienced. The advances in sound quality that have happened with digital systems are really extraordinary. There are relatively affordable DACs, CD players, and streamers with a performance that even at high-end levels you will have fantasised about ten or even five years ago. Right now, digital music has acquired the potential to produce genuinely coherent and involving music at every level. So the challenge right now is to design cables that are transparent enough—particularly in terms of their ability to carry a signal coherently—to work with some genuinely high performance components that are sold at bargain prices. +

GUIDE TO CABLES: MASTER DESIGNERS: NIGEL FINN HI-FI+

Ray Kimber of Kimber Kable

***Hi-Fi+*: When, how, and why did you start making audio cables?**

RK: In the late 1970s, with our first prototypes braided by hand, to control noise incursion from lighting systems into sound systems in discotheques.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

For loudspeaker level signals, geometry is most important; or low-level signals, insulation. But since it is impossible to construct a cable without geometry and conductors and insulation, they are all required.

How have your cable designs evolved over the years?

The fundamental value of braided design cables has been re-investigated and re-proven to us over the years. We have, of course, taken advantage of advances in conductors and insulation, along with being innovative with the use of braiding technology. An important aspect of evolution is that of always looking to improve the manufacturing process, in terms of cost efficiency and build quality and consistency.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?
Provided that there isn't an obvious deficiency in the three types of cables, I would recommend first power cables, then speaker cables, and then interconnects. This priority assumes only one cable can be replaced and should be taken only after a trial of each to determine which gives the best result.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?
I consider this to be equipment brand and model dependent. If a piece of equipment had all of them it is likely that one of them might be sub-par to the others or that one would be superior to all the others. Equipment manufactures might have a particular fondness/skill or aversion/ deficiency regarding particular interfaces.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?
It might start out as "all ones and zeros", but the signal from the output must change from one to the other and the input device has to determine at which point a one becomes a zero and vice-versa. If a cable causes the voltage rise time to lag or linger it will cause problems.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?

Some do. Our new NΩhm-series cables, for instance, do contain a complex circuit, using no ferrites or inductors, to lower noise.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?
Both are viable connectors and we use them about equally.

Do you recommend bi-wiring for loudspeakers? Why or why not?
In general if the loudspeaker can be bi-wired then it should be considered. Back-EMF from one section of the loudspeaker could lower the fidelity of the system. The output impedance of most amplifiers is near zero and will act to short the intra-section EMF mischief. However in some cases, one would benefit musically from stepping up a level in cable and using jumpers.

What is the reasoning behind cable lifters or risers? Do you recommend using them?
We typically don't use them but I will concede a theoretical advantage in very advanced systems, and on some floors and with cables susceptible to proximity

GUIDE TO CABLES: MASTER DESIGNERS: RAY KIMBER HI-FI+

interactions. I sometimes struggle to determine if the theoretical advantage is emotional or technical (running for cover).

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
Here again this is very equipment dependant. Some designers have a particular skill/preference for one or the other type of circuit. Some parts of the system are inherently balanced such as loudspeaker drivers; others are single-ended, such as the digital output of a laser pick-up.

Has the vinyl revival meant developing new tonearm cables for the modern world?
Yes, and we look at every aspect of the design and materials with an eye to making persons love the vinyl experience.

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?
Our new Axios headphone cables are designed to be the absolute best and to look and feel alluring at the same time. Some of the challenges were directed at micro-phonics. We had to work on the mechanical transmission of noise from the handling of the cables.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?
This would be highly system dependant. If the electronics are from a single manufacturer, then perhaps a single brand of cables might (only might) be considered.

If you are at liberty to say, what new cable development projects will you tackle next?
(Mr. Kimber chose not to answer this question. However from his comments in this interview and from Kimber Kable's submissions for our articles on 'What's Next in High-End Audio Cables?', it seems safe to say that Kimber's new to-tier NΩhm-series cables and Axios-series headphone cables are indicative of the firms newest design initiatives. –Ed.) +

GUIDE TO CABLES: MASTER DESIGNERS: RAY KIMBER HI-FI+

Bill Low of AudioQuest

***Hi-Fi+*: When, how, and why did you start making audio cables?**

BL: Way back in 1976, when I was just giving up my struggling little appointment-only hi-fi store in Portland, OR, Polk Audio brought Cobra Cable to the alt-CES gathering at the Bismarck Hotel in Chicago. I refer to that episode as the audible starting gun for the audio cable business in the US. A couple of years later, when I went back to retail, selling out of my apartment in Santa Monica, I wanted superior cables to use and to sell in my store.

Fortunately, another appointment-only dealer down in Anaheim had the same intention, and between us we ordered two different cables, each to be used as both interconnect and speaker cable—what I refer to as the Original Recipes that AudioQuest grew out of. That was 1978. It wasn't until I was already selling these cables to a few other dealers, and to a Japanese distributor, that in 1980 I founded AudioQuest.

There was a lot right with those first two cables, first called Hotwires and later LiveWires, which were designed by Dave Gore, best known as the designer of the very popular Quatre DG250 amplifier. I was very fortunate to have such a sophisticated starting point for my empirical learning curve.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

I'm fond of saying that the answer one gets will depend on the appropriateness of the question one asks. Your phrasing was very productive, but often the question is more along the lines of "what's the magic key, what's the one thing I need to know?" which is a defective question leading to a very limited and incomplete view of how good design works, of where good products come from.

So, the answer is yes, and no, all and none—because everything matters. Only when making the compromises necessary to design an actual physical product, especially on a limited budget, must the designer decide, for example, that more money in the conductor quality comes before a more expensive geometry, as in AQ speaker cables, or vice versa, as in AQ's AC power cables.

AudioQuest has developed design language shorthand of sorts, by establishing four primary "ingredients," which we call Elements, as the building blocks for all cable. Each Element requires very careful management, and all are areas in which more sophisticated construction or superior materials make productive differences.

We often show the effects of each Element in sequence (and in isolation) when we make comparisons—or what we call "shared evaluations".

First, we show that better stranded-conductor design, even with "both hands behind our back", as I call the constraints of a stranded parallel cable, is still an arena in which considerable improvement is possible, and with less than half as much metal for less than half the price.

Then, we use a cable of identical design, except with solid conductors—a fun process that usually provokes at least one mumbled comment to the effect that, "if it's that obvious, how come everyone doesn't do it?" Good question.

Next, using the exact same solid conductors, we share the audible performance difference between parallel and twisted-geometry cables, where geometry changes alone can yield a surprisingly more open and subjectively more dynamic presentation.

Going further, we move to a cable of identical design, but with higher quality copper conductors, and once again, the clear sonic difference has a clear cause-and-effect.

Last in this progression is another pair of the same better-metal cables, except with our Dielectric-Bias System (DBS) attached. We use identical cables except for the DBS—a controlled experiment with a single variable in-play: namely, the amount of interference caused by the insulation, the dielectric.

Directionality is our honorary fifth element or ingredient, although because it is a factor always in play with any cable, and not part of any particular design hierarchy, it doesn't quite fit in the same category as the others.

All drawn metal has a directional impedance variation at higher RF/EMI noise frequencies. By 'law', energy must follow the path of least resistance, so we employ this impedance variation as a mechanism for consciously directing noise either to Earth or to whichever attached circuit is less vulnerable to noise. The key is to direct noise to where it will do the least damage.

How have your cable designs evolved over the years?

The have evolved slowly and steadily, most often as a result of happy "accidental" discoveries along the way.

There are a limited number of ingredients and variables that can be manipulated to affect cable performance. Much of my accumulated knowledge comes from having observed, often stumbled upon, a change in performance when no change was anticipated, and then working, through analogy and investigation, to transform that new awareness into a predictable means and method for minimizing a distortion mechanism.

Sometimes we have picked up bits and pieces of information on cable performance that we couldn't readily understand, but that we could empirically act upon. Over time, some of those discoveries slowly coalesced to become visible features in our products. Two examples would be our current understanding of directionality and my Noise-Dissipation System. I felt my way around in the dark, learning what physical differences mattered and acting on those facts.

In this fashion, we've had 35 years of incremental progress: progress which has slowed down a bit compared to the heady early days, but which will never stop, because there will never be a perfect cable.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?

It's a great question, though impossible to answer. As an overtly value-and-performance-minded New Englander, I always suggest looking for the least expensive way to make the most improvement. The answer could be any part of a system, depending on its particulars.

With that said, I am in the cable business because I find some cables most often are the "links" that, if carefully upgraded, will make progress on the upgrade-path the least expensive and the most rewarding.

GUIDE TO CABLES: MASTER DESIGNERS: BILL LOW HI-FI+

I caution, though, that the biggest difference and the biggest improvement are not necessarily the same thing. Much of the upgrade-path is actually more about injecting novelty into the relationship with one's system—and while anytime the listener is happy, that's a good thing, our industry often loses friends and customers after music lovers make too many obvious changes, which only made them more unhappy with their system once the novelty wore off.

For best results with digital audio, would you recommend USB, I²S, Ethernet, or traditional coaxial S/PDIF connections? Why?

I often explain that my job is to make the cables that connect the holes on one piece of gear to the holes on another piece of gear, with as little interference and as little distortion as possible. As for digital interfaces, AudioQuest's resident computer-audio maven, Steve Silberman, is quick to point out that, with so many variables, there is no one absolute winner for every situation and scenario. Context is everything!

Assuming that all proposed interfaces are being designed and executed to their highest standards—but wait, that never happens…

Due to the hardware designer's preferences, capabilities, and budget, any one of several digital interfaces might be the best or worst to use with a particular piece of hardware. Talk about there not being a one-size-fits-all answer!

As for the digital transmission choices today, I²S is an excellent interface. Having one word-clock and one data line ensures the potential for reliable and accurate transfer. However, I²S has had very little acceptance as an external interface on conventional boxes (DAC and transport), while it has found near universal acceptance as an internal solution (within a DAC or integrated CD player).

USB 2.0 is something of a darling today, and can offer very high performance up to three meters, and up to five meters with some equipment and some cables. Ethernet can also offer very high performance, all the way out to 100 meters. Both have the potential to achieve truly high levels of performance, but, again, that's assuming that the hardware and cables are executed to the highest possible standards.

But there are caveats: We strongly recommend against using USB from an external hard drive when the same USB bus is being used to feed data to an external DAC, although there isn't always a choice (you might not have a Thunderbolt input). And while using USB 3.0 to batch download files to an external hard drive is fine and expedient, one should generally not use USB 3.0 while playing music from an external drive, because it activates twice as many devices and often results in lower performance due to the extra noise.

For those waiting for USB-C enabled 3.1—please remember, the race for speed and more current through USB is not because either of those is good for audio. In the high-speed world, digital audio is slow-speed, but very sensitive to forms of compromise that printers and other peripherals don't care about.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?

In responding to questions about whether digital cables are 'snake-oil' or science, I often exaggerate in order to make a point—that engineering is the application of the known, while science is the investigation of the unknown. Science also has a fundamental built-in humility, recognising that the facts are only the best we know today and thus are only theories and hypotheses that haven't been proved wrong—yet. Audio theories and measurements, though useful, only take us so far.

Even more difficult for some people to wrap themselves around is that, as in a saying made famous by Donald Rumsfeld, "we don't know what (it is that) we don't know." We don't know how to weigh the variables we can measure relative to the presently unknown variables we don't yet realise we should be measuring.

While AudioQuest explains as much as it can about cable technology and its digital cables, listening to the product ultimately is the only valid way to judge any audio component.

GUIDE TO CABLES: MASTER DESIGNERS: BILL LOW HI-FI+

No component ever becomes superior or effective simply because we think that theoretically it ought to be.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?
Apart from our DBS modules, which are not in-line with audio signals, we do not use boxes on AQ cables.

Back at one of the 1990's Stereophile Shows, we gave out a few buttons with images on them that alluded to things AudioQuest believes are important. One was a European road sign version of "no," a red circle with a red slash, shown over an illustration of a cable with a box on it. That was a bit flippant and provocative, but very useful for starting conversations.

The boxes you are most likely referring to are in-line modules, and so do raise a number of legitimate questions. With some in-line cable boxes, the theory seems to be that one can, after-the-fact, fix a problem (or signal damage) caused within cable.

In sharp contrast, my philosophy is that the best path is to minimize the damage in the first place—because it can never be truly fixed afterwards.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?
The purest answer, one I admittedly do not employ myself, is to put the cable's bare metal into a hopefully good amp or speaker connector, and screw things down so tight that one has a gas-tight, can't-corrode connection. As I often say, one can't make a good compromise if one doesn't have a sense of what is the impossible ideal.

Now that AudioQuest custom fabricates its own spade and banana connectors, both of which use extreme purity Purple or Red copper and are plated in the same advantageous "hanging" manner, I use whichever connector the component requires. When there's a choice of spade or banana, I'll probably use spade lugs the first time, until I switch something in the system and just don't want to wrestle with spades again. AQ's bananas and spades are essentially equal, but sometimes one or the other can have the advantage depending on the component's connectors.

In applications not using AQ cables, I would strongly advise against using banana plugs if you don't have to, because most banana plugs use inferior metal, have multiple contacts within the plug itself, and gold-over-nickel plating—sin upon sin upon sin.

Do you recommend bi-wiring for loudspeakers? Why or why not?
Out in the real world many ask, "Is it really worth spending twice as much to bi-wire my speakers?" I never answer the question as posed; instead, I reply that I never want to tell someone how much money to spend, but I do have strong opinions about getting the most for one's money. From this perspective, I can strongly state that bi-wiring is a way to get better sound for the same or less money.

The current passing through a cable modulates the electrical characteristics of the cable (or conductor). Bi-wiring allows most of the current and associated larger magnetic fields, to be removed from the cable feeding the treble. My favourite analogy is that it's like taking the waves out of the water while you're trying to swim.

There is one point of caution. The rule is: Do not use different cables for bass and treble, because any difference in the inductance or capacitance between the two cables will essentially be an unproductive 'redesign' of the speaker's crossover. The exception is that if two cables are identical in design, but use different grades of metal, one can make a very cost-effective combination by using a lesser metal cable on the bass of a three-way speaker (where the cable carries only bass), while using a higher quality metal on the more sensitive treble. However, if the speaker is a two-way with the crossover above the midrange, the cables really must be identical.

Then again, AudioQuest Rocket, Flat Rock, and Tree-series speaker cables offer no-compromise designs specifically for full-range use, though they also can be re-terminated for bi-wire applications.

What is the reasoning behind cable lifters or risers? Do you recommend using them?
Again, it's complicated. Cable lifters or risers can make a difference, but the reasons for their effectiveness, or not, are system and context dependent.

One variable is whether there is a need to break up vibration nodes, within a cable, or in-between pieces of equipment. Another pertinent factor is noise-induced distortion, such as radio frequency noise and electromagnetic noise. Both have an appreciable effect on system performance. The act of simply moving the cable, raising it above floor level, or decoupling it from the dielectric of a carpet, can yield a small measurable difference in RF noise pickup.

With that said, our observation is that cable lifters can have unpredictable effects on cables—helping the performance of some but hindering the performance of others. For this reason, AQ doesn't make or sell cable lifter accessories. I value predictability too much for that, most especially in something I need to have the guts to recommend to others.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
I prefer to use components that do the best job of delivering unmolested music. In the current AudioQuest working system, that happens to be all balanced electronics. In my home systems, I'm using Octave's amazing integrated amplifiers, which are single ended, but I'm using a source component that is balanced, because I love it whether used single-ended or balanced.

GUIDE TO CABLES: MASTER DESIGNERS: BILL LOW HI-FI+

I respect that an electronics designer must have a clear vision as to their being able to make better music by spending the money on less single-ended circuitry, or on more balanced circuitry—but as a consumer, I'll take rats running around on a wheel if that's what does the least damage and gives me the best music.

Has the vinyl revival meant developing new tonearm cables for the modern world?
AudioQuest has been in the analog business from Day One. In the mid-80s, phono cartridges were more than half of AudioQuest's business and the high-output moving-coil AQ 404 phono cartridge was the DragonFly of its day, single-handedly changing the market's perception of what a high-output moving coil could be. Today, AQ offers five models of dedicated tonearm cables—flexible cables that don't compromise even a light-floating suspension, fitted with JIS tonearm connectors This is not, however, because analog is making a comeback; it's because that's who we have always been.

The evolution of turntable and tonearm design away from JIS connectors underneath the tonearm also hasn't provoked any new designs, because AudioQuest's seven models of 2-channel Bridges & Falls cables exactly fit the bill. Only now we are supplementing those cables with two levels of GroundGoody cable, cable designed to optimize a ground connection in order to reduce noise and direct it away from the turntable.

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?
Perfectly timed question, thank you. The seven models of Bridges & Falls cables I just referred to are available with a choice of 3.5mm miniplug, two RCA plugs, a DIN plug (as necessary for Naim) on either or both ends. So yes, we very definitely offer cables for optimizing the performance of portable devices.

I've been much too slow to offer after-market headphone cables, in part because the Bridges & Falls models are the best-sounding headphone cables, though only for headphones with a single 3.5mm input. Those cables are an intimidating and to a degree impossible reference—however, as with the AudioQuest NightHawk headphones, most better headphones have separate inputs for each "can," and so we supply an appropriate superior dedicated cable with NightHawk, and will have even better aftermarket versions for NightHawk and other headphones in 2016. There will also be more flexible models specifically for headphones with a single 3.5mm input.

The ingredients for good headphone cable design are, not surprisingly, the same as for other analog cables. However, the ergonomics and need to be able to withstand being repeatedly bent and abused is a very real challenge.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?
(The answer is) easy, at least in theory. Practice can be more complicated. Every component, every cable, is its own problem and should be chosen to interfere with the music as little as possible.

In the analog domain, voicing is a very real and fundamental phenomenon and I would recommend choosing cables based on their lack of voice, instead of choosing for a particular voice. This way one won't be tempted by the extremely counter-productive inclination to voice the system by choosing a colored cable. One never wants a colored cable, for whatever the tonal color, it's just more damage. A cable should be evaluated for its lack of character. Neutral is neutral.

This means that one might want to use all analog cables from a single brand, although it is important to bear in mind not all manufacturers are equally good at designing cables carrying power, such as speaker cables, and cables carrying low-level signals. For this reason, one might choose low-level interconnects and speaker cables, or AC cables, from different suppliers.

Digital is another bag of worms, though very closely related to designing cables for analog video, which I of course did for many years. In digital, pretty much all tides rise or fall, and I am often irritated by commentary about digital cables that reads as though different speakers are under evaluation.

In digital cables, noise problems, or return-loss, or skew, or other distortion mechanisms, all affect a mono stream of data, of ones and zeros so to speak, as information conveyed by an analog carrier from one piece of hardware to another. Particulars of these distortion mechanisms can affect the sound in different ways, giving some credence to the notion of digital cables having a voice, but most of that voice is a secondary effect—not so much an absolute truth about the cable.

While there are pronounced differences between digital cables, the hierarchy is usually pretty straightforward, and so a single brand is that much more likely to be good, or not, at designing digital cables. And because there may not be a sonic correlation between a company's analog and digital cables, they should be evaluated separately.

If you are at liberty to say, what new cable development projects will you tackle next?
Well, I mentioned the combination challenge of audio performance, ergonomics, and durability with headphones cables. That's a current project. +

GUIDE TO CABLES: MASTER DESIGNERS: BILL LOW HI-FI+

hi-fi+

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John McDonald of Audience

***Hi-Fi+*: When, how, and why did you start making audio cables?**

JM: Audience started making audio cables in 1997 because we felt that we had something of real "audio" value to offer end users. And, of course, an audio company needs products to sell in order to exist.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

Perhaps geometry; however, each aspect is very significant.

How have your cable designs evolved over the years?

Audience continually looks for means to increase conductivity and lower dielectric absorption, impedance, and eddy current resistance. Audience cables have evolved in all of these areas.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?

Arguments can be made in favor of prioritizing each of these three cable types. Ultimately though, if pressed, I would place speaker cables as the most important; however, only by a small margin.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?

At this time, I do not feel qualified to definitively answer this question.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?

Digital signal is ones and zeros, a lot of them! However, those who argue against the use of specialized digital cables overlook one exceedingly important factor which is the "timely conveyance" of all of those ones and zeros. In some digital components the lack of timely conveyance of digital signal is referred to as jitter. The electric current in all cables, by which digital information is conveyed, is impacted by conductivity, dielectric absorption, impedance, eddy current resistance and correspondingly the integrity of the timely conveyance of the massive amount of digital information is also altered. At the end of the day, I use the most sophisticated and precise test instrumentation in the world, the human hearing system. And, by that standard alone it is clear that different digital cables have a big impact on the sound.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?

Absolutely not.

GUIDE TO CABLES: MASTER DESIGNERS: JOHN McDONALD HI-FI+

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?
I prefer banana plugs for convenience. However, the metallurgy and design of an individual termination is the most important to consider.

Do you recommend bi-wiring for loudspeakers? Why or why not?
Most often Audience recommends using a single wire with an equal quality jumper. We say "equal quality jumper" because the character of the jumper is conveyed back into the full spectrum. We find that simplicity is usually better than sending the speaker signal through multiple cables. Over the years we have let our customers compare single wire with an equal quality jumper to bi-wire and they have usually agreed with our philosophy. Interestingly, however, customers tend to prefer bi-wire cables with a few consistent brands of loudspeakers.

What is the reasoning behind cable lifters or risers? Do you recommend using them?
Yes, we recommend cable lifters to remove cables from potential close proximity environmental affects.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
Whereas balanced cables were developed for long runs of cables in the pro-audio market, a balanced circuit is typically doubled and therefore the signal passed through much more circuitry, with all that implies. Having said this, there are benefits to using balanced cables when both sending and receiving components are true balanced components.

Has the vinyl revival meant developing new tonearm cables for the modern world?
Yes, absolutely. Audience uniquely offers different impedance cables (tone arm to phono stage) to optimally match to the impedance of various cartridges to maintain the greatest integrity of the micro voltage signal of phono cartridges.

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?
I would not limit personal audio to headphones. Audience makes two small world class "personal reference monitor" loudspeaker systems. Audience offers extremely high quality/low price cables for such applications that represent extremely high value cable offerings. This cable line is our OHNO line named after Dr. Ohno who invented the method of making mono-crystal wires. Audience also plans to offer headphone cables in the not too distant future.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?
Audience tends to take the non-tone control approach. As such, Audience cables work best as a brand loom and are compatible with a wide range of components. However, with cables that add any noticeable amount of tonal character, mixing brands might be more optimal.

If you are at liberty to say, what new cable development projects will you tackle next?
I am at liberty; however, I chose not to disclose unannounced technologies that we might be considering. +

GUIDE TO CABLES: MASTER DESIGNERS: JOHN McDONALD HI-FI+

Touraj Moghaddam of Vertere Acoustics

_Hi-Fi+_: When, how, and why did you start making audio cables?

TM: It was almost eight years ago when I became convinced that connecting cables were by far the weakest link in every system that I had come across—from super high end all the way down to entry level. So this journey began then and it took over a year for me to identify the discrepancies and come up with the solutions. Once I had understood what was required and the challenges, I first designed the internal conductors that Vertere subsequently commissioned to be made. Upon arrival of these internal conductors, I began the process of constructing and building the first pair of interconnects which then became known as the original Hand-built Pulse interconnect cable.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

First and foremost is the understanding of the nature of what we are trying to conduct faithfully—an electromagnetic wave. Once we realize this, then it becomes even clearer that conductive materials used, any plating, physical parameters, insulating materials, manufacturing techniques, and geometrical construction are all imperative to the design of the cable. Otherwise there is no way to guarantee the desired results.

How have your cable designs evolved over the years?

All our cables are derivatives of the original Hand-built Pulse cable. Their evolution mainly has been through improvements in the bespoke connectors and materials used, and also improvements in manufacturing techniques that have helped get the cables closer to being blueprinted.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?

Vertere was born from recognizing and sorting out the most important component in the system—its weakest link. And that is just as true now as it was then. Systems are invariably different to each other and set in different environments. In one system it may be the speaker cables that need sorting out first. In another it could be the tonearm cable. So the 'best' long-term improvement comes by identifying which one of those cables is constraining the performance of the system most. Starting there and moving on to the next weakest link and so on will ensure every improvement to the system is most noticeable and generally permanent. No chasing tails and no getting lost in a maze.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?

GUIDE TO CABLES: MASTER DESIGNERS: TOURAJ MOGHADDAM HI-FI+

This is more a function of how correctly the outputs of the source and the inputs the DAC are designed and made. Given the best designs then I'd recommend I^2S or AES/EBU Balanced digital (which is not mentioned in the list).

However, we have managed to get amazing results in numerous cases with our USB, Ethernet, and coaxial S/PDIF cables. It is important to remember though that USB and coaxial S/PDIF are not suitable for long cable lengths.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?

The digital signals that are used in our audio equipment are not dissimilar to an analogue signal, only that they are constant amplitude but still constitute numerous frequencies. Exact representation of these frequencies in relation to triggering and lack of unwanted interferences influences the end result—the music that we hear. It is really the DAC that interprets the signal as 'zeros & ones'. The signal itself is just made up of waves, albeit square waves.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?

Some of our highest-level cables do have in-line 'boxes', but these are designed for 'Shield Management' and not signal. There are some products where the grounding and shielding of their inputs and outputs require or prefer different configurations. On our in-line 'boxes' we provide three options that can be used to optimize the grounding and shielding interfaces.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?

Our reference connectors, banana or spade, are both bespoke designed and manufactured by us to ensure having the optimum contact material, low impedance, with long-term consistent contact. Generally though, we recommend banana connectors as our design can provide an airtight contact with ultra-low impedance and consistent contact over a very long period of time. This will avoid any degradation over time and keeps the terminal/cable interface as close to one piece as possible.

Do you recommend bi-wiring for loudspeakers? Why or why not?

Bi-wiring can be beneficial when the power amplifier output isn't sensitive to cable impedance characteristics and when the speaker crossover design is such that the tweeter circuit is independent of the woofer circuit. Here the tweeter circuit will have minimum interference from the woofer' back EMF as the two circuits 'meet' the amplifier's speaker output—the lowest impedance point with maximum damping factor.

If, however, the amplifier's behaviour is compromised due to the increased capacitance and reduced inductance (when bi-wiring, capacitance is doubled

GUIDE TO CABLES: MASTER DESIGNERS: TOURAJ MOGHADDAM HI-FI+

and inductance can be halved) then it's recommended not to bi-wire.

Another consideration could be financial; foregoing bi-wiring could mean affording a better speaker cable!

What is the reasoning behind cable lifters or risers? Do you recommend using them?
Any part of the system can suffer from microphonic interference and cables are no exception. The question is to what extent this affects the performance of a particular system. One has to weigh the benefits against purchasing a better interconnect, for instance. But if you are going all out, then sure, why not; every little bit can help.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
As previously mentioned, there are good balanced designs and bad balanced designs. And the same applies to single ended designs, by the way.

Given the best, I'd go for balanced inputs and outputs. It is, however, important here to emphasise that balanced is merely the same single ended output that is out of phase by 180 degrees, which is added to the original signal, effectively doubling the output. This balanced signal conducted through a balanced cable, when received at the input then halved in level where the noise picked up along the cable is reduced and it benefits from common mode rejection. I thought it important that I say this as sometimes it is incorrectly assumed that there is some inherent benefit in balancing the signal.

Has the vinyl revival meant developing new tonearm cables for the modern world?
I'm not quite sure what is meant by 'Modern World' (?). Vinyl replay and record players have always been at the heart of what I do and will remain so as long as possible. As such, we ensure the best tonearm cables are offered at all levels.

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?
I believe we were the first, when over three years ago Vertere clearly demonstrated how much more performance could be achieved from such portable devices. If my memory serves me right it was *Hi-Fi+* that said 'D-Fi is not so much a cable as it is a generation gateway'.

Our D-Fi range of cables includes analogue interconnects, headphone cables, speaker cable, plus USB and AES/EBU digital cables. D-Fi has already brought high end to many personal audio/on-the-go devices as well as home hi-fi and AV equipment. The challenge was to ensure flexibility of application and performance to cost ratio, both of which I can confidently say we have maximised.

And, looking ahead, watch this space!

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?
For us, setting commercial considerations aside, we connect all our systems with our Pulse-HB range of cables—from mains power to loudspeaker. The makes for no compromises, as at any level the systems work at their optimum with the HB-series cables.

For others, I'd still stick to my motto that the most important component is the weakest link, and as such every link must be checked and the weakest one corrected first. Then move on to the next and the next and so on. Once the process is over, then you'll find out whether you've ended up with one brand or several.

If you are at liberty to say, what new cable development projects will you tackle next?
Actually we've just finished the HB range with the addition of the HB speaker cable and our portfolio is pretty much complete. We have, however, on going R&D work throughout the range, applying the weakest link principle. As soon as we have identified an area or a product that requires investigation we address that first—maybe something new for our younger generation next! +

GUIDE TO CABLES: MASTER DESIGNERS: TOURAJ MOGHADDAM HI-FI+

Graham Nalty of Black Rhodium

***Hi-Fi+*: When, how, and why did you start making audio cables?**

GN: I started designing cables about 1990 because I wished to make sure that the audio amplifiers that I was making then would be demonstrated to show their best sound. I already used a screened silver plated cable for internal wiring in amplifiers. I attached RCA plugs at each end and sold the cable as a stereo interconnect that later won the Hi-Fi Choice 'Best Buy' award in a group test of 10 cables.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

Every part of the design of a cable is highly important. We have found that almost all distortion in cables is due to the natural behaviour of the fundamental laws of physics. We apply engineering solutions that will reduce each type of distortion systematically. Different types of construction or geometry are simply the result of engineering new solutions that reduce specific types of distortion. We use materials science to reduce the effects of distortion in the conductors.

How have your cable designs evolved over the years?

When I first started designing cables, I found that changing the quality of the conductor wire always made the most cost-effective improvement in sound quality. Over the years, I have learnt by experiment and study how the reduction of other forms of cable distortion further improves sound quality and enhances our listening experience.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?

There is no simple answer. All cables are part of the music system and all need to be designed for the highest sound quality. The short answer might be the cable that has been engineered to remove the most different types of distortion.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?

I do not advise on choice of digital interface(s) as our purpose is to provide the best connection between whatever interfaces are provided in our customers' music equipment.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?

We are confident that we can demonstrate the positive differences that come through using our digital cables in music systems, making for a far more enjoyable listening experience.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?

Not at the present time, though we would if we were persuaded that we could improve sound quality.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?

We generally use banana plugs, as these connectors are more prevalent in the UK. We are always happy to offer other connectors that the customer requests, By the time the customer orders from us, via our dealer or distributor, the choice between spades and bananas has already been made.

Do you recommend bi-wiring for loudspeakers? Why or why not?

If asked, we would advise a customer to bi-wire their speakers, but the demand for bi-wiring is not now as strong as it has been

GUIDE TO CABLES: MASTER DESIGNERS: GRAHAM NALTY HI-FI+

in the past. On a like-for-like basis, bi-wiring gives a slightly clearer sound for which the slightly higher cost of a bi-wire is more than justified.

What is the reasoning behind cable lifters or risers? Do you recommend using them?
I suppose you mean the items that lift a cable off the floor. They remove some of the vibration that the cable might pick up from the floor. I prefer to design a cable to damp its vibrations, but if it improves sound quality, then why not. This may be an area I will examine in the future.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
Again, we find that the customer and dealer have already made that decision before they order and we are happy to offer both. We do have some cable designs that are only suitable for RCA connectors.

Has the vinyl revival meant developing new tonearm cables for the modern world?
We have recently launched a mid-price tone arm cable with DIN connectors. This has received superb reviews from two publications. Its special feature is a very low capacitance and that makes it very suitable for magnetic cartridges. But our development work on lightweight flexible cable for use with 3.5mm connectors tells us that we can take the performance quite a long way further.

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?
We are looking for opportunities for headphone cables at the very top end of the market and we have gone as far as making a prototype for one very serious high-end earphone.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?
Single-brand cable looms are a good marketing ploy by manufacturers and make life easier for some customers who are not equipment buffs, but the ultimate aim is to enjoy music. It is better to choose a good cable regardless of its source of supply.

If you are at liberty to say, what new cable development projects will you tackle next?
During 2016 we plan to introduce some of the technology of our new high-end (above £500.00) cables into the lower end models. We have done a few tests and the results are extremely exciting. +

GUIDE TO CABLES: MASTER DESIGNERS: GRAHAM NALTY HI-FI+

Joe Reynolds of Nordost

***Hi-Fi+*: When, how, and why did you start making audio cables?**

JR: Nordost started manufacturing the original Flatline Speaker Cable in 1992 in Massachusetts. We decided to develop a very durable, flat FEP cable, which derived from a design originally made for the aerospace industry, and specifically tailor it for a hi-fi audio application. Originally, our unique design was simply meant to solve common installation problems. The flat and thin nature of our cable made it perfect for under carpet and in-wall installation. However, after research and testing, we discovered that our precision FEP manufacturing process drastically lowers the capacitance of our cables (five times lower than most of the popular brands on the market). Our dealers and distributors were quick to appreciate the sonic benefits of Nordost cables.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

Nordost cables stress the importance of both mechanical construction and wiring geometry. Over the years we have developed several proprietary technologies, such as Micro Mono-Filament. The use of Micro Mono-Filament creates a separation between the insulation and conductor so that 80% of the conductor is suspended in air (85% when using Dual Mono-Filament). This unique geometry gives our cables far greater bandwidth and speed. This, along with precise manufacturing techniques, which can be seen just by looking at our power cords and speaker cables, are the key to great cable performance.

How have your cable designs evolved over the years?

Over the years we have evolved our designs to improve upon the mechanical and electrical performance of our cables. We started out with extruded FEP, which has progressed to Micro Mono-Filament and even Dual Mono-Filament designs. Also, as time went on, we started to pay a lot of attention to the resonance of the materials we use, by incorporating mechanically tuned lengths. You can see the results of our efforts across our range of cables, but especially in our reference series, where we have taken our design philosophy even further, extending it to our own, proprietary HOLO:PLUG® connectors.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?

At Nordost we have always maintained that the most important cable in your system is the power cord, or more specifically, the power cord that feeds your distribution device. Ensuring that your sound system is receiving "clean" AC, with the least

amount of electromagnetic interference and radio frequencies as possible, is the key to great sound. Acuity, a research facility in the UK, has done extensive research for us, measuring the performance improvements in amplifiers and CD players while using Nordost power cords and QRT products. These are the improvements that we constantly demonstrate at shows and dealer events around the world. After power, I would place the most importance on interconnects, followed by loudspeaker cables.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?

For best results with digital audio, I would recommend a traditional S/PDIF connection since this cable can be controlled most precisely in terms of impedance. Nordost is able to control the impedance of our digital cables to a very tight tolerance of plus or minus 1%.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?

As the only specialized manufacturer of HMDI and 4K UHD cables in North America, Nordost has put a lot of R&D into digital transmission. We have found that when digital cables are being used, it isn't numerical 1s and 0s, but analog square waves that represent 1s and 0s that are actually being transferred. The "less square" a wave is, the harder it is for a DAC to make a distinction between the so-called 1s and 0s, which results in timing errors. In order to achieve sharp analog square waves, the cable must have a large bandwidth and be capable of high transmission speeds. Therefore, quality cable design makes a tremendous audible impact in digital cables.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?

No, we do not use in-line boxes in any of our cables. Nordost does not believe in putting network filters, which act as tone controls on the music, in-line with audio signals. The frequency range of human hearing is 20 to 20,000 Hz. However, we are still aware of frequencies that extend from either end of that spectrum. Filtering-out these peripheral signals impacts the tonal balance that you are meant to experience from the music that you are listening to. When you filter something, you tend to filter out a lot of "the good" along with "the bad". Nordost aspires to deliver the music in its pure, intended form, rather than imparting our own signature onto the sound.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?

In our Leif and Norse 2 series we advise our customers to use Nordost's gold-plated, Z-plug banana when possible. The design of this connector not only achieves a full 360° of contact when it's inserted into a binding post, but the mass of the connector itself matches the mass of the conductors of the cable. However, for our Valhalla 2 and Odin 2 ranges, we have developed a new, proprietary HOLO:PLUG® spade connector, which has mechanical properties that enhance the performance of our reference speaker cables.

Do you recommend bi-wiring for loudspeakers? Why or why not?

For many years, bi-wired speakers were very fashionable and, in turn, we sold a lot of bi-wire loudspeaker cables. In fact, the flat ribbon design of our speaker cables lead very well to the construction of bi-wire cables. However, we stopped making bi-wire loudspeaker cables when we discovered that bi-wired cable tends to introduce frequency phase shifts to the signal. Today, Nordost has a better solution. We recommend connecting one set of speaker cables to the binding posts of the loudspeaker, and replacing the standard metal connecting strip with our

GUIDE TO CABLES: MASTER DESIGNERS: JOE REYNOLDS HI-FI+

Norse or Reference Bi-Wire Jumpers. These mechanically tuned jumpers produce great results for bi-wired loudspeakers.

What is the reasoning behind cable lifters or risers? Do you recommend using them?

The reason for using cable lifters is to lower the capacitance of the cable by suspending it away from the floor. Using lifters can also reduce microphonic effects that may be induced onto the cables. We are currently developing a new product called the Sort Lift, which will present a unique solution to address this problem.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?

This is not an either/or choice. Technically, properly balanced interconnects will always have a lower noise floor than single-ended interconnects. In the real world however, this is not always the case, since certain products don't use truly balanced circuitry. We use both types of systems in our sound rooms and with good care in setup we can get fantastic sound from either type of system.

Has the vinyl revival meant developing new tonearm cables for the modern world?

Yes, the vinyl revival has dramatically increased our tonearm cable business. Nordost technologies, including our proprietary Micro Mono-Filament design, produce fantastic results with delicate cartridge signals. We have developed special low-mass 5pin Din terminations for both MoonGlo® (used in our Leif and Norse 2 series) and HOLO:PLUG® (used in our Reference and Supreme Reference Series) connectors. We also supply Micro Mono-Filament internal tonearm cables, which are currently being used by manufacturers of high quality tonearms such as VPI. The amount of musical detail that this upgrade reveals is amazing.

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?

The Heimdall 2 Headphone Cable is the first designated personal audio cable that Nordost has offered. It is available in a wide variety of terminations to accommodate the most popular brands of headphones. When we began with this project, it was a challenge to produce a cable that was not only technologically advanced, but was extremely delicate, as well as durable. There was also the hurdle of making our design compatible with the myriad of connectors that are being used in the personal audio market. Now that we have perfected our first headphone cable, we will be able to add to our line. In fact, we introduced a Blue Heaven Headphone Cable at CES in January 2016.

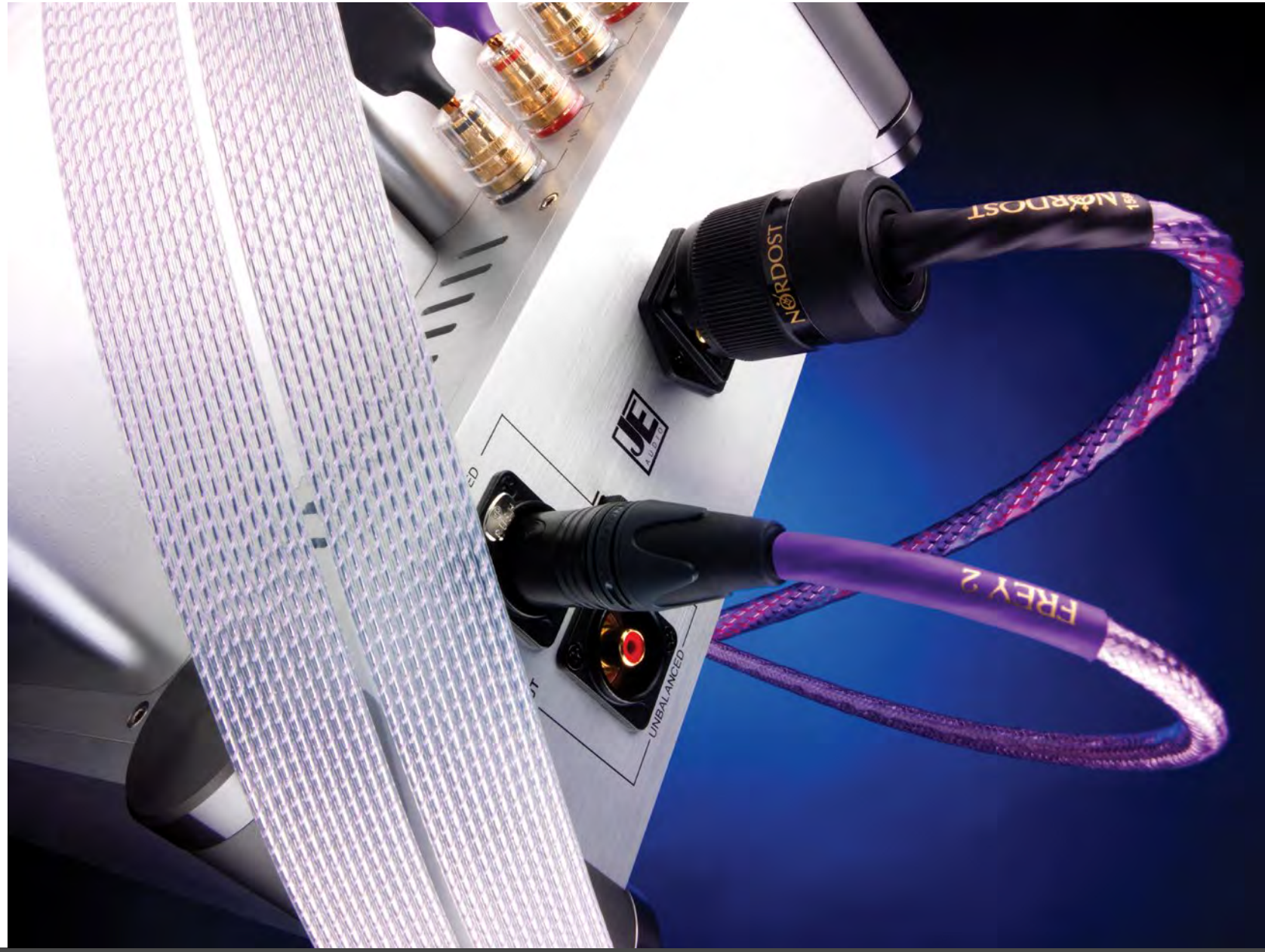
GUIDE TO CABLES: MASTER DESIGNERS: JOE REYNOLDS HI-FI+

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?

I think we were the first company to espouse the philosophy of a single brand cable loom. It makes perfect sense to have all of the cables throughout a system employing the same design philosophy and working in the same way. If, for example, you place a high-end interconnect cable between a CD player and an amplifier, then use a generic cable further down the listening chain, you will not be able to hear the full potential of the system. A full loom of one cable brand makes sense; a full loom of Nordost cables makes even more sense.

If you are at liberty to say, what new cable development projects will you tackle next?

We have a number of new cables in development for this coming year, including: two high performance Ethernet cables in our Leif and Norse 2 series, digital cables (both S/PDIF and AES/EBU) in our Tyr 2 range, and the Blue Heaven Headphone Cable. +



GUIDE TO CABLES: MASTER DESIGNERS: JOE REYNOLDS HI-FI+

David Salz of Wireworld

***Hi-Fi+*: When, how, and why did you start making audio cables?**

DS: I first realized that I would become a cable designer in 1980, right after I performed my first cable test. I had become frustrated in my search for an interconnect cable to connect my preamp and amp. All of the cables I tried clearly changed the sound, but none of them seemed to let all of it through. I knew that I wanted a cable that would let me hear everything and that simply comparing cables could not tell me what they were losing, so I decided to try a scientific test. I made a short adapter that allowed me to dock the components together directly. Everything sounded and felt much more like music through the reference. As soon as I began comparing cables to direct connections, I realized that I had found the way I could learn how to perfect cables.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

The first thing I learned in testing cables is that conductor geometry issues create most of the coloration and loss we hear in cables. The reason for that is logical. The conductor geometry controls the electromagnetic field, which is what actually moves the signal through the cable by vibrating the electrons in the conductors. To preserve more music, the conductor geometry must make that process more efficient.

How have your cable designs evolved over the years?

For many years, my designs were mostly refinements of the dual concentric conductor geometry that was originally invented in the 1930's and adopted by Mogami in the 1970's. After generations of successful cables based on that concept, I realized that it did not allow me to optimize all of the electromagnetic effects. Therefore, I formulated and patented a new concept based purely on those requirements. The new structures, which we call DNA Helix, utilize layered conductors to channel electromagnetic energy more efficiently than others.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?

Understanding the impact of the weak links in a system is always a challenge and often unpredictable until the appropriate tests are made. That being said, I usually focus on making the first improvements upstream, meaning interconnects and power cords.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?

I^2S is technically superior because it includes a separate clock signal that reduces jitter, but

the quality of cable can have a greater sonic impact than the choice of formats.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?
I explain that those ones and zeros pass through cables as streamed waveforms with jitter that creates measurable data errors that change the sound we hear. I also offer to send them white papers published by test instrument manufacturers on that very issue.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?
No.

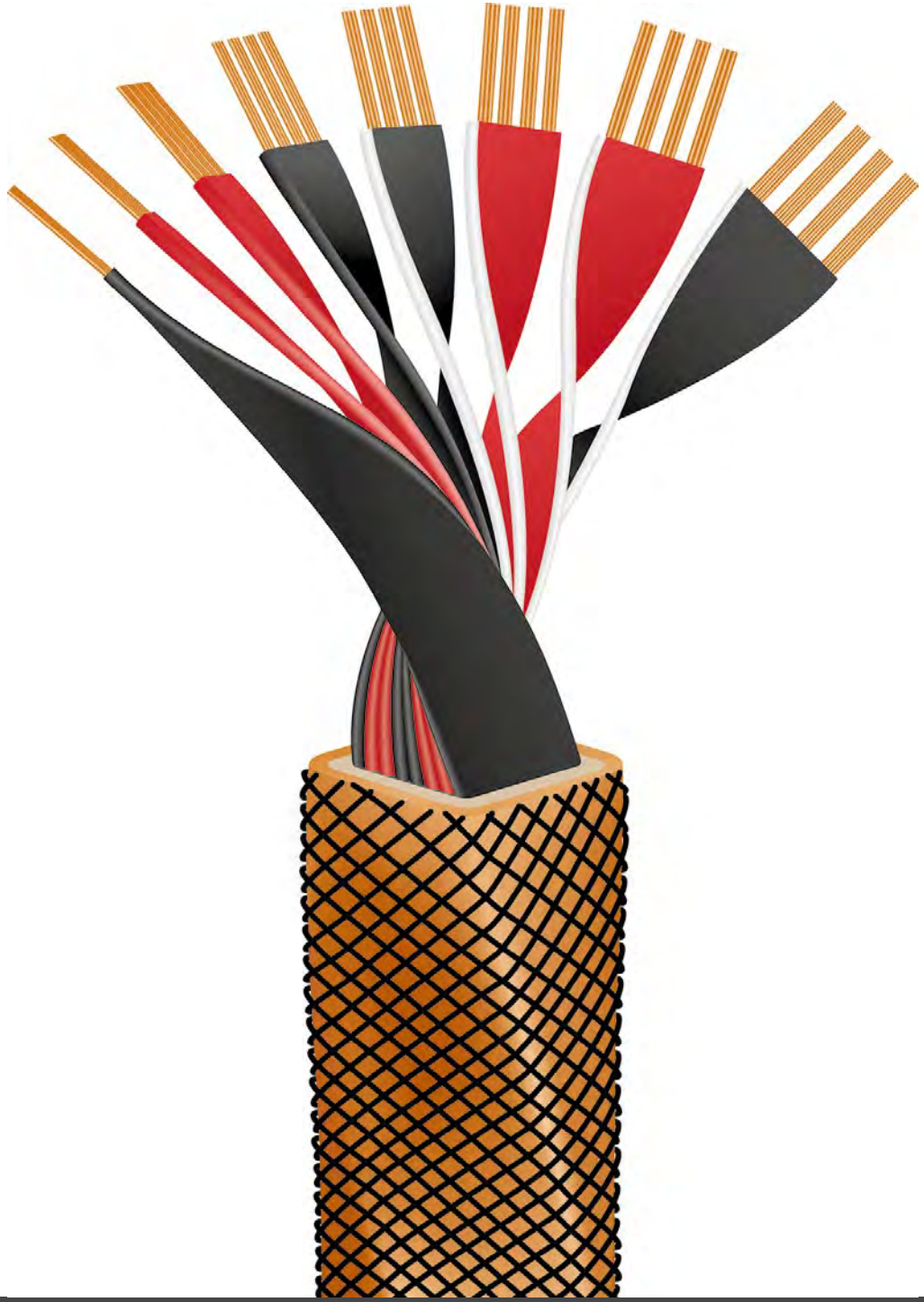
For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?
Both spade lugs and banana plugs can make great connections if they are made of the most conductive metals. Silver contacts are dramatically more conductive and sonically transparent than any other metal, even when they are only on one side of the connection. Therefore, other metals should only be used where silver would be too expensive.

Do you recommend bi-wiring for loudspeakers? Why or why not?
Yes, because I respect the speaker designer's choice of including bi-wiring as an option if they believe it is helpful. On the other hand, hi-fi is often unpredictable, so I still recommend experimentation.

What is the reasoning behind cable lifters or risers? Do you recommend using them?
It's interesting that the sound of some speaker cables can change when they're lifted off the floor. What those changes mean, is that the cable is generating noise. Many cables are shielded from electromagnetic noise, but few are designed to avoid noise created by static charges within the cable. This is called triboelectric noise and it's the reason that guitar cables create sound through the amplifier when they're touched. It also turns out that the various colorations we hear from cable insulation materials are caused by differences in the noise they add to the music. My quest to eliminate that noise led to the development of our Composilex 2 insulation materials, which are much quieter than the Teflon we used in the past. If the cable is truly quiet, risers will make no difference.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
I prefer balanced connections because they can provide the lowest noise, but the advantages vary with the applications and some of my favourite components are single-ended.

Has the vinyl revival meant developing new tonearm cables for the modern world?
Yes, I've developed a whole new series of cables for tonearm and microphone applications.



Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?

We've recently introduced our Nano series cables for headphones and personal audio applications. Our first challenge was to create the best test for developing the design. The solution to that issue is the test we call 'The Headphone Cable Polygraph,' which uses an adapter to create a reference by connecting a music player directly to headphones. Now that the Nano design is optimized for musical preservation, we are dealing with the great challenge of supplying cables with the many types of the connectors used on headphones.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?

Mixing brands is often problematic, because many companies produce interconnects and speaker cables with complimentary colorations that only sound reasonably neutral when used together. Of course, the highest fidelity can only be achieved when all of the cables are neutral, because all cable colorations are caused by losses.

If you are at liberty to say, what new cable development projects will you tackle next?

I'm in the midst of developing a radical new design for CAT7+ Ethernet cables and a minimalist DNA Helix cable for internal speaker wiring and DIY applications. +

Joe Skubinski of JPS Labs

***Hi-Fi+*: When, how, and why did you start making audio cables?**

JS: JPS Labs began in 1990 with a product called The Golden Flute, an active bass alignment (boost) filter custom tuned for various models of loudspeakers: B&W, KEF, Thiel, and others. The Flutes required a pair of interconnects to place into the line level section of the audio chain. The cost of good interconnect became a hindrance to sales of Flutes so I needed to come up with an interconnect that could be sold at a reasonable cost as a compliment to the Flutes that would be as neutral an additions as possible to any high-end system.

Mechanical construction, wiring geometry, or materials science – which considerations are more important in your cable designs, and why?

It all matters… When it comes to designing the best possible cable for audio, every facet of performance must be scrutinized and optimized for its intended use. In my opinion this process starts with the conductor and works its way out from there.

If the conductor has audible flaws you must add more flaws into the design to compensate.

How have your cable designs evolved over the years?

I would say it takes a good 10 years for any audio designer to come into their own. As some point a direction is found, and it's a matter of time and money to the designs into their own. I've been fortunate to not have to recreate products every year or every few years. Our well thought-out designs tend to have a long product life cycle. A few of our products have been around 'since the beginning of time'.

Our Alumiloy conductor has been refined over the years to its present clarity and needs no further material refinement. We have, however, gone toward greater flexibility/ease of use, which requires design adaptations on a number of fronts to do so while also maintaining their sonic refinement.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?

Each cable is a small part of the whole system; they're all important if your goal is to hear the source for what it is. There are, however, shortcuts that can be taken to speed the decision making process during the system's evolution. I would first concentrate on interconnects from source to amp, get those right for a clean, clear signal to the amp, and then by all means dabble

GUIDE TO CABLES: MASTER DESIGNERS: JOE SKUBINSKI HI-FI+

heavily with the rest, including very good AC cables on the amp and source.

For best results with digital audio, would you recommend USB, I²S, Ethernet, or traditional coaxial S/PDIF connections? Why?
USB has taken over as the preferred method to convey digital audio to an external DAC, and for good reason. It works extremely well at any recorded resolution, given a well designed USB cable and DAC.

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?
They're correct in that the ones and zeros in the data remain ones and zeros through the connecting cable. Where it all goes to hell is when it's converted to analog at the other end, and that is where the connecting cable and equipment interactions wreak havoc with the clarity of the sound.

A digital source outputs data, and noise. The quality of the cable determines both the integrity of the data and how noise travels. Today's digital gear should be looked upon as an RF system and while designed to play through faults, the quality of the analog output, particularly the very low-level signal portions that brings about a sense of space and other life-like qualities, is highly dependent on the care taken in the transport of the digital signal. Resolution is not black and white, but rather shades of grey.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?
In my opinion, if the cable is designed properly there is no need for additional passive components. However, our Digital AC-X cord is specifically designed to isolate noise with both absorptive dielectrics and passive components moulded into the plug ends… no box though.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?
I prefer to see the customer use the best termination for his or her application rather than worry about slight sonic trade-offs one way or another. All of the connectors we use are of excellent quality, so no worries either way.

Do you recommend bi-wiring for loudspeakers? Why or why not?
To bi-wire or not to bi-wire is a very tricky question to answer properly, which is why the effects of bi-wiring tend to be controversial. In order to narrow down the answer one needs to know the loudspeaker design, the speaker cable design and length, and the amplifier design, and to understand how they interact.

The simplest and usually the best approach is to use a single, large, high quality speaker cables and call it day. If the loudspeaker has two sets of terminals for bi-wiring you must pay attention to the jumpers in use

GUIDE TO CABLES: MASTER DESIGNERS: JOE SKUBINSKI HI-FI+

connecting them together. I believe we were one of the first companies to sell aftermarket bi-wire jumpers.

What is the reasoning behind cable lifters or risers? Do you recommend using them?
I'd like to think our cables could stand on their own.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
Within the components, preamp, amp, etc., single-ended design is far easier to implement properly. Given this I tend to favour RCA interconnect unless both components being connected were designed specifically for full balanced operation throughout. You'll tend to know when this is the case as the cost typically exceeds $10K per device in high performance audio circles.

Has the vinyl revival meant developing new tonearm cables for the modern world?
I guess so... We finally have a small, flexible DIN phono cable.

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?
We did one better. We not only designed a cable for headphones, but also developed a unique planar magnetic headphone itself along with building a new manufacturing division named Abyss Headphones. The headphones are far more challenging.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?
There's something to be said about consistency to sound. The best sounding systems tend to favour the same brand of electronics, and the same brand of cables throughout. This is, however, conditional on the brand.

Fine-tuning to taste with a particular AC cord on the source is also cool—something we do in show settings where there are variables outside of our control. Having nine different AC cords at our disposal makes this easy.

If you are at liberty to say, what new cable development projects will you tackle next?
We are working on very thin, flexible cabling for upcoming headphone models. +

Edwin and Gabi Rijnveld of Siltech and Crystal Cable

When, how, and why did you start making audio cables?

ER: In 1983 two university graduates with an audiophile interest started a company. After some experimenting they quickly found different sounds originating from different construction and materials. Silver became their favourite. The brand name Siltech was born soon—an abbreviation for Silver Technology.

I joined Siltech as an electronic engineer in 1992 and became its CEO later.

GR: We started Crystal Cable in 2004, after discovering new technologies for high performance silver/gold cables in an extremely slim, lifestyle design.

My musical background found a welcome continuation getting into high end audio, with a clear mission for bringing live music and high end audio together through high-tech, beautifully designed equipment.

Mechanical construction, wiring geometry, or materials science—which considerations are more important in your cable designs, and why?

All aspects are important, with the conductor quality and metallurgy playing a major role. High-tech insulators allow the conductors to perform best. And finally the construction has a strong influence in basic parameters, bandwidth, and microphonic behaviour.

The substance, heart and soul of Crystal Cable is its quality and sound, in spite of its size and appearance. The technology allowing this is based on very high-tech, special metallurgy conductors, super high-tech insulators, and dedicated construction.

The choice of the above elements determines the cables design and the special, musical sound that belongs to all Crystal Cable products.

How have your cable designs evolved over the years?

Metallurgy is at its eighth generation now with higher purity and conductive properties like amorphous and single crystal technologies.

Constructions have been refined to improve stability while bending cables.

To achieve the highest quality possible, we have largely replaced our original high-tech insulation snare with more complex multi-layers

Crystal Cable started with a special, customized silver/gold alloy, making extremely thin but big sounding, high-tech audio cables. During our first decade, we improved the conductors, insulators, and connectors, adding the highest purity

GUIDE TO CABLES: MASTER DESIGNERS: EDWIN AND GABI RIJNVELD HI-FI+

monocrystal to the product lines in the last couple of years.

The construction of Crystal Cable products is always coaxial, ensuring a very neutral, transparent, and detailed sound, translating the music without coloration.

Which is more important for overall system performance: power cords, interconnects, or loudspeaker cables? Why?
Power cords tend to influence the background noise of the total system.

Interconnects have the most impact as they are the first component after the source.

Any loss in quality here can't be corrected later on in the audio chain.

Good speaker cables must be selected to ensure a good harmony between amplifier and loudspeakers. Just like the loudspeaker itself, the speaker cable is the most component dependent of all as it forms the bridge between amp and speaker and its behaviour will influence the sound. Some ultra-low impedance speaker cables, for instance, may positively or negatively influence the subjective performance.

The customer should test the speaker cables to make sure they are a good sonic fit or match for the sound system.

"If I only can afford one cable, which one should I buy? " I often get this question and my quickest answer would be: start with a

GUIDE TO CABLES: MASTER DESIGNERS: EDWIN AND GABI RIJNVELD HI-FI+

power cable from the wall to the system. This will clean up the sound very noticeably, filtering out distortion and noise from the AC.

The second purchase would be the interconnect set connecting the source component to the amplifier, to ensure highest audio quality.

For best results with digital audio, would you recommend USB, I^2S, Ethernet, or traditional coaxial S/PDIF connections? Why?
USB and Ethernet cables are normally built around unequal twisted pairs to optimise channel separation. This configuration causes major jitter and picks up noise, which is not simple to remove later. Coaxial connections are easier to optimise for low jitter and low noise performance. Building USB from coaxial pairs solves the problem, too.

At the end, the receiving and sending electronics and connectors have their own problems as well. Here Ethernet fails as their standard connection is poorly implemented mechanically in regard to impedance and jitter.

So it all depends on the mechanical and electronic implementation…

How do you answer those who argue that specialised digital cables don't and can't make a difference since digital audio is 'all ones and zeros' anyway?
The zeros and ones are not the problem. It is about jitter and noise causing a different sound. Jitter causes timing errors, easily heard as an unpleasant sonic effect.

Advanced materials and specialized construction will make a difference, reducing noise and improving sound quality.

Do any of your cables use in-line 'boxes' of any kind? If so, what's inside those boxes and why do you use them?
In our opinion, sound should never be interrupted by any filter. However some models have boxes for special functions effecting the external shield.

The shield can be switched to perfectly match the unknown grounding of your equipment. As this varies per brand, our selectable shield is extremely useful to get the best sound out of your existing system.

Using the most advanced materials, there is no need for filters.

For speaker cable terminations, do you prefer spade lugs or banana plugs (or perhaps something else)? Why?
It depends on the quality of the plug and terminal. Often spade lugs cause less loss, but many there are many exceptions to the rule based on the terminal construction. Both systems can be made near perfect, at least in theory; unfortunately this is hardly the case in practice.

When using high quality materials, the two should be equal. Spade lugs have more surface area for connections, while banana plugs are prettier and easier to use.

GUIDE TO CABLES: MASTER DESIGNERS: EDWIN AND GABI RIJNVELD HI-FI+

Do you recommend bi-wiring for loudspeakers? Why or why not?
Yes! The main advantage is having less loss overall with four terminals versus two for single wiring. Not often used, but biwiring also allows for bi amping, a costly, however serious improvement of your sound.

Yes, in this case more is more—more material, more connections, more sound quality.

What is the reasoning behind cable lifters or risers? Do you recommend using them?
It's simple.

First, steel bars in concrete floors work like transformers conducting a magnetic field from the 'transformers' to your cables. Lifting the cable two inches or so dramatically reduces any possible coupling and reduces your noise floor (no pun intended…).

Second, some lower quality cables are microphonic, and taking them from a resonating floor will improve sound.

Neatly organized cable runs will sound cleaner as they don't react to distortions induced from floor or from each other.

Given the choice, would you prefer to work with components that used balanced or single-ended connections? Why?
Balanced is better in theory, or differently said, if perfectly implemented. However, almost every product we know derives the negative channel from the positive with an extra circuit. This causes a time delay, subsequently leading to unequal timing of the XLR and audible degradation.

Single ended (RCA) does not have this problem, but depends more on the shielding quality of the cables for perfect noise performance.

A further discussion is about the connectors themselves. They differ largely in sound depending on the quality of the material used.

Has the vinyl revival meant developing new tonearm cables for the modern world?
We always produced tone arm cables and improved them over the years.

The current standard of our brand is made of exceptionally high quality single crystal silver in a truly flexible DuPont jacket.

Given the physical properties of Crystal Cable products, it's an obvious product category with different material choices and price points.

Both silver/gold and pure monocrystal tonearm cables are available and used by many analogue colleagues and manufacturers.

Does your firm offer, or plan to offer, specialised cable for personal audio applications? If so, what challenges do you face in bringing high-end audio cables to the headphone world?

GUIDE TO CABLES: MASTER DESIGNERS: EDWIN AND GABI RIJNVELD HI-FI+

Headphone and portable applications place unique demands on cable design and construction. Not only do they present extreme mechanical challenges, both in terms of noise performance and mechanical stability and longevity, but the emergence of portable high-resolution file replay systems combined with rapidly advancing headphone performance has created one of the most sonically exacting markets. It's a field in which cable performance has become a critical limiting factor.

The superb conductivity, shielding, and high-tech insulation materials used by Crystal Cable are perfect for the low-signal level, low-power applications typical in portable audio systems. They make the most of every last little bit of signal, while dedicated designs combine their inherent flexibility with skin-friendly outer sheathing to set new standards for unobtrusive comfort.

The complex construction of the Crystal Cable Next conductors demands precise termination. Each cable is precision stripped and trimmed before being hand-terminated—for this new challenge extreme skills and machines are needed.

The new brand name Crystal Cable Next describes our desire to reach out to the next generation as well as to the existing audiophile taking the next step to personal audio besides to the domestic systems.

Some enthusiasts believe in choosing 'coherent, single-brand cable looms' while others argue that it's best to 'choose the right cable for each component'. Setting commercial considerations aside, which approach do you favour and why?
We would recommend the best cable for the job. In practice, customers may favour certain behaviours of a particular brand of cables and this often leads to them favouring one brand in their system.

Using the same brand all around makes sense in terms of sound character, coloration, and musical preferences. Using the same quality materials, even from different brands, will give an undeniable synergy in the system—just like the four tyres of a car…

If you are at liberty to say, what new cable development projects will you tackle next?
Siltech's new top model, the Triple Crown, is the most advanced cable product we ever made.

Crystal Cable's Absolute Dream is equally advanced, but unique in a totally different direction and technology.

Future products will learn from both our flagship product ranges to reach a larger audience. +

Cable Looms: Does the 'Single-Brand Wiring Loom' Concept Make Sense?

Alan Sircom

From a position of an electrical engineer outside of the audio business, the concept of any sonic benefit coming from using cables from the same family – the 'coherent cable loom' – is nonsense on stilts. That being said, from that same position, the idea of signal cables making a significant difference to audio performance at all is nonsense, anyway. Those more involved with audio – whether as a consumer or 'in the trade' – tend to be more receptive to the concept, even if it's electrically counterintuitive.

It is contrary to conventional thought because, notionally at least, the output impedance of a source component and the input impedance of an amplifier should contribute more to the sound of a system than the cable connecting the two. And yet as if to challenge that convention, there are cables with clear and repeatable sonic characteristics that apply universally.

The idea of a single-brand loom (more specifically a set of power cords, interconnects, loudspeaker cables, and perhaps even digital cables from the same range within a specific brand) tears up that conventional thought. Instead, the concept suggests that because cables from one brand often have a common sonic signature, using such cables throughout will act in a consistent and coherent manner to all the devices in the audio chain. This is the sonic equivalent of putting all your ducks in a row, if you like.

This could be considered a 'tonal' view of cable looms, and challenges the oft-held notion of using cables as some kind of mild tone-shaping devices to balance out inconsistencies in a system. Using cables to iron out inconsistencies in individual components in a system is now commonly dismissed as an incorrect way of balancing audio systems. Yes, you can 'slug' a bright sounding CD player with a particularly dull sounding cable, or vice versa, but common consensus today holds that using a cable to draw out more of the basic properties of a component is a less sonically-troublesome scheme than a form of audiophile balancing act. Even those who remain sceptical over the need for cable 'families' tend to have dismissed the tonal balancing act as a fundamentally wrong-headed approach.

Tonality is not everything in audio cabling. There is a school of thought that suggests using the same cables throughout bestows more than just consistent tonality on a

Images courtesy of AudioQuest

system. Cables that have a common goal of RF busting, and strive to limit this form of interference in a consistent way throughout, are routinely thought to produce a better sounding system than those that cut RF and EM interference in a haphazard manner. If having common tonal properties can relate to 'all your ducks in a row', having consistent RFI and EMI characteristics is like making sure all your aerials are pointing at the same radio tower.

Naturally, cable brands are extremely keen to promote the concept of a cable loom, because it means buying every cable from the same brand instead of mixing up a system with cables from many companies. But most of those who stress the idea of a full one-make cable solution tend to view the sonic performance of their products as something deeper than simply 'tonal consistency.' Nordost perhaps best exemplifies the stem-to-stern concept, as few other brands have stressed the 'coherent cable loom' with quite as much fervour as audio's rune-casters. Nordost actually goes so far as to suggest it's best to think of a system from the power cords outward, as the cables between the power outlet and the amplifier's power inlet make the most fundamental difference to the performance of a system, and makes a very convincing argument for this position, both in the company's public demonstrations at shows, and in private listening rooms. Few other brands make so significant a statement about power cords, but few other brands have a power cord like Nordost Odin 2!

Are there points where this coherent loom can be broken? Typically, audio enthusiasts who express an interest in the concept are divided. Many feel the universal approach is the best, using cables from the same 'family' everywhere from the wall to the loudspeaker terminals (some even go further, insisting on rewiring loudspeakers and equipment case wire, and even the power cables behind

Images courtesy of Nordost

the wall going back to the 'company head'. Others, however, are less restrictive in approach, and feel there are places where the loom concept can be broken, without undermining the benefits of consistency in the process.

One such place where this loom concept need not apply is the non-permeable barrier between digital and analogue audio. It's possible to gain benefits from a damn good digital interconnect, even if it is not a close family relative to the analogue interconnects and loudspeaker cable. In this case, if you have more than one digital product requiring direct digital connections, we'd recommend using the best digital cable you can afford for each task, rather than choose them all from the same brand. So, it might be that someone uses a Gutwire USB cable, a Transparent S/PDIF coaxial cable, and a Wireworld AES/EBU cable on the digital side, and all AudioQuest interconnects, power cords, and loudspeaker cables on the analogue side.

The other place where the break can be made is at the power cord. But here, consistency is important. It's possible to use, say, Cardas Clear power cords with Kimber interconnects and speaker cables. Or vice versa. However, it's important to stress the power cords must all be from the same 'family', even if that is a different family to the signal cables. This is an approach that should be carefully considered, though, as it is easy to get a sound that is unbalanced thanks to the mismatch between power and signal cables. Generally, we would choose power cords from companies that either make other power products and have their own internal consistency in design, or take a very strong EMI/RFI-busting approach.

Finally, there is the 'step-by-step' approach to cabling your system. When a cable brand has more than one range in its portfolio, is it good to choose from the same group, or can you choose the cheaper interconnect range and partner it with loudspeaker cables from a more expensive range from the same brand? This is harder to judge, except on a case-by-case basis. In fact, this is one of the great hidden arbiters of very good cable design: vertical (and horizontal) consistency. If the cheaper cable sounds very, very different to the more upmarket cable, not only will you struggle to balance the system, but also the cables do not share common goals. A cheaper interconnect in the range, for example, should perform like a scaled-down version of a better cable, not a different cable in its own right. The best brands often retain this consistency both within a range and throughout the ranges.

The key point to take from this, however, is to test cables for yourself. Don't just try one cable – change the whole cable system over for a more consistently designed and executed grouping. Seek out those companies that stress the concept of the coherent cable loom and try it for yourself. You might be pleasantly surprised! Fact or fantasy – you be the judge! +

Using the Right Cables in the Right Ways

Chris Thomas

Cables are the arteries of an audio system. In prepping for this feature, I was shocked to realise that I had almost 20 of different types of cable in my audio system carrying power, low-level, and high-level audio signals, digital information, clocking frequencies, and a rather long connection to the network router. That's a lot of arteries, and a lot of places where you could give your system (or your bank account) a heart attack if you get things wrong.

Fortunately, there are time-honoured strategies to put a system together correctly. Unfortunately, some of them don't apply universally, are outmoded, or are just plain wrong. Take cable length, for example. The time-honoured strategy in the UK is to use short interconnects throughout and long loudspeaker cables, while in the US listeners frequently choose to use short interconnects between sources and preamplifier, long interconnects between preamplifier and power amplifier, and short loudspeaker cables. To fan the flames, there are those who insist there are optimum lengths for each cable and suggest building a system around these set parameters (in fairness, this is a fairly extreme viewpoint).

In fact, the relationship between interconnects and loudspeaker cable length is probably best taken on a case-by-case basis. High-impedance outputs coupled to low impedance inputs at line level can allow relatively long interconnect runs, but this introduces a propensity to pick up noisy ground loops and sonically-deleterious radio frequency hash at low levels. Heavily screened interconnects might help, but as such cables often have higher series capacitance than less shielded alternatives, and that capacitance contributes to high-frequency attenuation and phase shifts, the cure might just be worse than the disease.

Meanwhile, resistance and impedance are more of an issue with loudspeaker cables, and long runs of loudspeaker cable will subtly alter frequency response at both extremes of the audio spectrum. This is a two-edged sword; too short a cable run can be as bad as too long. Some cables will also take the electrical output of the amplifier into account, essentially working either as a filter network, or as a precise extension of the amplifier's output stage. This means the oversimplified concept of 'the shortest possible cables throughout' is not necessarily the right course of action. Instead, work with the manufacturers and dealers of your electronics, loudspeakers, and cables to find an optimum path.

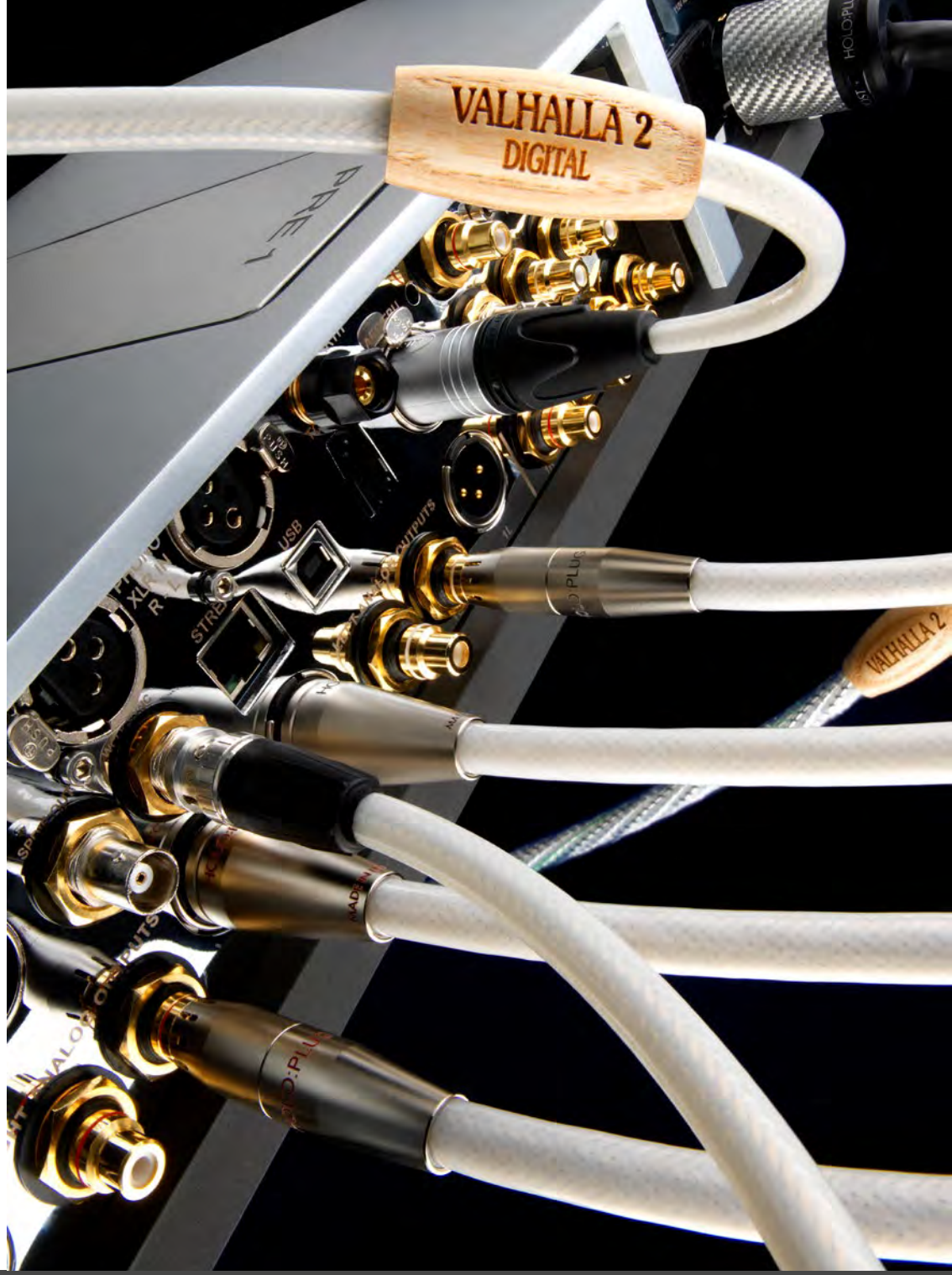


Image courtesy of Nordost

Similarly, the received wisdom among audio enthusiasts until about 20 years ago was that power cords made no difference at all. That changed in the late 1990s, but even after that cables outside the direct signal path (such as cables that pass timing signals between a DAC and a precision clock, for example) were thought not to make a difference. I was surprised at just how significant a difference can be heard by moving from generic copper coaxial cables to upmarket digital connections in this setting (this is an uncomfortably expensive experience, too, because upgrading the non-signal cables between all four boxes of something like a dCS Vivaldi player can easily cost as much as a sports car). And now, people are starting to report sonic benefits in Ethernet cables, despite this being a packetized system rather than a datastream.

All of which means attempts to create a cable 'strategy' are prone to failure, or at least subject to regular and healthy amounts of revision. Even suggesting a percentage of the total cost of a system as a worthwhile amount to spend on cables has largely fallen from use. We would, however, suggest apportioning the amounts spent on cables in one of several strategic manners. One method is to take the 'power first' approach, which suggests using higher-than-expected quality power cables, and apportioning appreciably lower sums on interconnects and speaker cables. Then there is the 'source

Image courtesy of AudioQuest

Powerful Connections

IsoTek®

An ordinary 'kettle lead' like those supplied free with hi-fi components contains only rudimentary conductors and connectors – the bare minimum to ensure the item works. Cables like these act as aerials to EMI/RFI, which affects the performance of audio equipment. IsoTek produce an award winning range of cables starting at just under £100 to £600 as featured below.

"Is there any audiophile who still doubts that power cables make a difference?"
Hi-Fi Choice

"IsoTek gets power, so it's logical that IsoTek is the go-to company for power cords"
Hi-Fi+

EVO3 PREMIER

- IsoTek's entry-level power cable – high performance, low cost
- 3 x 2sqmm silver-plated 99.9999% OFC conductors
- Teflon FEP dielectric extruded over each conductor
- Solid copper, 24ct gold plated connectors

EVO3 SEQUEL

- Upgraded version of EVO3 Premier
- 3 x 2sqmm silver-plated 99.9999% OFC conductors
- Enhanced strand geometry and sheilding
- Teflon FEP dielectric extruded over each conductor
- Solid copper, 24ct gold plated connectors

EVO3 ELITE

- IsoTek's mid-level power cable – uncompromising audiophile performance
- 7 x 1.25sqmm silver-plated 99.9999% OFC conductors
- Enhanced strand geometry and sheilding
- Teflon FEP dielectric
- Solid copper, 24ct gold plated connectors

EVO3 OPTIMUM

- IsoTek's top-level power cable – unparalleled performance for high-end audio systems
- 3 x 3sqmm silver-plated ultra-pure OCC (Ohno Continuous Cast) copper conductors
- Teflon FEP dielectric and sheilding
- Solid copper, 24ct gold plated connectors

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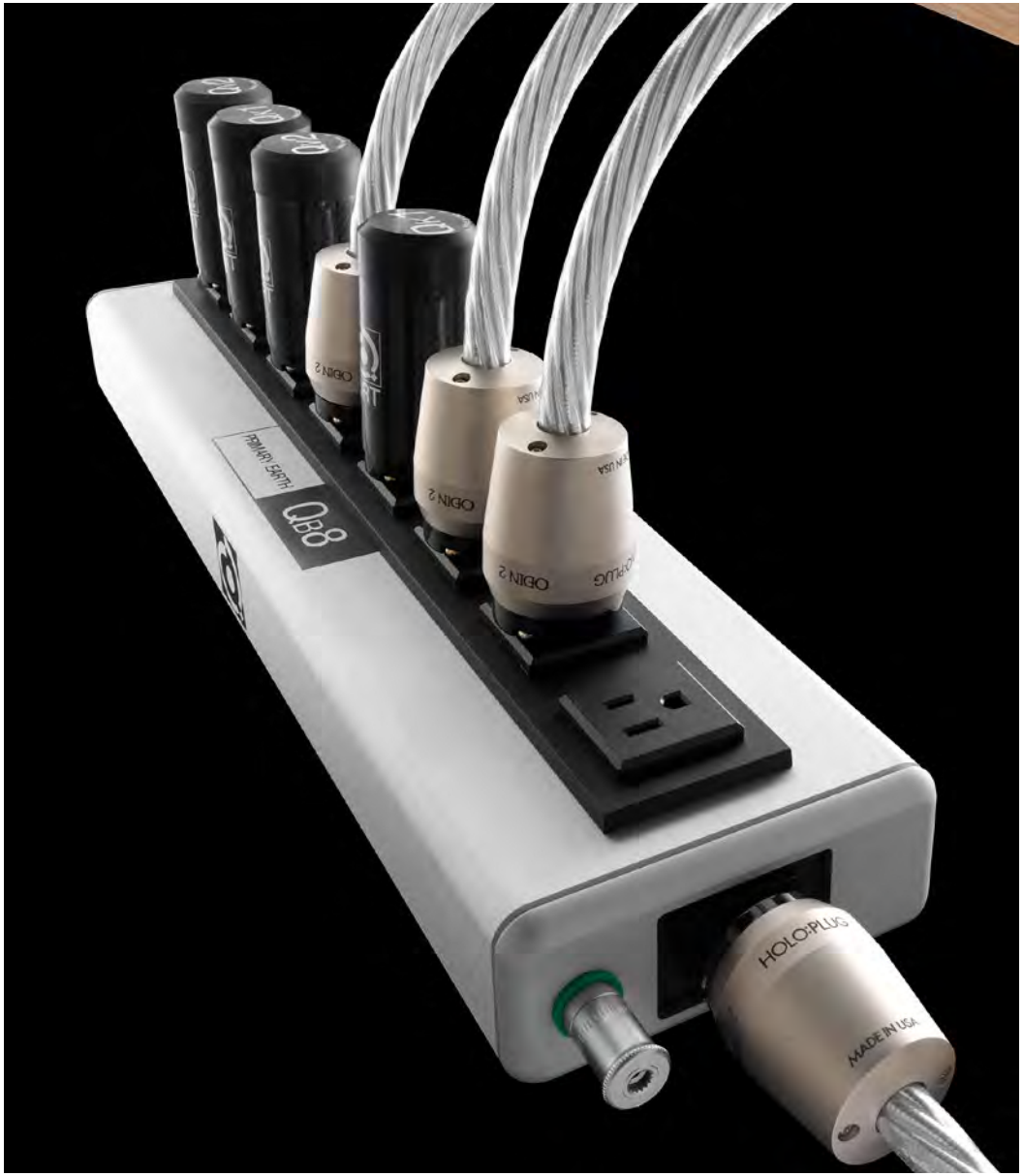

Image courtesy of Nordost

first' approach, which suggests spending more on the interconnects between source and amplifier, the 'amp first' approach that reckons the connection between preamp and power amplifier is the most important, and finally the 'speaker first' approach, which posits the case that the loudspeaker cables 'do the heaviest lifting' and should be weighted accordingly.

I favour a more 'balanced' approach, where all the cables across the system are given equal weighting. Naturally, any secondary components need not be included in this balanced approach, but otherwise this means not spending significantly more on one section of the whole cable system, even if that means the overall cable set comes from a slightly cheaper line. I find this balanced approach gives slightly less 'fireworks' than one star cable in the signal path, but it creates a longer-term appeal thanks to its even-handedness.

Where I periodically disobey my own rules is in digital cables, although I must admit USB and Ethernet are currently minority interests. I've found the improvements in digital cables can make significant improvements in the overall sound of a system, so if there is a 'good', 'better', 'best' hierarchy in cables, I am a little more comfortable in using a 'best' digital cable in the context of a 'better' cable loom, than I am using a 'best' cable elsewhere in that loom.

When it comes to analogue audio, whether to go with balanced or single-ended connections is an area where I am firmly on

Image courtesy of AudioQuest

GUIDE TO CABLES: THE RIGHT CABLES HI-FI+

the fence. Originally balanced terminations were introduced, primarily for microphones, to enable long lengths of cable runs to be employed without excess noise or serious signal degradation. However, many domestic audio devices are 'pseudo-balanced', using balanced-type XLR connectors, but with single-ended circuitry. Regardless, whenever I have compared single-ended against balanced on equipment equipped with both I find the balanced route often offers a neater 'shape' to the sound. It may even appear to provide a touch more resolution. But I also find that the frequency extremes are a little squashed and unnatural. Single ended RCAs, in comparison, have often seemed to me to give the music a somewhat looser and freer feel. That said, I've not tested everything, some disagree strongly, and if there are RCA interconnects longer than 5m (16') involved, balanced is usually better sounding.

Whatever cables you use, it's important to 'dress' them correctly. There are a number of potentially great systems let down by a 'Gordian Knot' of wires bound together at the rear of the equipment stand. While it's also possible to develop a very bad case of OCD trying to keep cables apart, there are some good rules to follow. First, try and keep power cords and signal cables as far apart as possible, and if they do cross, try to make them cross at 90° to one another. On no account should a power cable run alongside a signal cable if it is at all possible to keep the cable separated. Similarly, although not in the same order of magnitude of importance, try to keep digital and analogue, clock and lock cables, and left and right analogue channels separated as much as possible. Also try not to put too many sharp turns or kinks in the cables; this might necessitate wider spacing of shelves on an equipment table. This might also involve mounting the components in an order that seems illogical at first, and pulling the equipment table out further from the rear wall.

When it comes to loudspeaker cables, remember that the cables will be the same length, even if the equipment is mounted to one side of the loudspeakers. This invariably means one loudspeaker cable is dressed correctly, while the other has some slack. Arrange this excess cable in a series of gentle loops, rather than letting it sprawl across the room or – worst of all – wind up in a coil (at its zenith, this will act as a source of additional inductance for that channel). Cable risers are never far from controversial; they are either the final indicator that you are an audio obsessive or one of those small details that, once experienced, you cannot live without. Watching the observations of my friends' wives, I would say that, in my case, it's more likely to be the former. Some swear by 'em; some swear at 'em! However, irrespective of any performance benefits they might have, risers do have an advantage in creating a consistent pathway along the floor, which can be useful for keeping dressed cables in top form.

Whichever cables you use, one final useful tip is to keep your cables and contacts clean. When I stripped my whole system down recently, I took the opportunity to clean every connector. I used some De-Oxit, followed by some Isopropyl alcohol after taking advice from friends. Many don't agree with this method though (citing residual gunk as a potential problem) and said that pulling each plug in and out several times was the way to maintain the best metal-to-metal contact. I also gave each cable a thorough clean up with the excellent Eco Static Inhibitor from Nordost, and the amount of dirt this cleaning frenzy produced was truly shocking.

I guess dust is pretty much ever-present, even in the obsessively clean world of the audiophile. This cable and contact wash and brush-up might just become my new Spring cleaning routine. +

Absolute Dream

by

Crystal Cable®

Crystal Cable's Monocrystal Silver Conductor - the Gold Star for signal transmission.

"an abundance of detail..."

"[the Absolute Dream] can fill the space of your room, from wall to wall to wall, with the sound of the studio or hall in which the recording was made,"
Jonathan Valin, The Absolute Sound, January 2013

"Rewiring your whole system with Absolute Dream is so far ahead of the pack, I'm not sure you can find a way back to the 'ordinary' world."
Alan Sircom, Hifi+, Issue 96

"..this cable offers the smooth, creamy lushness of the warmer-sounding cables and yet combines this with a spaciousness and the sparkle of the livelier sounding cables. Absolute Dream USB is well-named."
Paul,Miller, Hifi News, June 2013

2012 the absolute sound PRODUCT OF THE YEAR AWARDS

hi-finews OUTSTANDING PRODUCT

2014 the absolute sound Editors' Choice Awards

GOLDEN EAR the absolute sound 2013 AWARDS

hi-finews EDITOR'S CHOICE

Absolute Dream – Because Music Matters

Each Absolute Dream interconnect or speaker cable employs four of our unique mono-crystal silver conductors (with dedicated designs for digital and power applications) for the best possible signal transmission and lowest possible resistance.
This ground-breaking construction has resulted in a totally new level of audio cable and audio system performance.
For more information about Crystal Cable's Absolute Dream and all other products visit **www.crystalcable.com** or follow us on **www.facebook.com/CrystalCable.IAH.**

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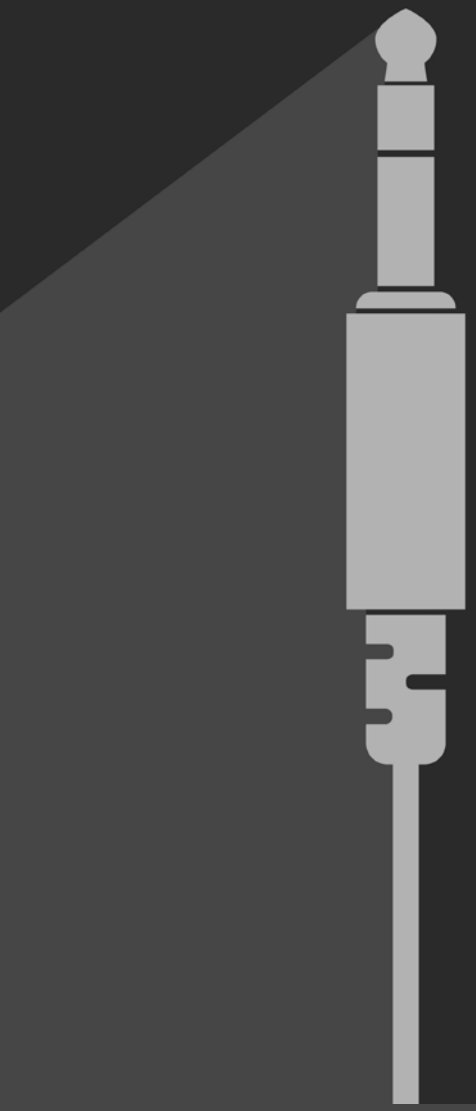

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HI-FI+ EDITORS' CHOICE

HI-FI+ EDITORS REVEAL THEIR TOP PICKS PLUS PROMISING MODELS TO WATCH

INTERCONNECTS & SPEAKER CABLES (COST NO OBJECT)

Cardas Clear Beyond

George Cardas radically revised his company's existing product line with the development of Cardas Clear. This cable uses 'matched propagation' conductors and cold-welded connectors to create a remarkably open and balanced sound. Clear Beyond loudspeaker cables (and Power Cords) bring the benefits of Cardas Clear to systems with high-power amplifiers.

Crystal Cable Absolute Dream

Crystal's mix of solid silver conductors, with PEEK and Kapton dielectric, a braid of gold-plated silver, and silver-plated copper monocrystal cables, arrives wrapped in a transparent sleeve and served in a presentation case. But it's not just about looks; Absolute Dream makes a powerfully coherent sound with excellent image separation.

Nordost Odin 2

Nordost's continual research into cable design has discovered the importance of precise termination and conductor placement in high-performance cables. The new Odin 2 sports the new Holo:Plug first seen in Valhalla 2, and includes Total Signal Control techniques to produce a cable that many audiophiles think towers over the competition.

Cables to watch

- **Kimber Kable NΩHM**
  Designed in association with Russ Andrews in the UK, Ray Kimber's new NΩHM cable builds upon the RF-busting nature of Kimber's existing braided cables with up to three stacked modules in pods. These are filled with non-ferrite, non-inductive passive components, in order to eliminate noise even into the gigahertz region.

- **Kubala-Sosna Elation!**
  Famously cagey about the construction and materials used in construction, the dark coloured Elation! is the current pinnacle of the company's RevolutionZ models, and features the company's OptimiZ2 architecture… and that's about all we can say, apart from the fact that these cables are making a lot of friends at audio's top end.

- **MIT Articulation Control Consoles**
  Proving that there's no such thing as 'too much' in audio cables, MIT's latest venture takes the 'articulation poles' concept originally seen in the Oracle MA-X and adds fine-tuning, allowing listeners to tine tune their cable's response to the system. The large price tag sets new records in audio cable, too!

GUIDE TO CABLES: EDITORS' CHOICE HI-FI+

Cables to watch (continued)

- **Siltech Triple Crown**
  Siltech discovered that consistency of the delivery of cable parameters is as important as those cable parameters, and the result is this supremely solidly built, shielded monocrystal silver loudspeaker cable, with terminations made by a watchmaker specifically for Triple Crown. Royalty… possibly, but we are in the presence of greatness!

- **Synergistic Research Gallileo**
  This system, complete with cable elevators that tease out the individual conductors 'strings' and active boxes at the beginning and end of the cable run, is unlike anything you've encountered before. The cables are terminated at either end with 'active EM cells', which sit proud of the floor on spikes.

- **Transparent Magnum Opus**
  The pinnacle of the Transparent Audio range, Magnum Opus is custom built to the individual's needs, with a carbon-fibre, epoxy-filled 8kg network box designed to be tuned to the amplifier, loudspeaker, and cable length for optimum component calibration at one of the most crucial steps in the audio replay chain.

INTERCONNECTS & SPEAKER CABLES: MID-PRICED (AND BELOW)

AudioQuest Castle Rock/Earth

AudioQuest's cable range is complex. Castle Rock is the entry-level speaker cable of its Flat Rock series and Earth is second in line in the Elements interconnect range. Both feature the company's Perfect-Surface Copper+ conductors and 72v Dielectric-Bias System to create an electrostatic field that polarises and saturates the insulation.

Black Rhodium Samba/Tempo

UK brand Black Rhodium specialises in using high-grade materials and clever layouts to create its musical magic. In the case of Samba interconnects and Tempo speaker cable, both designs feature silver-plated copper stranded conductors with silicone rubber insulation. The result is a remarkably dynamic and even-handed sound on any system.

Cardas Clear Reflection

When Cardas changed its range to Clear, it meant the end for the popular, long-running Golden Cross and Golden Reference cables. However, Clear Reflection is designed to deliver the detail of Clear with the warmth and luxuriousness of its predecessors. Perfect for those who think modern audio is too 'forward'.

Chord Sarum/Sarum TA

Chord's Sarum fights way above its weight class and in many respects is every bit as good a performer as the cost-no-object designs. Especially now that Sarum interconnects are fitted with the company's own Tuned ARAY deliberately reflecting termination wire. One of the most temporally correct cables money can buy.

INTERCONNECTS & SPEAKER CABLES: MID-PRICED (AND BELOW)

Gutwire Chime 3/Uno-S

The antidote to bright, brash sounding cables, the Canadian Gutwire brand uses good, solid copper designs with copper/Mylar shields and Teflon insulators to make RF-busting cables with very large diameters. These hand-made Uno-S interconnect and Chime 3 speaker cables deliver a fundamentally correct and honest sound, with very powerful bass.

Nordost White Lightning

The entry point in Nordost's popular Leif cable range, White Lightning retains much of the speed, the attack, and the clarity of Nordost's more upmarket designs, but does so at a very attractive price. Good enough in its own right, this is also a gateway drug for future Nordost upgraders!

Snake River Audio Cottonmouth Gold/Mamushi Signature

Named after venomous snakes, SRA's Cottonmouth Gold speaker cables begin as 24ct-gold plated copper wires, with RFI-busting copper shields, while the chunky Mamushi Signature uses silver-plated copper and a capacitive woven outer shield. These so impressed our reviewer Jimmy Hughes, he changed cables for the first time in 15 years!

Mid-priced and value-priced cables to watch

- Audience OHNO
  This high-value range of interconnects and loudspeaker cables are named after one Dr. Atsumi Ohno, who gave his name to the Ohno Continuous Casting process that makes it possible to fabricate monocrystal copper conductors. These Audience cables are stripped down to the basics and yet still deliver the sonic goods! Remarkably given the cost, OHNO is also a monocrystal design.

- **Nordost Purple Flare**
  Next up from White Lightning, but still on the budget side next to Nordost's Norse range, Purple Flare takes the original Flatline cable concept and drags it into the 21st Century. With greater cable gauge and an increase in the overall size and number of conductors, Purple Flare has promise!

- **Wireworld Silver Eclipse 7**
  Using 10-gauge, silver-clad copper conductors and custom Composilex dielectrics, and all laid out in Wireworld's unique DNA-like helix construction, Silver Eclipse 7 is about mid-way through the Wireworld catalogue. One of the infinitely useful Wireworld developments is interchangeable terminations for different systems. This is definitely one to look out for.

GUIDE TO CABLES: EDITORS' CHOICE HI-FI+

INTERCONNECTS & DIGITAL CABLES: COST NO OBJECT

AudioQuest Diamond USB

The pinnacle of AudioQuest's USB cable range, Diamond features Perfect Surface solid silver conductors and silver-plated terminations, foamed-polyethylene insulators, which are energised using the company's 72V Dielectric Bias System external module, and a three-layer carbon noise dissipation system. Sonically, Diamond simply places you in the studio with the recording artists!

Crystal Cable Dreamline Plus USB

Dreamline Plus takes much of Crystal Cable's Absolute Dream cable technology and presents it in a more attainable package. With around half the monocrystal of Absolute Dream conductors in each cable, it's surprising just how close Dreamline Plus gets to the top table. This is an insightful, grain-free, and inherently musical cable.

Fono Acustica Armonico USB

Fono Acustica is perhaps not the best-known brand in the cable world, but its cables combine luxury appeal with high performance and are designed by listening test rather than mere specifications. Armonico is a cryo-treated design with a hand-woven geometry to produce a sound that is musically evocative and natural.

Nordost Valhalla 2 75-Ohm

USB for Nordost stops at Heimdall 2. For its 'reference' and 'supreme reference' ranges, it's back to 75-Ohm S/PDIF cables. Valhalla 2 is a monofilament silver-plated copper wire with a FEP dielectric, but the precision of the connections ensures a perfect 75-Ohm transmission throughout, which is vitally important!

Cost-no-object digital cables to watch

- **Crystal Cable Absolute Dream USB**
  Following the same basic design as other Absolute Dream designs, Crystal Cable's top USB is commonly considered the best of the best by USB-playing cognoscenti. The inherently natural and insightful character of Absolute Dream USB designs shines through, even when using cables from other manufacturers elsewhere in the signal chain.

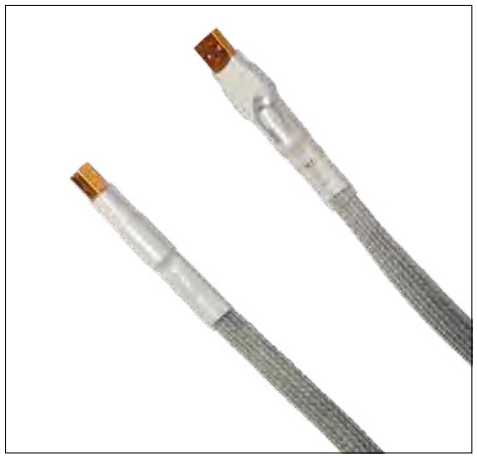
INTERCONNECTS & DIGITAL CABLES: COST NO OBJECT

AudioQuest Carbon USB

Mid-way along AudioQuest's six-strong USB cable range, Carbon bears a strong resemblance to the top-end Diamond cable, missing out only on the 72V DBS system and using silver-plated (in place of solid silver) conductors. In use, this USB cable is the king of soundstage and detail, at a reasonable price.

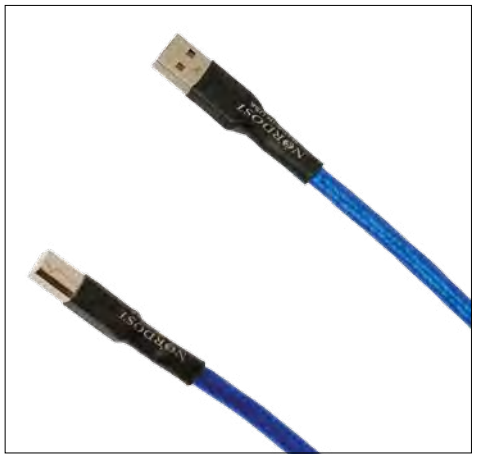
Gutwire USBe-1

Gutwire's only USB cable features four 20 AWG solid-core high purity copper conductors and a braided shield, Teflon insulation, and – uniquely – a beryllium-copper USB shell. This all combines in an USB cable that eschews the normally forward, bright sound of digital audio, and sounds all the better as a result!



Nordost Blue Heaven USB

Nordost's first USB cable (now joined by Heimdall 2) is a monofilament design with all the usual sonic benefits associated with the brand. A cable that can highlight the most recalcitrant leading edges, and that infuses any music played with uncanny detail and energy Blue Heaven is a slice of paradise!



Tellurium Q Black USB

Like Kubala-Sosna, Tellurium Q doesn't like handing details to rivals, so there's scant information on hand about the cable designs. So there are few clues as to why this cable works as it does, but this is a big, rich sounding cable that teases out subtleties of musical texture well!

INTERCONNECTS & DIGITAL CABLES: MID-PRICED AND BELOW

Digital cables to watch

- Audioquest Forest CAT7 Ethernet
  The idea that Ethernet cables can make a difference to sound quality is a questionable concept… until you've heard the difference they can make. Forest is not an expensive cable by audiophile standards, but the 0.5% silver conductors, high-density polyethylene insulation and gold plated nickel contacts make this worth investigating.

- **Chord Company Clearway 75 Ohm**
  Chord Company's Clearway is the company's popular entry-level digital design. Clearway has found a new place for the 75-Ohm S/PDIF cable thanks to an optional 3.5mm mini jack digital connector: it's the perfect choice for connecting the Chord Electronics (no relation) Mojo headphone DAC to a digital audio player.

- **Tellurium Q Blue USB**
  If Tellurium Q Black is too rich for your blood, the popular Blue is said to offer much of the same performance for about one third of the cost. Once again, there is practically no information available about how this cable is constructed, but it offers much for relatively little!

INTERCONNECTS & MAINS CABLES/POWER CHORDS: ALL PRICE RANGES

Audioquest NRG-4

The mid point in AudioQuest's range of power cords, NRG-4 feature's the company's Perfect Surface Copper+ conductors, carbon-based insulation (designed to dissipate noise and crosstalk), a counter-spiral geometry, and cold-welded terminations. NRG-4 is the natural partner for AudioQuest's interconnects and speaker cables, but delivers the details in its own right.

Cardas Clear M

Cardas Clear interconnects and speaker cables arrived before the trio of power cords. All three use Cardas' golden ratio copper wire strand layout, the principal difference being size of the conductors. The 'M' in Clear M stands for 'Medium' and is for low-to-medium power applications. A refined and unforced performer!

Chord Sarum TA

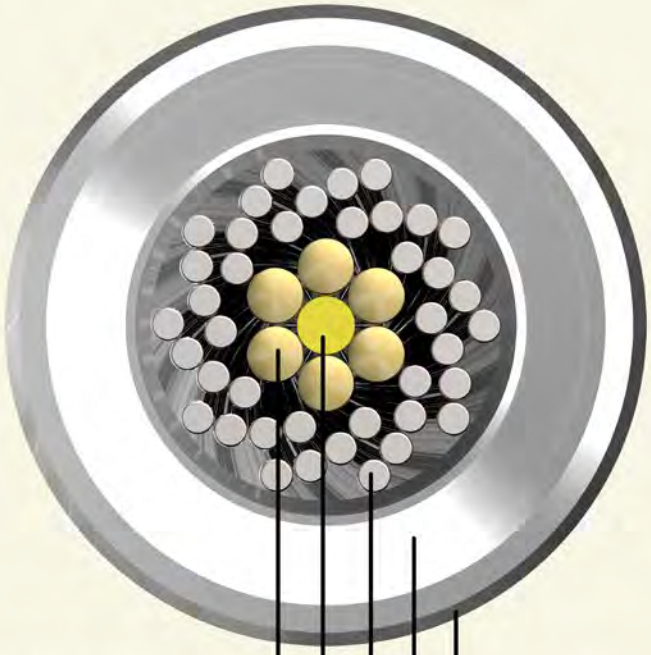
Chord's Sarum mains cable (that's how the British spell 'power cord') has been upgraded with Tuned ARAY technology, which adds an internal flying lead to tune the cable in the time domain. If you think a mains cable cannot improve the timing of a system, give Sarum TA a listen!

Crystal Cable Absolute Dream

The power cord in a good cable system is the icing on the cake. In the very best – like Crystal Cable's Absolute Dream – the power cord forms an integral part of the whole package. The level of musical involvement and insight this power cord delivers will leave you truly stunned!

Crystal Cable® next »

Taking High-End Sound Along with You



High purity silver-gold conductors

Aramid fiber core for ultimate strength

Silver plated monocrystal copper shield

Anti-allergic, skin friendly, ultra flexible

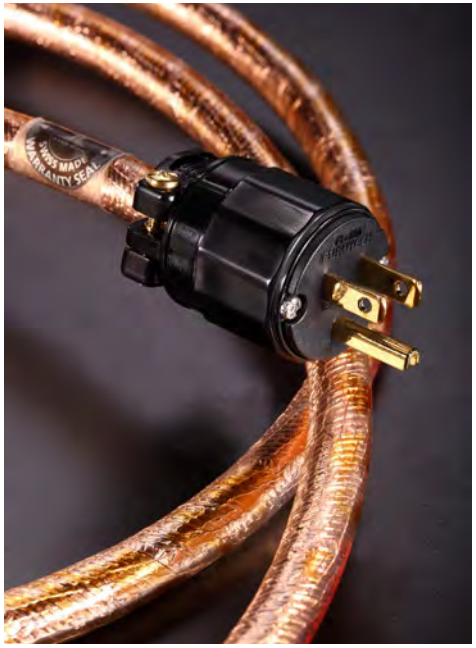
Biocompatible transparant sleeve

Crystal Cable Next sets new standards for the next generation of headphone and earphone products. The superb conductivity, shielding and high-tech insulation materials used by Crystal Cable are perfect for the low-signal level, low-power applications typical in portable audio systems.
Crystal Cable Next is available exclusively through Astell & Kern: www.astellnkern.com
For all other Crystal Cable products visit **www.crystalcable.com** or follow us on **www.facebook.com/CrystalCable.IAH.**

INTERCONNECTS & MAINS CABLES/POWER CHORDS: ALL PRICE RANGES

Ensemble DALVIVO

The Swiss Ensemble brand produces every component in a CD-based replay chain, and suggests good audio promotes well-being. The DALVIVO power cords accent the harmonic structure of music for those seeking refinement and elegance. Be warned – other products may follow because DALVIVO is a gateway to a full Ensemble system!



IsoTek EVO3 Elite

IsoTek is a power specialist – making conditioners and regenerators – so it stands to reason that the company's mains cables are high performance designs. This polished and very dynamic sounding seven core, high purity copper cable with FEP insulation is designed for sources, preamps, and small to medium sized power amps.

LessLoss DFPC Reference

This unique Dynamic Filtering Power Cable deploys what LessLoss calls 'skin filtering' to reduce electromagnetic interference. DPFC Reference's braided, low resistance cable consistently lowers the noise floor – especially on phono stages – without compromising dynamics, and manages to make your system sound like you wanted it to sound, with less fatigue!

Nordost Odin 2

The benchmark by which all power cords should be tested, Odin 2 makes one of the biggest changes to system sound you can get from any cable. With its carefully constructed monofilament construction, this heavyweight packs a punch and its sense of timbral and tonal organisation and precision is palpable!

INTERCONNECTS & MAINS CABLES/POWER CHORDS: ALL PRICE RANGES

Mains cables to watch

- **Clearer Audio Silver-line Power Cable**
  The three-strong Silver-line range from UK experts Clearer Audio are proving extremely popular among British high-enders. They feature 99.999% pure OCC silver conductors (of increasing gauge) with individual copper foil shields for each conductor and further six-layer copper silver shielding, PVC insulation, and Clearer's own Super Suppressors to reduce noise.

- **Furutech Nanoflux**
  Simply the best power cord Furutech knows how to make, the double-sheath, nylon jacketed Nanoflux cable features Furutech's own 3.8mm Alpha-OCC copper conductors in PVC insulation, treated with the company's special Nano Liquid. The gold-and silver particulates in Squalene oil helps fill in any concave or convex surfaces in the conductor.

- **IsoTek EVO3 Optimum**
  Like Cardas Clear, IsoTek's EVO3 mains cable also comes in a larger size for the more husky power amplifier. The 16A EVO3 Optimum features silver-plated copper OCC conductors with a slight twist, Teflon FEP insulation, a Mylar dielectric wrap, a copper shield, and bright red PVC outer, for high-power use.

- **MCRU The New Ultimate**
  MCRU's Ultimate III mains cable was one of the best, but when Furukawa ceased production of the UP-OCC copper cables used in its manufacture, the company went back to the drawing board to make a cable worthy of the name. The radical, undisclosed overhaul is claimed to improve performance, too.

ENCYCLOPAEDIA CABLEXICON

DIGITAL TERMINOLOGY EXPLAINED, *Hi-Fi+* Staff

High-end audio cables, much like other categories of audio components, have gradually developed a specialised vocabulary all their own. And, as sometimes happens with other types of audio products, 'cable speak' can at first seem confusing if not dauntingly obscure to the uninitiated. But not to worry; help is on the way. The *Hi-Fi+* team has assembled this 'Encyclopaedia Cablexicon' document to explain cable terminology in a manner that interested laymen will be able to understand (or at least that's the plan). Enjoy.

Analogue Interconnects (or Interconnects)

Analgue interconnects are audio cables specifically designed to carry low-level analogue audio signals from source components to amplification components, or from preamplifiers to power amplifiers.

Typically, analogue interconnects come in two forms: single-ended cables (in most cases fitted with RCA jacks at both ends) or balanced cables (usually fitted with a male three-pin XLR plug at one end and female three-pin XLR socket at the other end).

Image courtesy of AudioQuest

Balanced Interconnects

The majority of interconnects are single-ended cables that have two conductors—one carrying +/– signals and the other serving as a ground.

Balanced cables, however, are different in that they have three conductors—one for the + signal, one for the – signal, and one serving as a ground.

When properly executed, balanced audio circuits offer either higher output than or lower noise levels than equivalent single-ended circuits, which allows longer runs of cables and that is why pro-audio equipment is almost universally balanced in operation. However, balanced circuits are inherently more complex to design and manufacture than equivalent single-ended circuits, and likewise balanced cables are more complex (and usually more costly) than their single-ended counterparts.

Some common balanced connector types include XLR connectors (much like the connectors you might see on professional microphones), TRS or 'tip-ring-sleeve' connectors (which look like ¼-inch phone plugs and are more commonly seen in pro-sound rather than high-end home audio applications), and AES/EBU connectors (which are used for balanced digital audio applications).

Bi-Wiring

Some loudspeakers are configured to allow bi-wiring, which means that instead of having just one +/- pair of connection terminals, the speakers—usually, but not always, two-way designs—instead have two sets of terminal, where one set is for the low-frequency driver and the other for the high-frequency driver.

When choosing to bi-wire, users would run two complete sets of speaker cables to each loudspeaker—one routed to the low-frequency driver terminals and the other to the high-frequency driver terminals. In theory, this practice can yield a purer, clearer, and more tightly focused sound overall.

Several technical explanations are offered to explain the ostensible benefits of bi-wiring, but opinions on the efficacy of bi-wiring can and do vary among high-end cable designers (see the Designer Interview section of this Guide for proof of this).

Image courtesy of AudioQuest

When choosing not to bi-wire, users would instead run a single primary set of speaker cables to their loudspeakers—typically to the terminals for the low-frequency driver, and then would run a set of short 'jumper' cables (ideally identical in configuration to the main cables) from the low-frequency driver terminals to their adjacent high-frequency driver terminals.

Capacitance/Resistance/ Inductance

These three electrical characteristics are the basic building blocks of all high-end cable designs; they are the essential variables that cable designers seek to manipulate in their quest for higher performance and better sound.

Capacitance is the ability of a cable (or a capacitor) to store an electrical charge. Generally speaking, most designers consider that lower capacitance is better. The train of thought is that one does not want an audio cable to absorb and store an electrical charge from the music signals being passed through the cable, because such charges will inevitably be released (or dissipated) later on in time, thus 'smearing' the sound of the music.

Inductance is the property of cable (or an inductor) to resist changes in current flowing through the cable through the process of inducing an electromotive force (EMF), which

actively resists current changes. Generally speaking, most designers consider that lower inductance is better, since ideally one would want cables to allow current changes to occur in a natural or free-flowing manner as required by changes in the music signal.

Resistance is a measure of the difficulty to pass an electrical current through a conductor—in this case a cable. Generally speaking, most designers consider that lower resistance is better, since the lower the resistance the less energy is dissipated within the cable when driving current through the cable. This factor can be especially important in designing cables that are meant to conduct very low-level audio signals with minimum signal loss and distortion.

Coaxial Cable

A type of cable construction often used in digital or single-ended interconnects with a central +/- signal conductor surrounded by an insulating (dielectric layer), in turn surrounded by a outer conductive shield or sheath used as a ground or 'return', with a protective insulation jacket on the outside. The central conductor and the conductive sheath both share the same axis; hence the term 'coaxial'.

Conductors

Technically, conductors are materials that permit electrons to flow freely and that allow electrical current to flow in one or more directions. Wires, in turn, are conductors that can carry electricity over their entire length. Conductive materials used in audio cables include copper, silver, gold, rhodium, and in some recent exotic designs, graphene. At least one manufacturer uses liquid metal conductors in the form of slurry containing gallium, indium, and tin.

Depending on which designer one asks, the exact composition of wires, both in terms of the conductive materials used, the metallurgy of the wire, and even the cross-sectional characteristics of the conductors, are thought to have significant impact on sound quality.

Stranded-Core designs: In many cases the wires used in audio cables are composed of multiple, bundled, small-diameter strands of conductive materials—collectively known as stranded-core designs.

Image courtesy of The Chord Company

Solid-Core designs: In other typically higher-end audio cables, wires use solid-core conductors that are considerably larger in cross-sectional area than the tiny conductive strands used in stranded-core designs. The size and shape of the solid-core conductors used are thought to have impact on sound.

Thus, at least one famous cable manufacturer touts use of 'rectangular solid core' conductors, while another uses solid-core conductors whose also rectangular cross section uses so-called 'Golden Section' proportions.

In a 'big picture' sense, the better the conductors an audio cable employs, the better it will sound.

Crystal/Monocrystal Conductors

The overwhelming majority of audio cables use metal conductors, but what few listeners realise is that the wires within those cables have a crystalline structure (many equate 'crystals' with gemstones, but metals are crystalline, too).

Under normal circumstances, drawn metal wires contain numerous metal crystals butted up against one another and many audio purists believe that the junctures between these crystals have a subtle, adverse effect upon sound quality.

However, one important development is the advent of manufacturing techniques that allow wire makers to produce monocrystal wires, where one metal crystal spans the entire length of the wires (meaning there are no crystal-to-crystal junctions to affect the sound in any way).

Cables featuring monocrystal conductors are highly prized for high-purity/high-accuracy applications, even though they are typically more expensive to make than conventional multi-crystal conductors.

Dielectrics

In simple terms, dielectrics are insulators—the materials or other related systems used to provide insulation for the conductors found in audio cables.

Dielectrics are important because they have much to do with the cable's capacitance and thus resulting sound quality (see Capacitance/Inductance/Resistance, above). The ideal would be to have dielectrics that absorb no electrical charges at all.

Some common dielectrics include fluorinated ethylene polypropylene (FEP), polyethylene, polytetraflouroethylene (PTFE, aka Teflon), and others—many of which are available either as solid or as "foamed" materials. Several manufacturers have experimented with insulation systems that use air or a vacuum as dielectrics (because, in theory, a perfect vacuum would be an ideal insulator, though for obvious reason vacuums are very difficult to manage in a cable context).

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Dielectric Bias System (DBS)

DBS is AudioQuest's trade name for a system (co-developed with loudspeaker designer Richard Vandersteen) for applying a bias voltage (via a small battery) across the dielectrics of audio cables, effectively making them highly resistant to accepting music-induced electrical charges. One claimed advantage of DBS is that it obviates the need for lengthy cable 'break-in' periods.

Digital Interconnects

Audio cables specifically designed for carrying low-level digital signals (or files) from digital source components (e.g., a CD transport, music server, or streamer) to a digital audio component capable of decoding those signals.

At first glance, it is tempting to think of digital interconnects as being 'just like' analogue interconnects, but in fact the two cable types have significantly different 'mission profiles'. Analogue cables must accurately convey analogue signals ranging in frequency from a few Hz on up into the kHz range.

Image courtesy of The Chord Company

Digital cables, instead, are expected to transfer square wave signals (representing digital 'ones' and 'zeroes') in the MHz range, loading into digital components whose input impedances are potentially quite different to analogue components.

Some common digital interface types include:

- AES/EBU (Audio Engineering Society/ European Broadcasting Union)—a quiet, balanced digital audio interface that uses XLR-type connectors.
- Ethernet—a reliable, well-documented, wide-bandwidth multipurpose digital connection borrowed from the computer world, which typically uses RJ-45-type connectors and sockets.
- S/PDIF (Sony/Philips Digital Interface Format)—a popular and robust digital audio interface that typically uses coaxial wires with RCA-type plugs.
- TOSLINK (Toshiba Link)—a popular and robust digital audio interface that, instead of wires, uses fibre-optic connections that typically use EIAJ/JEITA RC-5720 optical connectors. Note: TOSLINK is essentially a fibre-optic implementation of the S/PDIF standard.
- USB (Universal Serial Bus)—an enormously popular, multi-purpose digital interface that has in recent years come to be the digital interface of choice for many high-end (and not-so-high-end) digital audio components. The USB specification allows for many types of connectors, but the ones most commonly seen in audio applications are: USB Type A (as found on many PCs and other digital sources), USB Type B (as found on many high-end audio DACs), and USB Mini A and Mini B (as found on many smartphones and small, portable digital audio components).

Image courtesy of The Chord Company

Directionality in cables

Although the subject is considered somewhat controversial, the fact is that most if not all audio cables (or more accurately, the conductors within those cables) exhibit directionality—meaning that signal flow works and sounds better running in one direction than the other. The technical explanations behind this are somewhat complex, but according to AudioQuest founder Bill Low:

> *"All drawn metal has a directional impedance variation at higher RF/EMI noise frequencies. By 'law', energy must follow the path of least resistance, so we employ this impedance variation as a mechanism for consciously directing noise either to Earth or to whichever attached circuit is less vulnerable to noise. The key is to direct noise to where it will do the least damage."*

What is more, some cable designs use asymmetrical shielding schemes (where noise blocking outer sheaths might be, for instance, connected to ground only at one end of a given cable), adding a further directional element.

Given this, expect to see markings (arrows, marker rings, and the like) on many high-end audio cables to indicate the preferred direction of signal flow. Some speaker cables, for instance, even provide terminations marked 'speaker end' or 'amplifier end'.

Image courtesy of The Chord Company

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Gauge (or Wire Gauge)

The gauge of a cable, typically expressed as AWG (American Wire Gauge), is an indicator of the cross sectional area of the wires used in the cable. AWG ratings are arranged so that the lower the AWG number, the more cross sectional surface area the cable possesses. A giant power cord, for instance would have a very low AWG number, while the tiny run-out wires in a tonearm headshell would have a very high AWG number.
Note: AWG numbers are considered useful indicators of a cable's current carrying capacity (the lower the AWG or gauge number, the higher the current load the cable can bear).

Hospital Grade Power Plugs/Sockets

In discussions of American AC power distribution, we often encounter references to 'hospital grade' mains sockets and plugs. The reference is to specifications for mains sockets and mains cable plugs designed for use in 'mission critical' hospital applications (you wouldn't want an AC plug to fail on a respirator, now would you?).

Hospital grade socket and plugs specify materials that can withstand both chemical and physical abuse and, in the case of plugs, also specify relatively tight-fitting connector pins that, by design, are extremely difficult to dislodge.

There is no direct UK equivalent to the 'hospital grade' socket (in part because the three-pin socket used in the UK is hard to dislodge), but audiophiles in the UK often opt for unswitched 13A designs in place of standard switched models.

There is much debate over whether hospital grade mains connections are necessary or beneficial for audio applications, but many purists choose to use them (both for mains cables and for power distribution components)—if only as a precautionary measure.

Litz wire

Litz wire is a specific cable configuration that uses bundles of multiple small-diameter, individually insulated strands of conductors, where the strands are typically twisted along the length of the cable. The main intent behind Litz wire is to mitigate the sonic problems associated with skin effect (see 'Skin Effect', below).

The most common result of skin effect is a tendency for a cable's AC resistance to increase at higher frequencies, potentially causing at least some degree of audible treble roll-off. Happily, Litz wire overcomes this problem for the most part.

A few power amplifiers designed to be used with conventional stranded loudspeaker cable have been known to 'struggle' with the low resistance of Litz wire. In most cases, these problems are now historic.

Mains/Power Jacks and Plugs

Often, we think of our own AC connections as the norm, forgetting that there actually numerous international standards for power distribution voltages, frequencies, and the sockets and plugs to deliver electrical power. The US Department of Commerce International Trade Association has identified 15 specific types of power plugs/socket in use worldwide (these plug socket combinations are assigned identifying letters from A through O).

The tricky part, however, is that various countries and regions use these 15 types of power plugs, some grounded and other not, in sometimes unusual or unexpected combinations. On page 92, we provide a table showing commonly used power plug/socket combinations for the UK, Europe, North and South America, and the Pacific Rim.

Image courtesy of Isotek

Image courtesy of Isotek

One upshot of all this diversity is that high-end audio power cable manufacturers must potentially create very broad ranges of models in order to address the needs of the worldwide market.

Ohno Continuous Casting (OCC)

Under 'Crystal/Monocrystal Conductors', above, we mentioned that 'monocrystal conductors are highly prized for high-purity/high-accuracy applications'. The man who successfully developed the manufacturing process that makes it possible to fabricate

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Mains/Power Jacks and Plugs

Country or Region	Mains Voltage	Mains Frequency	Grounded Connector	Non-Grounded Connector
Australia	230V	50Hz	(Type I) Grounded AS-3112	Not applicable
Brazil	127V/220V	60Hz	(Type N) Grounded IEC 60906-1, NBR 14136	(Type C) Non-Grounded CEE7/16 Europlug
China	220V	50Hz	(Type I) Grounded AS-3112	(Type C) Non-Grounded CEE7/16 Europlug, (Type A) Non-Grounded NEMA 1-15
Denmark	230V	50Hz	(Type K) Grounded SRAF 1962/DB, DS 60884-2-DI (Type F) CEE 7/4, (Type E) CEE 7/7	(Type C) Non-Grounded CEE7/16 Europlug
France, parts of Europe	230V	50Hz	(Type E) French-style Schuko	(Type C) Non-Grounded CEE7/16 Europlug
Germany, parts of Europe	230V	50Hz	(Type F) Grounded CEE7/4 Schuko	(Type C) Non-Grounded CEE7/16 Europlug
India	230V	50Hz	(Type D) Grounded BS-546 'Small' and, rarely, "Large"	(Type C) Non-Grounded CEE7/16 Europlug
Israel	230V	50Hz	Grounded SI 32 (IS 16A-R)	(Type C) Non-Grounded CEE7/16 Europlug
Italy	230V	50Hz	(Type L) Grounded CEI 23-16/VII, (Type F)CEE 7/4 Schuko	(Type C) Non-Grounded CEE7/16 Europlug
Japan	100V	50Hz/60Hz	(Type B) Grounded NEMA 5-15	(Type A) Non-Grounded NEMA 1-15, Non-Grounded JIS C 8303
North America	120V	60Hz	(Type B) Grounded NEMA 5-15	(Type A) Non-Grounded NEMA 1-15
Russian Federation, parts of Europe	220V	50Hz	(Type F) CEE 7/4 Schuko	(Type C) Non-Grounded CEE7/16 Europlug
South Africa	230V	50Hz	(Type D) Grounded B-546 'Small', (Type M), Grounded B-546 'Large', (Type N) Grounded IEC 60906-1	(Type C) Non-Grounded CEE7/16 Europlug
Switzerland	230V	50Hz	(Type J) Grounded SEV-1011	(Type C) Non-Grounded CEE7/16 Europlug
Taiwan	110V	60Hz	(Type B) Grounded NEMA 5-15	(Type A) Non-Grounded NEMA 1-15
UK, Ireland, Malta, Malaysia	230V	50Hz	(Type G) Grounded BS-1363	Not applicable

monocrystal wires is Dr Atsumi Ohno, and his famous process is called Ohno Continuous Casting, typically abbreviated 'OCC', not to be confused with the familiar psychological acronym, OCD.

Plugs, Lugs & Jacks for analogue audio cables

Audio cables use a wide variety of connectors, with certain connectors optimised for interconnects and others for speaker cables. When thinking about connectors it is helpful at times to remember that for plugs and lugs there is always a corresponding jacket, socket, or terminal to complete the connection.

Image courtesy of AudioQuest

Banana plugs and jacks: Banana plugs are extremely popular as terminations for loudspeaker cables. (The spring-loaded connector surfaces of the male Banana plug look somewhat like miniature, metal 'bananas'—hence, the name.) Banana plugs typically connect to loudspeaker cable-binding posts that, by design, have banana jacks bored into their outer ends. Banana plugs are very easy to use, allowing simple push-to-connect, pull-to-disconnect operations.

Banana plugs typically make a 'press-fit' connection with their associated sockets. Note, however, that some banana plugs are 'locking' designs, with thumbscrews that, when tightened, clinch the plugs for an extremely tight fit within their jacks.

BFA connectors: Built For Audio/British Federation of Audio terminations are a variation on the theme of the 4mm banana plug (effectively built inside out and coated in ABS), designed to express safety concerns raised because the similarity of this plug to the live and neutral terminals in a EU 'Schuko' AC terminal. The 4mm banana plug is (notionally at least) 'banned' in the EU, which is why amplifiers include little red and black inserts that prevent their use, but you can remove these inserts with a penknife and continue to use banana plugs as before.

BNC connectors: Male BNC (Bayonet Neill-Concelman) connectors are sometimes used on coaxial interconnect cables for use with components fitted with female BNC connectors, although BNX interfaces are relatively uncommon in high-end audio applications and components. Male BNC connectors use a quick-connect, quick-disconnect, twist-to-lock collar or 'nut' that latches on to two bayonet locking pins found on the female BNC connector.

BNC connectors are desirable in settings where it is important (or even critical) that cable connections do not work loose and where a 'fail-safe' locking mechanism is therefore required.

RCA plugs and jacks: RCA plugs are the de facto standard terminations for analogue interconnects and for coaxial S/PDIF digital interconnects. Corresponding, RCA jacks are the standard socket fitments for single-ended analogue and coaxial S/PDIF interfaces on audio components. RCA plugs provide a central post, carrying +/- audio signals, and an outer sleeve that serves as a ground, or 'return'.

As with banana plugs (see above), RCA plugs make press-fit connections with their associated sockets. However, many audiophile-grade RCA plugs feature 'locking' mechanisms, most of which work on the principle of firmly clamping the plug's outer sleeve against the mating surface on the RCA jack.

Spade lugs: Spade lugs vie with banana plugs as the most popular terminations for loudspeaker cables. Spade lugs, as their name suggests, look almost like miniature, metal garden implements. Typically, spade lugs provide a sturdy wire receptacle at one end (where the cable's conductors attach to the lug), and a flat, thick, two-pronged metal connecting surface at the other end, which is designed to fit around the central shaft of a traditional loudspeaker binding post.

Loudspeaker cable-binding posts have threaded metal shafts, traditionally fitted with beefy metal locking nuts or collars. To make firm connections using spade lugs, one would first back off the binding post's locking nut, then insert the spade lug so that its prongs fit on either side of the binding post shaft, and finally tighten down the locking nut or collar as firmly as feasible to clinch the spade lug in place.

Some contend that spade lugs offer inherently superior connections to banana plugs owing to their robust construction and large surface area, but one point to bear in mind is that it takes two hands to connect spade lugs properly—one hand to hold the spade lug in place against the binding post shaft while the other tightens the locking nut. Also, users should be aware that—depending upon cable positioning—the weight of the speaker cables can apply torque on the spade lugs, causing the binding post locking collars to become loose over time.

XLR connectors: XLR connectors are the de facto standard for use in all types of balanced analogue and digital interconnects. In traditional, loudspeaker-based audio systems, the most common variant would be

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three-pin XLR connectors where, as noted under 'Balanced Interconnects' and 'Digital Interconnects' above, one pin carries the + signal, another carries the – signal, and the third serves as the ground, or 'return'.

By convention, three-pin XLR output jacks provide a socket with three outward-facing pins, while XLR input jacks provide a socket with three pin receptacles. To accommodate this convention, XLR cables are invariably set up with different connectors on each end, with a distinct signal input end (providing receptacles for the pins from the audio component's XLR output socket) and a signal output end (providing outward-facing pins that plug in to the receptacles of the audio component's XLR input sockets). Virtually all XLR sockets and plugs features spring loaded mechanical latches that lock the connectors firmly in place (typically the latches feature thumb-actuated release catches).

Image courtesy of AudioQuest

In headphone-based systems, however, one might encounter both three-pin or four-pin XLR connectors, where the four-pin variant is a stereo (two-channel) connector, providing two sets of +/– connections pins. Some higher-end headphones ship with balanced signal cable sets terminated either with dual three-pin XLR connectors (as used, for example, on the Abyss AB-1266) or with single four-pin XLR cables (as used, for example, on top-tier Audeze or HiFiMAN headphones).

Power Cords/Mains Cables

You might think all mains cables are created equal (or nearly so), but in our experience, high-performance mains cables can and do have a profound effect on sound quality. Indeed, several leading edge cable designers would say that, if you could only improve one cable in your entire system, it should be the mains cable that runs from your wall sockets to whatever power distribution component you choose to use.

The key differentiators between 'garden-variety' power cords and the high-performance models we recommend include: higher gauge conductors, conductors fashioned from superior and very high-purity materials, more sophisticated dielectrics, superior internal geometries (often focused on blocking noise), superior shielding schemas (again, focused on blocking noise), and ultra high-quality plugs at both ends of the cables.

Purity of Conductors

High-purity conductors are thought to have a direct and significant impact on sound quality and for this reason a number of purity-related acronyms and terms have come into play. Here are three you might encounter frequently:

- **HPC (high purity copper):** Manufacturers who use copper conductors and have been selective in their choice of materials suppliers will often say that their cables feature HPC conductors. Caveat emptor: The term HPC implies that care was used in choosing sources of copper wire, but it does not tell you precisely how pure the copper actually is (although some manufacturers might clarify this point with additional specifications).
- **OFC (oxygen free copper):** Oxygen is one of the most common 'contaminates' of pure copper, so manufacturers who have taken steps to source copper that is very low in oxygen content will often tout their use of OFC conductors. In many cases, references to OFC conductors will feature supplementary specifications to indicate the exact-level of purity.
- **'Five-Nines' or 'Six-Nines' conductors:** These slang terms indicate levels of purity, expressed as, for example, 99.999% or 99.9999% pure metal, whether referencing copper, silver, or other metals. Obviously, more 'nines' describe conductors of higher purity, higher cost, and—it is thought—higher sound quality.

Skin Effect

Skin effect is the tendency for an alternating current (AC), or an alternating music signal, to flow or become concentrated mostly near the outer surface (or skin) of a conductor. The higher the frequency of the signal the thinner the functional depth of the skin being used to pass the signal, which means that the AC resistance of the cable tends to increase at higher frequencies. This is why some cables can exhibit a certain degree of treble roll-off.

Certain cable geometries (for example, woven Litz wire geometries) can, however, mitigate the problem of AC resistance increasing at high frequencies owing to skin effect. The point is that it pays to seek out cables whose designs minimise or eliminate skin effect problems in the audio range.

Speaker Cables

Some audiophiles draw a distinction between 'signal-bearing' cables (namely, interconnects) versus 'power-bearing' cables (namely, speaker cables). Stated another way, speaker cables are responsible for delivering the often high-wattage output of amplifiers to our loudspeakers and doing so with high bandwidth, minimum noise, low distortion and colouration, and maximum delivery of current as demanded by the loudspeaker.

To meet these demands, speaker cables place the same emphasis on geometries,

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materials, conductors, and noise-blocking shields as interconnects do, but with the added demand of being able to handle potentially very high levels of power (power = voltage x amperage).

Some speaker cable terms you may encounter are these:

- **(Internal) Bi-wire cable:** A speaker cable that internally has double runs of conductors, with a single pair of +/- connections at the amplifier end and a double set of +/- connections at the loudspeaker end. In this configuration, the double runs of conductors are housed within a common sheath or jacket.
- **'Shotgun' cable:** A speaker cable that provides double runs of conductors, each housed in its own sheath or jacket, where there is a single +/- set of connections and a double set of +/- connections at the speaker end. The term 'shotgun' comes from the fact that the dual-runs of conductions, each in its own jacket, look somewhat like the barrels of a double-barrel shotgun. +

Image courtesy of AudioQuest

The Perfect Connector

should have…

Complete continuity of conductor material
Consistent geometry irrespective of socket size or tolerance
Massive mechanical stability but low mass
Consistent contact pressure across all connections
Easy insertion but complete security of connection
Enhanced grounding integrity

It should be strong, silent AND good looking!

Meet the Triple Crown Connector family - innovative, self-centering, variable geometry, lockable designs exactingly engineered with mono-crystal silver contacts and precision machined, low-mass bodies, designed to meet the termination demands of our finest ever cables.

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