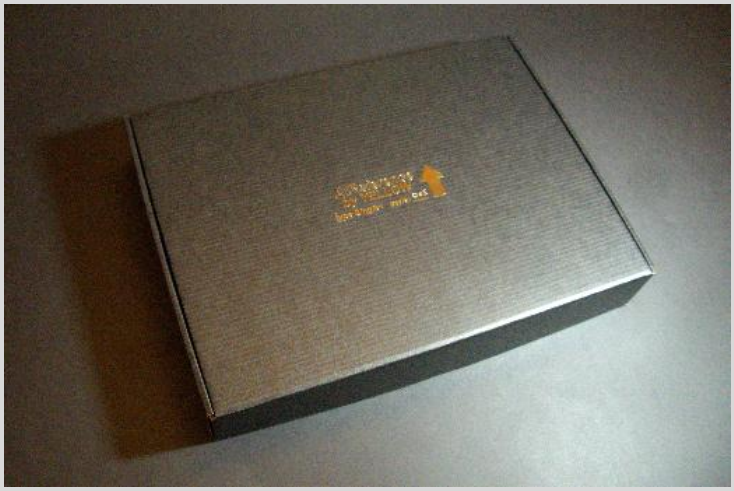
AIReference by YELLOW interconnect

AIReference by YELLOW interconnect *is the line-level connecting cable between the components in a high-end music reproduction system. Interconnecting cables are no less important part of reproduction system than any other component itself. Good interconnect cables significantly contribute to system performance.* AIReference by YELLOW interconnect *is one of the best.*

Excellence

Needles to point out, music reproduction system consist of many interconnected components. The chain starts with live music and the space it is performed in, continues with sound recording and recorded signal storage, then, of course, reproduction chain electronics, transducer of electrical signal to sound waves, the space transducer is playing in, and finally the very ears and brain of the listener.



When all of these are well matched to the task at hand, as well as well-matched to one another, magic happens. Magical excellence is what audiophilia and audiophiles are all about.

Audiophilia

Is audiophilia real? In today's world flooded with brobdingnagian overflow of information on any subject imaginable, pruning true from false is all but easy. Let us start with Oxford, Webster, and Wicki.

Audiophilia: "Strong interest in the high-fidelity reproduction of recorded sound." (Oxford English Dictionary: occurs 0.01 times per million words).

Audiophile: "A person who is enthusiastic about high-fidelity sound reproduction. "(Merriam-Webster Dictionary: first known use in year 1951).

Audiophile: "Is a person who is enthusiastic about high-fidelity sound reproduction. "(Wikipedia: there is substantial controversy on the subject of audiophile components.).

One can resume audiophilia is real, but contested. How to decide? Due to subject nature, direct experience is the only way. Just listen to reproduction systems as much as you can. Compare what you hear to actual live performance.

And last, but not least, do you care?

Accessibility

If the answer is yes, you can always build and fine tune your own music reproduction system. Component offerings cover vast areas of purpose and technical solutions. Some are built-to-a-price-point, some are price-is-no-objection type.

Many built-to-a-price-point devices perform superbly, many price-is-no-objection only glitter and shine. It's complex. When one is out-of-his or her depth, the best way out is to get help from the source one trusts.

Interconnect cables are no exception. There are many excellent cables, but they usually come with price tag digit counts of four, or even more. It has come to pass, that expensive cable did not always bring expected compound performance gain to the system.

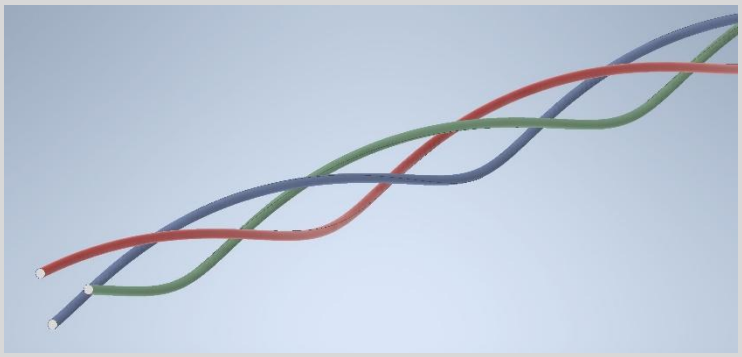
AIReference by YELLOW interconnect *will change that.*

New kid on the block

AIReference by YELLOW interconnect *brings performance excellence to the table, bypassing price-is-no-objection cost at the same time. This is the first time a price tag in low three digits buys a pair of one of the best interconnect cables available. How is this possible? With lots of enthusiasm, and a hefty dose of ingenuity, of course. Let us sift through solutions interconnect designers use, and how they come into play.*

Geometry

AIReference by YELLOW interconnect *uses the air-helix cable geometry. Multiple conductors spiral along cable length, avoiding conductor running in parallel. This reduces cable parasitic capacitance and inductance.*



Most multiple conductor cables make use of this trick. Conductors are kept apart with different means. Conductors have to be kept from touching, of course. In machine-built cables, various plastic materials are used to fill inter-conductor space.

This brings filler dielectric constant into play. Filler dielectric constant influences cable performance when transmitting alternate current signals. Audio signals are by far the very worst load cables have to suffer. Nowhere else does highest-to-lowest-frequency transmission reach so high ratios.

Power cables transmit 60Hz, and some harmonics only, the less the better. Radio frequency cables use very low top-to-bottom ratios. Audio cables are different. Since filler dielectric behaviour is frequency dependant, this has audio cable designers pulling-out the hair.

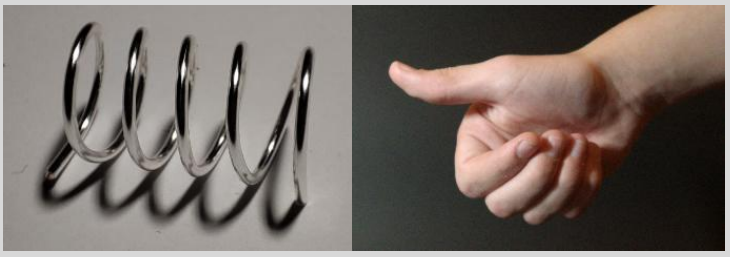
Designer has to use as low filler dielectric constant as possible. When choosing filler by these criteria, the very best one is vacuum. Regretfully, not applicable here.

Next best one is plain air. Air is what AIReference by YELLOW interconnect *uses. There exist other cables with air-helix geometries, but as already mentioned, at much higher prices.*

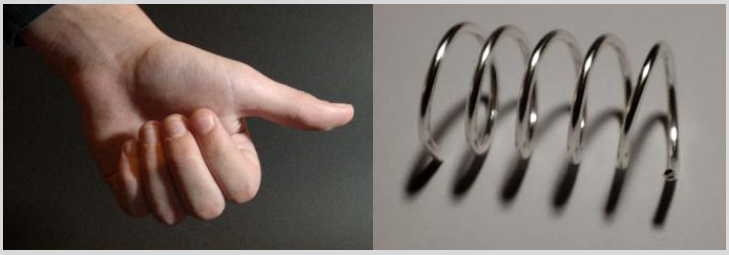
Spiraling

Cable designers have been searching far and wide for geometry solutions with low impedance and reactance. Cable signal propagation velocity variation by frequency, and other measurable, and non-measurable properties behavior should be as uniform as possible. Therefore, best designs often opt for air-helix spiraling spatial geometries.

Spiraling conductors is used throughout AIReference by YELLOW interconnect *cable design. Spatial geometry with spiraling multiple conductors is called the "helix" structure. All "helix" spatial structures, by geometry nature, have one of two possible "chirality's" (directions), "right" or "left", regardless of viewpoint.*



"Right" and "left" chirality's are named after human hands, where thumb points to the helix progression, while fingers point to the spiral coil (winding) direction. The two helix chirality's are unique and non-inter.changeable.



Winding multiple conductors with the same helix chirality with appropriate slope, results with conductors crossing each other at angles, instead of running parallel.

Construction

Keeping conductors apart in plain air is not easy. There has to be a supporting structure, with as low added non-air as possible. The structure has to be fully flexible, while still maintaining required cable sturdiness. These requirements do limit material options, and element joining solutions.

Supporting structure parts can be machine produced, but machine assembly is out of the question. Manual work, among other issues, prevents pulling price tag digit count below three.

Supporting structure is "cable spine", individual members ("vertebra") link up to each other. Spine provides mechanical support to conductor helix, as well as means of keeping multiple conductors apart in empty space and away from outer cable skin (sleeve).

Given uniform longitudinal alignment of vertebra, conductors can be threaded through straight and parallel to each other, or spiraled one or more pass-through holes left or right per vertebra.

Each conductor threading strategy brings to table its own set of cable impedance, reactance, and signal propagation speed issues. Many cable designs with multiple conductors, bypass spine spatial structure solution by using alternate spatial geometries. Some embed conductors in injection molded

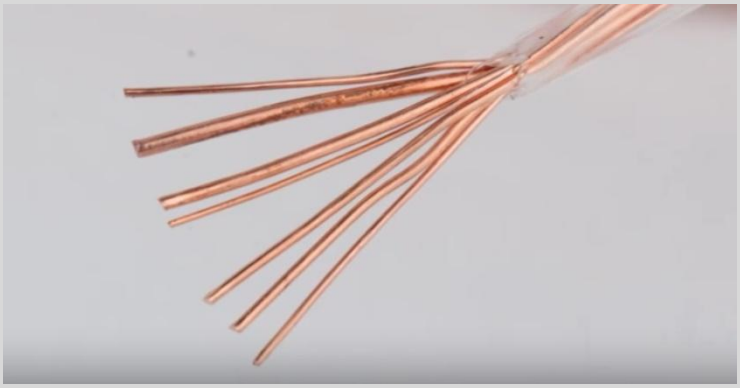
ribbons. Some braid conductors to circular inter-weaved structures. Some weave conductors through solid insulator filled cables. These solutions can be machine assembled, cutting the spine assembly cost. Each spatial geometry has its own issues related to the solution the designer chooses. One has to opt for least issue prone one.

Go for the best compromise. AIReference by YELLOW interconnect *!*

PET "Techflex" cable sleeving braid is not advised. Dielectric constant is way out of desired range. AIReference by YELLOW interconnect *uses glass fiber braided sleeve.*

Conductors

Conductor specific resistance has to be taken under consideration first. Whereas conductor resistance does not significantly vary with frequency, low values are desired regardless. Due to prohibitive prices at high conductor cross sections, designers of reasonably priced cables avoid inherently low specific resistance stuff like pure silver.



Luckily enough, cable designers can borrow from advances in copper metallurgy here. AIReference by YELLOW interconnect *conductors make use of high purity copper casts. Best wire casting solutions of today vary from just plain copper, through OFC (Oxygen Free Copper cast), to OCC (Ohno Continuous Cast) technologies. OCC process results with longer and better aligned copper crystals. Purity grade notification is with N (nines) units. 2N is 99%, 4N is 99,99%, and so forth.* AIReference by YELLOW interconnect *OCC conductors use 8N grade copper.*

Each conductor is wound with several strands of various diameter non-plated wire. For reasons explained in "skin effect" section, diameters are kept at, or below 0.5mm. A thin coat of Teflon (PTFE) protects strands from oxidation. No coating would, of course, perform better, so we use best available plastic coating material.

Instead of pervading multistrand, some high-end cable designs employ single solid core conductor. Alas, this results with less uniformity of high to low frequency propagation speed, known as "skin effect". Low frequency current travels uniformly throughout conductor cross section, while high frequency is "pushed" to the surface. Surface current propagation speed in plated wires is higher, hence solid core conductor diameter has to be kept low to reduce canter-to-surface distance, high frequency propagation speed and phase overshoot.

In addition to signal propagation speed uniformity, smaller conductor diameter grants better cable flexibility.

Flexible cables with larger conductor cross sections obviously must use multiple thin strand cores. Multiple strand conductor winding topologies vary. Small cross section conductor winding pattern is most times single helix. Larger cross section conductors employ various multiple opposing left-right helix chirality's.

Since conductors in air-helix designs are kept apart from each other in empty space, surface coating is necessary. However, coating conductor prevents surface deterioration from oxide buildup. In cables with coated conductors, coating layer thickness is kept as low as possible to minimize lower grade dielectric use.

Skin effect

Physical nature of conductor behavior, when conducting alternating electrical current depends on voltage/current frequency. Low frequency current propagates throughout conductor cross section, but high frequency current gets pushed towards conductor surface (skin).

This effect intensifies with rising alternating current frequency. Since audio signal current carries many different frequencies at the same time, all parts of audio reproduction chain suffer from frequency dependent impact on transmitted signal.

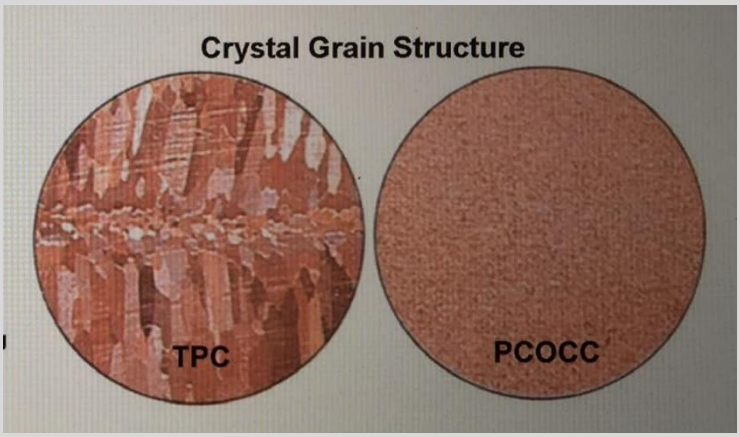
Cable designer has to ensure low and high frequency signals travel along with similar speeds. That is why plated wire is not advised. High frequencies get pushed towards wire surface. When wire surface is plated with lower specific resistance stuff, than the rest of wire (i.e. with pure silver), high frequency surface current travels faster than the lower part of the spectrum.

Surface current speeding causes phase advance of high frequency signals. Phase shift is definitely not welcome in high-end sound reproduction systems. Therefore AIReference by YELLOW interconnect *cables use non-plated conductors.*

Skin effect calculation for AIReference by YELOW interconnect *non-plated cable conductors at 20kHz frequency indicate that individual wire strand diameter should be kept at or under 0.5mm, which is consistent with the geometry solution of the conductor we use.*

Cryogenic treatment

Cable designers have borrowed cryogenic treatment from recent advances in metallurgy as well.



Tough Pitch Copper and Pure Copper Ohno Continuous Cast.

Everything made of atoms has a structure to it. Solid metal structure is crystalline below specific temperature. This point is different for each metal, of course. Wherever the crystal structures ("grains") meet within the material, there are microscopic "grain boundaries". When electricity flaws

through material, it meets less resistance across fewer grain boundaries.

The organization of the crystalline structure of a metal wire is dependent on the purity of the material used, and more importantly the manufacturing process of the wire itself. By using casting techniques at controlled temperatures, it is possible to create metal materials which are organized as one continuous crystal structure as opposed to a fractured assembly of crystal structures. Organized continuous structure results with fewer grain boundaries. Dr. Atsumi Ohno (1926-2017) invented and patented the "Ohno Continuous Casting" process (OCC) for casting copper wire like this.

So far these are well settled scientific facts, not audio theory. The theory postulates that flowing the alternating current signal along a single crystal structure, unimpeded by the boundary breaks, one smooths the signal propagation. Many-crystal formation of the regular metal material with multiple ragged boundaries is inferior, of course.

Performance benefits of using OCC copper wire in speaker cables and interconnects have been verified long ago. There is no doubt OCC works as advertised. There is still some controversy on cryogenic treatment though.

Deep Cryogenic Treatment or DCT has been around since the 1960s and is most commonly used in the motor sport industry to reduce wear and increase the life of the engine and gearbox components amongst other things. It's also used in aerospace components and more recently has been applied to brass instruments and even guitar strings.

It was initially discovered that treating steel at extremely low temperatures removes most of the softer "austenite" structure, giving a much harder crystal structure. With DCT, the components to be processed are gradually cooled to typically -300F, held at this for a time, then gradually brought back to room temperature, with a cycle time of several days to avoid thermal shock. In non-ferrous materials, as a result of the production process, be it drawing wire, casting or cooling of thermoplastics from the molten state, stresses and dislocations occur in the crystal structure. Deep CryogenicTreatment relieves a lot of these stresses and dislocations and purifies crystal boundaries, to enhance signal transfer.

Using AIReference by YELLOW interconnect

AIReference by YELLOW interconnect cables should be used in resolving audio systems, with best audio sources, in well behaved listening rooms. One can treat listening room for better performance without spending a fortune on diffusors, traps, etc. Just follow your gut feeling, and listen to results.

AIReference by YELLOW interconnect cables need to be burned-in prior to evaluation.

When connecting cables to sound reproduction system component terminals, one should observe correct cable direction. Cable hot end (arrow base) always connects to signal source (component output), while cable cold end (arrow point) connects to signal sink (component input). Cables neither mind nor prefer one direction over the other, of course. Arrows are for system set up help only. Once the cable is burned in with signal propagation from hot to cold end, one should always run it with the same orientation. Reversing the direction after the cable burn-in will deteriorate the sound reproduction system performance.

AIReference by YELLOW interconnect cable significantly enhances imaging performance in resolving sound reproduction systems. Soundstage gets wider and deeper. Imaging has better clarity, focus, and separation. There is better focusing on individual performers, and more coherence. Dynamics are prominent.

One should always bear in mind that sound reproduction system is a chain of components. Compound chain performance will be as good as its weakest link performance. Therefore, when enhancing any system with AIReference by YELLOW interconnect cables, one should also fix any other weak links, if and where they exist.

Chain links to consider are source signal recording, analog or digital signal carrier, analog or digital source device, amplification components, sound transducer, system setup, listening room behavior, and your own ears. Never miss the chance to compare what you hear in your listening room, to actual live performance.

AIReference by YELLOW interconnect
design team, Zagreb, spring of 2025