Cable Controversies *(Part 3)*

IN THIS THIRD PART OF HIS MAGNUM OPUS ON HI-FI CABLES, MARTIN COLLOMS DISCUSSES IMPEDANCE MATCHING AND DISTORTION MECHANISMS, THEN REVIEWS A COMPREHENSIVE SELECTION OF INTERCONNECTS

MARTIN COLLOMS

Cable designers have a hard time of it. There are many more failures than successes, and they need to be obsessed with the science of small differences; otherwise performance improvements occur more or less by chance. The sheer variety of form, colour and size reflects the disparate approaches adopted by the designers, and you could be forgiven for suggesting that a dose of snake oil is an integral part of the audiophile cable business. Furthermore, the extravagant claims often made for the advantages of specific constructions do not help establish credibility.

The decisive factor that can cut through the confusion is the 'try before you buy' service offered by some suppliers, allowing the cable to be returned if you don't find an anticipated improvement sufficient or convincing.

Metallurgy and Stranding

Metallurgy – the element or alloy chosen to conduct the signal – is one of many aspects of cable technology that can affect sound quality. Simple copper is available in a range of purities down to six decimal places, and is capable of excellent performance. Beyond that, copper can be plated, or better still clad in a co-extrusion process (a technique different from electrochemical silver plating), most commonly using silver. Various other alloys can be chosen for the conductor, as well as costly pure metals such as silver or even gold.

The conductor can take many forms, ranging from a single strand to arrays of simple multiple strands, multi-gauge strands or individually insulated strands (called Litz, after the inventor). Many divers stranding styles and geometries have been formulated, and are generally offered for sale with near occult theories explaining their specific innate superiorities.

The type of insulator used to separate the conductors and build the cable also influences sound quality. Use of exotic materials such as gold wire and foam Teflon insulation may or may not guarantee excellence. Build quality matters, as does the physical properties of the assembled cable. Above all, there is the skill of the designer.

Impedance matching

Some cable makers speak of impedance and matching, generally on the basis that a matched cable is terminated with its 'characteristic impedance', conferring a transmission behaviour that is free from electrical reflections. We are led to assume that 'reflections' and 'mis-termination' are both bad for performance. However, only rarely is it possible fully to match an audio cable in a hi fi system, and even then the benefits are questionable: indeed the conditions imposed may even prove destructive to system performance.

Take a pair of conductors closely spaced to form a cable. When transferring signal energy from source to load, electromagnetic forces act on the cable. As James Angus recently reminded me, the current component results in a magnetic force tending to push the wires apart, and here the cable may be considered inductive (eg a 'double-barrelled' or 'shotgun' type). Conversely the 'electric', electrostatic field component of the electromagnetic wave propagating down the cable has an attracting relationship. With the conductors closer together (for example, a twisted pair), the cable may be seen more as a capacitance. Field equations show that there is a particular conductor spacing where the magnetic and electric forces balance out, inductance and capacitance matching each other, resulting in a 'neutral', purely resistive characteristic impedance, one that may be matched or terminated by simple resistors. With the mechanical forces balanced there should also be no self-induced vibration. Although characteristic impedance designs have been tried, it is generally impractical to try and match this for perfect electric 'wave' propagation, since the impedances involved are so low.

A wide-spaced shotgun cable, for example like those used for free pin-up indoor FM aerials, is about 300 ohms. Many audio interconnect cables are coaxial in construction, with an impedance of 50 to 100 ohms. Designers would certainly rather avoid trying to match line level signals at such low load values. The currents required have been found to impair dynamic resolution in line drivers.

For long audio cables of up to 100 metres, such as those used in rock concerts and studios, wave propagation effects may become significant, while impedance matched drive [source] and termination [load] preserves the frequency response and provides reliable signal-to-noise levels. It is customary to use 600 ohm impedance matched drive and terminations with shielded balanced lines, usually with a twisted pair conductor set.

For high fidelity electronics the designer may select

almost any value for the input impedance of an audio component, which in real terms is usually decided by a simple resistor. For example, for a pre-amplifier, low input resistances such as 4,700 ohms are less sensitive to hum and noise, but may impair the fidelity of a connected source, which has to drive more current into this relatively low resistance. Even if a source such as a CD player has an intrinsically low output resistance of say 47 ohms, it is likely to sound cleaner and more dynamic when driving a high pre-amp impedance, say at least 20k ohms, and ideally 50k or 100k.

This fact throws the idea of matching source and load impedances for a particular design of cable right out of the window.

Consideration of source loading also means that a source will sound better if the cable capacitance is relatively low, say less than 75pF/metre, Low interconnect cable resistance is itself helpful in minimising induced hum where minor hum current leakage is present between source and load components, especially in respect of the signal ground or minus connection.

Matched cables have been attempted for the loudspeaker connection, but what impedance value do you choose in the face of the great variation in load impedance with frequency exhibited by so many loudspeakers? Some pseudo-matched 8 ohm cables have been available, but can create serious amplifier compatibility problems. When typically mis-terminated, they approximate a large 1uF capacitor, which can create instability and damage in some amplifier designs.

Cable distortions

Credulity must be stretched to consider the question of distortion in cables. If a cable is subject to a simple harmonic distortion measurement, it will be found to be essentially perfect, say better than -120dB of distortion or 0.0001%. Cable harmonic distortion variations can be traced way down at -150dB to -170dB, a hardly credible factor for an audio experience. However, on the test bench it is possible to show that the contact quality can affect precision measurements, for example raising the indicated distortion reading for a power amplifier from a potentially excellent -120 dB to as high as -100dB (ie 10 times worse); both Stereophile editor John Atkinson and myself have experienced this problem with ageing speaker terminations on lab test cables. The effects of poorly made and/or weakly tightened speaker cable connections are also audible.

However, there is much more to this subject. If a cable was truly inert and lossless at all frequencies, distortion would probably not be an issue. But a cable is necessarily built with an insulating dielectric. The resulting capacitance has a complex loss factor which varies with frequency, and in most cases can add a characteristic if mild coloration to the sound, as do the insulators in many discrete component capacitors. This coloration may be considered a form of distortion.

A neat contradiction arises when considering connector practice: how to reconcile the vital objective for stable, low resistance, vibration-proof metal-to-metal contacts, with the potential benefit of mechanically decoupling the cable assembly from the mildly vibrating audio component to which it is connected.

The microphonic behaviour of a cable may be stimulated by vibration emanating from a product casing, communicated to the cable via its connector. One approach is a tight-fitting electrical connection, but one allied to a mechanically decoupled link to the cable itself. Some accessory designers have specialised in seeking to control the very real propagation of audio vibrations down connecting cables.

Well tensioned, oxidation resisting contacts, preferably spring- or locking-tension-loaded, help control the distortion that may result from momentarily intermittent contact under audio vibration excitation. For an operating audio system at a realistic volume level, these accelerations may be considerable, and easily felt with the fingertips. Vibration from the live sound field appears in everything in the listening room – floor, furniture and not least the components of the audio chain.

There is an air path propagation delay from the speakers back to the devices being vibrated, so that their physical disturbance is out of time with the original signal within the electronics. If the delayed vibration is capable of significantly feeding back into the audio chain, it can damage several aspects of the listening experience. Such false information, strictly speaking a distortion, dilutes the sensation of dynamic expression, adds coloration, and impairs both depth and transparency, the latter through the masking of low level detail. At low and mid frequencies it can adversely affect bass tune playing and overall clarity.

INTERCONNECT CABLE REVIEWS

This issue of HIFICRITIC features the third tranche of Martin's magnum cable review opus, this time examining a large batch of interconnect cables. As with the speaker cable reviews, they range from the truly inexpensive to the stratospherically priced. Sound quality ratings make no concessions with respect to price – the scaling is absolute,

from the current 130 points (not 100%) set by available references, to the judged ratings of the review samples.

CD-to-pre-amp and pre-to-power connections were both tried, with generally consistent results, save for the van den Hul *The First Ultimate* pure carbon cables with their higher ground line resistance, which can give mild induced background hum with some pre-power combinations. Generally, one metre lengths were assessed, and the measurement data referenced to 1m lengths. The various cables have been arranged in approximate ascending order of price, again referenced to 1m pairs.

MONSTER INTERLINK 400 Mk II

(£45 per metre pair)

This cable's greatest strength is that it sounds remarkably inoffensive and fairly neutral overall. No aspect of the sound quality stood out, but unfortunately it was also rated significantly below average in all areas that matter for an aspirational audio system. It doesn't time well, dynamics are muted, stereo depth is well below average, as is detail and bass definition.

Loss 0.0085 (low), capacitance 184pF (medium), inductance 1uH (low), resistance 0.045 ohms (very low).
Sound quality score: 20

QED QNEX 3

(£50 Per metre pair)

Compared with costly audiophile cables, this design sounds a bit rough and forward in the treble. Focus is reasonably good, with moderate image depth, while singing voices are quite well projected, though with some attendant 'sharpness' in the upper midrange. Bass has above average definition and depth. With more complex music it begins to sound cluttered, appearing to lose detail and depth. Regardless, value for money is sufficient for recommendation.

Loss 0.004 (very low), capacitance 130 pF (low), inductance negligible, resistance 0.102 ohms (medium).
Sound quality score: 23

VAN DEN HUL THE NAME

(£60 per metre pair)

This middle market cable has quite firm and powerful bass, is smooth and neutral on voices, and has quite good transparency. There's a hint of sibilance in the upper frequencies, and also moderate treble brightness, which accentuates the leading edges of transients. This could be used to advantage in some systems. It has good dynamics, quite good timing and is recommended.

Loss n/a, capacitance 59pF (very low), inductance negligible (75 ohm co-ax), resistance 0.03 ohms (very low).
Sound quality score: 33

BRILLIANCE HI FI SYNERGY

(£87 per metre pair)

First impressions were quite good, this cable sounding quite neutral and well balanced with above average timing, but as the session continued a sense of midrange coloration began to obtrude. The upper mid, which should be open and clear, seems to sound a little congested, and the approval rating dimmed somewhat. It rates average on specific performance aspects such as focus, depth and transparency, and is worth considering.

Loss = 0.007 (low), capacitance 57 pF (very low), inductance 0.4uH (low), resistance 0.055 ohms (low).
Sound quality score: 32

WYREWIZARD DREAMCASTER

(£95 per metre pair)

This cable gave a similar 'zippy' treble impression as *Enchantress*, but did not fill out so well, sounding lightweight with some noticeable vocal sibilance. It's less neutral and the soundstage has a two dimensional feel. The midrange is considered coloured, almost 'boxy', while dynamics and rhythm are somewhat muted.

Loss 0.0042 (very low), capacitance 165pF (medium), inductance negligible, resistance 0.07 ohms (low).
Sound quality score: 25

WYREWIZARD ENCHANTRESS

(£115 per metre pair)

First impressions were of a slightly bright and zippy sound, but extended listening found the balance filling out with strong, informative and tuneful bass and

good overall dynamics. It sounds involving with good rhythm, and these above average ratings also apply to focus and image depth, while that slightly zippy high treble doesn't upset the good rating. I suspect that a superior version could be made available with better plugs, as those used did not fit very tightly. Recommended.

Loss = 0.0025 (very low), capacitance 250pF (high), inductance negligible, resistance 0.04 ohms (very low).
Sound quality score: 43

NORDOST BLUE HEAVEN

(£125 per metre pair, Neutrik terminated)

This open construction silver ribbon design might

suffer from RF problems, depending on the system, and has two recognisable subjective features: a mild 'white' glare in the high treble, and muted dynamics. Focus is better than average, but this cable is not very transparent and also shows a loss of ambience and low level detail. Bass impact and timing are considered a little below average, but it remains worth considering.

Loss 0.008 (low), capacitance 30pF (very low), inductance 1uH (medium), resistance 0.05 ohms (low).
Sound quality score: 43

WIREWORLD EQUINOX 5

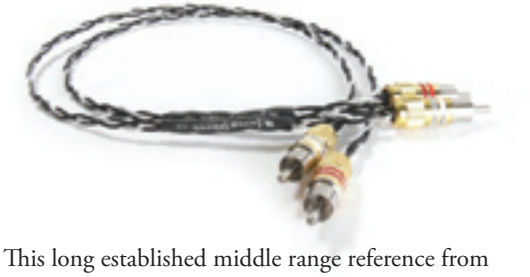
(£200 per metre pair)

In our reference system *Equinox 5* was found to be a little 'forward' sounding, reflecting a uniquely 'stronger' than usual sound (ie not quite neutral), but with very well defined bass to the lowest frequencies. The high treble shows slight grain and is not quite co-ordinated with the rest of the range. Timing and dynamics are above average, focus is good, but there is also some loss of image depth and low level ambience.

Loss 0.0025 (very low), capacitance 200 pF (medium), inductance 0.4 uH (very low), resistance 0.04 ohms (very low).
Sound quality score: 45

KIMBER SILVER STREAK

(£235 per metre pair)



This long established middle range reference from my cable library is essentially pleasant throughout the frequency range. Formally re-assessed here, it delivers taut bass, good dynamics, a mild loss of timing, but above average imaging and depth. Slightly laid back, micro dynamics were rated good and the sound is generally upbeat – a fine all rounder which remains on my recommended list.

Loss negligible, capacitance 45pF (very low), inductance 0.6uH (low), resistance 0.05 ohms (low).
Sound quality score: 63

VAN DEN HUL THE FIRST ULTIMATE

(£250 per metre pair)

It was refreshing to re-review this pure carbon conductor cable after some years. With slightly restrained macro dynamics, this cable nevertheless shows very good micro dynamic resolution. While there is a hint of upper mid nasality, a mild coloration, and the bass is also slightly lightweight, it sets a stunning pace for clarity, image depth, focus, rhythm and timing. There remains some ground loop dependency, particularly when feeding power amplifiers. Some aspects of sound musicality are unmatched by any other design, by van den Hul or anyone else, so it remains a top recommendation provided it suits your system.

Loss 0.005 (very low), capacitance 50pF (very low), inductance negligible, resistance 32 ohms (centre 28, screen return 3.7 ohms) (high).
Sound quality score: 110

CRYSTAL CABLE PICCOLO

(£260 per metre pair)

This beautifully packaged miniature cable shows a somewhat 'forward' midrange and a rather dry, if crisply defined acoustic. Some moderate coloration gives what we can only describe as a mildly contrived 'hi fi' sound. Depth is not exceptional, though timing is better than average, while the bass is a little lean and was described as

'thumpy'. There is also some presence excess in the upper midrange, which may well suit some systems.

Loss = 0.0045 (very low), capacitance 330 pF (high), inductance negligible, resistance = 0.9 ohms (medium).
Sound quality score: 43

VAN DEN HUL ORCHID

(£325 per metre pair)

This very slim cable has a light tonal balance where the upper treble is brought forward and did not seem to be perfectly integrated. It has a crisp bass, but depth was considered unexceptional and there was also the merest hint of glare in the upper midrange. Well focused with good definition and detail, grain or other subjective distortions were absent. Compared with the references a loss in timing and rhythm information was noted. Clearly we did not get on well with this design.

Loss = 0.01 (high), capacitance 100pF (medium), inductance negligible, resistance 0.6 ohms (medium).
Sound quality score: 36

NORDOST FREY

(£630 per metre pair, WBT terminated)

This cable is nicely balanced and weighted, the sound is smooth, lucid and well structured. Bass is solid and

tuneful, while the mid has above average focus and depth. Treble is clean with a quite spacious soundstage. A bit laid back, timing is average and there's also some loss of dynamics, suiting it more to classical than rock program – a nice cable, but rather costly.

Loss 0.0023 (very low), capacitance 120 pF (medium), inductance 0.6 uH (low), resistance 0.085 ohms (low).
Sound quality score: 50

CARDAS GOLDEN CROSS

(£730 per metre pair)

Similar in construction to *Gold Reference*, this cable is also very similar in overall performance, though in some respects it is considered better balanced, more neutral

overall, but with not quite such obviously high definition. Some enthusiasts find it a little easier to get on with. Available balanced or single-ended, with good hum rejection, it is easy to recommend.

Test data: N/A. (Similar construction to Golden Reference.)
Sound quality score: 115

CARDAS GOLDEN REFERENCE

(£800 per metre pair)

Compared with *Golden Cross* this cable is slightly brighter in the upper treble, but still very tidy. It's slightly more transparent and dynamic, and the overall standard is extremely high on all audiophile parameters: midband neutrality, focus, image width and depth, resolution at all levels, plus very fine timing and rhythm. On a balance of qualities it is a front runner and is a clear recommendation in both balanced and single-ended forms.

Loss 0. 004 (very low), capacitance 55 pF (very low), inductance 1 uH (low), resistance 0.3 ohms (medium).
Sound quality score: 130

TRANSPARENT XL REFERENCE

(£957 per metre pair)

Tested in balanced and unbalanced forms, this established design is not entirely free of character – you would need an improbable symbiosis of Cardas and van den Hul carbon to achieve that – but it does not get in the way of the music. Every time you use it, this cable's grip on focus, transparency and fully dimensioned imaging is unmistakeable. Add in top grade dynamic expression, extended powerful and taut bass, delicately resolved treble, upbeat tempos, and involving timing, and it shows just how good a good cable can be. Awkward to install with heavy RF suppression 'terminators', it nevertheless delivers audiophile performance every time.

Loss = 0.015*, capacitance 1,530 pF*, negligible inductance, resistance 0.04 ohms (very low) (SE).
*(includes lossy termination)
Sound quality score: 120