How you can Enjoy Much Greater Dynamics from your Hi-fi Music System by using Low Microphonic Cables

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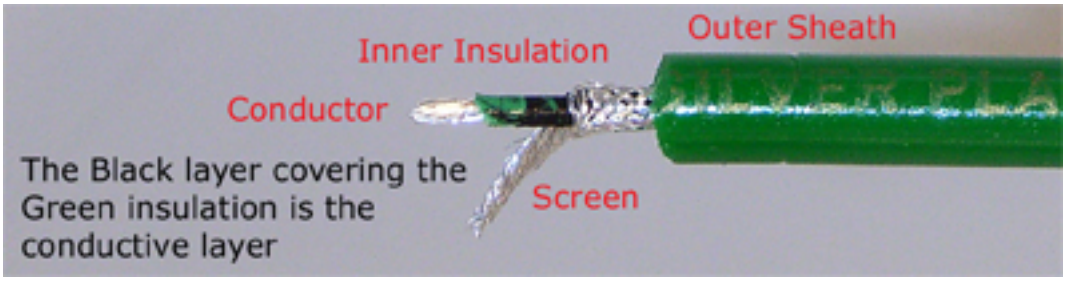
The Basic Co-axial Cable

A coaxial cable, such as is used for analogue audio interconnects, consists of 4 parts:
1. The Inner core conductor that carries the music signal
2. The insulation
3. The screen that also acts as a return conductor
4. The outer insulating sheath



1. The inner core conductor carries the music signal from one electronic unit to another such as from a CD player to and amplifier. The inner core conductor is typically made of copper, tinned or silver plated copper or silver. For truly highest quality audio, other conductors of rare expensive metals may be used to convey a much more lifelike experience of the music. The inner conductor may be a single core or may be stranded with up to, and sometime exceeding, 100 separate small strands.

2. The insulation is made from a non-conducting material and its purpose is to prevent the signal being connected to any other conductors in the cable. The insulating material may be PVC as used in low cost cables, but not recommended for sound quality, or Polyethylene, PTFE or Silicone Rubber in high performance cables. The insulating layer is thick enough to prevent electrical conduction of the highest voltage that that the signal conductor is ever likely to receive in use. All cables exhibit capacitance between conductors. The effect of cable capacitance on the music signal is to attenuate the higher frequencies over longer lengths cables so a lower cable capacitance will extend the useful length of the cable. Insulating materials with a lower dielectric constant will, for the same insulation thickness, create a lower capacitance in the cable.

3. A conductive screen that acts a return conductor for the music signal and also provides screening to prevent noise and interference reaching the delicate low level music signal. The levels and types of noise that now exist to contaminate sensitive electrical signals include radio frequency (RFI) noise from broadcasting, telephony and computers, electromagnetic interference (EMI) from power transformers and electrostatic (ESI) from fluorescent lights, dimmers and relays. With the growth in the use of computers and computer based electronic equipment, the demands for good screening become more significant every day.

The most popular types of screen are:

- Braided screen made from very thin wires
- Spiral wrapped screen also made from very thin wires.
- Aluminium foil shield made from mylar backed aluminium foil with an un-insulated drain wire to terminate it electrically.

4. The outer sheath is made of a material that reflects the use for the cable. A high gloss sheath may be used for a high end audio cable to reflect its market value whilst a material with good abrasion characteristics may be required for a professional musicians cable. For many high end audio cables, the outer sheath may be covered over with an expandable sheath to indicate the exclusivity of a hand built cable.

The Cable as a Capacitor

All co-axial cables act as capacitors, with the inner and outer conductors representing the plates of the capacitors and the insulation being the dielectric.

The Triboelectric Effect

When the plates of a capacitor are deflected (a musician treading on a cable during a performance), or when an electric charge is generated by friction between the screen and insulation (known as the triboelectric effect), a voltage is created between the signal and return conductors that is in addition to the music. As that electrical signal is not part of the music, it is noise – a very much unwanted noise. That noise is the microphonic effect generated by the cable.

Applications of Low Microphonic Cables

The main application for Low Microphonic Cables is for cables for electric guitars and other similar musical instruments where stage musicians may tread on the cable during a performance and the resulting microphonic noise would be highly undesirable. Another applications is in instrumentation where measurements may be required from a moving object. Techniques that reduce the microphonic effects of cables to the minimum are well developed in these industries.

Reducing Microphony in Cables

The technique for minimizing microphony in cables is to place a conducting electrostatic shield between the inner insulation and the screen.
This conducting screen is usually made from a carbon based compound, such as conductive PVC, which is placed over the inner insulation before the screen. Its effect is to bleed away the small electrical charges caused by triboelectric effects before they can reach a voltage that would be audible through the speakers. In some cases, a conductive plastic screen can replace the metal screen as well, but its screening effect is limited at the highest audio frequencies and above.

Designing a Black Rhodium Low Microphony Cable.

The demand for a low microphony cable arose as a result of requests from customers for a high quality cable to be used with musical instruments. In response to these requests cables were made using a high quality PTFE insulated audio cable that had for many years being highly acclaimed by customers and by the Hi-fi press. We were very surprised when one customer had returned a cable to us saying that it was microphonic.

We contacted our supplier and talked with their technical experts. They advised us of a cable that they had developed where the item under test moved whilst measurements were being taken. We obtained a short sample of that cable and tested it in a quality audio system. We also tested the nearest equivalent cable from our own range of cables. Both cables had a very small diameter conductor which made them both too bass light for normal use as analogue interconnects. However, listening to the music via the low microphony cable just seemed more pleasant and enjoyable. The effect was significant enough to justify the design and development of a new low microphony cable for stereo audio use.

Black Rhodium Prelude was designed as low microphony cable for stereo audio applications. It was based on the very popular Black Rhodium Rhythm but with a 50% increase in the area of the conductor carrying the audio signal to improve the balance between bass and treble, and a conductive layer between the inner insulation and the screen to reduce noise caused by the triboelectric effect.

Listening to music using Black Rhodium Prelude

The experience of listening to Black Rhodium Prelude is that listening to music immediately becomes a more pleasurable experience. The moment that Black Rhodium Prelude is connected it is more difficult to switch the music off. Transients, especially those of high frequency instruments become louder and more dynamic. On switching back to another cable, the music suddenly becomes, by comparison, slightly boring.

I had the privilege of hearing a retailer demonstrate a lower priced pair of speakers using appropriately priced electronics with a Black Rhodium Prelude connected between the CD player and amplifier. I was certainly very surprised by the overall enjoyment that the overall system gave in relation to its price. There must be a very big market for Prelude amongst dealers who want to sell their electronics and speakers without using expensive cables to boost the performance.

Low Microphony – an Explanation of the Sonic Benefits.

There are many precedents towards an explanation of why a low microphony cable should make a more enjoyable listening experience than one that exhibits microphony. These are the many recorded instances where the use of vibration damping parts and materials in amplifiers and loudspeakers have improved the dynamic qualities of music.

The explanation lies in the electrical music signal, which though it is very small (tens of millivolts in a line level interconnect) creates forces between the inner core and outer screen. These forces create displacement between the conductors that results in an electrical charge being generated. In addition any movement between the screen and the insulation will cause friction that will generate further electrical charges by triboelectric effect.

The presence of either of these two sources of electrical signal, however small, will generate electrical noise. In a microphonic cable the noise voltage occurs after the moment of time when the electrical signal causing them passed. The result is a noise distortion voltage that may be easily audible as an echo during a quiet passage of music. If it occurs during the passage of music, its effect as 'noise' is masked by the music, but it severely distorts the character of the music and this form of time smearing distortion is very easily noticed by the human ear as a reduced clarity of how each musical note sounds and how it rises and decays with time.

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