magnan audio cables

Magnan Type Vi and Signature Cables

The Magnan interconnects and speaker cables are the result of years of research to develop the best possible audio cable regardless of cost of materials and labor. Through the use of new and innovative techniques, the Magnan interconnects and speaker cables drastically reduce audio band time smearing, associated phase shifts, and low level noise. There is a dramatic clarification of everything in the sound field with much better image focus, depth and width, much finer low level detail, and reduction of background noise. Highs are much more detailed but smooth and natural, and lows much more distinct and powerful. Multiple layers of congestion, muddiness, blurring or smearing of image, and overbrightness are removed and revealed to be interconnect and speaker cable degradations that had always been assumed to be caused by the electronics, speakers and recordings.

The philosophy of the designer, based on experience, is that the ultimate subtlety and resolving power of human hearing perception is vastly beyond present instrumentation capability and acoustical/neurological theory. Nevertheless, it has been very valuable to develop some understanding of underlying phenomena so as to be able to predict the most likely design approaches and materials selections. The development of the Magnan cable designs was made possible by the discovery that the ear is very sensitive to the removal or reduction of skin effect-caused time domain distortions of the music signal occurring in the cables used in a music system.

Of course, any recording already contains the time smearing and distortion of many feet of conventional cables used in recording, mixing and mastering. Despite this, the time coherence of the few feet of cable used in playback is found to be critical to the final reproduced sound quality. An optical analogy is useful in understanding how this can be. An example is a film projector. The film print is very blurred and noisy because of film grain relative to the original scene due to losses in the negative and many steps of processing and duplication using imperfect lenses and film. Despite the "program material" being noisy and distorted, the image projected on the screen is still obviously different and inferior when using a poor quality projection lens when compared with a high quality lens. The quality lens is superior because it is achromatic (no color fringing and sharper focus) and because it has a flat field (entire picture in focus) with little geometrical distortion at the edges. The visual system easily detects a small reduction or increase in distortion and noise in an already distorted and noisy image. The auditory system must be similar in this capability. This is a sophisticated pattern detection ability and seems to be especially sensitive to differences when the comparison is between two different reproductions.

The skin effect phenomenon has been found to be the major signal degrading effect in conventional audio cables. These effects include smearing of musical details, smearing together of instrumental images, flattening of the sound stage, and usually a general overbrightness. Almost all conventional audio cables utilize relatively thick stranded or solid wires which inherently cause gross audio band skin effect time smearing. Even the existing ribbon designs are far too thick to significantly reduce the problem. The conclusion that skin effect is of preeminent importance in audio cables is based on lengthy experimentation with different conductors. The second most important problem parameter has been found to be dielectric absorption, primarily with interconnect cables. This is also addressed in the Magnan interconnects through use of a TFE Teflon/air space construction. Distortion introduced by dielectric absorption in most plastic insulation materials is also a form of time smearing of the signal waveform which points again to the great sensitivity of the ear to time-related distortions. Many other commonly used parameters in audio cable design have been found to be either relatively unimportant or not applicable at audio frequencies. Examples are extreme conductor metal purity and characteristic impedance.

The physics of skin effect phase shift in wires have been well known for many years. A change in driving voltage causes a corresponding change in the electric field which is propagated almost instantaneously from source to load in the space around the conductor. The skin effect is physically caused by the frequency dependent attenuation and slowing down of the induced signal current as it penetrates into and propagates through the conductor. The higher the frequency the more the current is attenuated and slowed with depth from the surface, to the point where at RF almost all the signal current is concentrated in a thin "skin". The voltage generated at the load termination of the cable at an amplifier input, for example, is what actually controls the amplifier. This voltage is proportional to the total instantaneous signal current passed by the cable into the load. Since the signal current is stretched out in time, the signal voltage at the cable load or amp input is identically degraded.

The key to the detail and image smearing caused by this phenomenon is the fact that the part of a music signal at any given frequency is also smeared or spread out slightly in time. The signal current at any frequency is propagated through the entire conductor with the slowing, corresponding time delay and attenuation increasing continuously from surface to center. The leading edge of a signal arrives nearly instantaneously at the load, but it is always followed by a slight "shadow" or time-smeared replica. In addition, since the high frequencies predominantly arrive slightly earlier than the mid and bass frequencies, the sensitivity of the ear to early arrival sounds causes an apparent overbrightness.

The total music signal, composed of many different frequency components, is also slightly smeared out in time with the highs arriving slightly early. In conventional wire and cable this effect is so severe to the ear-brain system that it destroys a multitude of small but important sonic details, resulting in the blurring and flattening of soundstage, muddiness, etc., described previously. The magnitude of the skin effect at any given frequency can be defined as the width in time of the signal waveform smearing. This time spread at any frequency is determined by the maximum distance the signal current can penetrate into the conductor (i.e., half the thickness), and by the maximum phase shift and attenuation which occurs at that depth. The more resistive the conductor material the less the attenuation and slowing of the wave as it penetrates and the smaller the maximum attenuation and slowing. Therefore, the thinner and more resistive the conductor, the less the skin effect caused time smearing and the greater the sonic resolution. No limit has yet been found to this relationship - no matter how thin or resistive the conductor is made it continues to improve the sound. This principle is the basis of the design of the Magnan interconnect and speaker cables.

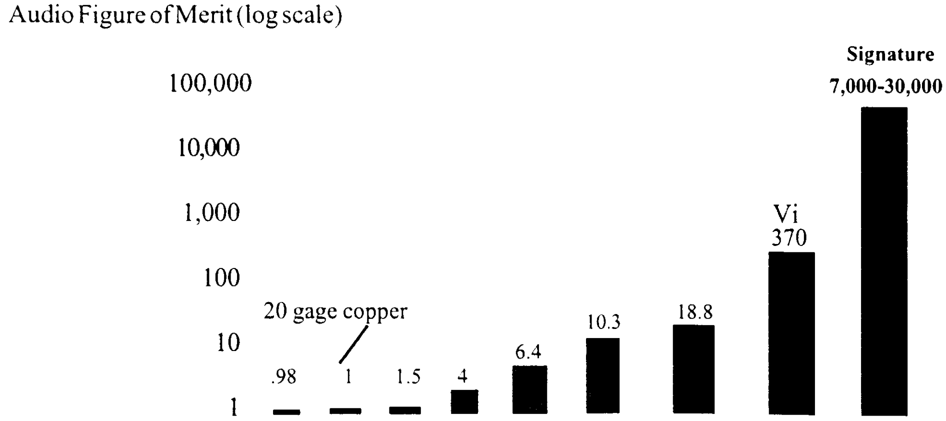
Magnan Cables has derived a "figure of merit" which in one number relates conductor thickness and conductor resistivity directly to the perceived sonic resolution of the wire when used in an audio cable. The larger the figure of merit the lower the time dispersion due to the conductor and the better the time and musical resolution. Listening evaluations of experimental cables using a large variety of different conductor materials and thicknesses have been conducted and have invariably verified the principle and calculated figure of merit as long as the conductor is nonmagnetic. These experiments have verified the principle that the greater the skin effect of a cable, the worse the time smearing, overbrightness and other degradations to the sound.

The data is graphically displayed in Figure 1. The figures of merit are relative to the performance of 20 gage copper wire, which is set equal to 1. A log vertical scale (1, 10, 100, 1000, etc.) is used, corresponding much more closely to actual hearing perception than a linear scale. As could be expected from the relative conductor performance figures, the Magnan cables achieve dramatic audible improvements over conventional cables.

It was found that skin effect in the ground conductor of a single ended cable (RCA-RCA) also causes significant audible degradation since it returns the signal current to the source. Consequently, the ground return needs to have as small skin effect as possible along with low DC resistance to prevent hum.

Use of a very thin high resistivity wire conductor is the least difficult and expensive construction minimizing skin effect. The Magnan Type Vi interconnects push the thin metal wire design approach as far as possible, using a 5/10,000 inch thick high resistivity bronze ribbon. The sonic results are transparency, ambience retrieval, image focus and soundstage size beyond any conventional cables using "normal" relatively thick wire. The Type Vi cables are completely handmade and are handsome in appearance, with a black braided nylon cloth jacket and label in gold and blue with directional arrow. Diameter is approximately 3/8" (RCA) and ½" (XLR). Maximum length is 25 feet.

A metal wire or ribbon can be made only just so thin before it becomes impossibly expensive to manufacture and too weak and delicate to utilize in a cable. The Magnan Signature interconnect cables drastically reduce skin effect caused degradations beyond



Conductor	Ag	Cu	Cu	Cu	Cu	Cu	Cu	Bronze	Polymer
Wire Size (AWG)	20	20	24	32	36	40	46	Ribbon	Ribbon
Thickness (inch)	.032	.032	.020	.008	.005	.003	.0017	.0005	

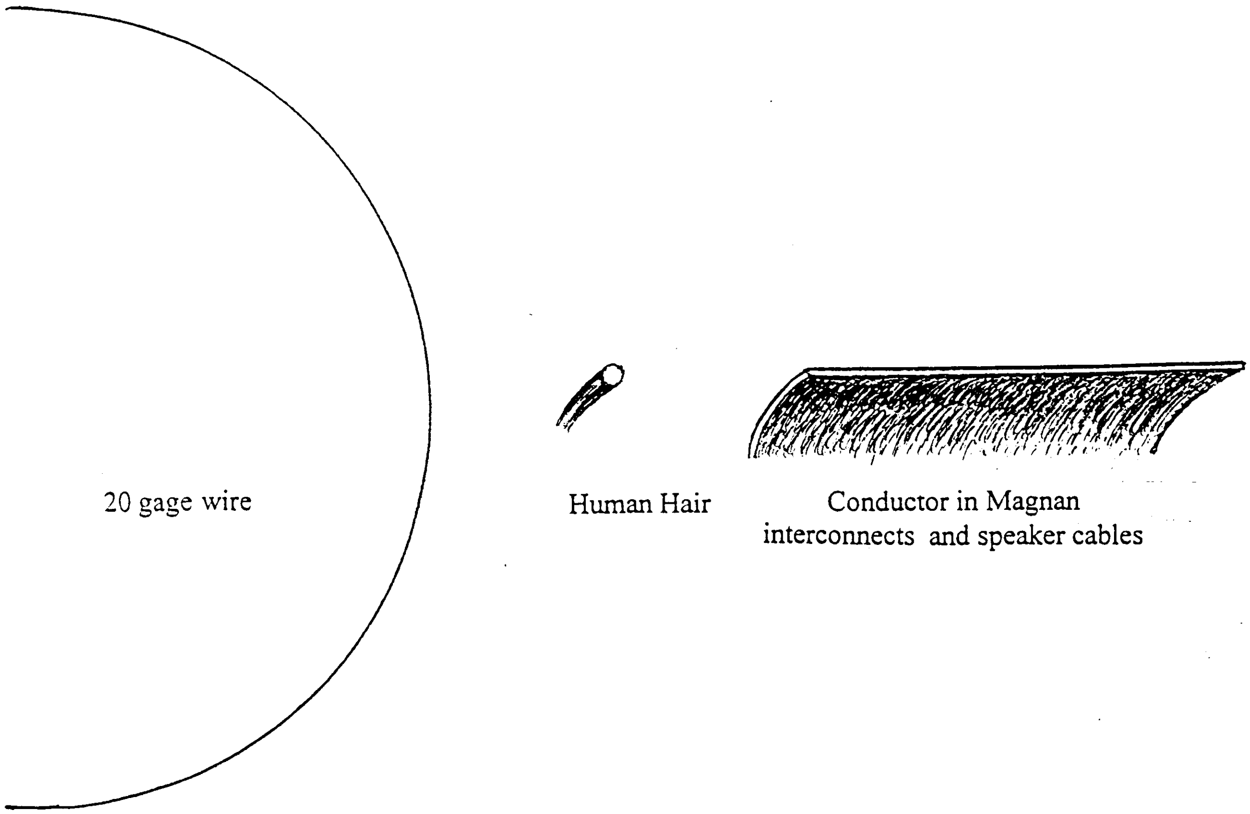
Figure 1. Figure of Merit - Relative Audio Time Resolution of Conductors

Ag = silver
Cu = copper
Bronze - copper/tin alloy (high resistance)

the level achieved by the Type Vi using a proprietary high resistance nonmetallic conductor in the form of a very thin coating of conductive plastic "paint" on a wide plastic ribbon substrate. The high resistivity (thousands of ohms) of the coating further greatly reduces the skin effect time dispersion of the conductor. Also, the use of a nonmetallic, amorphous polymer conductor confers a large additional audible benefit in terms of greatly reduced background noise due to the absence of metal crystal grain boundaries and other discontinuities in the signal path.

To give some idea of the actual conductor dimensions involved, Figure 2 illustrates to scale the relative sizes of a fairly small conventional wire, a human hair, and the bronze ribbon conductor used in the Magnan Type Vi. The conductive plastic coating used in the Signature interconnect cable is 2-3 times as thick as the Type Vi bronze ribbon, but has thousands of times the resistivity of the bronze.

The total design of the Signature cable is complex and involves many tradeoffs resulting from the physics of materials and the constraints imposed by actual interfacing circuits. The key factor involved is that high resistance (thousands of ohms) is inherent in the conductor in order to achieve very low skin effect in the audio band with correspondingly very high time resolution. The better the time resolution performance the thinner and more resistive must be the signal conductor. The large resistance necessary for high time resolution in the Signature interconnect creates several interrelated performance tradeoffs which establish practical limits to achievable cable time resolution.



The primary tradeoff is between cable time resolution and overall system gain. The cable signal conductor resistance in conjunction with amplifier, etc. load input impedance creates a voltage divider which reduces gain. Most systems have enough reserve gain to compensate for this. As an example, a 50,000 ohm cable into a 50,000 ohm input impedance at the amplifier would result in a 6 dB power or volume loss.

Another constraint on maximum achievable cable time resolution (i.e. on maximum allowable cable resistance) is the fact that the cable resistance in conjunction with cable internal capacitance plus load input circuit capacitance and load input resistance form a low pass filter. The maximum allowable cable resistance and load input resistance must be limited so as to keep this high frequency roll off well above the audio band. With tube input circuits the input grid capacitance will probably be greater than the cable capacitance, due to the so-called Miller effect where interelectrode tube capacitance is amplified by the tube voltage gain. Because of this, cable resistance needs to be limited to approximately 35,000 ohms when the cable drives a tube amplifier or other tube unit.

These tradeoffs have been worked out with the goal of optimizing overall performance with most systems. The Signature interconnect cable resistance is standardized at 30,000 ohms (approximate). Longer than standard 4-foot length cables utilize a wider ribbon and/or more layers to achieve the same total resistance and net time resolution as the 4-foot cable. Maximum length is 10 feet.

The Signature interconnect cables are terminated in short (3 ½") small flexible leads ending in the RCA and XLR connectors. Due to the basic design, most of the cable length is of large diameter. The RCA-RCA version is approximately 7/8" in diameter and the XLR-XLR version is 1 ¼" in diameter. Despite their bulk, the cables are flexible due to use of convoluted Teflon tubing.

The best available connectors are used (based on listening tests). Of necessity, the Magnan Signature interconnect cables are completely handmade from the conductors out and present an exotic, rich appearance using double layer monofilament braid sleeving (translucent over black).

Magnan Signature Speaker Cable

In the case of speaker cables, it is much more difficult to greatly reduce audio band skin effect because of the need to have high conductivity metal with large cross-sectional area for low total resistance. Only one method has been found to work well - the "brute force" approach of using a very thin, very wide copper ribbon with a resistance of no more than approximately .003 ohms per foot. This low a resistance is needed for good bass control and extension due to the high drive currents and corresponding maximal cable voltage drops involved.

It was found that this simple design requirement was by far the most important for the speaker cable. The many other parameters commonly used in speaker cable design were found to be either relatively unimportant in the ribbon cable or not applicable at audio frequencies. Examples are extreme metal purity, dielectric material and characteristic impedance.

The resulting speaker cable is in the form of two separate five-inch wide flat cables for each speaker. For best performance the two separate flat cables driving a speaker should be laid side by side where possible rather than on top of each other. The physical appearance of the Magnan Signature speaker cable is high-tech with a glossy black nylon woven jacket.

The cable termination design accommodates closely spaced, hard-to-get-at speaker and amplifier binding posts by narrowing the end 7" down to a point to which is attached a short flexible lead with the required spade lug or banana connector. Standard length is eight feet, with maximum length 25 feet.

Please call Magnan Cables, Inc. for dealer information.