Frequently asked questions about cables

Version 2
By: A.J. van den Hul

Dear website visitor,

For many Audiophiles, cables are pure mystery and sometimes even worse: misery.
Plenty of money can be spent on low quality products, despite their high image packing boxes.
To demystify cables somewhat, I have assembled over 200 questions and answers which may lighten your cable path. I hope you read them with a critical mind, so life with your conductors becomes easier and your “sound” at home gets under better control.
“That this Cable FAQ may help you to enjoy your Hi-Fi system more emotionally instead of just technically” is my sincere wish after all creative work invested in this section.

Pleasant reading,

A.J. van den Hul

Subject Index:

Tip: For easy moving back and forth through this document use your browser's "Back" and "Forward" buttons,
or alternatively: the "Alt + Left Arrow" and "Alt + Right Arrow" key combinations.

Sections:

1: Questions about Van den Hul (and related subjects):

2: Cables: General (and related subjects):

3: Cables: Sound (and related subjects):

4: Cables: Use and Function (and related subjects):

5: Cables: Problems (and related subjects):

6: Cables: Construction and Conductor Materials (and related subjects):

7: Cables: Insulation Materials (and related subjects):

8: Cables: Corrosion, Decline, Lifespan and Time Stability Factors (and related subjects):

9: Cables: Technical Parameters (and related subjects):

10: Cables: Connections and Connectors (and related subjects):

11: Cables: Termination and Soldering (and related subjects):

12: Cables: Digital Audio (and related subjects):

13: Cables: Buying (and related subjects):

14: Speaker Cables: General (and related subjects):

15: Speaker Cables: Sound (and related subjects):

16: Speaker Cables: Size (and related subjects):

17: AC Power Cables (and related subjects):

Cable FAQ:

Section 1: Questions about Van den Hul:

1-1 Q: What is the reason for the great interest of your company in cables and conductors ?

A: This interest originates from around 1975 when I was repairing phono cartridges. Rewinding the coils with 20 micron wire taught me that wires were not all equal, despite the fact that the specific resistance was the same. So my interest was triggered to find out where the sonic differences came from. It proofed afterwards that the sonic differences are the result of the quality (purity) of the conductor and the manufacturing methods.
Especially the manufacturing can damage a good basic material. And with this basic understanding, plenty of new production technologies have been worked out in the meantime.
Al this knowledge is now combined in the full range of Van den Hul products sold world-wide.

1-2 Q: Why does the Van den Hul company make cables ?

A: Because with good cables there are great possibilities to improve the rest of the audio system. My first cable (fundamentally wire) experiment happened with very thin wires used for coil repairs in Moving Coil cartridges. And from a single centimetre at that time, we now supply many kilometres per year. When someone would have told me this, I would never have believed him. So don't stop dreaming, sooner or later you are in the mattress business, believe me.

1-3 Q: How does the Van den Hul company design quality products ?

A: Based on many years of critical listening, we know what works and what doesn't. In 1948 my first piece of electronics was a single tube receiver, where I used the DF 91 for high frequency and for audio at the same time. And once you are infected by this audio disease, it never stops again. It is a matter of time, and soon you are running a whole operation because you want other people to hear the same things as you did. And with a creative mind, products show up in your mind like styli, cartridges, thin wires and thick cables. It is mostly a matter of knowing what good sound should sound like and what to do to achieve the same in reproduction. Cooks are not so different with food.

1-4 Q: Why does the Van den Hul company pay so much attention to the environmental aspects of its products ?

A: Cables are always a combination of conductors and insulators. Both materials involve environmental effects during manufacturing. And also at your home there are emission effects when the materials are not right. But the worst is the disposal of the cables. They are often burned to retrieve the copper. Especially when the insulation is made of the commonly used PVC, side effects such as HCl (hydrochloric acid) and toxic Dioxin production are actual problems. In 1990 our company has taken the drastic (and expensive) step to completely switch from PVC to halogen-free insulation materials. This not only to avoid HCl but also HF, HBr and HI (the other halogen acids), beside of course the different types of Dioxin. It also helps to keep your world cleaner.

1-5 Q: What new technologies and/or products do you have in the pipeline or in your mind to improve the sound quality in a hi-fi set ?

A: At the moment (2004) I am putting extra research time in metal technology to achieve the same sonic result as obtained with our carbon products' Linear Structured Carbon ® Technology.
The first and very successful step in this direction was our Fusion Technology. The idea behind this technology is, what can be described as, Fixed Atomic Position (FAP).
FAP in principle means that - to maintain the sonic quality - external forces (within reasonable margins) can not inflict dramatic changes in the atomic structure. Of course there is always a change, but the less the better. So, more electrons must be used for atomic coupling/bonding (an older idea about atomic structure by the way) and thus less free electrons are available for conductivity. The higher the "coupling factor", the stiffer the material and the more stable it is in the long run, this despite the external mistreatment of your cables.

Actual I have another process to obtain the same or an even better result compared to what we do with our Fusion Technology. The first prototype has been made and it is really a delight or even more than that. The new technology is called: Tunnel Technology and our first product employing this is our The ORCHID, a highest quality level audio interconnect suitable for both balanced and unbalanced use.

1-6 Q: Are all Van den Hul cables company-owned designs ?

A: Yes. None of our products are also produced under other brand names. But our company does produce several products which are sold to other companies under their brand name. This may have caused your misunderstanding.

1-7 Q: Does the Van den Hul company also have industrial buyers ?

A: Yes we have a big group of industrial buyers. But there is a rule: Don’t tell which manufacturer buys what. Among our clients are mixing console manufacturers, many well known and even famous loudspeaker manufacturers all over the world, big recording studios and studio equipment installers. We also supply typical tone arm products and signal lead-out cables to turntable manufacturers.

1-8 Q: Why did the VDH company make its own recordings ?

A: Many of the currently available recordings are very interesting at first listening, but after a short while there are so many audible defects that a proper evaluation of audio equipment is hardly possible. Especially the quantity of mono information makes listening tests focusing on harshness impossible. Also the lack of natural acoustics and the addition of digital delay without respect for the original acoustics makes listening not easy. So reasons enough to produce our own CDs using a very natural and minimal recording approach, without “black boxes” or artificial effects. We even used just two omnidirectional microphones.
As a result, with these CDs one is able to do product quality evaluations within 2 seconds. And that helps when comparing to the many years of uncertain feelings many audiophiles have about their own equipment.
More information about our CDs can be found on our website.

Section 2: Cables: General:

2-1 Q: Can you give me some tips to improve my hi-fi setup ?

A:

- Take the loudspeaker cables as short as possible. The interconnects must be somewhat longer when you work with a separate pre-amplifier and power amplifier(s).
- The sound quality gets better when you install two mono power amplifiers instead of one stereo power amplifier. Connect both monoblocks to the same mains outlet.
- Keep the interconnects and AC power cables as far as possible apart. And when they are together, let them cross perpendicular. This also applies to your speaker cables.
- Do not loop cables which have excessive length. Loops form a pick-up coil; An effective way for interference to find its way into your system.
- Always use one wall outlet to power all equipment by means of a multiple socket mains distribution board. This avoids large ground loops along the interconnects and the power cables. The power amplifiers must be connected as close as possible to the mains input of this connector block. The lower power consumption equipment can be connected more to the other end of your mains connector block.
- Don’t stack all equipment on top of each other. This causes extra hum due to magnetic (stray) field emission from poor quality transformers. Even the better types of transformers can produce extra hum in other equipment.
- Make position experiments and move your phono amplifier around (even rotation can help) to have the lowest hum. Measuring the hum level with a digital volt meter (DVM) at the output of your power amplifier produces objective results.
- When possible, create your own dedicated ground connection, independent from the ground lead in your mains outlet. A so-called “ground bar” made of copper, where all equipment is attached to, can be the right solution with many hum problems. Connect this ground bar directly to your own installed ground wire (best and safest is to have all done by a professional → please read our disclaimer). The end of this ground wire is dug in to groundwater level and must be made of stainless steel, because copper will disappear or gets oxidised after a while. Especially in Madras - India because the groundwater there is very salty...
- Use very well shielded cables to avoid penetration of high frequency interference.
- Keep all contacts clean to avoid harsh sound. Our “The SOLUTION” contact treatment and protection fluid works well here.
- Use our POLARITY CHECKER to reduce unnecessary ground currents.
- Have a professionally installed separate power group from your fuse box to supply your audio components. This minimizes mains pollution and interference from other appliances.
- When possible, try our The MAINSSTREAM HYBRID AC power cable to improve the sound quality. You will be amazed again.
- Many more related tips and hints can be found in our separate paper “Hi-Fi Tips and Hints”.

2-2 Q: What other applications are there for your The SOLUTION in my hi-fi system ?

A: The SOLUTION is in principle a perfect contact protection fluid. It does not oxidize or run away and has no chemical activity at all. Also it will not evaporate. Just reliable stuff.
But besides contact protection there are more applications: I have used The SOLUTION as a strand coating in multiple strand loudspeaker cables: Hang your loudspeaker cables vertically and with a syringe you can inject the oil at the top. Apply again after a while, so that the internal strands are smoothly coated with The SOLUTION. Produces a superb internal chemically protective coating (also see 8-3).
Also application on internal amplifier contacts, like switches, will work very well. Especially older tuners feel fine again with The SOLUTION on oxidized contacts of the rotating multiple section capacitor (mind not to wet the capacitor plates themselves or your tuning will be off).
And what goes extremely well: Apply The SOLUTION to the valves’ pins and sockets in tube amplifiers. Most tubes, especially the 6C33 with The SOLUTION applied on the pins at the glass pearls of its socket end, will have a much longer life: Any micro cracks developing in the glass at the pins due to thermal expansion effects become filled and sealed. Inward diffusion of gas is effectively restrained.
Regarding The SOLUTION’s lubrication properties, also all kinds of rotating wheels in recorders will benefit from a drop of The SOLUTION in the bearings (*).
Don’t forget the spindle of your turntable and the bearings of your turntable motor (*).
Personally I also have applied The SOLUTION as an extra dope to the motor oil in my car (*).

*: Although our The SOLUTION is excellently suitable for these purposes, we also have more specialized lubrication fluids

in our program, like our TLF Oil I and II and our Turntable Spindle Oil.

The SOLUTION furthermore provides an excellent metal coating on moving parts. The number of applications is equal to the quality and quantity of your own imagination.

2-3 Q: I want to make my own cables. What technical points should I mind ?

A: Take all cables a bit longer than you intended. In case of problems there is some spare length. De-insulate very careful to avoid broken conductors. First make a kind of test to see how things work. A hot soldering tip is a better tool to de-insulate compared to a sharp Stanley knife (also see 11-1). Avoid all possible cable shorts and measure first before you start to solder. The cable must fit in the connector. When not, take a bigger one. This is a better solution than seriously damaging the cable by applying too much force. Also don't bend or twist the cable. All extra applied force creates conductor structure damage. Solder with a clean soldering tool at a temperature of 275 degrees Celsius (527 °F). Soldering time must be very short to avoid structural damage and/or molten insulator. Also be very careful not to move your cable and/or connector for minimally 10 seconds after the solder tool's tip has been removed. If you consider using silver solder, read 11-2. Pay special attention to the mechanically made electrical connections, e.g. between the cable shield and the body of RCA type connectors. In many cases this is a mechanical pressure solution and not a soldered connection. So, when you can, apply some of our "The SOLUTION" contact treatment and protection fluid where the cable shield is clamped and don't forget the connector's mating contacts. Don't use brute force to close the connector. Fixed is fixed. Furthermore, keep in mind that also connectors need their "burn-in" time.

2-4 Q: Do I really need compensation networks in my interconnects ?

A: No, you don't need them for any audio connection. And if good high frequency cables are used, there is also no need for networks in digital or antenna connections.

2-5 Q: What is conductivity ?

A: The question is simple, the answer a bit more complex. Conductivity is based on the assumption that electrons are the moving electrically charged particles in a metal conductor. Electrons are the outer particles in an atom and (in metallic conductors) are able to transfer from atom to atom. The higher the number of electrons available to change atom partner, the lower the resistance of the conductor. So a good conductor (from the conductivity point of view) has plenty of free electrons. In an insulator the situation is just the opposite: No or very few free electrons. With a DC current in a conductor, all free electrons move from the minus end to the plus end of the conductor. By the way, the speed is very low even when the current is high: There are plenty of free electrons in a good conductor like e.g. copper, so a stiff current means electron movement of some micrometers per second. With AC currents like e.g. with music, electrons move to and fro.
Where conductors are a large collection of crystals of all kinds of shapes and sizes, electrons pass many crystal borders during their musical life. These crystal borders and also the impurities play an essential part, not only in conductivity but also in other properties like strength. Iron can be e.g. 1000 times stronger when there would be no impurities and crystals. This is the result of tests made in space. Also your copper loudspeaker cable is blessed with many impurities and crystals.
The movement of electrons from atom to atom is not as simple as it looks like. Atoms have a big distance among each other. Think about how our solar system is similar to the structure of an atom. To have Yuri Gagarin in space was really excellent, but he never reached the moon. The USA managed to make the jump from earth to moon. To move electrons from atom to atom however is like moving from the one solar system to the next. But in your loudspeaker cable all these problems are solved by nature. But still the question remains: How?
The answer is rather simple: Electrons are at the same time mass (a particle) and an energy packet (a wave). So at or around the atom, I think that we can think about particles, and in between atoms I think we have to do with energy packets. Something like with Star Trek: You travel between two positions in an energy state and not in a material state. Knowing this makes the design of conductors more easy, because it is now possible to focus especially on material properties and not just on another nine-nines purity. One of the results of this different way of thinking is e.g. our Linear Structured Carbon ® cable line. But also our "Fusion Series" is based on these assumptions. And the next generation of products - based on an even more progressive technology: "Tunnel Technology" - even has a more futuristic approach. Actually I will not go into more detail to avoid text and/or idea copying, which I have already seen too many times in the world.

2-6 Q: Why did you introduce the term Cross Crystal Distortion? No other company refers to this terminology.

A: Cross Crystal Distortion (CCD) is a phenomenon I discovered in 1982. It made clear that continuation of conductivity was not so obvious as regarded up till then. It explains several audible effects based on mechanical and chemical properties. As a result, also differences between products can be explained by CCD, again based on mechanical and chemical causes (see 3-1). And especially different production methods avoiding CCD effects have proven to be better after very careful listening sessions. It is one of the production technology criteria of our company to maintain a high technical product quality, also for the future. For the consumer, this means that he is assured of a better return after investment in our products. All our cable production is based on the same rules to avoid CCD. This helps when you want to buy your next cable.

2-7 Q: What interconnect cable in your program has the best balance in conductor technology, screen damping, mechanical and chemical stability ?

A: Without any doubt: Our The SECOND ®. The conductors are made from ever lasting Linear Structured Carbon ®. With its four shields, the screen damping is very high. With its carbon technology and its halogen-free HULLIFLEX ® cable jacket, the mechanical stability is also very high. Furthermore, because our carbon is a very inert material, the chemical stability is practically everlasting. This as long as your cat does not think that our The SECOND ® is the tail of another animal species.

2-8 Q: Why are there big differences in the pricing of your products in all kinds of countries around the world ?

A: In many countries outside the European Community (EC) there are all kinds of import duties to protect the own industry. This is not the case in the EC (anymore). And in some countries there are state import duties, territory state import duties and even local import duties. And don't talk about the prepaid VAT. Also the shipping costs are quite different to many countries. A shipment from the Netherlands going to Greece is much cheaper than going to e.g. the Federation of Russian States. And don't even think about the transport costs to e.g. Australia where our products cost more than double compared to e.g. Germany or Spain. And Brazil has its own typical import duties, which also doubles the price.

2-9 Q: Why don't big cable manufacturers produce any audiophile products ?

A: Big cable manufacturers think big, so they don't care so much or not at all about the audiophile market. Their machines are not made for audiophile productions, so why should they go for this small corner of the big cable market? Cable production with audiophile understanding is a specific job, and already many different suppliers (with even more products coming from not so many factories) are active in this market. Also, each day someone around the world has the bright idea to "be" in cables. Not that many which are active today will be there tomorrow. Just a few will continue because they have the material and product experience. Cable business is not so different from what you see in the car business.

2-10 Q: Are cable tests in hi-fi magazines reliable ?

A: In many cases yes. But the final ranking also depends on the equipment used. So, a test is more reliable when the cables under test were connected to e.g. different sets and the sonic result is still in the same order. Many tests are not done this way, so the result is that the final ranking is related to only one situation, and for sure that is not your situation.

2-11 Q: Why are there still manufacturers and reviewers who don't care about cable quality ?

A: Because the fact that they are in the audio profession does not mean that they are experts. Many loudspeaker manufacturers still think that wire is wire. The cheaper, the better. I have seen very expensive loudspeakers costing really a fortune with flimsy AWG 18 (0.82 mm^2 Ø) wiring inside. So don't be surprised. It directly shows how serious they are with sound quality or their bank account.

2-12 Q: I regularly see new established cable manufacturers and brands which already have been operating in the market for a longer time just disappear. How does this happen ?

A: Without innovations, it is hard to stay on the market and sell the same copper technology year after year. So you

regularly see fantastic hilarious stories with all kind of claims in the press. That is in many situations also the end of the company, because not all customers are crazy. They even have ears. So that company dies and another takes the same position, with this time sand and water in the cable. Or an existing cheap cable is sold as a very expensive product: When you have paid plenty of money for a cable, you afterwards of course can't tell your wife that you bought rubbish.

2-13 Q: What does the future look like concerning cables ?

A: The number of linked equipment will grow dramatically, but the number of visible cables will reduce. A lot of the connections will be made by wireless. When the rules to sort out this type of communication are not set well, I am afraid that in the end everything is hard wired again - also to reduce all kinds of interference in the house. Because with too much interference, equipment needs to be bandwidth limited which reduces the audio quality again. The question is really: Is the human body made to be exposed to all this high frequency (HF) energy? And how does this work out in the long run? Because in the end, everywhere there will be a substantial level of HF around (and in) us.
Not for the business but just for all the other reasons, I think that working with cables saves us a lot of trouble and also saves us all kind of industry manipulations by new standards and new types of transmitters and receivers. It's not so much different as we saw in the past with e.g. Scart and currently with DVI and HDMI.

2-14 Q: When I take account of the environment, what to do with my old cables ?

A: Give them away to someone who will use them again. When you are the last person in the chain, it is better not to put them in the waste, because you don't know the temperature of the incinerator (most cables contain PVC insulation, which, when burned, produces toxic dioxins, also see 7-3 and 1-4). And don't burn them yourself, because you also will create dioxins. This dioxin problem I can't solve for you. Just hand them to the household chemical collection passing your house every 14 days. The next best thing is to put them in the attic till you know what will happen with your beloved friends.
You can anyhow re-use the connectors, because in many cases they last longer than the cables.

2-15 Q: My neighbours always complain that I play my Bose 901 speakers too loud, but I personally think that I am not playing loud enough to enjoy The Stones, my favourite group. What to do ?

A: Maybe you have lost ear sensitivity over the years. Buy a sound level meter with calibrated input sensitivity and try to play your music around the 75 - 80 dB level. When you pass the 90 dB, there is a serious reason for your neighbours to complain. Regular walls between apartments have a damping of 45 - 50 dB for middle frequencies. But for bass the damping is much less. So all your extra bass will shake the neighbours up to the highest level of emotion. When you really like to damage your ears, as it looks like, buy a good pair of headphones and give the lady next door flowers and a warm kiss. Suddenly she will like you again.

2-16 Q: I intend to start my own cable manufacture under the brand name: Dragon Cable. What are the best conductors I can use and which established brand can I copy to have immediate success with my business ?

A: I assume that the dragon is a part of your cultural background. Dragons are symbols of power and wisdom. So, behave like a proud dragon and don't immediately copy the hard work of others in your profession. In the end it doesn't contribute to a better world. Creativity in life is a higher level of self discipline than inaccurate thinking. And regarding your question about the conductors: Please study first before you start. It makes you happier when you achieve positive results at the end of the day. It's not only money that counts in life.

2-17 Q: I want to establish a high-end amplifier brand in the Federation of Russian States. Do you have a good brand name in mind, because finding a good sounding brand name is always very difficult ?

A: Marx Leninson will certainly work well.

2-18 Q: I bought cheap loudspeakers from the brand: Terry Bell. Do you know Mr. Bell and what can I sonically expect from these loudspeakers ?

A: It is better to fall in love with his daughter Deci instead of falling in love with her father's experiments.

Section 3: Cables: Sound:

3-1 Q: Why do some cables start to sound harsh and even aggressive after a while ?

A: Metals like copper or silver are sensitive to chemical activity caused by the presence of humidity and impurities. Impurities will act as trigger points for chemical changes (i.e. corrosion) of the original metal. The manufacturer of your cables therefore should avoid impurities, and you as an owner should avoid the humidity. An additional hint is to keep your cables cool: The lower the temperature, the less chemical activity.
All chemical activity induced changes in a metallic electrical conductor will create difficulties in the movement of electrons between the one group of metal atoms and the next. These groups, containing large numbers of structurally arranged metal atoms, are named crystals. Especially the boundaries of metal crystals are vulnerable to chemical activities since the structure is weaker there. The enemy always attacks at the weakest side of a structure.
After the crystal borders have been subject to chemical activity for a while, electrons with a low speed seeking to pass them will not have enough energy to bridge the chemical gap. I have called this effect: Cross Crystal Distortion (CCD).
The sonic effect is about the same as with a power amplifier which exhibits CrossOver Distortion (COD).
The difference with the amplifier is that this crossover distortion is already there at the moment you buy your amplifier from your dealer. With bad manufactured cables however, it usually takes a while before this type of distortion becomes noticeable. You can't be having to change your interconnects every half a year after they have started to sound really harsh.
A serious manufacturer will pay a lot of attention to avoid these chemical effects: his products still sound the same after a year and on. Cheap and low profile products, like the many nameless ones on the market, are different and are basically not designed for long durability. So, a low quality interconnect will already have a harsh sound before you bought it.
Once chemical activities and their induced Cross Crystal Distortion (CCD) have set foot in your cable, they will persist and sound harshness will worsen over time. Even when you don't listen to your music, the chemical activities will continue. For instance after a long holiday, during which the temperatures at home were high, your sound system will sound more aggressive. So, next time buy an interconnect with a high durability - this due to the extra care your manufacturer has paid to his products.

3-2 Q: Does a conductor with the lowest measured impedance sound better compared to a product with a higher value ?

A: This is mainly true for loudspeaker cables, (also see 16-3). But even here there are exceptions; For instance our The THIRD ® has a DC impedance of 0.07 Ohm/meter. This is a relatively high value, but sound-wise it is such an excellent product that, despite all loudspeaker cables we have in our program, The THIRD ® is my favourite. And the next is The INSPIRATION HYBRID.
For interconnects the answer is somewhat different: Interconnects are always used in higher impedance circuits. The input impedance of a regular power amplifier for instance is between 20 kOhm and 100 kOhm. In such circuits an Ohm extra or less series impedance introduced by an interconnect is not important. What counts here is the chemical and mechanical stability of the conductor beside other electrical parameters, (also see 9-2).
And don't forget: When you measure the impedances of your expensive loudspeaker cables, you never read lower than say 0.6 Ohm. This is because the two very thin leads connected to your Ohmmeter together are 0.6 Ohm. So, any measurements with your expensive meter and cheap instrument cables are useless.

3-3 Q: What sounds better: A thick interconnect or a thinner version ?

A: This is a question in the category: What tastes better: a thick pizza or a thin one?
A thick interconnect may contain a lot of extra metal and/or have more space between the conductor(s) and the shield. The latter provides a lower parasitic electrical capacitance. Thin interconnects always have a higher capacitance which is not a great advantage (see 3-18, 4-5 and 4-12). The best solution I can give you is: Try both designs in your hi-fi system and take some time for serious listening. Your ears must tell you the truth. When there is no difference, buy the cheapest interconnect and use the rest of the money for a fine thick pizza.

3-4 Q: Is there a relation between cable sound quality and mechanical conductor strength ?

A: These two properties are not directly linked together. However, I found that interconnects made of soft metals may sound well, but give up after a while as a result of just that property. So our company came up with stronger metal compositions to overcome this problem. Fusion Technology, like used with The INTEGRATION HYBRID and The INSPIRATION HYBRID is a typical example of this approach. And more is coming, (also see 1-5).

3-5 Q: Is any cable able to restore lost quality by e.g. low quality equipment ?

A: The simple answer is: No. But based on experience, our carbon product line can for a part. Especially introduced harshness, reduced spatiality (also see 3-13 and 5-1) and reduced resolution all three are treated well in the positive direction. This has to do with the structuring effect carbon has on electrical signals.

3-6 Q: What is the sonic difference between a good interconnect and a bad product ?

A: A good interconnect protects the audio signal against hum and high frequency signals. It also maintains the sonic quality of the input signal. So, plenty of space, acoustics and delicate strings and voices. A bad product does just the opposite.

3-7 Q: Can I improve the sound quality of my new cables by some technical treatment ?

A: Yes, you can. Generally cables start to sound better after a while. We call this “burning-in” (which is not the same as a burning inn). Burning-in is a simple process where after a while the sound gets better as a result of several hours of AC current passing through the cable (also see 3-8 and 3-9). It sounds like more resolution and reduced distortion and is caused by creation of electron bridges between the conductors’ crystals. The disadvantage of this whole phenomenon is that any movement of the cable will bring you back to start. So be careful.
Another method to maintain the quality is to inject our The SOLUTION protection fluid in the cable by a syringe (also see 8-3). The SOLUTION protects the electrical conductors against aging.
When the cable uses cheap connectors, you can make an improvement by replacing them by a better type. At the same time you can also improve the solder work (also see 2-3). And when in the end you doubt the quality of the cable, change to a better type and at the same time mount your new connectors.

3-8 Q: What is the so-called “burning-in” of a cable ?

A: Any cable’s conductors consist of many groups of atoms, clustered in crystals or atom clusters. The borders between these crystals or clusters are critical zones where electron movements are hindered when the condition of these boundaries is getting worse. This worsening takes place e.g. when your loudspeaker cable is moved every day and/or chemical activity is around - latter amplified by higher humidity levels, elevated temperatures and air pollution. Also imperfections in the cable insulation can trigger conductivity changes.
Burning-in is the effect that, despite any affected crystal borders, the sound quality improves again thanks to electron movement through conducting zones like so-called electron tunnels. But... when you move a cable again, those tunnels are “broken” and you then have to start again by playing your music.
You may wonder why (especially) on Sunday evening the music sounds so good again, this after a week with plenty of sound problems. Your cables finally are burned-in. But as soon as the killing Hoover (vacuum cleaning) hour on Monday morning comes and the over-active cleaning lady messes about with your cables, the problem returns: your cables are “burned-out” again, remaining that way until the following Sunday...

3-9 Q: What is a cable enhancer ?

A: A cable enhancer is a signal source connected to a power amplifier. The enhancer generates special signals which are intended to link a connected cable’s metal crystals together. The enhancing signal can come from a CD or from a noise generator. Any pink noise generator will do well here.
When you think about enhancing a set of interconnects, just connect the two cables between your CD player or noise generator and a pre-amplifier.
When you want to enhance your loudspeaker cables, connect them between your power amplifier and an 8 Ohm resistor.
When you think of enhancing your interconnects, loudspeaker cables and your loudspeakers at one time, just connect everything together and start playing. It can take 1 to 24 hours.
When you think you are ready, don’t move the cables anymore, otherwise you’re back at the start again: By enhancing you create electron bridges between crystals or atom clusters. These tunnels easily break again when you move your cable.

3-10 Q: A friend made some experiments by putting his cables in the refrigerator for a while. His claim was that, after this, the sound quality was substantially improved. Is there a serious reason to believe him ?

A: Well, your friend's deep freezer must get extremely cold before he will notice any serious and positive effects. The clue is that in metals, when held long enough at real low temperatures, a reorientation of groups of atoms takes place, a kind of slow recrystallization. For this to take place, the cool down time to reach, say -200 degrees Celsius (-328 °F)), must minimally be 4 hours. The metal then needs to be kept at low temperature for at least 24 hours. After all groups of atoms have settled, the warming up to room temperature also should take place slowly (another 4 hours). Handle the cables with respect during and after this cryogenic treatment. Avoid all twisting and bending, other mechanical stresses or sudden temperature shocks like exposure to direct sunlight. The sonic result is an improved spatiality of reproduction and more detail. But don't expect serious results with the -15 to -20 degrees Celsius (5 to -4 °F) temperatures of your friend's deep freezer, even after 5 days.

3-11 Q: Are there differential time delays in an audio cable? Is it possible to get a perfect signal time alignment in audio cables by the application of more conductor layers with each a different length? And is electrical time-alignment in cables necessary to get better sound ?

A: Yes there are differential time delays in audio cables (different frequencies can undergo different delays) and in pure theory it is possible to get a perfect signal time alignment in audio cables by the application of more conductor layers with each a different length. But the real question is whether perfect time-alignment in cables is necessary to get better sound: Electrical time-alignment only works well when you would be able to hear frequencies up to around 1 - 10 MHz, since only within such high frequency bandwidths the usual cable induced differential time delays would become large enough to be noticeable. With common audio cables and within the audio frequency range you have to think of differential time delays which are in the order of parts of nanoseconds. (During one nanosecond, in air sound travels a distance of about 0.33 micrometer). The much larger differential time delays caused by various components at other points along the total recording-reproduction chain generally render your cable's nanosecond figures quite negligible. The difference in distance between your speakers' drivers and your ears, for instance, is a multiple multitude of mentioned 0.33 micrometer. Also other shortcomings of speakers, like defects in timing of your big speaker cones and crossover filter issues, are so much more a problem, that it is most valuable to start solving them first.
The frequency dependent time delays introduced by all analog filters along the recording-reproduction chain, like your speakers crossovers, possible tone controls and many others are much stronger than the timing effect of your cables. But, there are very dedicated listeners who don't care about this, because they are able to hear the remarkable timing corrections from their cables, and in the meantime ignore all other (much stronger) defects of their hi-fi set. The world of hi-fi is still an excellent collection of special and for certain non-logical effect lovers.
Time-alignment is just one parameter in the whole process of sound quality. Regarding audio cables, to my opinion, the quality of the conductor material is more important.

3-12 Q: Do cables have a "direction" when connected between equipment ?

A: The term "cable directionality" is often used when experiencing differences in sound between connecting an audio interconnect cable in one direction and the other way around.
When differences are audible, it's mostly a spatial effect caused by electrical differences in the contact crossings made by the connectors (this of course includes the mating parts at the equipment itself): The contact surfaces can be polluted/ corroded (cleaning: see 10-1) but also the quality and age of the connectors can make a difference (also see 10-5 and 10-3).
Another possibility are flaws in the production process which can cause the cable to have non-constant electrical properties from end to end.
A further "directionality" issue is that, with balanced cabling, the immunity to external noise/interference and the sound can depend on at which equipment side the cable's shield is ground connected; Instead of coaxial cables which have only one internal conductor, balanced cable designs use two internal conductors for respectively signal + and signal –. The high frequency (HF) pick-up by the covering and separate shield therefore can much less easily interfere with the audio signal: The HF signals are directly drained to the ground end of the cable. The equipment side at which this happens can make a sound difference. With our balanced cables which are wired for unbalanced/asymmetric signal transport (i.e. are fit with RCA type connectors), we always mark this grounded end by a special sticker. In creating a link between, it is up to you to connect this grounded end either at your pre-amplifier or at the power amplifier. In case you are not certain, we advice to connect at your pre-amplifier (i.e. grounded end at the signal source).

3-13 Q: What keeps the spatial effect in music reproduction most alive when I have the choice between several types of cables ?

A: Always use balanced connections (with XLR type connectors) or balanced cables wired for unbalanced applications (see 4-18). Take cables which have more than one screen or even more than two screens. Use cables which have very stable

conductors, like our Linear Structured Carbon ® or Fusion Technology types. Avoid ground loops and minimize residual ground currents by means of our POLARITY CHECKER. Use very time coherent loudspeakers without any funny peaks in the frequency response. And pay a LOT of attention to the acoustics of your listening room. In many cases plenty of products are changed to get better spatial reproduction, though with some simple but smart changes in the room acoustics a dramatic improvement of the reproduction is often the result. So get to work.

3-14 Q: Do I need to keep all my equipment switched on for ever to maintain a good cable transfer quality ?

A: No, not at all. But to maintain a good equipment quality, you may do so. Especially low signal level equipment, like pre-amplifiers or CD players, benefits from being kept switched on.
Keep in mind that with an average power consumption of 25 watt, the total energy use per year can easily run up to 219 kilowatt-hours. And that is only your pre-amplifier. With your class A power amplifier's quiescent power consumption of, say, 250 watt, it easily runs up to 2190 kilowatt-hours a year for that amplifier alone. And that costs a pretty penny. So, for quality and thermal stability reasons: Yes. For the environment: No.

3-15 Q: Every Saturday when I start listening to my hi-fi set, I have to listen for an hour or two before the sound is right again. How come ?

A: When your room was cleaned during the week, all your cables may have been moved and some of them may require some anewed burning-in before sounding right again (also see 3-8). Your equipment furthermore may have been cold. It takes some amplifiers days before they sound well, but also I know equipment where the sound is on spot after just 5 minutes. And there is the human factor as well: Your ears also need some time to adjust to the sound quality (mostly colourations of your room and loudspeakers). The combination of all three mentioned factors is most probably the case.

3-16 Q: Why does the same cable sound quite different in combination with different equipment ?

A: Because with a good cable you listen to the equipment and not to the cable. And as it is with cables, also equipment has specific sound properties. Partly thanks to internal power conditions and partly due to circuitry and components.

3-17 Q: Is it possible to hear differences in interconnects when the loudspeaker cables are not of the highest standard ?

A: The answer is yes, even where you think it can not be possible. After a while of listening, the brain is able to filter out or to recognize the sound patterns of the loudspeaker cables. It is like with sunglasses: After you wear them for a while, your eyes are able to recognize colour differences despite the tinted lenses. It works the same way with low quality loudspeaker cables. Your ears focus on differences above the stable level of imperfections of the loudspeaker cables.

3-18 Q: With the same CD player/amplifier combination, some cables sound well and others less good. How can this happen ?

A: The main reason is that some cables are, in principle, good and others are worse. This is independent from any CD player/amplifier combination.
But sometimes there is the effect that interconnects with a high cable capacitance (also see 9-2) demand extra current to run. The high capacitive load takes this higher current, especially at high frequencies. When the integrated circuit responsible for the signal output cannot deliver the required currents without becoming overloaded or even clipping, you'll hear plenty of distortion.
Also older cables with already a long (shop) life behind them can suffer from funny effects you are not looking for.

3-19 Q: Is there a sonic difference between a 50, 75 or 110 Ohm interconnect ?

A: First of all it depends on whether the 50, 75 or 110 Ohm interconnect is to be used for analog audio or digital audio signal transmission.

Regarding use as an analog audio interconnect: As long as the output impedance of your pre-amplifier is low enough (something like 300 Ohm or less), there will hardly be a sonic difference between the various impedance types. With higher output impedances and large length cables on the other hand, there is risk that the cable's parasitic capacitance induced high frequency roll-off point will become audible (also see 7-6). Worth knowing here is that, by design, the

parasitic capacitance per meter decreases with cable impedance, 110 Ohm cables having the least.
The remaining main parameters exerting influence on the sonic quality are the quality of the cable screen and the manufacturing quality of the conductors in general. The better the shielding, the cleaner the sound. The better (more careful) the conductor manufacturing, the lower the harshness in sound reproduction and the greater the spatial impression. Mind that 50, 75 or 110 impedance cables specifically have been optimised for high frequency signal transmission. They are applicable, but usually are less suitable for use as a high-end audio interconnect (also see 3-20).

When used as a digital audio interconnect, the sonic differences between the various impedance cable types are large. The two prevailing digital audio signal transmission standards - SPDIF (Sony/Philips Digital Interface) for consumer equipment and AES/EBU for professional use - each employ their own characteristic cable impedance of respectively 75 and 110 Ohm. Applying different impedance cabling here will yield signal reflections between the cable ends and as such will give rise to so-called jitter distortion, (also see 12-4).

3-20 Q: Can I use a good antenna cable as an interconnect ?

A: Yes you can, but don't expect real high-end quality. The product is not made for this job.

3-21 Q: I work in a recording studio where I experienced that single cables don't sound aggressive, but a number of complex multicables do. How can this happen ?

A: With single cables there is much less mutual crosstalk compared to in a multicable where all lines are closely bundled together. Crosstalk in a multicable especially will be high when the individual audio lines' screens are very open and their internal conductors therefore easily can "see" the neighbours. (I.e. a mutual capacitance with the neighbouring audio groups due to inadequate shielding). This means that, especially at higher frequencies, signals can leak from one group to another. It is those higher frequencies which create the impression of harsh sound. So what do we learn here? A multicable must have more-than-perfect screens to avoid this effect. Our The BIG MIC is just such an example.

3-22 Q: Does typical household cable work in a hi-fi system ?

A: Are you thinking about using the power cord of the vacuum cleaner or the metal clothesline (your mother used when she was hanging your washed nappies drying outside to re-use them again) as speaker cable? The power cord generally connected to vacuum cleaners is AWG 16 to AWG 18 (1.3 to 0.82 mm² Ø). Not a real contribution to conductor diameter or size. Beside that, the self-winding power cable connected to a vacuum cleaner has been rolled so many times that it can hardly be expected to be a genius product in the world of hi-fi. Also lamp cord is often used for loudspeakers. With a cheap audio set, the included cables are equal or even less in quality. So improvements can be expected. For serious hi-fi setups however, you have to consider more valid products to meet the quality of the equipment you just bought. Otherwise you did not need to spend all that money your wife was not aware of.

3-23 Q: I'm using the heavy mains cable from our very old washing machine between my power amplifier and my loudspeakers. The sound is great now. What can I do further to improve the sound quality ?

A: When you like the sound, also use the same cable inside your loudspeakers.
Washing machine power cables however are not the top in audio. When they sound great, it's quite likely that something else in your hi-fi set needs improvement. Or it could be that the cables you previously used between your power amplifier and loudspeakers were of a very moderate quality. Then any change always yields a better sound.

3-24 Q: The old power cord from our Swedish vacuum cleaner sounds terrific in my sound system. So I have the plan to collect many old vacuum cleaners and start my own cable business. What do you think about this super idea ?

A: Success !!

3-25 Q: Is there a link between colours and sound ?

A: People often describe sound as dark brown when the top frequency end is missing. Turntables should sound black when there is no background noise from e.g. rotating motors and spindle bearing noise. Amplifiers are less frameable, but loudspeakers even more.

Both colours and sound have a spectrum. And we have organs to detect their spectrum's components: I.e. their contained frequencies and intensities. White noise e.g. contains all frequencies, like white light contains all colours.
The ear is more sensitive for a single frequency, despite the fact that we are able to hear 10 octaves. The visual spectrum is just about one octave. With the ear we can easily hear single tones in a complex signal. With the eye it is more difficult to see one specific colour. But all is a matter of training as all audiophiles will know.

3-26 Q: Is it possible to measure sound differences and are there measuring methods to determine the sonic quality of cables ?

A: With a very good spectrum analyzer you can measure sound differences. But still I have my doubt if it's really possible to measure what we are able to hear. But just the simple technical parameters, like resistance, capacitance and inductance as well as other things like spectral balance and time are easy to measure. Other methods working with non-related frequencies and tracing the intermodulation so far failed to establish predictable results. Minor audible differences between cables are hard to measure. Partly because the circuitry of the analyzer is not made of the same audiophile quality as your cables are. What always works is the critical ear, but in many cases this produces rather subjective results. The complex ear is much more sensitive for sound quality compared to today's electronic analysers...

3-27 Q: Are there reliable methods to determine the sound quality of a cable, regardless of it concerning an interconnect or a loudspeaker cable ?

A: Not with regular electronic equipment, (also see 3-26). Only with the ears. But it requires to start with a very good recording without any distortion. Many recordings however are blessed with distortion. For the freak this distortion sounds like resolution or detail. The typical recording & replay distortion focuses the sonic attention at the loudspeakers, whereas honest resolution and detail creates a spacious and especially in-depth reproduction of the original soundstage.
To hear the difference is a matter of training. A very well working method is to rotate the speakers sidewards. With a distortion free recording, the sound image stays intact. The soundstage is not changed, despite the fact that the first (direct) sound from your speakers is fired sidewards and not in your listening direction anymore. On the other hand, with a recording having so-called resolution and detail but in practice just distortion, the centre of the sound image is empty and the two sound sources (your loudspeakers) can easily be found, even with the eyes closed. With the distortion free recording, a good cable maintains the imaging between the two speakers. With a low quality product, the imaging in the centre between the two speakers disappears completely and you hear two different sound sources: one on the left and one on the right.

3-28 Q: What source material is the best to compare different cables ?

A: Something you can try is your own made (analog) recordings. For certain there is a good quality tape recorder around in the family or in the attic. Clean the machine, put fresh oil in the bearings and get hold of a test tape (if you can find or buy one) to adjust the heads. Take two omnidirectional microphones and start the experiment in your garden with the birds, the wind, the traffic and the neighbours as sound sources. If you have a power stabilizer available, everything will be better. Also in a forest close to a pond with frogs or at the seashore you can make perfect recordings. And airports - when you really like dramatic effects - are also very interesting as a sound source. I found swimming pools, football fields (with a game of course), the beach and horse racing perfect locations for recording - beside of course organ performances in big churches and concert halls with a very good orchestra.
Especially regarding music, take non-complex compositions with a good harmonic structure. Experimental music with now and then a bang and bong on something is good for the tape company but not well for sound quality evaluations.
Everydays sounds are known best by the ear, so record what is around the house. Also pleasant for later when your children leave the nest. Their voices are still around. You know them best.
When the tape recorder is already at the waste dump, take a DAT recorder or a good PCM recorder like the Sony PCM F-1 from many years ago. There are still some around. Keep in mind that many recordings were made with the F-1, so it must really be good quality.
What also helps is using a collection of pre-recorded tapes. Around 1953 - 1968 such tapes were available from many companies, especially in the USA. Without having to make all recordings yourself, such tapes in many cases are excellent material for use with listening tests.
Last but not least, if you simply want to use CDs for comparative listening, we can recommend our "Carbon Recordings" CD range (also see 1-8) which has been recorded bearing comparative listening in mind.

3-29 Q: How do I train my ears to improve my listening ability ?

A: Start with a good recording on LP or CD (*). A good recording is characterized by a perfect equilibrium between detail, frequency balance and spatial information like depth, width and height of the soundstage. Also care for very low distortion and mind not to make the mistake to confuse distortion with extra detail.
Start listening to only one aspect, like detail. Take a track which you like most and replay it several times. Then start again and listen for instance to spatial information. When you are able to recognize this very well, combine both properties and try to capture both during your next replays. After you are able to enjoy both aspects, add another property like e.g. frequency balance. This style of listening teaches you all aspects of the LP or CD you chose within an evening. The next day take another music sample and start again. You will find that the learning is faster and that you need less time to find out all listening aspects. The final result of course depends on the quality of your system, but even with limited equipment there are good possibilities to train your listening ability. Anyhow, be critical and don't accept everything as perfect. Many recording are not, despite their high price.
Do the whole experiment over again at your friend's house. He will also learn from your experience and you can do the same experiments with the same LPs and/or CDs on different equipment. The latter is another aspect of listening: Try to hear trough the equipment. In the end you are able to evaluate sound quality within 2 seconds in any situation and in any place.

*: We have produced several CDs which excellently serve product quality evaluation and listening training purposes (also see 1-8). You can find the information about these CDs when you search for "Van den Hul Carbon Recordings " on our website.

3-30 Q: I'm a reasonably experienced listener. Reproduced sound doesn't have a lot of secrets for me. Despite this I would like to know some sound quality factors I have to pay attention to for my quality evaluations. Can you give me some you use yourself when you test new products ?

A: The following alphabetic list of properties are more or less standard in my sound quality evaluations:

- the **B**alance in tonal character,
- the lack of **C**ompression,
- the reproduction of the stage **D**imensions,
- the reality of **D**ynamics,
- the structure of the **F**eel,
- the reality of **P**resence,
- the definition of the **P**itch,
- the **S**ignal **S**trength,
- the **S**tylistic **R**ange,
- the **T**ransient **R**esponse and
- the total **T**ransparency.

The words with the capitals are the properties I evaluate during listening.

3-31 Q: Are there differences in the evaluation of sound quality in different countries ?

A: Yes there are plenty of differences.
What I found is that listening in e.g. Taiwan and Korea is mostly based on plenty of detail and less on space.
In Japan, beside a high focus on detail, there is also attention for spatial reproduction.
In Hong Kong there is a growing interest in spatial reproduction with high resolution, and the over-focused attention for detail is moving away. In many situations "detail" means a higher output of the system at 20 kHz, mainly caused by some component distortion. Owners of equipment do not agree with this statement, but this is what I personally experienced.
In Thailand I found a good balance with sometimes also over-attention for detail.
The situation is not so different in Europe. Also here, in many countries listeners focus on detail where cables serve as the pepper and salt in the system. But too much attention for detail is unnatural. When you regularly visit life performances you hear quite different aspects in sound, like position of instruments, distance of the instruments, positioning in the total sound image and height and width of the soundstage. In many listening situations I missed all these aspects.
So there is still a lot of work to do. All our audio cable products seriously contribute to imaging aspects and not specifically to detail only.

3-32 Q: Why do reviewers world-wide all have such different opinions about the same cable ?

A: Reviewers often forget that they are also human beings. But the most important factor is that reviewers perform their

comparisons using all kinds of different equipment at both ends of the cable. However, what works well in combination with one selection of equipment doesn't always work in a quite different setup.
Like a smooth sounding cable that works fine with rather harsh sounding transistor equipment, whereas the same cable is too smooth with tube equipment.
A harsh sounding cable on the other hand can be the best match with mild sounding tube equipment and too much in combination with semiconductor stuff.
A perfect cable reveals all defects of the equipment itself. But some reviewers do not like this effect because they regard electronics superb compared to simple cables.
It would be better to think just the other way around.
And keep in mind that, after having married to a reviewer, many ladies discovered what very special hobby or - even worse - profession her husband had. This "family effect" has an even stronger influence on the outcome of all kinds of sonic product evaluations...

3-33 Q: Is there a relation between the very positive reviews some cable brands receive and the reviewer involved? It is too often that a reviewer talks positive about just one or two brands and seems to ignore others.

A: I have also made the same observations. And having been an audio journalist for 13 years myself, I am very aware of this phenomenon. So don't get sleepless nights when your favourite cable is not mentioned. It is not always the cable but the policy. Policy can make a lot of noise but not always good sound.

3-34 Q: My friends try to convince me about the sound qualities of their just bought new interconnects. Though I come to the conclusion that my older The SECOND ® sounds better. How can this happen. Isn't new technology always better ?

A: New technology is just new technology and not always better...
The advantages of The SECOND ® are in its materials as well as in its individually insulated multiple carbon fibre construction. Especially the application of Linear Structured Carbon ® contributes to its very highly appreciated sound quality and lack of aging thereof. The high shielding factor brought about by its four layered screen furthermore keeps the signal very clean. But I don't need to tell you all this. It's more for your friends to know that you are happy with your products.

3-35 Q: Do cables sound better when I use Peter Belt stickers on the product ?

A: For the very young readers among us: Successful Mr. Peter Belt among other things invented a special aluminum sticker which fixed to any audiophile product improved the sound. (Sometimes I hear his daughter, Ms. Deci Bel(t) but not very often. Sound today is also more deciBel oriented).
During the mid 1980's, the Belt stickers were very popular, so for plenty of careful listeners they must have been a sonic upgrade. Why not try for yourself?

Section 4: Cables: Use and Function:

4-1 Q: I am a fanatic guitar player. Do you have any products in your program that can help me to perform better with my instrument ?

A: A regular hit is our The SECOND ® Linear Structured Carbon ® cable. Provides a very natural and mellow sound. Brings pleasure and delight in play. Also highly recommended comes our The INTEGRATION HYBRID. In a recent test in a leading USA guitar magazine The INTEGRATION HYBRID got the highest score; Quoting:

> *“Van den Hul seems to have designed first for balance, achieving as much clarity as possible within that tenuous framework. Its tone is absolutely addictive, with a remarkably involving midrange, amazing feel and lifelike attack. This is probably the most exciting cable for high-gain, with near perfect balance and astounding harmonics. Played clean...simply exceptional”.*
>
> If you want to read more, the full text is available on our website (search for “Cable Summit”).

In addition, a much loved item by many professional guitarists for wiring their effect racks/equipment (i.e. where no excessive cable movements are involved) is our D - 102 III HYBRID.
By the way, much can also be gained in sound when you revise your speaker wiring, see 16-4.

We can produce the required lengths for you, including highest quality Neutrik brand jack or XLR connectors.
General advice: Always use a balanced cable (shielded twin core cable) even were the connections are unbalanced (see the “Male Unbalanced Jack to Male Unbalanced Jack” page in “Audio and Video Cable/Connector WIRING DIAGRAMS for DIY purposes” available on our website). Our The SECOND ®, The INTEGRATION HYBRID and D - 102 III HYBRID are all balanced, very well screened and apply Linear Structured Carbon ® to reduce microphony. (Microphony: see 7-8).

4-2 Q: I am building my own mixing console. Which of your cables can I use inside ?

A: Always use very well shielded cable for the signal wiring. This to avoid crosstalk and signal pick-up from other sources. With high frequency leakage from other channels, the audible effect will be a harsh sound (also see 3-21).
Our FLEXICON B4 and our The PATCHBAY B5 are especially made for audio mixer inside wiring. The latter being better shielded and involving our hybrid technology. Both products have a very small diameter, so no problems with space. Internal space is always a problem with mixing desks.

4-3 Q: Is using microphone cables to interconnect my audio equipment better than using regular interconnects of a good quality? Microphone cables are at least used for making recordings and there should not be any better product around.

A: Fact of life: Many microphone cables are much worse compared to what is sold on the high end market. This is related to the fact that many studios regard these cables as the last post on the budget. All other components involved are often the latest of the latest, the cutting edge of technology. Despite this fact, there are studios run by audio freaks who really care about the cable quality. The sonic results are amazingly good, even where the rest of the equipment is not the top of the top. In this case it is also valuable to mention the application of Neutrik silver plated contact XLR connectors and preservation/protection of the silver contacts.

4-4 Q: I work in the restaurant of my mother and my hobby is audio. So, I like to make a 75 meter connection from my recorder in my sleeping room to the amplifier in the restaurant. The reason to do this is that, due to all served fried sausages and barbecued beef, but also because of the loud singing of the local beer and shooting clubs, I am afraid that my delicate recorder will give up soon. But how to connect ?

A: Use the cable with the lowest capacitive load you can find. (The cable should of course also be very well shielded to avoid pickup of hum and other interference on the way). The lowest capacitance cable in our program is this the D - 403 with around 27 pF/meter. Anyhow use a low output impedance pre-amplifier between your recorder and the cable. The lower the output impedance, the higher the high frequency roll-off point will be (see 7-6). And this is typically what you have to take care of when you replay your tapes with favourite beer and shooting songs.

4-5 Q: Is it correct when my interconnects have a different length? I use two mono power amplifiers and they are situated very close to the loudspeakers. One interconnect is 5 meter and the other is 8 meter.

A: When the source impedance of your pre-amplifier is low enough (something like 300 Ohm or less) then there is no problem. The effect of long interconnects in combination with a high signal source impedance is an audible roll off at the top end of the frequency range. Here, big differences in the length of interconnects will always produce a milder sounding channel at the longer interconnect's side. In such a situation - when able - buy interconnects with the lowest capacitance between signal and ground. Any remaining reduction in quality then will be minimal or not noticeable.

With speaker cables this is a somewhat different story. All our products are American Wire Gauge (AWG) related. In case you have a more than 20% difference in cable length, my advice is to take a heavier speaker cable (i.e. with a lower AWG number) for the largest distance. With help of our AWG to METRIC conversion chart (available on our website) an AWG number indication can be found to choose the heavier speaker cable; This, as to approximately equalize the series resistance in both speaker channels.
E.g.: Let's say that your standard is our The ROYAL JADE HYBRID loudspeaker cable for the right channel. The left channel speaker is at a 20% larger distance from your stereo power amplifier. For the left channel then take our CS - 122 HYBRID instead of The ROYAL JADE HYBRID. This compensates for the larger length. The internal strands are of the same make, so don't bother too much about differences in performance quality.

4-6 Q: What sounds better: Short interconnects between my pre-amplifier and power amplifier and long loudspeaker cables or the other way around, because my power amplifiers are in that case very close to my speakers ?

A: When the quality of your interconnects is average or less, keep them as short as possible. This because the prevalent low signal levels/currents in interconnects are more susceptible to sonic degradation, mainly due to average or low cable production quality. Any centimeter extra will then change the sound quality in a negative way. As a result of this decision you will then have to use longer speaker cables. The current in speaker cables however is higher, so the material and metal induced effects on the sound are less.
By the way, with interconnects and speaker cables these effects disappear to some extent by "burning-in" (also see 3-8 and 3-9).
As a result of choosing for longer speaker cables, their series resistance will be somewhat higher. As a consequence, the damping effect of the power amplifier on your speakers will be less and your speakers can sound somewhat more "boomy". Long speaker cables therefore need to be thicker than short ones.

4-7 Q: I bought a very good interconnect. What is the best place to use this product in my hi-fi setup ?

A: Always at the connection with the lowest signal levels. Your worst product should be used for the connection with the highest signal levels.

4-8 Q: Are there some rules I have to keep in mind when I have a mix of interconnects and loudspeaker cables on the floor of my room behind my equipment ?

A: Keep your speaker cables and interconnects away from each other as far as possible. And when you can not avoid close distance, let them cross perpendicular. Also stay away from transformers and power cables. Again, when you can not avoid such, let the power cables cross at right angles. Better is to use shielded power cables like our The MAINSSTREAM HYBRID and The MAINSSERVER HYBRID.
Furthermore, always keep your speaker and interconnect cables as short as possible. Longer cables never sound better compared to a short ones (also see 4-6). Cables which have excessive length should not be looped. Loops form a pick-up coil; An effective way for interference to find its way into your system. You can also run experiments to support the loudspeaker cables by extra dampers. I have never experienced a big improvement by these devices, but some audio friends positively informed me about their experiences. So, worth trying.

4-9 Q: I have only one very superb interconnect cable: Your MC - SILVER IT. Where should I use this cable? From tone arm to phono pre-amplifier or from pre-amplifier to power amplifier ?

A: With the last option all your music reproduction enjoys high quality. But, the MC - SILVER (*) works really best when connected to a tone arm. So, if you play records, you'll play even more when connecting MC - SILVER between your tone arm and phono section.

*: I.e. the MC - SILVER IT Mk III Balanced or the MC - SILVER IT Mk II Balanced.

4-10 Q: I want to rewire my turntable to improve its sound. Do you have special cables and wire in your program that I can use ?

A: Yes, we have, because I am very committed to analog reproduction.
Since the prevailing signal levels are very low, the quality requirements for turntable wiring are very high. The inside wiring must have a very high signal resolution and also be very flexible. The cable to the pre-amplifier in addition requires a very high screening factor and must be balanced.
Inside the tone arm I advice our MCS - 150 M; A very flexible multi-strand wire made of 7 x 80 micron diameter thin pure silver conductors, available in four colours: transparent, blue, red and green. The wire is direct solderable; The insulation works as a solder flux. We even have the small 1.0 and 1.2 mm headshell wire connecting clips and ready-made headshell connection wire sets in our program.
From the arm to your phono input we advice our D - 501 HYBRID or D - 501 SILVER HYBRID (the best) or our D - 502 HYBRID (a twin line D - 501 HYBRID with an extra ground lead in the centre). The D - 501 SILVER HYBRID is my personal favourite. We have been regularly supplying these products to SME in the UK (for more than 20 years). Mr. Robertson Aikman so far has had no complaints. Also happy and pleased are the regular buyers of thousands of the SME 3009, SME 3012, SME 309, SME IV and SME V series tone arms. So, join a big group of 501 & 502 cable owners world-wide.
The above mentioned 500 series tone arm to pre-amplifier cable types are available ready made. For the do-it-yourselfer we however also have the required 5 pin 270 degree angle configuration tone arm connector: our The TAC and RCA type connectors separately available. Just ask your dealer to supply you with these products.
Much more phono replay related questions and answers can be found in our PHONO FAQ by the way.

4-11 Q: Can high-end audio cables also be used for car hi-fi ?

A: Yes, of course. But put your best high-end cables only in the cool places of the car. Risen temperatures will shorten the high quality-lifespan of your best friends.
When it’s unavoidable for your cables to run through locations with high running temperatures, provide them with an extra thermal screen to extend their life.
And keep in mind that vibrations do have their side effect on the sonic quality. Additional secure fastening and mechanical damping will help you to enjoy your music for the years to come.
When you wish to maximize the lifespan, use e.g. our SCS - 6 or SCS - 4 loudspeaker cables. These very thick (AWG 6 and AWG 4) Teflon insulated conductors are ideal for car hi-fi because their ability to vibrate is practically zero. Besides this, their resistance against temperature effects is also very high. Maybe an idea to try.

4-12 Q: Do I need other types of cable between tube equipment than between semiconductor equipment ?

A: In case the equipment has an outspoken sound character, you can cure these effects by a fine-tuned choice of cables. Semiconductor equipment generally sounds better with interconnects having a higher capacitance per meter and tube equipment works very fine with cables which have a low electrical parallel capacitance. This is just a part of the story, but generally speaking it’s an effective and always working rule. Keep in mind that the best sounding semiconductor equipment is equal in quality as fine tube equipment. Here only counts: The best is just good enough.

4-13 Q: After a lot of work, I have installed your HQ - 1 spark plug cable. It works fabulous, but why is still a mystery to me. Can you give me some more information ?

A: Using our HQ - 1 ignition cable has the following benefits:

1. The engine runs stationary with a very stable number of revolutions per minute. This avoids extra petrol consumption and reduces vibrations of the engine.
2. Saving the environment, the exhaust gasses are cleaner and have a much lower CO_2, CO and N_xO_y reading.
3. Due to a more complete combustion, the fuel efficiency is higher. Power production is 1% - 2% higher for the same petrol consumption.
4. At higher rpm’s the higher efficiency is maintained instead of reduced.
5. Your motor oil needs to be changed less frequently because it blackens less over the time.
6. Expensive modifications to meet environmental requirements can be reduced to lower cost modifications because the exhaust is already cleaner.
7. Once you use the HQ - 1, you never need to change to another ignition cable. The HQ - 1 lasts for ever. Just some cleaning of the exterior is enough.
8. The rated working voltage is 40 kiloVolt. Tests have been made up to 80 kV.
9. The dielectric absorption (i.e. pulse smear due to energy absorption by the cable insulation) is extremely low. The

ignition pulse energy is thus immediately and fully available, meaning a sharp ignition pulse timing and a high instantaneous ignition pulse power delivered at the spark plug. No delayed effects or afterburning.

10. And especially regarding tropical environments with a high humidity: Your car starts immediately without all the hassle of getting the thing ever working or even never.

As you see, an impressive list of properties making it worth to spend a Saturday afternoon in removing your old stuff and replacing it with our HQ - 1. Keep in mind that the best connections are soldered and not crimped. Avoid the suppressors and also apply the Bosch Platinum +4 spark plugs with four electrodes.

4-14 Q: I am lost with all the different cable colours in my multi-channel system based on THX. Can you help me ?

A: Front left is blue, front center is green and front right is red. Surround (= rear) left is blue-white. Surround (= rear) right is red-white and your subwoofer connection is color-coded brown. Care for enough metal cross-section area in your speaker cables. AWG 12 (3.3 mm² Ø) is a good start for all of them, despite the fact that your wife may consider you as ready for a psychiatric treatment with so many cables around.

4-15 Q: Can loudspeaker cables also be used as an interconnect ?

A: Yes, indeed. A few can. But it is important that the cable is shielded.
An example from our own cable program is e.g. The INSPIRATION HYBRID. This cable is designed as a loudspeaker cable, but after a brainwave, we tried it and it did also work very well as an interconnect. It's not easy to mount RCA type connectors (we have special connectors for this rainy Saturday afternoon job), but after all the work it's a real sonic delight. You will never forget the emotional shock you got after switching on your equipment connected with The INSPIRATION HYBRID!
(Similar exotic possibilities from our program are The REVELATION HYBRID and its thinner sister The REVOLUTION HYBRID).

4-16 Q: Is it a bad idea to use The MAINSSTREAM HYBRID as a loudspeaker cable ?

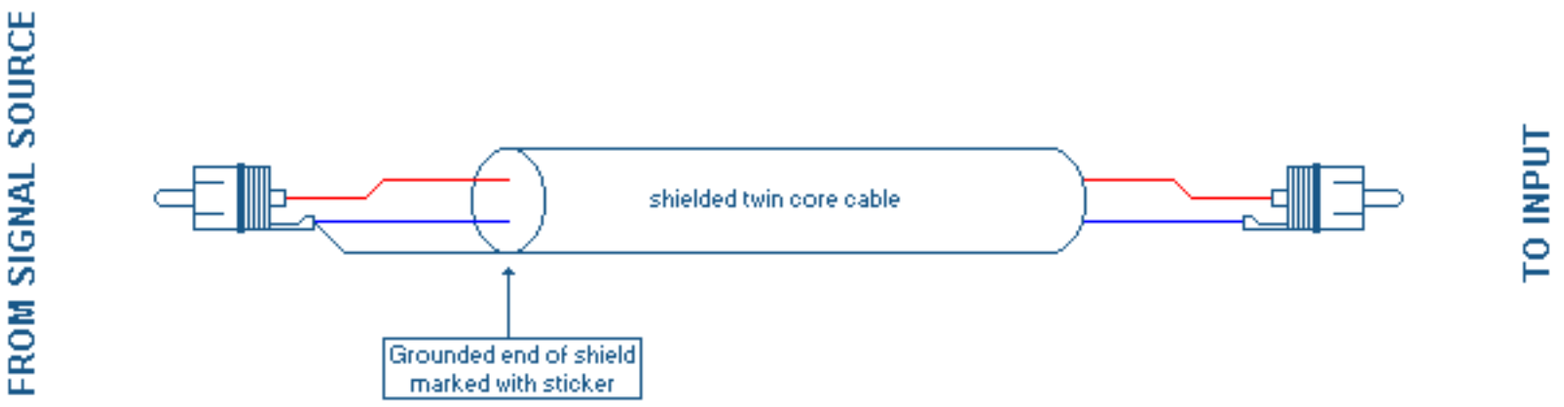
A: No, I think it is a very good idea. Just make very clear that these pieces of The MAINSSTREAM HYBRID are the loudspeaker cables and not your mains cables, otherwise your speaker replacement costs run out of control...
The main advantage of The MAINSSTREAM HYBRID as a loudspeaker cable is its extra shielding. This shield avoids high frequency interference from entering the leads and reaching back to the amplifier's input stage (also see 5-7). It therefore provides a cleaner sound. Also the cable's internal multiple conductor construction is advantageous to the sound quality. The conductor materials furthermore are not merely cheap copper because it just being a mains cable: Even in this case we have applied the best materials, also adding to this cable's excellent sound quality.
(Regarding shielded speaker cables we also carry The SUPER NOVA and The INSPIRATION HYBRID).

4-17 Q: I am the local electronic supply shop owner and the football team has asked me to mount a public address system around the play field. What loudspeaker cable should I use ?

A: When it is a 100 Volt system, the wire diameter is somewhat less important. The minimum AWG wire diameter number is 14 but I would prefer using AWG 12. Our CS - 122 HYBRID is for more than one reason the perfect choice. In case the CS - 122 HYBRID is too massive, consider The GOLDWATER or The ROYAL JADE HYBRID. All products are insulated with HULLIFLEX ® which provides an excellent protection against all environmental evil. After mounting the cables, close all (open air) ends with nail varnish to avoid the penetration of water or chemicals in outdoor use. (With indoor use see 8-3).

4-18 Q: Can a balanced cable be used for unbalanced/single-ended connections ?

A: Yes very well. And it is very simple too:
Use one internal conductor of your balanced cable (like e.g. our D - 102 III HYBRID) in a signal up connection. Solder the ends of this conductor (say the cream colour insulated conductor) to the centre pin of each phono connector. The other internal conductor (say the one with the brown insulation) must connect between the shells (= grounds) of both phono connectors. And last but not least, the cable shield must be connected only at ONE side to the ground of a phono connector, this at the same point where the brown insulated conductor makes contact. The other end of the shield must be kept electrically insulated at the other phono connector.



The one phono connector that has the shield connected is called the “Ground-End” connector and should be marked as such. When making connections between equipment, this “Ground-End” side connector is advised to be always plugged into the signal sending side.
This balanced lay out of mounting keeps audio and pollution separate: The internal conductors are exclusively dedicated to audio signal transfer between signal source and receiver. And, in connecting the shield to ground only at one side of the cable and lifting it at the other side, it functions as a true screen: It does not carry any audio signal; It screens the inner conductors and drains away unwanted noise to one location.
An unbalanced (usually cheaper) cable also could have done the same job, but with risk of high frequency interference. So, always look for a balanced cable even where your equipment is unbalanced.

4-19 Q: Do you have a balanced and well shielded microphone cable which can be used in seawater ?

A: Especially for this purpose our THUNDERLINE was produced. In an improved version it is still in our program. And in the meantime it also has been converted to a Hybrid product by adding carbon layers. Especially with longer cable runs this helps to reduce microphony as well as providing an improved transmission quality.

4-20 Q: My car hi-fi installation uses 725 Amperes. Do you have a power cable in your program that fits this requirement ?

A: With a 12 Volt battery, 725 Amperes means a power consumption of 8700 Watt. Such heavy amplifiers must produce a hefty sound level in your Fiat 500; A creative way to demolish a decent car. But to answer your question: Yes, our SCS - 2 manages to transport even more than 725 Amperes without any mentionable losses. So, enjoy your trips again.

4-21 Q: Why do some cables have a specific impedance like 50 Ohm, 75 Ohm or 110 Ohm? When I measure with my Ohm meter, they are all around 2.3 Ohm.

A: The 2.3 Ohm you measure mainly consists of the DC impedance of your Ohm meter’s two probes including the leads and their connectors.
At high frequencies, on the other hand, each cable has a specific impedance which is based on its electrical capacitance and inductance and also partially on the real resistance of the conductors. Above, say, 1 MHz, this value is more or less stable and is called the characteristic impedance of the cable. The higher the cable’s capacitance, the lower its characteristic impedance. So, when used as an audio interconnect (also see 3-20), a 110 Ohm cable forms a lower capacitive load (per meter) to your pre-amplifier compared to a 75 Ohm cable.
Both values, 75 Ohm and 110 Ohm are accepted as standards for digital audio signal transmission. The 75 Ohm cable is always coaxial in layout and the 110 Ohm is always balanced.

4-22 Q: Why are all your AV products 75 Ohm and why do you pay so much attention to this value ?

A: Because the standard is 75 Ohm. And the better the cable impedance matches the 75 Ohm standard, the better it fits between all other equipment which has also been built with the 75 Ohm standard in mind. Especially with video and digital audio the results are negatively influenced by impedance mismatches.

4-23 Q: Who established that funny value of 110 Ohm for balanced digital connections? Is it by happy coincidence half the value of Europe’s past mains voltage ?

A: No it is not funny and also isn’t half of the mains voltage. The value comes from some calculations based on the established value of 75 Ohm for unbalanced connections.
75 Ohm multiplied by the square root of 2 equals 106.066 Ohm and this value was upgraded to 110 Ohm. By precise calculations of the balanced cable configurations, it also worked out that 110 Ohm technically was a good value to work

with.

4-24 Q: Which of your cables are good for use as a high quality antenna cable ?

A: In principle all our coaxial 75 Ohm cables, though, the longer the distance to be bridged the higher the requirements are. The standard choice for short to medium distances are our VIDEOLINK 75, The NAME and our thin VIDEOLINE 75. Better is The TRIAXIAL Professional 75 Ohm, and if you really want to use something superb, think about our The DIGI-COUPLER 75 Ohm. Due to their higher number of screens, latter two, in order of increasing performance, especially work very well in high frequency interference polluted environments with strong nearby noise sources and/or where large distances are to be covered.

4-25 Q: I see ever more different sorts of AV interconnects with all kinds of difficult connectors in the shops. Is a simple phono connector at the end not good enough ?

A: AV is getting more and more complex. This mainly because the quality requirements are getting higher and higher. So the market is developing in the direction of steady quality improvement. Especially the frequency bandwidth and frequency dependent time/group delay parameters are very important to get the best visual results. By reason of technical developments, this means that constantly a new range of products will be designed and sold. And to connect all components together, you need more complex connections. To keep it simple for the consumer, the required higher number of connections is made with more complex connectors like e.g. the 21 pole SCART connector. But there is hope: A 3 component video format connection just requires three 75 Ohm coaxial cables in parallel, having not more than 2 times 3 connectors. Our The COMPOLINK 75 & The COMPOLINE 75 are typical examples. The connectors can either be RCA type (phono) or BNC. Preferable are 75 Ohm RCA type connectors.
In some situations you may need 4 x 75 Ohm coax. We'll soon have a product with this configuration in our program.
Currently also DVI and HDMI cables are getting very popular. Both use another type of connector as you are used to. So your old Scarty can go in the trash and you need to get a proper DVI or HDMI cable, like our The VDH HDMI and The VDH HDMI HQ HYBRID.

4-26 Q: Can I put a very good component video cable together from your cable program ?

A: Of course. Besides the two 3 component video cable types (The COMPOLINK 75 & The COMPOLINE 75), which we have ready made from our program, the utmost quality option is to use 3 x MC - SILVER IT Mk II 75 Ohm in parallel, with all 3 cables of the same length to avoid mutual signal timing differences. Using 3 x The DIGI-COUPLER 75 Ohm or 3 x The TRIAXIAL Professional 75 Ohm (ground their outer shield only at one side of the cable and their separate inner shield at both sides) also produces fabulous results (also see 4-29). Again, all three the same length. Also with 3 x VIDEOLINK 75 very fine results are obtained.
Some experiments can certainly be made; Start with the cheapest product and when not happy go one step up in price. In our product program the prices are related to the technical quality and performance, not to the cosmetics. Our The COMPOLINE 75 consists of 3 times VIDEOLINE 75 in parallel. The same with The COMPOLINK 75: 3 x VIDEOLINK 75 in parallel.

4-27 Q: When I install video connections for my job, I always twist the 3 video cables together. But your company introduced a flat version of the same. Why ?

A: A flat cable's elements are mechanically tight and neatly arranged along the entire length. They much less squeeze each other when the available space is tight. This is important, since pressure exerted at any spot causes a local change in the cable's characteristic impedance and with it a lower transfer quality. Also the general crosstalk between the 3 coaxial cable elements is lower. This again helps to keep the picture clean. So there was a serious reason to produce our The COMPOLINK 75 and The COMPOLINE 75. Especially at longer distances between source (e.g. your AV receiver) and recipient (e.g. your plasma screen) it is very important to keep the impedance and other electrical properties of all three lines exactly the same. Time delay differences automatically produce blurred images on your expensive screen.

4-28 Q: Is a component video cable better compared to a RGB video cable ?

A: A RGBHV video cable (short named RGB cable) consists of five 75 Ohm coaxial lines and a component video cable only of three. It depends on the bandwidth, internal losses, inter-signal timing and the precise 75 Ohm match of both products which type of cable performs best. And even the way the connectors are mounted already makes a difference. It is not

just the cable itself...
Generally spoken and provided good cable is used, the more an analog video signal's partial information components are transported separately, the better the resolving performance possible in display. Having all video information contained in one signal which is transferred by a single cable (e.g. composite video) involves video signal bandwidth limitations and requires more signal processing to encode and decode. With it unavoidably comes more performance degradation in display.

4-29 Q: I have just bought a new video screen with two types of video input connections: Component and HDMI. Which of the two do you advise me to use ?

A: Simple, always use three-wire component video or five-wire RGBHV (usually referred to as just RGB) such as our 3 component video cable types The COMPOLINK 75 and The COMPOLINE 75, or our RGBHV cable type RGB-5-75. For optimum picture quality make sure that all coaxial signal lines are equal in length, always keep the contacts clean (see 10-1) and don't squeeze the cables. Pressure exerted at any spot causes a local change in the cable's characteristic impedance and with it a lower transfer quality.
When extra noise immunity is required (e.g. when needing to bridge larger distances, say larger than 7.5 meter) it is better to use triaxial signal lines instead of coaxial ones. Compared to coaxial ones, triaxial signal lines are surrounded by an extra shield which strongly reduces any possible crosstalk between the signal lines as well as external interference. Our high quality triaxial cable types The DIGI-COUPLER 75 Ohm and The TRIAXIAL Professional 75 Ohm are excellently suited for this purpose. Their outer shield should be grounded (i.e. connected to the connector's shell) only at one side of the cable (preferably at the signal source's side). Their inner shield of course connects between the connector shells at both sides of the cable.

4-30 Q: It is my intention to wire my whole house with video cable so we can look at our own video recordings in all rooms. Presently I don't like the TV programs anymore with all those Hollywood disasters. Can you give me some tips and hints ?

A: First of all, there are two possible internal insulation methods in video cables: The softer polyethylene (PE) foam and the harder solid PE. Both types of video cable have a standard characteristic impedance of 75 Ohm.

Video cables with solid PE internal insulation and in-wall tubing:
If you intend to run all video cables inside large length in-wall tubing with bends, always use the solid PE internal insulation types. With the foamed PE cable types the mechanical stresses involved in drawing the cable(s) would more easily change the diameter of the internal foam than with solid PE. The resulting local cable impedance deviations would have a direct impact on the picture quality, so after all the hard work done the result would still not be as desired.
Although solid PE internal insulation cable types are less susceptible to mechanical stresses than the foamed PE types, care should still be taken. So, when drawing the cable(s) through the in-wall tubing for instance first apply a suitable lubricant, don't use too much force and avoid sharply bending the cable (also read the second next section).

Video cables with foamed PE internal insulation:
When not running the cables through large length in-wall tubing the soft insulated (foamed PE) type can be used, but all means of mechanically distorting the cable should be avoided. The softness of the cable's internal foamed PE insulation makes it more susceptible to force induced cable impedance deviations which result into loss of picture quality. So, if you apply cable clips or clamps when mounting and guiding the cable, they shouldn't be too small and press the cable out of shape. There is also a higher risk of doing such when hammering the clips in place and/or when using metal ones. When soldering inside the connectors at the cable ends, mind to keep the soldering time very short, else the foam insulation will melt and result into another local cable impedance deviation. Likewise, avoid sharp bends (read below).

On bending, connectors, attenuation and shielding (concerns all video cable types):

Bending: Regarding bending any video cable to get around corners, a good rule of thumb is to never let the video cable's radius of curvature be less than ten times its diameter. I.e. a bent section of 7 mm coax cable should fit against a circle with a radius of 7 cm. The fitting circle should not be smaller.

Connectors: Regarding the video cable's connectors it's very important to use good quality types having a characteristic impedance of 75 Ohm (also see 10-13), else another local cable impedance deviation is introduced having a negative influence on the picture quality. It's also very important to keep the connectors' contacts at both ends as clean as possible. So, apply some of our The SOLUTION contact protection fluid.

Attenuation: The attenuation is a figure which indicates a high frequency cable's natural amount of signal loss per unit length, usually given in deciBel (dB) per meter or per 100 meter. The attenuation figure becomes especially important when large distances need to be bridged. Cheap (and thin) video cables generally have a higher attenuation figure and with large cable lengths the risk exists to loose enough signal along the cable to end up with a noisy picture. So compare the attenuation figures between available video cable types and when in doubt get advice from a professional. Useful to mention here that for instance our The NAME has a very low attenuation figure and is very well shielded.

Shielding: The quality of the cable shield is always important but especially starts to count when large lengths are used and/or multiple cabling is run in parallel and/or in environments with lots of high frequency interference. External interference can enter a cable and disturb the transported signal, but also the other way around: The transported signal can radiate from a cable and interfere with the cable running next to it. When needing to bridge distances in excess of a few meters, having a single braided shield with less than 100% coverage is just not good enough. So, cable types with both a braided shield and a closed metal foil layer or another braided shield below are nearly always advisable, and if absolutely the best shielding is required consider using so-called "triaxial" cable. A triaxial cable is in fact a coaxial (video) cable contained inside (and insulated from) an extra outer shield. Our high quality triaxial cable types The DIGI-COUPLER 75 Ohm and The TRIAXIAL Professional 75 Ohm are excellently suited for this purpose. Their outer shield should be grounded (i.e. connected to the connector's shell) only at one side of the cable (preferably at the signal source's side). Their inner shield of course connects between the connector shells at both sides of the cable.
Another point worth mentioning regarding shielding is that when metal in-wall tubing or metal ducts would be used to run the video cables through, their sensitivity to external interference would be largely reduced. Their shield(s) however would still need to be good to avoid mutual interference (crosstalk) amongst themselves and with other cabling running in parallel.
When comparing the shielding factor and -performance of various high frequency cable types their so-called "(surface) transfer impedance" figures or graph are the criterion to use. The transfer impedance is a measure for the amount of protection a cable's shield offers against incoming interference as well as the amount of reduction of its own signal emission. The lower a cable's transfer impedance the better. To remember this: You want low transfer through the shield, therefore a low transfer impedance. To give a rough indication: Well shielded cables have a transfer impedance of around or below 10 milliOhm per meter in the frequency range of interest and so-called "superscreened" cables have a value below 50 micro Ohm per meter.

Regarding three-wire component video or five-wire RGBHV cabling:
In case you intend to use the video cables for a three-wire component video or five-wire RGBHV link, always make sure that their length is equal. This to avoid mutual signal timing differences. Also see 4-26.

4-31 Q: Your The NAME is used both for audio and video connections. I thought that the design of an audio cable is really an art ?

A: That is correct, but the design of a good video cable is also an art. And sometimes both arts can match, as is the case with our The NAME. The fact that The NAME is a 75 Ohm video cable (see 9-8) does not mean that The NAME - in its use as an audio cable - is also 75 Ohm in the audio frequency range.
The NAME's electrical impedance at audio frequencies is very much higher, so there is absolutely no risk of any mismatch occurring between signal source (e.g. your pre-amplifier) and load (e.g. your power amplifier) and the cable in between. The general condition for having a high electrical impedance at audio frequencies is that the parasitic capacitance between a cable's conductors is low enough (The NAME is just 59 pF/meter). A much lower value than commonly seen with audio cables. A low parallel capacitance of the pre-amplifier to power amplifier connection helps to maintain a fine spacious image.

Section 5: Cables: Problems:

5-1 Q: When I listen to my hi-fi set, I hear everything, but there is no depth and imaging in the sound picture. What to do ?

A: I am afraid that you are not enjoying the full sonic possibilities of your system. In many cases this effect is created by defects in the signal transmission in cables and amplifiers.
These defects originate from what I have called: Cross Crystal Distortion (CCD), (also see 3-1 and 2-6). High CCD generates higher harmonics in the musical pattern and reduces the authenticity of the instruments and the replay quality. The higher harmonics are a kind of extra harmonic distortion with the side effect that the imaging is reduced and the spatial reproduction is blocked. Music with a harsh accent, but without the acoustics is the result. You can solve this problem by changing the cables for a better type. First get them on loan from a good friend who is a local authority in spatial sound reproduction. Clean all contacts of your hi-fi set and treat them with our The SOLUTION contact fluid. Plenty of spatiality should be your reward, this assuming that your hi-fi set is not suffering from the same defect: Older amplifiers with plenty of electrolytic capacitors have the same problem. This can be cured by replacing all electrolytic capacitors. Also don't forget to clean and apply some contact fluid to all internal contacts and switches while you're at it. It may take more than a rainy weekend, but your hobby is not just spending money but also requires an active involvement.

5-2 Q: Why do very complicated AV systems almost always have some hum present ?

A: A complicated AV set involves a lot of equipment. All devices are connected to the mains as well as being interconnected by means of AV cabling. It is therefore quite possible that ground loops are present, which are quite prone to induce hum. In many cases the equipment is also stacked on top of each other and/or at close distance. Here, the devices' internal power transformers can make up an extra source of hum due to their magnetic (stray) field emission.
For some tips to improve your hi-fi setup on these points see 2-1, 5-3 and 5-11.

5-3 Q: How do I avoid hum in my audio set ?

A: First minimize the residual ground currents flowing along your interconnects. For this purpose we have a special POLARITY CHECKER in our program. (When all equipment is already connected to the extra ground connection pin (the third pin) at your mains socket, skip the next paragraph which gives a short description of how to minimize hum using The POLARITY CHECKER). For a more detailed version see its manual available on our website.

> Disconnect all equipment from each other, and then, with each separate audio device in your installation: First connect to mains. Then, with our The POLARITY CHECKER, measure the voltage at audio ground somewhere at the rear panel. Then reverse the 2 mains leads by rotating the mains plug. When this is not possible, like in the UK, then open the mains plug (unplugged!) and reverse the mains wires → please read our disclaimer. Close the mains connector and measure again. The mains plug position which gives the lowest reading on the scale of our The POLARITY CHECKER is the best. This means that after you have gone through this procedure with all equipment involved, the ground leakage currents running along the interconnects' shields or ground leads are at the lowest level. This action takes about 5 minutes and reduces the hum level markedly.

Another source of hum are transformers, especially unbalanced constant voltage transformers/power stabilisers. So avoid the latter whenever possible.
Keep in mind that transformers work by building up an internal magnetic field. But... these wonderful fields tend to also radiate from (non-toroidal) transformers. They can penetrate the circuitry of the next amplifier and induce hum. So don't pile up equipment, but reserve space with enough distance between your devices. Also try to keep your interconnect cables well away from transformers and (unshielded) mains cables.
A special source of hum can be the environment of a phono cartridge: Serious attention must be given to ground loops built along the ground lead of the phono cartridge. And make a separate grounding for the arm and the rest of the turntable, thus again avoiding another ground loop. So, keep the tone arm electrically isolated from the rest of the (metal) turntable. (Also see our Phono FAQ's points 48, 126 and 130).
Take care of the proper ground connections at the rear of your amplifier(s). Keep them clean and when necessary use "The SOLUTION" (also see 10-1), our contact fluid.
There must always be a good signal ground connection between all equipment to ensure a correct signal return. When something is wrong there, you have hum!!! Try finding the culprit by swapping interconnects and using logic. Measure suspect candidates with an Ohm meter, checking for (intermittent) shorts between and interruptions in the signal and ground lines. Also verify that the cable is correctly wired; See the "Audio and Video Cable/Connector WIRING DIAGRAMS for DIY purposes" available on our website.

It is furthermore very important that all equipment receives its power from the same mains socket, this to ensure that all equipment is connected to the same ground point (also see 5-11). By feeding all equipment from one socket, you avoid another huge ground loop in your listening room and with it another potential source of hum.

5-4 Q: Why does my coaxial microphone cable hum ?

A: Hum mostly originates from strong inductive fields, like from transformers or from ground loops in the system. Furthermore, non-dense cable shields can cause problems. And another serious cause can be having connectors with oxidised joints, which produce a too high impedance in the ground to shield connections. So go for a well shielded (i.e. multiple shielded) coaxial cable with proper soldering (also in the amplifier). Best however is to use balanced cables with XLR connectors. This is the standard professional solution used all over the world.

5-5 Q: I noticed some hum when I use your The FIRST ® Ultimate. What can I do to reduce this effect ?

A: The shield of The FIRST ® Ultimate is slightly resistive. Here, excessive ground loop currents flowing through the shields of your interconnects or magnetic stray fields (e.g. from power supply transformers) may induce some hum. Both effects generally are stronger with tube equipment than with semiconductor designs.
What can be done?

- Keep your interconnects well away from transformers and power supply wiring.
- With our POLARITY CHECKER, you can simply fine-tune your audio system to eliminate, or at least strongly reduce residual ground currents and thus improve your system's performance.
- You can bypass the shield of The FIRST ® Ultimate with a metal wire, or ask your dealer to replace The FIRST ® Ultimate for The FIRST ® Metal Screen. Problem solved.

5-6 Q: When I switch on the light in my listening room, I regularly hear very big "bangs" from my speaker system. What is wrong in my hi-fi set ?

A: Sparks in of your electrical system (like a sparking starter with fluorescent lamps) emit a wide frequency range electromagnetic field. And as long as there are connections between your equipment which are not well protected against high frequency interference you'll hear big "bangs", crackling sounds etc. The cables act as an antenna and the equipment acts as a receiver. The advice is to take care of better shielding and especially of better cable shield grounding, see 5-7.

5-7 Q: I hear all kinds of interfering foreign radio stations when I listen to my hi-fi set, this especially in the evenings. How is this possible? I always have my tuner switched off and the frequency range of my audio equipment stops at 100 kHz. I also regularly hear the mobile of my neighbour coming through. What to do to stop this ?

A: Your neighbour's mobile antenna signal is close by and thus relatively stronger than most of the other signals in the "air". But much more than just your neighbour must be audible.
The interference you experience can originate from the high frequency (HF) radio signals entering your interconnects, but also (in particular longer) loudspeaker cables can act as an antenna.
With interconnects, especially when not having a proper connected screen, the internal wires can act as an antenna and the HF signals are "detected" (i.e. electrically rectified and thereby turned into audio) by thin layers of oxidised metal(s) inside the cables, at their connectors and/or in the input circuitry of your amplifier(s) (mainly the pre-amplifier).
With speaker cables the HF radio signals reach the amplifier's input (where they are detected) through the feedback circuit.
As indicated, with interconnects the shield is the first place for HF interference to enter. So, start by checking all the shields of your interconnects for proper ground connection at the connectors (also see the "Audio and Video Cable/ Connector WIRING DIAGRAMS for DIY purposes" available on our website).
After checking the cable shields also clean all metal-metal contacts (see 10-1). Afterwards, further clean and preserve them with our "The SOLUTION".
When the above doesn't solve the problem, try mounting ferrite rings or clips (RF suppression hinged ferrite clamp cores) around your loudspeaker cables and position them as close as possible to the binding posts of the amplifier. If possible, also twist your loudspeaker cables (per loudspeaker of course) with 3 to 5 turns per meter.
You can also do the same with all your interconnects: Twist each link's left and right channel lines together with 3 to 5 turns per meter.
When you still enjoy the BBC World Service, The Voice of America (VOA), Radio Vatican, Deutsche Welle and what else

there is in the air, a further drastic solution would be to mount high frequency filters (*1) in your pre-amplifier, but more advisable is to try better interconnects with a high shielding factor and/or shielded speaker cables (*2).
Regarding interconnects, our D - 102 III HYBRID for instance has three shields and only the two inner conductors are carrying the audio signal. The three shields are grounded at one connector only, thus keeping audio and HF separate. Coaxial cables, on the other hand, have just one internal conductor and are more sensitive to HF pick-up because the shield also acts as the audio signal return. HF interference entering the audio signal is easier in this case. So change your unbalanced coaxial interconnects for unbalanced wired balanced cables like e.g. our D - 102 III HYBRID.

*1: Regarding mounting high frequency filters in your pre-amplifier: It concerns input capacitors of 1000 pF soldered in parallel with all audio inputs. This is really a high frequency interference killer, but it can also reduce the sound quality if you have music signal sources' which output impedance exceeds 1 kOhm, (also see 7-6). The best capacitors for this purpose are Styroflex (=Polystyrene) types.

*2: Regarding shielded speaker cables: In our program we carry The SUPER NOVA and The INSPIRATION HYBRID.

5-8 Q: A while ago, suddenly all wireless equipment in and around our house started reacting funny and not as expected. Even our neighbours and also theirs suffer from strange effects, like not working remote controls, a weather forecast station predicting hot sunshine while it actually freezes, and last but not least, our car only wants to start at a distance of more than 200 meters from our house. What is the spooky thing in and/or around our family's house ?

A: There are two possibilities: Maybe a new mobile antenna has been installed in your direct environment. The frequencies used in mobile communications however are not the same as those which are common with your other equipment experiencing trouble. So, I expect that there is a strong consumer transmitter communicating at the same frequency (or frequencies) as the equipment in trouble. Have a check in and around your house. Can the transmitter of your wireless headphone set be the problem? Or the same in the house of one of your neighbours? Or some wireless video system in someone's house?
We must be aware that in the near future all the new wireless systems in and around our house will create a lot of technical problems (also see 5-7 and 2-13), where up till then simple wire connected equipment always worked very safe. Sometimes one step forward at the same time is two steps back. In the future with all kind of wireless communications, this will be a very common problem. So think twice before you really switch to wireless.

5-9 Q: How do I reduce the HF emission from the 75 Ohm cable between my CD player and DA converter ?

A: High frequency (HF) emission is a matter of design of the cable. The closer its impedance remains to 75 Ohm over the entire frequency range and the higher its number of screens, the lower the emission. Also, the more stable (constant) the output impedance of the player and the input impedance of the converter are, the better. Keep in mind that an SPDIF digital audio signal contains frequencies that extend far beyond (up to 500 MHz) the usually specified minimum required bandwidth (~6 MHz); The digital interconnect must really be of superior quality.
Our MC - SILVER IT Mk II 75 Ohm, The DIGI-COUPLER 75 Ohm and The FIRST ® Ultimate are excellent digital cables. Especially The DIGI-COUPLER 75 Ohm, which even has seven screens. Its emission damping (screening attenuation) at 100 MHz is 128 dB: an amazing factor of 2,500,000.
When you want to continue with your actual coaxial cable: wrap aluminum foil around the entire cable length (several turns) and connect it to ground.

5-10 Q: I bought a very good quality coaxial antenna cable and all worked well. But after a while the reception quality became so bad that I had to replace the product. What happened ?

A: Wet weather conditions can create a problem. You probably have corrosion and/or water has entered the cable, most probably at the antenna end, but there may also be some punctures in the outer insulation of the cable. The penetrated water speeds up the oxidising of the conductors, locally changes cable impedance and attenuates the signal. And once water has entered the cable, it can take very long for it to fully evaporate away. So, seal your new cable's outside end with weather resistant grease - e.g. silicone grease (don't use silicone adhesive/sealant, because such products contain a corrosive acid).
Other points that can be wrong have to do with the way the cable is led to the receiver: In guiding the cable from antenna to receiver, all ways of mechanically distorting it should be avoided, since local changes in the cable shape - e.g. through pressure exerted by clamps or sharp bends - cause local changes in the cable's impedance. At such points the antenna signal will be partially reflected back (leading to signal loss at the receiving end). With TV reception, these reflections inside the cable also cause picture blurring or even so-called "ghost images" if the cable is very long.
Regarding bending the cable to get around corners: A good rule of thumb is to never let the radius of curvature be less

than ten times the diameter of the cable. I.e. a bent section of 7 mm coax cable should fit against a circle with a radius of 7 cm. The fitting circle should not be smaller.
Regarding mounting and guiding the cable: The clips or clamps should not be too small and press the cable out of shape. Too large and the cable jacket will wear due to wind induced cable movement. Here add some soft padding or weather resistant glue. Clamp distance should be sufficiently small to avoid wind induced motion, causing metal fatigue and breakage of the cable's conductors.
Treat the antenna cable with respect and the product will serve you many years.

5-11 Q: I'm experiencing hum in my audio system after connecting the TV, radio/tuner, set-top box, video recorder, satellite receiver or computer sound card to my audio set. What can I do to avoid such problems ?

A: Tuners, TVs, set-top boxes, video recorders and satellite receivers get their input signal either from an antenna, cable (TV) network or satellite dish connection. The hum you experience almost always originates from a so-called ground loop: Your hi-fi system most probably has a connection to ground at some mains outlet (which for safety reasons you should not interrupt). Your hi-fi system however is also getting connected to ground along the antenna cable (which system is not grounded at the same point as your hi-fi system is), thus causing a ground loop. The differently located ground points are never at the same voltage and their trying to balance out causes hum currents to flow along the shields of your audio cables.
To solve the hum problem, four situations need to be distinguished between:

A. Cable (TV) network connections:
   When you are connected to a cable (TV) network and unplugging the antenna cable(s) removes the hum, the problem can be solved by interrupting the ground loop(s) at the point(s) where the antenna cable(s) enters your radio/tuner, TV, video recorder or set-top box. This by means of a device called an "antenna isolator" (sometimes also called "antenna ground isolator" or "ground loop isolator"). These are readily available from specialized shops but you also can make a simple one yourself: At the antenna cable's plug entering your radio/tuner, TV, video recorder or set-top box interrupt/disconnect the cable shield and insert a small ceramic capacitor (valued between 1 and 10 nF) in series (i.e. connecting between the plug's shell and the cable's shield). If that doesn't remove the hum, also interrupt/disconnect the cable core and insert another identical capacitor between the plug's centre pin and the cable's centre conductor. The capacitors let the high frequency antenna signal pass unhindered but block the low frequency ground loop (hum) current.
   Specifically regarding set-top boxes, video recorders or other reception devices that are equipped with an optical digital audio output (SPDIF, Toslink) and hi-fi systems equipped with an optical digital audio input there is another more elegant option to break the ground loop: Make sure that digital audio input to your hi-fi system is taken from the set-top box or video recorder's optical digital audio output and ascertain that the TV or video display device has no further connections to your hi-fi system (i.e. the TV or video display device is only connected to the set-top box or video recorder).

B. Antenna amplifier connections:
   When you have a radio and/or TV antenna amplifier for your own antenna and unplugging the antenna connection from your radio, TV or other reception device removes the hum, the antenna amplifier is the culprit, either by having a ground connection along its mains connected power supply or by some accidental contact to ground in the antenna part of the system. To solve the hum problem you can first try to reduce the ground loop by feeding the antenna amplifier from the same mains outlet as your hi-fi set is using. If this doesn't work, the "antenna isolator" solution mentioned at point A above (inserted where the antenna cable's plug enters your radio, TV or other reception device) should help.

C. Satellite receiver connections:
   When you have a satellite receiver for your own satellite dish and unplugging its connections to your TV and/or hi-fi set removes the hum, the satellite receiver is the culprit, either by having a ground connection along its mains connected power supply or by some accidental contact to ground in the satellite dish part of the system. To solve the hum problem you can try to reduce the ground loop by feeding the satellite receiver from the same mains outlet as your hi-fi set is using. If this doesn't work, inserting an antenna isolator (as described at A) is not an option since the receiving end inside the satellite dish (the LNB) gets its power along the antenna cable and the antenna isolator would block this DC power. Inserting the antenna isolator after the point where the power supply feeds the antenna cable and before the receiver's high frequency input generally requires modification of the receiver's inside circuitry and therefore is not an option.
   Specifically regarding satellite receivers that are equipped with an optical digital audio output (SPDIF, Toslink) and hi-fi systems equipped with an optical digital audio input there is the elegant option to break the ground loop: Make sure that the digital audio input to your hi-fi system is taken from the satellite receiver's optical digital audio output and ascertain that the TV or video display device has no further connections to your hi-fi system (i.e. the TV or video display device is only connected to the satellite receiver).
   When you don't have optical digital audio in- and outputs another option is to insert audio isolation transformers

(one for each audio channel) between your satellite receiver's audio outputs and the hi-fi system's audio inputs while ascertaining that the TV or video display device has no further connections to your hi-fi system (i.e. the TV or video display device is only connected to the satellite receiver).

D. Computer sound card connections:
If you have a computer sound card connected to your hi-fi system and disconnecting it removes the hum (this while not having any TV, radio or other antenna cable connected reception device hooked up to your hi-fi system) the computer is the culprit. First of all it is important to note that almost all computers do need a mains ground connection for safety reasons. So trying to break the earlier explained ground loop by interrupting the computer's wall outlet ground connection is not an option. You can try to feed your computer from the same mains outlet as your hi-fi set is using, but for reasons of the computer's generated mains interference this is generally not desirable. A better solution is to insert audio isolation transformers (one for each audio channel) between your sound card's audio outputs and the hi-fi system's audio inputs. The most elegant solution however works with modern hi-fi devices and computers that are equipped with optical digital audio in- and outputs (SPDIF, Toslink): Make an optical fiber digital audio connection from your computer soundcard's optical output to e.g. your audio system's Digital to Analog converter's optical input. This certainly will solve the hum problem.

Section 6: Cables: Construction and Conductor Materials:

6-1 Q: What is most important for a good cable: The conductor quality or the insulator quality ?

A: The conductor quality always comes in first place. A low conductor quality will show up after a while due to negative side effects like corrosive chemical activities (from contained impurities) which degenerate the metal structure of the conductor. So, regarding sound, in the first week just the conductor quality counts. After a year the insulator quality for sure also starts to pay off: The insulation should provide permanent and good protection against conductor quality decline by also effectively blocking external/environmental corrosive chemicals from reaching the conductors.
A good insulator does not contain any plasticizers and halogens (unlike the commonly used PVC). Our halogen and plasticizer free HULLIFLEX ® insulation material is a good example. It is used throughout our entire cable program. HULLIFLEX ® is chemically extremely stable, also long-term. So, with our products all comes down to the conductor quality.

6-2 Q: Is there a sonic difference between cables made of pure copper and cables made of pure silver ?

A: As long as the type and extent of purity as well as the production method are the same, there is no sonic difference. But... silver costs much more than regular copper. There is a lot of copper around in the world, so the prices are relatively low and it is mass produced. As a direct result, for copper the production speed (the wire drawing speed for example) is much higher, therefore the material integrity is less compared to the slow speed drawn silver. This effect by itself is already reason enough to prefer the silver cable over the same product in copper. But also all handling of the silver as a metal is more careful: Like avoidance of storage in the open air, better machines involving less conductor vibrations, better strand support, better polished wire drawing dies and more of such qualitative conditions which will result in a better conductor anyhow.
When during manufacture your copper cable has been treated the same way as silver then you're a lucky product owner. Our company puts a lot of extra effort in the same conditions for both metals.

6-3 Q: Why are there big sonic differences between cables all made of the same metal like copper ?

A: The final quality of your cable's copper conductors does not so much lie in the type of metal itself, but rather is the result of many different processes: It starts at a specific copper mine which automatically determines the purity of (and impurities found in) the product. Also the subsequent refining and thermal treatment processes have a big influence. After that also the storage of the raw product and all further mechanical and chemical treatments involved in producing the final conductor are very important.
It is like with coffee. What you drink is called coffee, but for sure you have your own favourites. With copper cables it's not different. Listening to different manufacturers' copper cables is listening to a great variation in production parameters and their final resulting effects on the sound. So the honesty of the manufacturer is essential for a good result.
All our cables are manufactured based on a large and stringent set of production specifications, so the good sound at the end is the result of many extra efforts.

6-4 Q: What is the difference between single-strand and multi-strand conductors ?

A: A while ago, especially in the UK press, there was the single strand / solid core hype. As long as the electrical conductor was made from a single strand, it would in principle be a better sounding product. But what all the reviewers forgot was that with the bending and twisting of the single conductor during use, it is damaged faster and more rigorously in comparison to a multi-strand conductor with the same metal cross-section area.
Any bending induces an extra pulling force on the metal at the outside of the bending curve and at the same time an extra pushing force on the inside. This causes a direct degradation of the metal structure. And keep in mind that even before you have bought your single-strand (say loudspeaker) cable, your product has already undergone a lot of bending and twisting during manufacturing. Also your dealer never nails your 7 meter single-strand loudspeaker cable on a straight piece of wood when shipping or packing it up for you. Furthermore, at home during unpacking and mounting there are equivalent bending effects.
With a multi-strand loudspeaker cable like e.g. our The MAGNUM HYBRID which has 483 thin strands per conductor, the effect of bending and twisting can be completely neglected. The thinner a strand namely is, the smaller the bending radius (i.e. the sharper the bend) can be before causing any serious structural harm.
With strands of 150 micron (0.15 mm) diameter each, the bending radius can be 600 micron. This never happens, because The MAGNUM HYBRID's outer insulation of HULLIFLEX ® does not allow you to do this experiment.
So, always go for multi-strand: The more strands per conductor, the lower the sensitivity to twisting and bending. This

helps to extend the life span of your speaker cables and of course also your interconnects. For the same reason, also all our interconnects are multi-stranded and especially the loudspeaker cables are equipped with a thick HULLIFLEX ® jacket for extra protection against material damage.

6-5 Q: Are flexible cables better compared to the same configuration with a stiffer and/or thicker insulation ?

A: A flexible cable is e.g. a multiple strand loudspeaker cable. The flexibility mainly comes from the high number of strands. In the long run this cable better “survives” frequent movements compared to a stiffer version with a lower number of strands. When the stiffer/thicker cable however is kept in a stable position, there is hardly any difference. So, thicker loudspeaker cables have a higher durability when you nail them straight on your wooden floor.

6-6 Q: Are thick cables better than thin cables ?

A: First of all, it is the conductor material and its quality that counts more than the diameter of the cable, but generally spoken a thick cable is better than a thin one, since:
Due to its diameter, a thicker cable is better protected against mechanical mistreatments. And in the long run this pays off in stability of the sound. (Though, if the strands of a thicker cable are not chosen to be sufficiently thin and only run straight {i.e. bunch stranded}, the cable’s outer strands undergo more stress when bent and the cable will earlier go down in transmission quality as a result of bending induced mechanical defects, (also see 6-4)). A thicker cable furthermore has more advanced technical design options because there is more inner space.
So, when loudspeaker cables are concerned, thick is better than thin, assuming we talk about a multi-strand configuration and assuming that the conductor is made of a very pure metal. A thicker speaker cable’s generally lower electrical resistance is also advantageous regarding the amount of control the amplifier has over the speaker drivers motions, (see 16-3).
When interconnects are concerned, for the same reasons mentioned above, thick being better than thin also holds. Also, thin interconnects always have a higher capacitance, which is not a great advantage, (see 7-6).
The related question whether thick cables also sound better than thin cables is treated further elsewhere in this document: For speaker cables see 16-1, for interconnects see 3-3.

6-7 Q: Why do some cable manufacturers use exotic metals like aluminium or even pure silver mixed with pure gold as conductor material? Am I missing a part of the story ?

A: Not all Italians consume pasta. They also happily eat anti-pasta. This means that not all conductors must be made of copper. As long as the product has stable properties, it is worth trying. And when it works up to an expected quality level, it is a product ready for the market. Each product has a certain quality and price justification. You as a consumer have the right to make your own decision on how much you like to pay for these products related to the expected quality. Keep in mind that long-time established manufacturers know their profession. A plunge in the pond with exotic metals is not always a sign of stability but sometimes more a cry for attention.

6-8 Q: Why does your company use so many shields around interconnect cables? Is a multiple screen really necessary ?

A: With the continuously increasing amount of wireless equipment around, the level of electromagnetic interference is growing every day. This also means that the interference with audio signals is getting stronger. Remember the strange signals you hear when you have your mobile telephone switched on in your listening room. There are many mobile signals around. Also the number of mobile network transmitters on houses, flats, buildings and masts is growing. The number of radio and television transmitters is expanding. More and more channels are opened. Think about the wireless Bluetooth links and the many other sources of high frequency signals.
To avoid such interference finding its way into your precious audio signals, the interconnects you use must be better screened. Here, multiple shields form a much more solid protection against interference of HF signals with your audio. Specifically from the point of view of HF interference, “open” (i.e. non full shield covered) cable constructions are nonsense and are reason enough to doubt the concerned manufacturers’ awareness of all the problems their customers are going to suffer from. Just to stick to a once created design does not mean that this is the right decision for the technical future.
Cosmetics are nice, but a cable is mainly a technical design and not an object of art.
Our company puts a lot of effort in achieving a high shielding factor. In other words, in the practical damping created by our cables’ screening against HF signal penetration into your audio signals. The higher the shielding factor, the cleaner your audio. And that is what you expect from an interconnect. Not just some piece of art behind your pre-amplifier...
As an example take our The DIGI-COUPLER 75 Ohm: Its screening attenuation is an impressive 120 dB at 1 GHz and 78

dB at 3 GHz. Figures that we are very proud of and also the figures that our competition can only dream of.
Even loudspeaker cables sound better when they are also shielded. We have some designs in our program with a perfect screen around the conductors, like our The SUPER NOVA and The INSPIRATION HYBRID.

6-9 Q: What are the differences between a coaxial/unbalanced cable and a balanced cable, and which is better ?

A: There are two basic designs in interconnects (the cable used e.g. between your CD player and your pre-amplifier).
The first design consists of a total of two conductors: One internal conductor embedded in an insulator and surrounded by the second conductor, being a braided screen consisting of one or (being better) more layers. Such a design is called a coaxial cable. (Often also named: single-ended, unbalanced or asymmetric). Practically all interconnects are of this coaxial type.
The second design, the balanced/symmetric cable, on the other hand has two (instead of one) internal conductors which are generally twisted. And of course, there is also the braided screen just under the cable's outer insulation jacket.
In the coaxial cable, the centre conductor is used as a signal up to the receiving equipment. The signal return is made by the braiding, which also serves as a shield to keep hum and high frequency (HF) interference fields away from the centre signal conductor. The shield thus has more than one function, and that is just the problem: The shield also acts as a kind of antenna, so the shield's conducted signal is a mix of audio and high frequency signals. In many cases the shield is also made of lower technology/quality material because it is just the shield. And this is a mistake of the first order: With a poor shield quality, there is always interference between the shield's returning audio signal and the shield's picked up noise signals. The final result then is that some of the shield's picked up environmental noise (hum and HF interference) ends up in the audio signal. Especially in busy cities with a lot of mobile telephone traffic, transmitters and other electrical activity, this effect causes degradation of the audio quality.
The better solution is the balanced cable design: Here the signal up and return are running along two internal conductors of equal construction and material. A big advantage of this is that the signal current does not face differences between the signal-up and signal-return conductors (as with coaxial cables). Even more important with balanced cables is that the outer shield just acts as a screen and nothing more: I.e. there is a complete separation between the shielding and electrical signal transport functions. In addition to the shield screening the internal conductor pair from external interference, with balanced cables the internal conductors are also twisted which adds to the cable's insensitivity to noise. If there's still any interference left, this takes place on an extremely low level without any harm to your music replay quality.
Note: Most of the interconnect cable types Van den Hul has in its program are balanced. When they are supplied fit with RCA type connectors, wired for unbalanced use, the above mentioned benefits of balanced cabling remain, (also see 4-18).
To gain full benefit of balanced cabling, the layout of all your equipment however also needs to be balanced, and that is not a common concept. In balanced equipment the internal signal path is twofold, this to handle the balanced audio signal's in-phase and out-of-phase part. So it roughly doubles all electrical components. But once having switched to balanced equipment, the advantage is a sound quality that you will hardly find in the unbalanced world. With some extra effort, even your phono cartridge can be connected in balanced mode.
So, there are several serious reasons to focus on balanced connections when you buy new audio equipment.
"Go, in the long run, for balanced" is my advice.

6-10 Q: Why is your "Fusion Technology" doing better than other technology ?

A: Our "Fusion Technology" is based on several innovative ideas:
By observing the change in electrical and sonic properties of standard conductors over a long period of time, it became clear that "softer" metals were more critical in treatment. It also became very clear that this directly had to do with the structure of the metals involved. The weaker the metal (like copper or silver) the more critical the mechanical treatment influences the electrical and (even more) the sonic quality. After several very well controlled experiments, these effects were reconfirmed and effects could even be scaled.
It became very obvious that stronger structured metals and/or compositions were an answer to the question: "How to improve conductor structures to positively contribute to an extended lifespan"?
The results of all theoretical work and practical experiments - combined with our experiences with Linear Structured Carbon ® - resulted in the composition of a metal mixture of silver, copper and zinc.
The next question was how to optimise the properties of this composition to produce the best stable sonic result. The resulting final conclusion was that combining individual metal evaporation and central deposition in a vacuum of silver, copper and zinc in a special fusion process, together with a thermal treatment afterwards was the solution. Thus was realized and the directly afterwards auditioned final result was a big surprise. After the first completed experiments, all steps were optimised, resulting in our cable named "The INTEGRATION HYBRID".
Sony Benelux was the first company world-wide to introduce our The INTEGRATION HYBRID together with the introduction of Super Audio CDs in The Netherlands. All Dutch dealers who got their first SACD players from Sony, also

With its severely controlled manufacturing conditions, our Fusion Technology produces a much more stable metal conductor than any other technology.

received a set of The INTEGRATION HYBRID to demonstrate the potential quality of Super Audio.
A remarkable and very positive regarded initiative of Sony.

6-11 Q: Why are all your cables' conductors silver coated ?

A: The electrical conductivity of silver and copper is about equal. Silver is from this point of view just a bit better, but above all it's a more noble metal.
The main reason for our company to apply silver to all our electrical conductors is that it acts as an extra protection layer against chemical attack from the outside world. Especially in chemically polluted environments like big cities, the effect of the extra silver coating is a substantial extension of the lifespan of our products. There must of course be a serious quantity of silver on the copper conductors to maintain this extra protection over the years.
A thin layer a few atoms thick does not provide enough protection. It only makes a visible impression. The protective silver layer must be 10 - 50 micron thick anyhow. That is what produces real and durable protection!
And that's what it's all concerned about.

6-12 Q: Many hi-fi lovers have experienced at one point that silver coated copper strand cables sounded more harsh and aggressive compared to e.g. pure copper or pure silver ones. Why does this sonic effect happen ?

A: It is not the silver layer on the copper conductor that changes the sound quality in a negative way itself; It lies in the method by which the silver coating is done:
As long as the silver coating is applied by means of fast electroplating in an $AgNo_3$ (silver nitrate) bath, the final sound will be negatively influenced. Especially when only one bath is used, which the conductor, suspended from two nylon wheels, passes over and over again. All passages combined, the conductor minimally experiences 50 turns (100 times bending and 100 times stretching). As a result, already many residue chemicals become enclosed between the silver surface crystals and especially within the already deep surface cracks in the copper, which were produced by the frequent bending. The thus embedded chemicals immediately start their detrimental corrosive activity and will never stop as long as there is any humidity around. And believe me, there is always some humidity around. So even before you bought your standard silver coated product, the sound quality was already far away from what you expected. As was and is the international experience.
Silver coated products from our company are produced in a totally different way, with an open eye for the problems described above. Knowing these effects, we have created different and innovative methods of silver coating without any chemicals involved. As a direct result, the high sound quality is predictable and long-term stable. Even in humid environments like tropical countries (by the way, the whole earth, it seems to me, is getting tropical), our cable products will maintain their sound quality over many years to come. Our MC - SILVER series is an excellent example of this innovative technology.

6-13 Q: Some manufacturers claim that their silver coated products are protected against the so-called "Skin Effect". Is this a correct claim ?

A: Due to any electrical conductor's natural self-inductance, AC currents experience a tendency to increasingly flow near the outer surface with rising signal frequency. This is the so-called "Skin Effect". Since with increasing frequency less of the metal cross-section area is engaged (i.e. the skin depth decreases), the impedance (AC resistance) of the conductor goes up.
Regarding the highest frequency in audio we think about 20 kHz. As a magic figure, for copper and silver the skin depth at 20 kHz is around 0.45 mm.
A thin layer of silver of around 1 micron is 450 times thinner. So there are no "Skin Effect" problems solved at all by this very thin silver coating. Forget the "claims". It is only a dishonest marketing hype.

6-14 Q: Why does your company use pure carbon as conductor material in cables like The FIRST ® Ultimate and The SECOND ®? We in the States use pure copper, which has a much lower impedance and is therefore much better.

A: Dear American audiophile. Not everyone likes beef burgers because they are so easy to eat. In life it happens many times that there's more than one reason to do things different than taking the obvious solutions. Here, the main reason is the sonic quality of carbon. Also its mechanical and chemical stability provide a very long lasting durability (also see 6-18). Carbon furthermore has a structural effect on music which is not available with any metal conductor. With carbon, especially the lowest signal levels are maintained where they are all lost with any pure metal (like your mentioned copper) or metal composition. Impedance is not the only parameter that we should regard as superior.

6-15 Q: No one in the whole hi-fi world uses carbon fibres as a conductor. So people in your company must be very crazy. Why do you still use carbon in and around the cables in your whole product program ?

A: Thanks for your sustaining expertise. The reason that we use carbon is the fact that the durability of carbon is endless. Its properties are stable and forever. With the application of our special kind of carbon (Linear Structured Carbon ® (LSC)) the usual deterioration of any metal conductor is dramatically reduced. This means that the durability of any conductor made of LSC with our standardly applied HULLIFLEX ® jacket as outer insulation is endless (as long as your pet does not use e.g. our appetizing looking The FIRST ® Ultimate as dessert).
Also, our extra carbon layer of LSC acts as a HF absorbing medium (also see 6-17). So the risk of interference by BBC World Service, Radio Vatican or The Voice of America is much less than with regular products like e.g. flat cables.

6-16 Q: What does the word “HYBRID” that is always printed on your cables mean ?

A: “HYBRID” stands for the combination of metals and non-metals, together acting as the conductors in our cable products. For our conductors we always use many dense silver coated copper strands. As the non-metal coating over these groups we apply a special carbon composition, called: Linear Structured Carbon ® (LSC). Sometimes this LSC is extruded, sometimes we apply LSC as a film.

6-17 Q: Why does your company apply carbon in its “HYBRID” named cable products? I think that copper is much better because all other manufacturers also use copper.

A: We apply carbon for mainly four reasons:

1. The carbon layer improves surface conductivity in case of minor damages.
2. The carbon layer reduces the penetration of high frequency interference to the metal conductors.
3. The carbon layer forms an extra protection against penetration of corrosive chemicals.
4. Carbon also helps to reduce microphony (see 7-8).

6-18 Q: What are the special properties of Linear Structured Carbon ® ?

A: Linear Structured Carbon ® (LSC) physically is a 5.5 micron carbon fibre with a 0.25 micron thick insulation around it. Even all of the 3.5 million fibres in The THIRD ® (our pure carbon loudspeaker cable) are individually insulated.
Each fibre is composed of 100% pure carbon. No other atoms of any kind are incorporated.
LSC fibres conduct electricity by means of their atomic structure’s available free electrons. The total number of free electrons in LSC however is less compared to regular metals. The electrical resistance is therefore higher, but not to an unusable point. The remaining electrons are engaged in binding the carbon atoms together, and in LSC the amount of these binding electrons is higher compared to the regular metals like copper, silver or gold. This high amount of available binding electrons renders the LSC fibres mechanically extremely strong and exceptionally inert to external chemical and/ or thermal influences.
With LSC temperature effects that start deterioration are unknown (at any rate up to 2000 degrees Celsius (~3600 °F)). Furthermore, interaction with chemical elements and compounds is not possible.
As a test, out of pure interest, I have put a piece of The THIRD ® in battery acid for more than one year: Not any change in material properties was noticed.
You cannot run such an experiment with any metal conductor besides pure gold or pure platinum. But the cost of those two metals is much higher than the price of the LSC we charge with our cables.
The ageing/break down effects and their resulting degradation in sound quality commonly found with metal conductors are unknown to LSC. Our interconnect and loudspeaker cables made of LSC therefore have an everlasting sonic quality.
And as an extra free award, all our cables with LSC exhibit an extremely low sensitivity to microphony (= electrical noise caused by mechanical movements).
LSC is exclusively applied by our company thanks to several patents we have applied for this special material..

6-19 Q: In your carbon interconnects, you use pure carbon with a medium conductivity. I have read that there are carbon fibers with a much higher conductivity. Why do you not use one of those types ?

A: It is not too difficult to produce carbon fibers with a higher conductivity. Just enlarge the number of atoms per volume and the number of free electrons also gets bigger. But.., as a result the fibre also gets more brittle, what means: Less

consumer friendly. I.e. the fibres can easily break when bent or twisted. The other method is doping with e.g. halogens like Chlorine. But then our products are not halogen free anymore and also these chlorides are not stable. They disappear again sooner or sometimes even later. And as a result, in the end you have about the same product again as before the doping. So the final choice was simple: Reduced carbon saturation and no halogens.

Section 7: Cables: Insulation Materials:

7-1 Q: What is the difference between PVC and your HULLIFLEX ® insulation material ?

A: From a practical point almost all cable manufacturers apply PVC (PolyVinyl Chloride) as their main insulation material. In our opinion this is the wrong choice. PVC is a basically a hard material. By adding a plasticizer, the composition obtains its soft properties and then is easy to be extruded as an external insulator around any kind of electrical conductor. But after a while the regular used plasticizers disappear to some extent, especially when the temperature is high (e.g. due to exposure to long wave infrared light of the sun). As a result, bending gets more difficult and puts extra mechanical stress on the internal conductor groups. This has its effect on the structural quality of the conductors. The disappearing plasticizers contain very environmental unfriendly chemicals including heavy metals.
As a side effect, PVC is not gas and liquid tight, it is a chemically non-closed structure which allows external pollution to penetrate and start chemical reaction with the internal conductors: Just watch the printing on a transparent PVC jacket. After a while the sharp printing will disappear and fade to coloured spots. The printing ink is absorbed by the PVC. Other chemicals will undergo the same effect.
And last but not least, PVC contains free chlorine that is able to react with the internal conductors (corrosion). As a result, black and even green copper conductors embedded in a more or less transparent or brown tanned insulation can be regularly seen. Reason enough for hi-fi freaks to buy another PVC insulated cable with the same disaster again after a year.
And in the incinerator your old PVC insulated cable will produce toxic dioxins, see 7-3. So think twice before you continue to buy PVC insulated cable or wire.

Our HULLIFLEX ® insulation material is in many ways better. It does not contain any plasticizers: This simply means that the flexibility remains equal in the long term and in any temperature zone. It is chemically completely inert and does not contain chlorine or any other halogens, so any kind of decay is impossible.
In contrast to PVC, HULLIFLEX ® furthermore is completely gas and liquid tight: Any chemical in contact with HULLIFLEX ® is unable to penetrate and reach the internal metal conductors. This has environmental as well as product protection reasons. HULLIFLEX ®'s hermetic properties safeguard the cable's conductors against corrosive chemical activity and extend cable lifespan. In the long run this means that your cable will provide the same sonic quality as on the day you bought the product. A more safe investment in your sound and in the future of your family... I think.

7-2 Q: I live in Kalimantan where the summers are very hot and humid. Does your HULLIFLEX ® provide enough product protection ?

A: Our HULLIFLEX ® cable jacket material doesn't contain any plasticizers so there is no breaking down over time. Furthermore there are no toxic ingredients involved (which is also very pleasant for your pets when munching on your cables). And HULLIFLEX ® is chemically completely closed, so no chemicals can penetrate the insulation and develop chemical activities at the internal conductors like e.g. the first screen. With HULLIFLEX ® as insulation material - even in the hot summers of Kalimantan - your cables will remain sounding like new even after many years. Trust your dealer this time...

7-3 Q: What are the negative effects of PVC as insulation material ?

A: PVC as cable insulation material finally ends up as waste. And the disposal of this PVC in an incinerator with an open chimney always produces toxic dioxins. The dramatic negative effects of dioxins are not well known among the public. Therefore some extra explanations:

Dioxins are one of the most toxic manmade substances. Absorption - even in very small quantities - causes cancer, reduces sperm counts and female fertility. Dioxins also harm the liver and impair the immune system. Dioxin is just a name for several hundreds of chemical compounds with similar characteristics and structures.

Incineration of PVC produces Chlorinated Dibenzo-p-Dioxins (CDDs), Chlorinated DibenzoFurans (CDFs) and certain PolyChlorinated Biphenyls (PCBs). The most toxic dioxin of all is 2,3,7,8-TetraChloroDibezo-p-Dioxin (TCDD), the World Health Organisation (WHO) said in 1998. Especially TCDD has been shown to cause dermatological problems, notably chloracne, a chronic and disfiguring skin disease. "The principal controllable sources of dioxin production are waste incinerators", the WHO said. Its scientists agreed on a tolerable daily intake range of 1 to 4 picogrammes per kilogram body weight. One picogramme equals one millionth of a millionth of a gram. Ideally, the WHO recommends that every effort should be made to reduce (human) exposure to the lowest possible level.

Agent Orange, a defoliant used by American forces in Vietnam to defoliate the jungle, remains in Vietnam's food chain. A

study done in 2002 by the Journal of Occupational and Environmental Medicine publicised in July 2003 reported that in Bien Hoa, north of Ho Chi Minh City, 95 per cent of the tested blood samples “were found to have elevated TCDD levels”, while “highly elevated” levels were found in 16 food samples including chicken and pork taken in the market, a lake and former Agent Orange dump. Ninety five per cent of the harm caused by dioxins comes from eating contaminated food and not by breathing it in. The dioxin contaminated food is the result of fallout of the incineration of dioxin-based chemicals like PVC. And these dioxin fallouts can travel far. Cattle and fatty fish are the main dioxin sources for humans. The body can not decompose or get away from dioxins and stores mainly in the body fat where it will remain till you need your fat after a serious decease to recover. You get sick again from your own toxins.
Although the spraying of Agent Orange ended already over three decades ago, in certain area’s of Vietnam food is still clearly an all day present route of intake of dioxin from Agent Orange.

Actually a better way to clean is a non-incineration method that basically turns the material into a liquid. The site of the 2000 Olympic Games in Sydney, Australia’s largest city, was a former industrial site until the 1970’s, housing a former abattoir, armaments depot and brick works. The Homebush Bay site held about 9 million cubic metres of landfill containing heavy metals, waste oil products, asbestos, pesticides and among other things also serious quantities of TCDD. The New South Wales Environmental Protection Agency decided to clean up the sites before the Olympic Games by containing it and not transferring it to another site “where it could become someone else’s problem”, as it said in a 1977 report. The Agency used two processes, indirect thermal desorption to concentrate chlorinated benzene’s and dioxins, then modified base-catalysed desorption to destroy the chlorinated compounds. Thermal desorption is an internationally accepted technology for cleaning up dioxin contaminated soil. Just burning the whole soil in standard incinerators will not remove the dioxins. The fallout will produce another and bigger area with heavy toxic contamination.
Actually there are complete new incinerator designs, costing a fortune, which are about 100% able to clean up dioxin contaminated soil. Their working temperature is much higher and there are very sophisticated electrostatic and water filters to clean the air output. But the output contains a higher level of CO_2 which contributes again to the greenhouse effect. So we pay now or we pay later...
Standard incinerators have a working temperature of around 800 - 1000 degrees Celsius (1472 - 1832 °F) and can’t clean well. Their original dioxin fallout including the just formed new dioxins by incinerating the PVC in the waste can come down even at 50 - 100 km distance.

7-4 Q: What works better: A solid insulation around the inner strands of an interconnect or a foam ?

A: A solid insulation provides a better protection but also produces a higher electrical capacitance in parallel with the cable (also see 7-6).
A foam insulation provides less protection but produces a lower capacitance. So when you like to use the cable outdoors, take a product with solid internal insulation. When you stay indoors and do the mounting once and forever, use a foam insulated product. Though regarding video cables also see 4-30.

7-5 Q: What is the advantage of Teflon insulation compared to PVC ?

A: There are both advantages and disadvantages of Teflon compared to PVC.

The advantages are:

1. Teflon is a better, more stable and more durable insulator.
2. The lifespan of Teflon is in principle endless.
3. The insulation resistance is much higher compared to PVC.
4. Teflon has better dielectric properties. Its dielectric loss factor is much lower than that of PVC.
5. Compared to PVC, Teflon contains no chemical additives (softeners) that can migrate out of the material.

The disadvantages are:

1. The temperature to produce the stable Teflon is much higher compared to PVC. Therefore the possibility of deterioration of the enclosed conductor by the higher temperature is also higher.
2. Teflon is a stiffer material so the mechanical “load” on the conductor is also higher at bending and twisting.
3. The basic material costs much more compared to PVC.

7-6 Q: What is a dielectric (material/medium) ?

A: In a cable the dielectric is formed by the insulation material applied around and between the electrical signal

conductors. A dielectric present between two conductors influences the value of the electrical capacitance between them. The amount of this influence is given by the so-called relative dielectric constant (ε_r) of the insulation material. Air is the best insulator and has an ε_r of one. Any other insulation material has a higher value ε_r.

An insulation material's value of ε_r acts as a capacitance multiplier:

When in a cable the capacitance between the inside conductor and the shield is 100 pF in case we would use air as an insulator, then by using an insulation material with an ε_r of 2.4 (still a very low value) instead, the capacitive load of the same cable to your (say) tube pre-amplifier's output would be 240 pF. A low value of ε_r helps to maintain the integrity of the high frequencies in your sound system: The musical signal source's output resistance combined with the cable's capacitance forms a filter for high frequencies. Its high frequency roll-off point may become audible when either or both the output resistance and cable capacitance are too high.

Formula: Roll-off frequency = -3 dB frequency $\approx 1 / (6.28 \times R_{out} \times C_{cable})$

Assuming: Frequency in Hz, R_{out} in Ohm, C_{cable} in Farad and the input resistance of the load (generally ≈ 50 kOhm) being much larger than R_{out}

Example: R_{out} = 1 kOhm and C_{cable} = 1 nF → -3 dB frequency ≈ 159 kHz

Insulators which mainly contain air as insulator, like Teflon tape (our MC - SILVER series) or polyethylene foam (like our D - 102 III HYBRID) have an advantage over other products with a solid insulator around the electrical conductors (also see 7-4).

7-7 Q: Why do some manufacturers produce cables filled with sand or even very special water ?

A: Both components are cheap and provide the product extra weight. This extra weight makes the usually charged high to very high price more acceptable for the innocent customer. The sand will add some mechanical stability to the product and will help to reduce the effect of mechanical vibrations in and around the cable. This insofar as it generates extra electrical signals as a result of cable microphony (see 7-8). The use of special water (i.e. deuterium oxide = heavy water) in some cables does not add benefits compared to plain water since the dielectric properties of both are almost identical. Next to the added weight, water with its large ε_r (relative dielectric constant) increases the parasitic electrical cable capacitance which realises an earlier high frequency roll-off in the signal transfer. Sounds cleaner but also less accurate.

7-8 Q: What is cable microphony ?

A: This unwanted effect comes from electrical charging and discharging due to mechanical movements of the cable: These movements cause internal friction which, depending on the insulation materials used, can give rise to static electrical charges. These charges are transferred to the cable's conductors, thus becoming audible. The lower the signal level transferred through a cable, the higher the signal is amplified afterwards and thus the higher the sensitivity to microphony will be. Cables with strong static effects are mostly sold to amateurs and hardly in the professional world.
A good test for product evaluation is to connect the cable under scrutiny (about 1 meter will already work well) to the 10 - 100 MegaOhm input of an oscilloscope. Knock the cable with e.g. a screwdriver and watch for a pulse on the scope. The higher the pulse on the scope screen, the more critical the product under test is with respect to microphony. (Always produce the same intensity of mechanical pulse at the same spot to draw conclusions).
As a matter of quality, thanks to several technical innovations our cables equipped with Linear Structured Carbon ® layers (these cables all carry the word "HYBRID" in their name) have very low microphony.
This is one of the pleasant reasons for professionals to use our products in critical applications.

Section 8: Cables: Corrosion, Decline, Lifespan and Time Stability Factors:

8-1 Q: How does a cable maintain its sound quality ?

A: Hardly any cable can maintain its sound quality. Any metal is subject to degradation of structure. It already starts at the production factory and it will continue even after you have disposed of it. This is a fact of life with any metal. With non metallic cables, the story can be different. And with our Linear Structured Carbon ® (LSC), this story does have a happy end. LSC like used in our The FIRST ®, The SECOND ® & The THIRD ® series does not degrade at all. Only the connectors after many years. So, without any degradation, also the sound quality remains exactly the same over all these years. Therefore the conclusion: It is more the material and how it is used than anything else which determine and maintain the sound quality, (also see 13-8).

8-2 Q: How does the ageing effect of cables take place ?

A: The same way in which you also age: The wrong movements, too many tropical years, the wrong food, too much stress and the wrong environment (friends). Cables don't behave so different from men. Also see 3-1 and 3-8.

8-3 Q: How can I extend the lifespan of my expensive interconnects and loudspeaker cables ?

A: Treat them as gems, so no big temperature changes, frequent movements or other experiments.
In case you are able to open the connectors, inject some of our The SOLUTION protection fluid with a syringe between the strands at both sides of the cable. This coats the conductors' strands and seals the internal world of the cable off from the exterior world: Due to each day's temperature variations, air namely tends to flow in and out of cables and with it all kinds of corrosive atmospheric pollutants.
This trick is also very effective with multi-stranded loudspeaker cables. Hang them vertically (before you go and see your mother-in-law over the weekend) and at the top side inject them with The SOLUTION fluid. After your return on Sunday evening and have connected your cables again, the weekend will still turn positive.

8-4 Q: My wife insists on cleaning my listening room with the vacuum cleaner every day. She always moves and lifts my loudspeaker cables. I am afraid that, despite the very clean room, the lifespan of my speaker cables now is very limited. Am I right ?

A: Yes. And when you like your music very much, you should also like your relation. So, tell her to stop the very regular cleaning of your music room and life will be even more peaceful together with your loudspeaker cables, the vacuum cleaner and your wife. Also see 3-8.

8-5 Q: My loudspeaker cables first turned black and now they have even turned green. What other colours can I expect, because we are at the point to change the carpet in my listening room and I am now looking for a good colour match ?

A: It somewhat depends on the level of pollution as to which other Van Gogh impressionistic art you can expect. But, despite the fine art on the floor, this should not happen at all.
Change your speaker cables for a type which doesn't have cheap PVC insulation, because the main reason for all these fantastic colours is simply the PVC caused pollution and chemical instability in and around the conductors.
From now on buy loudspeaker cables with a PVC-free jacket to avoid all these problems. All our speaker cables employ halogen-free insulation, which is even a step ahead of PVC-free materials.

Section 9: Cables: Technical Parameters:

9-1 Q: Do you have a chart with AWG numbers and related technical parameters ?

A: See the AWG to METRIC conversion chart on our website which provides much information.

9-2 Q: Is there a relationship between the technical specifications of a cable and its sonic effects ?

A: Cable specifications are just pure technical and sonic effects are, for sure, mainly emotional. But with some better understanding about what the technical aspects specifically relate to, you can for instance already predict some of what a cable's sonic behaviour will be after one year of use.
Like e.g. the insulation material: When it's made of PVC (also see 7-1), your sound gets harsh after a while. Especially when you use your product in a humid, chemically polluted and high temperature environment. PVC contains a plasticizer which slowly disappears in time so the insulation will change in properties and get stiffer. From a chemical viewpoint the plasticizer poses a very open window. All kinds of undesired chemicals can penetrate the PVC-jacket and start chemical reactions with the underlying conductors. This works out in colour-changes of the conductors in the first place. Somewhat later the sonic qualities are changing.
Even when the cable's electrical conductors are made of the highest grade copper ever man-made - nine-nines 99.9999999% pure - but are further kept unprotected (e.g. no high quality silver coating) they are prone to break down by chemical activity, first at the metal surface and later also deeper inside. Again your sound will slowly become harsh.
Another technical aspect is the quality of the cable shield: When the braiding of the outer shield contains gaps and is visual partially transparent, a lot of high frequency interference can enter and will mix with your clean audio signal. So, this is another reason to have a critical look at the technical specifications.
How the product is made is also very important. By visual inspection this tells you what you can expect after a while. Not all parameters obtained by measurements will give this fast result. So, a critical inspection of the product in the shop can tell you more than a long story from the sales person.
Furthermore, with a coaxial/unbalanced audio interconnect, it is very important that the capacitance between the shield and the centre conductor is very low. Around 75 pF/meter is a nice value. Lower is even better; We have some very low capacitance interconnects in our program.
With a balanced interconnect, not only the capacitance between the two centre conductors should be low, but the capacitance between either one of the centre conductors and the shield should also be equal. The lower these last value are, the more spatial the sound quality.

9-3 Q: Does a wide frequency range with coaxial audio interconnects also tell me something positive about the sound aspects ?

A: Not directly. The sonic quality in the first place depends on the quality of the applied materials in all aspects. A high frequency range is an indication of a high production standard and stable product manufacturing - which is positive - but it doesn't say much about the copper quality, and the audio quality therefore can still be very limited. Despite the cable's high frequency range, its susceptibility to high frequency interference also still can be high. So don't automatically combine all properties into being good when one of them is ok. The other properties may just be very limited in performance.

9-4 Q: In your program I have seen an interconnect cable, the MC - SILVER IT 65 G, with a frequency span of 65 GHz. I don't see any advantage of such a high value for audio connections. Can you explain me why you aim at such a useless high figure ?

A: It is not our first aim to produce cables with such a high roll-off frequency.
The frequency range of an interconnect cable is the result of many technical efforts. The better all production technology is under control, the better the result. One of the critical parameters is e.g. the frequency range. Any variation of the diameter of the inner conductor or its insulation will immediately result in a limitation of the maximum frequency span. Also the quality and dimensions of the shielding are very critical. In particular there should not be any variation in conductor dimension, braiding angle, overlap of the silver foil, variation in the thickness of the dense silver-coating, the dielectric parameters (very critical in this aspect) and many more specific parameters. When all fits very well, there is the joy of the extended frequency range. So with the MC - SILVER IT 65 G, when measured, it was 65 GHz. Therefore the name: MC - SILVER IT 65 G. For you, it is reason enough to trust this product and your sound quality.
Conclusion: The higher the frequency range of a cable, the higher the production standard and the more stable the final product. Especially when first-rate basic materials are used for the conductors and insulation, this adds to the sound

quality.

9-5 Q: Does “Skin Effect” exist with audio cables? And when the answer is yes, what methods are there to overcome the problems caused by this effect ?

A: Skin effects exist also in audio cables.
The skin effect is the physical phenomenon that with increasing frequencies the alternating electric current in a conductor starts to distribute itself more and more near the surface of the conductor. Since with increasing frequency less of the metal cross-section area is engaged (i.e. the skin depth decreases), the impedance (AC resistance) of the conductor goes up. The problem this may cause in audio cables is an increase in signal loss as the frequency rises. The amount of this high frequency signal attenuation and, with it, its possible audibility mainly depends on the manufacturer’s chosen cable’s design (e.g. conductor dimensions, stranding and materials used).
The only effective way to minimize the influence of the skin effect is to maximize the effective surface area of the conductor(s), given a certain outer diameter. This can be done by using an as large as possible amount of individually insulated separate strands and braiding them. One such approach is called “litz wire”, which employs multiple tens of insulated strands. Our audio cables in which our Linear Structured Carbon ® technology is applied employ multiple thousands of strands...

9-6 Q: Why do many USA cable manufacturers use compensation circuits in their cables? I never see any in European products. There must be a serious reason for this.

A: The serious reason is that once you start with such a circuit, your story does not allow you to dismiss later, because it then shows that the truth has two faces. The background of such compensation circuits is that a longer time ago, an early cable designer made the discovery of his life when he found out that the impedance of a cable was rising at higher frequencies. We talk here about 10 MHz and higher. To create a controlled impedance, a compensation network was necessary (also see 9-7). And having licensed his knowledge to other manufacturers, all involved were (and still are) using the same idea. In Europe and also in other parts of the world, we don’t follow a cable leader but manufacturers rely on their own findings and knowledge. A steak in the USA (especially in Texas) also tastes different and steak eaters there like it very much.
So, accept the differences and understand that everyone is happy with his own habits. This makes live even more interesting.

9-7 Q: What is the secret circuit in the big metal or carbon boxes at the end of several USA made loudspeaker cables ?

A: By incorporating a special circuit, these loudspeaker cables have a constant impedance at higher frequencies (something around 1 MHz - 10 MHz). This is intended to avoid a roll-off at these frequencies, caused by the generally higher series inductance of speaker cables at again 1 MHz - 10 MHz. You may ask yourself what the effect is on frequencies at the top of the audible range around 10 kHz - 20 kHz. But that is another story.
Following our own design philosophies, our company will not introduce any product with this impedance correction circuit in any of our products.

9-8 Q: A lot of video and digital cables have an impedance of 75 Ohm. What does this mean ?

A: The 75 Ohm impedance is a world-wide accepted value for all kinds of coaxial high frequency signal connections.
Impedance is another word for the value of electrical resistance for alternating current: An alternating voltage applied at one cable end results into an alternating current flowing into the cable. The voltage to current ratio is the impedance.
When you measure a coaxial 75 Ohm cable between its shield and core with an Ohm meter you will however measure an open circuit and not 75 Ohm. This because your meter measures using direct current, i.e. measures DC resistance, not AC resistance.
A coaxial cable’s AC resistance (= impedance) value arises from the electrical capacitance between the centre conductor and screen as well as from the electrical series inductance of the centre conductor and screen. This capacitance and inductance are distributed along the entire cable length and at higher frequencies their interaction allows for the electrical signal energy to travel along the cable in the form of an electromagnetic wave - just like radio waves or waves in a pond, but very effectively channelled within the cable. The cable’s capacitance and inductance values per meter constitute the typical construction parameters of a coaxial cable. This capacitance and inductance must exhibit low electrical losses and be very stable along the entire cable length to achieve a good 75 Ohm impedance cable which allows maximum signal energy transfer over a wide frequency spectrum. This maximum energy transfer is much like with an amplifier and speakers: Your power amplifier for instance produces the highest output power (voltage x current) at 8 Ohm.

9-9 Q: Are balanced cables also 75 Ohm ?

A: Regular balanced cables have a higher impedance, like the standard 110 Ohm AES/EBU type for professional digital audio transfer. In special applications balanced 75 Ohm cables can be applied, but the layout of the design is different and the capacitance between the two conductors is somewhat higher.

Section 10: Cables: Connections and Connectors:

10-1 Q: How do I keep all the electrical contacts in and on my hi-fi set clean ?

A: Inside is somewhat more difficult, but most electrical contacts are situated within rotating, linear or toggle switches. By very regularly rotating, pushing or tumbling, you keep them reasonably clean. By the extra application of our special contact fluid “The SOLUTION” you protect all metal parts against oxidation when they are not contacting each other inside the switches. In addition they are lubricated, thus reducing wear.
The same solution works for all external contacts like the female phono connectors on the rear of all amplifiers: Take a well-made male phono connector and push this male connector in the female connector that is under treatment. Rotate this male connector several times to clean the contact surfaces and then apply a drop of our The SOLUTION on the inside and on the shell of the female connector. Having done all of them, reconnect your male phono connectors at the rear of your equipment, also rotating them several times. When you give your equipment this treatment (once in every two or three months), you have the best possible result without any high cost.
Without this treatment, all sound quality will slowly come down and will make you unhappy after a while. So, at that moment you decide that you have to buy another pre-amplifier (again). Save the expense and just buy a bottle of The SOLUTION. You will be as happy as before again.
The SOLUTION is supplied in a small bottle with an application brush incorporated in its screw lid. Containing 25 cc. of fluid, this amount will serve you for many years.
Applied on metal contact surfaces The SOLUTION forms a thin protective layer which prevents pollution, humidity and dirt particles from causing harm to the precious audio signals being transferred. Also with sliding contact surfaces (like in rotating switches and when inserting/subtracting connectors) the wear becomes much less because The SOLUTION acts as a contact lubricant. The gold coating will not wear off so fast anymore.
And... your loudspeaker connections will not oxidise when you also apply The SOLUTION at your power amplifier’s and loudspeaker’s binding posts.
And... when the electrical contacts inside your loudspeakers are just made by push-on connectors, solder them or apply The SOLUTION. This will maintain the sound quality without you having any sleepless nights on what to do to improve your audio system again and again. You already did it.

10-2 Q: How does contact liquid work ?

A: Contact liquid is non-conductive; it is a pure insulator and it coats metal surfaces where it is applied. Afterwards, only direct metal-to-metal contact is still conductive, especially when both the metal surfaces are very clean. So, clean first before applying.
The first function of contact liquid is to provide a protective barrier against airborne dirt, chemicals and humidity, thereby blocking corrosion of the contact surfaces. The second function is to provide contact lubrication: reducing subtraction and insertion wear on the connector’s precious metals. Both functions strongly combine to maintain the purity and integrity of the connectors’ contact surfaces (which often are coated with a vulnerably thin gold layer), thus ensuring both a good, undisturbed signal transmission as well as extending connector lifespan. And keep in mind that what works well for the connectors, also works very well inside the cable. That story is not very different.

10-3 Q: Why do fresh connectors sound many times more pure compared to the “oldies” ?

A: Mechanically and chemically aged connectors have been exposed to serious surface wear, deposit of environmental products and even some corrosion. The metal contact surfaces, despite perhaps still being shiny, have become contaminated and are altered compared to what you bought at the moment they were fresh. So, the signal transmission has also changed and this especially has a devastating effect on the low signal levels. As a result, the resolution in the sound is replaced by harshness. This is a negative sonic effect which many hi-fi freaks suffer from. Till you visit a life concert in a concert hall without public address system, like e.g. a good opera or a jazz cafe. You will then realise that you have got the extras (unwanted harshness) at home - which you thought was the real thing, but in real life it wasn’t.

10-4 Q: Why are there always big sonic differences with equal looking connectors ?

A: It is not always what you see that makes the difference. Especially with connectors it is very important which materials are used and how the different layers are chemically structured, (also see 10-5). Especially the application of nickel in audio connectors is a disaster. Better to stay simple and find other solutions. A scratch over the flimsy thin gold coating in many cases shows you the nickel underneath.

10-5 Q: A while ago I have bought very expensive gold plated phono connectors and the gold now actually falls off. I am afraid that the quality is not what I paid for. What to do ?

A: First go to your dealer and ask for assistance to solve this problem. But keep in mind that he is also a human being with a family.
Despite the fact that there is a protective gold plating on top, when the metal layer underneath the gold plating is not clean and chemical residues have not been washed away very well, the chemical activities that remain always cause the plating to come off after a while.
Many (cheap) connectors furthermore have a nickel layer underneath their gold plating. The nickel acts as a chemical barrier for the gold electroplating bath's acids. But nickel has a big sonic disadvantage: The sound gets harsh and its image looses depth. So avoid connectors with nickel. To solve your problem, ask your dealer to mount a proper quality.
By the way, gold that falls of is not always pure gold but in many cases a look-alike.

10-6 Q: What is better: Soldering cable to a connector or mechanical clamping ?

A: On short term both methods produce a good electrical contact between the cable and the connector. Soldering however is a better way to assure a long-lasting quality, since it allows to block entrance of air and with it the entrance of corrosive humidity and pollution. Crimping/clamping does not give you full warranty that there is no air penetration possible between the strands: With temperature changes, the air inside the cable will contract or expand and thus move in and out between the crimped conductors' strands. This air movement means transport of impurities and humidity. As a result, your crimped connection becomes the weakest link in a perfect cable terminated with an even better connector. (Even worse is that some manufacturers simply use screws to fix the bundles of speaker cable strands. A very bad method with a very fast and negative impact on the sound quality).
We exclusively advise soldering. Soldering with a thermally activated flux cleans all strands, and both the partial melting of the insulation and the absorption of the solder's flux will seal the conductor's end. So, always solder to be 100% sure about this part of your electrical connections. Soldering simply means that they are tight forever. And that is what you expect from good connections.

10-7 Q: Do I need loudspeaker cable connectors to connect my cables to the binding posts of my power amplifier and speakers, or can I just twist the strands together and fix them by tightening the nuts firmly ?

A: Twisting the strands together or soldering connectors does not make much difference on short term. But in the long run soldering is better (also compared to clamping), because all strands are engaged in conduction and make good contact (also see 10-6). By soldering you also keep the air away from the strands. This avoids oxidation and helps to maintain a better sound quality.
It is furthermore useful to clean all contacts every 2 to 3 months and coat them with a drop of our "The SOLUTION".

10-8 Q: I have a thick loudspeaker cable. How do I connect this sturdy product to my amplifier having the binding posts at the traditional 19 mm distance from each other ?

A: In our program we have the so-called "Bus Connector". A universal connection system employing a barrel with two separate openings. One end is AWG standardised and is used for solder connection of a single or multi-strand loudspeaker cable. The other end is threaded and takes a matching spade or banana connector. The barrel is available in various opening diameters for cables ranging from AWG 00 (2/0) to AWG 14. So a perfect fit for practically any cable.

10-9 Q: I regularly see look-alike connectors equal to WBT designs. Is the sound quality the same ?

A: By experience the answer is: No. Besides that, look-alikes are not allowed to be sold. All designs are registered and it is not allowed to copy them. Especially in - what we in Europe call - the Far East, it is common to produce look-alikes. The production cost is much lower so the retail price is also more fun. But you buy a copy: A look-alike and not a sound-alike.

10-10 Q: How do I connect a balanced interconnect to a so-called XLR connector ?

A: XLR stands for: Shield, Life and Return (so actually "SLR" instead of "XLR").
XLR connectors have three pins, each of them marked by a number.
The easiest way to look at the order of soldering is to take the male XLR and look at the connections from the rear (=solder) side. Here the pin order is 1, 3 and 2 (clockwise):

Pin 1 connects to the cable shield. Pin 3 (the connection in the middle) connects to the return audio signal (– / antiphase) and pin 2 connects to the hot or life signal (+ / phase). The female XLR connector has the same pin numbers at opposite positions, thus maintaining pin-signal designation.
A rule of thumb regarding XLR plugs, helping you to learn its pin designations by head is: **XLR** = **S**hield, **L**ife, **R**eturn = **1**, **2**, **3**. All good XLR connectors have numbers printed next to the pins, so a mistake is hardly possible.
Also see the “Audio and Video Cable/Connector WIRING DIAGRAMS for DIY purposes” available on our website.
For quality reasons we exclusively apply Neutrik XLR connectors to all our balanced cables.

10-11 Q: My pre-amplifier has balanced outputs and my power amplifier is unbalanced. How to connect them without too much quality losses ?

A: Please refer to the “Audio and Video Cable/Connector WIRING DIAGRAMS for DIY purposes” available on our website. For those wishing to make standard or special cable/connector configurations themselves, this extensive section provides cable wiring diagrams, connector pin designations and much more useful related information.

10-12 Q: Is there a technical difference between Phono, RCA, Cinch, Tulip or Coaxial plugs ?

A: No, they are all names for the same type of functional design. The brands and the cosmetics are, of course, always different.

10-13 Q: When I use a regular phono connector on the end of a video cable, is the total impedance still 75 Ohm ?

A: No, because each regular phono connector has its own typical high frequency impedance and depending on its design any value is possible. The risk that this impedance is not 75 Ohm is much higher than it having the correct value of 75 Ohm. Due to impedance mismatch between the 75 Ohm cable and non 75 Ohm connectors, signal reflections occur which blur the image in video applications or introduce jitter distortion (see 12-4) in digital audio applications.
Our phono/RCA type connectors are designed to optimally support 75 Ohm applications.

10-14 Q: Why is the 5 pin DIN type connector not used on cables anymore? Some English brands still have connections of this type on the rear panel.

A: There are several reasons for stopping with these products. One is the low channel separation in the plug itself. Also the generally poor manufacturing quality of the connection pins was a problem. Strong oxidation after a while was very common. The locking, or more precise, the non-locking was a problem. Also, all the internal wires were too close together to produce a stable cable-to-connector quality. And don’t forget the confusion about which pin had to be connected to which wire, because at the time there was a difference in configuration between the input pins and the output pins. (Also see the audio cable / DIN connector wiring page in the “Audio and Video Cable/Connector WIRING DIAGRAMS for DIY purposes” document on our website).
The only place where the DIN type connector (though differently shaped) keeps a firm position is at the bottom of your tone arm. For such purpose we also have this type of connector in our program: The TAC (which stands for Tone Arm Connector). A 270 degree 5 pin configuration.

10-15 Q: I am very happy with my Acapella loudspeakers from Germany. The tweeter is an ion/plasma driver flat to 50 kHz. How do I connect this tweeter ?

A: The input of the modulator is RCA female. A very high quality interconnect must be used for this purpose like e.g. our MC - SILVER IT Mk II Coaxial. This product gives you a very superior sound quality. And because of the double shielding, the influence of high frequency spurious signals is also very low.

Section 11: Cables: Termination and Soldering:

11-1 Q: How to de-insulate a cable or wire ?

A: De-insulation is also called stripping. The best way is not to use any mechanical force. Therefore, use thermal methods as much as possible. Stripping the insulation from a loudspeaker cable for instance works very easy when you use the tip of your soldering tool. Just move the hot tip around the conductors and remove the insulation. Afterwards clean your solder tip, otherwise the soldering of the connector gets more difficult.
This stripping method also works very well with interconnects. However, when the insulation is made of Teflon or Polyurethane you have to apply a cutting tool since these materials don't melt. Always avoid cheap mechanical strippers because they damage the outer layer of the strands, especially when the adjustment of the stripper is too tight. And be very careful when the strands are silver coated. Never scratch the silver away by careless stripping.

11-2 Q: Do I need a solder type with some silver content when I make my own high quality connections and should I also use silver solder with Van den Hul cables ?

A: When you want to produce more stable connections with a reduced sensitivity for oxidation and other corrosion you need silver containing solder. Although the extra silver in the solder brings about a higher melting point, when solidified, the silver content at the surface of the solder joint is higher compared to the content on the inside; The silver first solidifies in a higher concentration at the outside of the solder joint. This higher silver content surface provides an extra chemical shelter against corrosion and recrystallisation of the solder in the long run. It also makes the solder joint's surface somewhat harder. The silver furthermore builds links between both parts in a web-like (dendritic) structure, and, due to its silver content, the conductivity of the solder is also slightly improved, but not at a big advantage.
When you apply silver containing solder (commercially available Tin/Lead/Silver (Sn/Pb/Ag) types with a 2 to 5.8 % silver content or our lead-free silver solder) be very careful not to move your cable and/or connector for minimally 10 seconds after the solder tool's tip has been removed: During solidification the silver builds a kind of silver tree inside the solder drop and when you move the cable and/or connector earlier, you may break this silver tree. The contact's sound quality then will be somewhat less.
In case you can not afford to buy silver solder, make a silver tip on your soldering tool. This tip will always dissolve some silver in the plain solder and provide the same result.
Another good message is that in case you use one of our Van den Hul cable or wire types, you don't necessarily need silver solder since part of the extra silver layer at the outside of all strands will partly dissolve in the liquid solder and directly creates a good silver content in the joint. This combination works best and also costs less.

11-3 Q: Is it possible to make silver containing solder myself ?

A: Yes, this is very easy. Replace the tip of your soldering tool by a solid silver one. Everything you solder afterwards automatically contains silver.

11-4 Q: What is the optimal soldering temperature ?

A: I regard 275 degrees Celsius (527 °F) a good temperature for use with standard Sn60/Pb40 (60% Tin / 40% Lead) electronic solder. At higher temperatures the solder surface gets burned (oxidised) faster with bad contacts as a direct result. Lower temperatures don't provide enough heat to maintain the solder liquid when the connector and the strands are brought together. Here, risk of creating a so-called cold (i.e. brittle) joint exists.
When interconnects are concerned, use a 20 to 30 Watt tool. A higher power soldering tool becomes necessary when you have to connect conductors of AWG 16 (1.3 mm Ø) and thicker: For AWG 16 you need around 40 Watts. For AWG 12 (2 mm Ø): 80 Watts minimal. Any AWG step down of 4 units (i.e. about 1.6 times thicker, also see the AWG to METRIC conversion chart available on our website) requires an extra power of 40 Watts to ensure fast work and high quality, but always keep the regulated temperature at 275 degrees Celsius.
In case you solder very thick cables like AWG 6, AWG 4 or even AWG 2, we advise to apply a propane or butane gas burner, otherwise it takes too much time to heat up and all the heat will disappear in the cable. This produces a lower sound quality in the end. Fast working and no movements at all are you best friends.

11-5 Q: How do I mount connectors to my loudspeaker cables ?

A: Always make a strong mechanical connection. One method is e.g. the WBT approach with a thin walled round tube

around the group of stands. The round tube with all strands is hexagonally squeezed with a special crimp tool. Result: all strands are very tight together and the hexagonal tube can be fixed in another connector or straight underneath a binding post.
In our company we standardly use the so-called “Bus Connector”: A bus type universal speaker connector consisting of a tube with an entrance made for various AWG numbers at one end and a screw thread at the other end.
The loudspeaker cable is soldered into the bucket, and at the other end a banana or a spade connector is screwed on. The soldering secures all strands and definitively keeps the air out, an advantage in the long run. The possibility to change between spade or banana furthermore makes this a very flexible configuration.

> Please note: For fast and easy mounting our program also carries solderless spade and banana DIY Screw-On Speaker Connectors, which high pressure clamp function creates a low loss electrical connection to all cable strands.

How to solder this bus connector?
Screw on the spade or banana part and fix this end facing down in a sturdy heat resistant clamp.
Take a small gas torch and warm up the connector’s solder bucket (the cable entrance side is facing up). Add solder and maximally fill up to two thirds with liquid solder. Continue to heat and SLOWLY insert the cable end’s twisted strands fully into the solder bucket. Stop heating and, without moving, keep the cable in a vertical position for about 10 seconds. Then cool down by dipping the bus connector with the cable in Propanone = Acetone or distilled water (also works and is safer).
Always take care of a good strain relief between the connector and the insulated cable. A heat-shrinkable insulation sleeve works good when during heat-shrinking the sleeve and the insulation mould together. With our cables’ standardly applied HULLIFLEX ® jacket this works well.
The strain relief will aid in keeping all the conductor’s strands together and will relieve bending stresses. And this is important, since strong and frequent bending at a specific spot of the cable (generally taking place near the connectors) will age the cable (metal fatigue) and will therefore negatively influence the sound quality of the whole cable.

11-6 Q: I have seen that there are two ways to wire an XLR connector. Which method is the best ?

A: Dating back from the time when no standard on XLR connector pin designations was agreed upon, there has been a confusion as to whether the XLR connector’s pin 2 should be wired hot and pin 3 cold or the other way around.
The nowadays uniformly used EIA RS297a wiring standard for XLR connectors is: Pin 2 = signal +/hot/in-phase, pin 3 = signal –/cold/out-of-phase and pin 1 = ground. (For wiring diagrams please refer to the “Audio and Video Cable/Connector WIRING DIAGRAMS for DIY purposes” available on our website).
Especially older audio equipment sometimes uses the reversed pin 2,3 signal designation, and when connected to modern XLR input devices the signal is phase inverted. When in doubt: The equipment’s manual often mentions the XLR pin configuration used. To get around such signal phase inversions you can either change the equipment’s internal XLR wiring or make a pin 2,3 crosswise wired XLR cable or change the polarity of your loudspeaker connections.

11-7 Q: Is it possible to mount my own connectors on a Linear Structured Carbon ® product ?

A: You can always try, but by experience we know that in many cases the sonic result is inferior to our own mounting quality. This has directly to do with the special tools we use and the applied forces. Both have a big impact on the final result. And beside that, there are people in our company which have collected plenty of experience from precise mounting work dating back to 1992 when our first Linear Structured Carbon ® interconnect The FIRST ® was brought out. And that helps for sure.

11-8 Q: How does your company mount connectors on The THIRD ® all carbon loudspeaker cable ?

A: The carbon to metal connection at each end of The THIRD ® is realised by multiple, thin silver coated copper wires of 120 micron diameter. We build a horizontal and vertical grid of these thin conductors and these wire groups traverse the whole bundle of 3.5 million Linear Structured Carbon ® fibres several times. The total impedance of this metal grid construction is only 0.001 Ohm. After all this braiding work is done, we solder our bus connector (see 10-8) at the end of this multiple stranded metal conductor group.
It takes the people in our company more than one hour to fix one connector. So with four pieces of The THIRD ® making up a stereo set, it takes more than 8 hours of labour to fix all 8 connectors. We however don’t charge even one penny for this time consuming job, because this product is so outrageously good that we like to support everyone who wants to listen with it.

11-9 Q: Why does your company use such a complicated connection method for The THIRD ®? I think that a clamped

bus around all the fibres will also work.

A: For those of you who are not familiar with our product program, The THIRD ® is a 3.5 million carbon fibre containing loudspeaker cable. All fibres are individually insulated. To mount connectors, we weave a grid of many thin wires at the cable ends. After several runs trough the total fibre bundle, a connector bus is soldered to the end of all metal wires (also see 11-8).

Your suggestion to do it faster and more simple is welcome, but it does not work in any other way. When we would use a bus over the whole fibre group and apply crimping, the impedance would raise dramatically just at that spot. So all the work done before to realise the lowest impedance gets lost: We tried it, and the nice low value of 0.07 Ohm/meter turned into 0.6 Ohm/meter. Besides this unacceptable high value, many fibres were broken. So, just extra problems and no serious solution.

Section 12: Cables: Digital Audio:

12-1 Q: I need a long digital connection in my system: about 23 meters. Should I use an optical or an electric cable connection ?

A: At such distances, using electrical cable generally is the best option.
With coaxial 75 Ohm SPDIF (consumer) or 110 Ohm balanced AES/EBU (professional) digital audio cabling at large cable lengths, the precision of the cable impedance (jitter at direct replay), the cable's noise immunity (shielding) as well as its bandwidth and attenuation become increasingly important (also see 12-2).
With standard optical cabling (Toslink) the noise immunity and bandwidth are excellent, however, at large lengths the cable's attenuation and so-called modal dispersion (the time difference of travel between the light rays traversing the fiber at various angles) become increasingly important (also see 12-2). A consumer-grade Toslink optical connection therefore has a shorter distance limit (depends on quality, but roughly 10 m) than electrical cabling.
With digital audio, the general practice is to use high quality electrical cabling for distances up to hundreds of meters. Here, our coaxial 75 Ohm SPDIF types The DIGI-COUPLER 75 Ohm and The TRIAXIAL Professional 75 Ohm or our 110 Ohm balanced type AES-EBU 110 Ohm Professional are excellently suited. They are also regarded highly by the professionals.
When extremely large distances are to be covered, where the bandwidth and attenuation requirements render electrical cabling impracticable and/or noise immunity becomes a problem, special professional quality single-mode or multimode fiber optic cables are employed.

12-2 Q: I can use an optical cable or a good 75 Ohm digital interconnect between my CD player and DA converter. Which sounds better ?

A: Although fiber optic cable exhibits a very high bandwidth and near perfect noise immunity by itself, keep in mind that two extra signal conversion steps are involved here: One in the player to convert the electrical information into light pulses and another one in the DA converter to convert these light pulses back to an electrical signal again.
The frequency bandwidth limitation caused by the extra involved optical transmitter and receiver parts in effect increases the amount of jitter distortion experienced at your D/A converter's input.
Other sources of jitter are light reflections between the two ends of the fiber as well as the time difference of travel between the light rays traversing the fiber at various angles (so-called modal dispersion). Various points in the total optical signal path also present signal attenuation, yet another performance limiting factor.

With the 75 Ohm cable, you can expect other quality issues:
First, the output impedance of the CD player, the interconnect's impedance and the DA converter's input impedance not always are a precise 75 Ohm over the whole frequency range (up to 500 MHz). Such impedance mismatches are a main source of jitter at your DA's input.
Furthermore, when the cable isn't adequately shielded, its susceptibility to external interference is another performance limiting factor. With good equipment and a good 75 Ohm digital interconnect, latter points however are adequately dealt with and no optical signal conversion steps are involved. Coaxial SPDIF transfer therefore is preferable if low jitter distortion replay is aimed at.
(A more detailed discussion of all effects mentioned above can be found on our The DIGI-COUPLER 75 Ohm's product information page).
By the way: In case you cannot get away from persistent ground loops (between the CD player and the converter), insert a high quality broadband pulse transformer or revert to optical cable...

12-3 Q: Why do coaxial digital cables always have a funny impedance of 75 Ohm, where I understood that the lowest impedance is always the best ?

A: For audio signal transmission a low impedance is the best, especially for loudspeaker cables. But digital information is not typical audio anymore. The frequency span can extend up to 500 MHz, meaning that quite different laws rule here. One of them is that optimal signal transfer is only possible when the output impedance of the source (your CD player), the impedance of the cable and the input impedance of the load (your DA converter) are the same. And many years ago, for technical reasons, the 75 Ohm impedance value was taken as a standard value.

12-4 Q: Why can your audio interconnect The FIRST ® Ultimate also be used as a digital interconnect ?

A: The FIRST ® Ultimate is a pure Linear Structured Carbon ® interconnect cable with a natural and even distributed

conductor resistance along the whole length.
When, with cable transfer of digital audio (SPDIF), the output impedance of the player and/or the input impedance of the DA converter and/or the cable's impedance deviate from the required 75 Ohm, so-called standing waves occur in the connecting cable between the two pieces of equipment due to signal reflections at the impedance mismatching side(s). These standing waves will upset the DA converter's audio signal clock retrieval circuitry in its very precise timing and thereby cause so-called "jitter" (i.e. fluctuations in the timing interval between the audio signal's samples). This jitter generates extra audible distortion which we can describe with a harsh and aggressive sound as well as reduced resolution and imaging.
The closer all impedances involved in the digital signal transfer are situated around 75 Ohm, the better. Assuming that your player's output impedance is not exactly 75 Ohm across the whole digital frequency range and also guessing that the input impedance of your DA converter has some minor fluctuations, the connecting cable for sure will develop standing waves. Especially in such situations it is very helpful to have a well defined resistive interconnect in between, which is able to damp the signal reflections and thus provides a clean signal to the DA converter. We performed measurements on The FIRST ® Ultimate as a digital interconnect using digital pulses (square waves) and a 50% termination impedance mismatch: Just two reflections remained before the signal echo dropped below -60 dB. In practice this means that by using The FIRST ® Ultimate as a digital interconnect, the cable and equipment interface sources of jitter distortion are eliminated. Cable signal reflections will not degrade the sound quality of your player/converter combination anymore.

Section 13: Cables: Buying:

13-1 Q: What is important for me to know when this time I want to buy a good interconnect cable ?

A: Don't think that a higher price is always related to a better product. Mostly it is related to a better brand marketing department or, to a greedier manufacturer or retailer.
First borrow and try your friends best products to find out what works well in your set.
Listen to a dealer you trust because in the past he has also given you good advice.
Read brochures and find out what attracts you in various manufacturers' technologies.
Think about long-term stability - this related to smart application of conductor technology and insulation materials (also see 13-8 and 8-1).
And have in mind that impressive packing does not sound better compared to low cost paperwork.

13-2 Q: What is important for me to know when I want to buy a new loudspeaker cable ?

A: The conductor quality and quantity.
The quality is not easy to find out because you have never been at the company's factory. But the colour of the pure copper or silver coated copper conductors can already tell you a part of the story. They must be as shiny as possible. When PVC is used as insulation material, the metal surfaces will not be shiny anymore after a while, (also see 8-5 and 6-1).
A cable with single-strand leads is more critical with regard to frequent movement (e.g. due to household activities) compared to a multi-strand product. Furthermore, speaker cables which have more strands and a larger conductor cross-section area (lower AWG number) are also better products regarding sound.
Having thin AWG 20 conductors will make sound but not always yield quality. The minimum AWG number you should look for is AWG 14 or lower. And when the distance between the power amplifier and your loudspeakers is more than 2 meter, the minimum advised AWG number is 12 or lower.

13-3 Q: Can you give some hints to keep in mind when I want to buy better cables ?

A: Do some listening with cables of your friends who claim to have the best of the world. Listening to their cables in their hi-fi set will produce a different sound impression compared to your having their cables in your set. So listen at home first before you copy their choice. When it is a sonic improvement, keep this in mind, but also keep in mind that their choice is not necessarily the ultimate for your set.
So, also get advice from your dealer and read magazine tests; Especially the reviews from writers who are really experts in this minefield.
When you intend to improve the whole set, it is valuable to take better products with an eye on the future.
Before buying anything, always specify for yourself what you like to have or hear better. Just better is too simple. Is it e. g. the dynamic or the spatial aspect you like to improve? Is your actual sound too harsh or just too soft?
The better you specify your intended improvements, the lower the risk to come back home with the wrong product.
When your dealer is willing to let you compare your current products with new ones, he is a great person and worth to respect. When he isn't, find another.
Take a test CD with you which you really know very well. The CD preferably should be recorded with just two omnidirectional microphones (sometimes also called spherical) and also should have a very low content of mono information per channel.
Available on our website is an article I have written about this subject, titled: "A simple hearing method for audio quality evaluation".

13-4 Q: Do I need to buy all cables from the same manufacturer ?

A: You don't need to. Each manufacturer has its own weak and strong products.
There is just one remark to be made: When a specific cable technology dramatically contributes to sound improvement, take the rest of the program in serious consideration. Because with this specific technology also other very good products are created in the same program.

13-5 Q: My dealer suddenly offers very nice looking cables produced in, what we call, the Far East. How high can my sonic expectations be ?

A: I assume that the pricing is lower than what you are used to pay. This is partly the result of lower wages and lower machine costs. Many products from the Far East have a very attractive cosmetical appearance. My personal doubt more concerns the quality of the insulation materials (like PVC) and conductors involved. At the low pricing of your dealer's cables, including his own profit, it is hardly possible to apply high technology. So, when you like the product, buy it and don't come back later with arguments about whatever it may be. And keep in mind that in the meantime many well known manufacturers have their full program produced in the Far East. You will not see a big difference in their pricing, but that is what we call high end. Our company has all its cable products produced in Europe and we will continue to do so.

13-6 Q: I live in a tropical country. What should I pay attention to when I want to buy new cables ?

A: Find cables without any PVC in their jacket. Or even better: Avoid all products with halogen containing cable jackets. Also avoid all non protected (e.g. not silver plated) and plain open copper stranded products. They degenerate very fast as a result of the extra high humidity and high temperatures.

13-7 Q: How long can I use my interconnects before there is the need for a product replacement ?

A: To speak out about other manufacturers is difficult for me, so I just advice you about our products: With our regular products built from silver coated copper and insulated with HULLIFLEX ®, when used in a moderate climate and a clean environment and assuming the interconnect is not moved every day, the answer is at least 15 years. In tropical conditions and a polluted environment: 10 to 15 years.
In case you use our Linear Structured Carbon ® cables, the replacement time in the first mentioned situation is 100 years or even longer. Regarding the second mentioned situation I must give you the same answer: 100 years or even longer. This very extended lifespan is based on all kinds of tough durability tests and on plenty of feedback from very happy product owners world-wide.
In case you use a regular copper product from another manufacturer with PVC as insulation jacket, the lifespan in situation one generally is about 2 years and in situation two maximally one year.

13-8 Q: Why do I need to buy new interconnects on regular basis? The sound deterioration is such that I am forced to do so to maintain my sound quality.

A: I assume you buy interconnects which have a low protection factor against decline due to chemical processes. So, next time focus on a better metal protection by e.g. a proper silver coating (see 6-12) and, what we do, also a carbon coating (see 6-17). Also pay attention to the insulation and cable jacket material(s) used. They should not contain any active chemicals. Such chemicals will constantly deteriorate your signal conductors, whether you are listening to music or not. (Also see 9-2, 6-1 and 7-1).

13-9 Q: My dealer regularly gives me cables for test listening at home. But I found that my conclusions on them are different from my audio friends' which have the same. Theirs are always better? What great miracle happens here ?

A: I am about sure that the test products you get from your dealer are exchange cables from customers who bought something better. So you listen to used (and mostly abused) products. The same product but fresh will sound better. So ask your dealer to lend you some new ones. He should be kind to you because you positively advertise him. Otherwise, you miss the message he wants to give you: Buy some products and don't every time claim others for free. Try to find the truth of life, not only about interconnects.

13-10 Q: Why do I regularly have pay to so much for cheap looking cables ?

A: Cheap and expensive are relative terms. But your findings are correct. For dealers, cables are a goldmine. That is why you often have to pay more, even for regular products.

13-11 Q: Many cables are just made of regular copper and simple insulators. Despite this, there is a big difference in pricing. Why ?

A: You don't just pay for the product quality but also for the image of the product on the market. Image building with e.g. luxurious advertisements today cost plenty of money because many hi-fi magazines can only survive with high

advertisement prices. So what you regularly see advertised in magazines is not particularly or necessarily the best product. The fact that you pay more is also based on extra costs involved to make you buy this product. So, you also pay a part of the money used to convince you to buy this product. Sounds a little bit stupid doesn't it?

13-12 Q: Is there a direct relation between the sales price for an interconnect and its sonic quality ?

A: A very cheap interconnect does not produce enough profit to pay for advanced technology. Also, many cable manufacturers claim applied technologies in their products without having any serious impact on the sound quality, but exclusively on the manufacturer's recommended retail price. Those claimed technologies are just there as a justification for a very unrealistic sales price. So, the art of buying is to find out which claimed applied technology is substantially contributing to the sonic quality and not just to a too serious price. The choice is yours.

13-13 Q: When I can not afford your Linear Structured Carbon ® products, what technology comes close ?

A: That is our Fusion Technology with e.g. The INTEGRATION HYBRID and The INSPIRATION HYBRID. The INTEGRATION HYBRID is a star quad interconnect while The INSPIRATION HYBRID is a star quad loudspeaker cable. Especially The INSPIRATION HYBRID is definitely cheaper compared to our Linear Structured Carbon ® The THIRD ® speaker cable. Soundwise they are close, with for me a personal preference for The THIRD ®. But for many freaks, The INSPIRATION HYBRID is "THE" choice.

Section 14: Speaker Cables: General:

14-1 Q: What is bi-wiring and how to implement it ?

A: Bi-wiring (i.e. double wiring) is so far only used for connections between the power amplifier and the loudspeakers. The connections are made like this:
At the amplifier there generally is just a regular single set of binding posts (+/– left and +/– right). To enable bi-wiring, the loudspeaker should have two sets of terminals, one for the bass section and a separate set for the mid-range/tweeter section. So, with four different binding posts at the loudspeaker and only two per channel at your amplifier, the basic question is how to connect them.
For each loudspeaker you'll need two twin-lead (*) speaker cables. At the loudspeaker they are connected separately: One to the bass section's terminals and the other to the mid-range/tweeter section's terminals. Both speaker cables come together (are connected in parallel) at the corresponding amplifier channel's + and – binding post. So two combined connections at the rear of your power amplifier are separately connected to the four binding posts at your loudspeaker. Mind correct polarity. And also mind that each loudspeaker's two shunt strips, which served to interconnect the bass and mid-range/tweeter section for non bi-wired operation, are removed. Otherwise, instead of bi-wiring, you have in effect just put two twin-leads in parallel, still an advantage but the sonic effect is less.

*: You can use two separate twin-lead cables for each speaker to be bi-wired. In our program we however also have special quadruple lead loudspeaker bi-wiring cables available.

14-2 Q: Is there an advantage in bi-wiring ?

A: The advantage is that the higher currents for driving the woofer and their influences are kept away from the lower, more delicate currents driving the other section(s) of your speaker. Electrical feedback from the woofer crossover section is not interfering with the mid-range and tweeter crossover section. Less interference keeps the total sound quality intact. The less both signals have in common, the better the final result.
Also the total cable impedance is reduced by 50%.

14-3 Q: What is better: bi-wiring or bi-amping ?

A: Bi-amping (i.e. two amplifiers per speaker) is always better.
In addition to separating each speaker's low and mid-range/tweeter sections drive currents by using dedicated wiring (as in bi-wiring), bi-amping also involves using separate amplifiers (or amplifier channels) for driving each speaker section. One advantage of bi-amping is that the workload placed on each single amplifier and cable is divided. Also, when the woofer's amplifier would clip, this distortion will not reach the tweeter, can't damage it and be less audible. Another advantage is that amplifiers and cables better capable of handling the power and current required for low frequency reproduction can be chosen and deployed separately from those that are better suited for handling the delicate mid-range and high frequency information. These advantages match with the loudspeakers, which themselves have their own separate drivers optimized for each frequency range.
The simplest implementation of bi-amping would be to use two stereo amplifiers, for instance one for each speaker. In that case, one half of each power amplifier is used for driving the woofer section and the other half of the same amplifier is connected to the mid-range/tweeter section. Both inputs of stereo power amplifier A (which drives the left speaker in bi-wired mode) are connected to the music signal source's left channel. Likewise for amplifier B and the right channel. The audio power separation is made in the two non-interconnected passive crossover circuits inside the loudspeakers. I.e. while each amplifier and cable is driven full frequency range, a connected crossover's mid-range/tweeter section for instance only demands mid and high frequency energy from one amplifier (section) through its dedicated cable, thus dividing the workload.

14-4 Q: When I buy interconnects, I always care about the capacitance per meter. Should I also do so for loudspeaker cables ?

A: You can do, but the current delivered by power amplifiers is so high that any extra small capacitive load will not matter as long as the value is not higher than 100 pF per meter. In the beginning of the high end cable era there was a famous cable produced in Japan with a total capacitive load of more than 7000 pF. I still have a sample at home. This cable caused a lot of problems for power amplifiers. After having been connected to this loudspeaker cable, many were acting as a power oscillator. And they were not made for this purpose, so a lot of broken amplifiers and blown tweeters. All starts are difficult...

14-5 Q: Is there mutual support or just the opposite when two conductors run parallel and close together ?

A: Assuming that one of the conductors runs to the “plus” of your loudspeaker and the other is connected to the “minus”, the direction of current in each conductor is always opposite. Two parallel wires which carry current in the opposite direction repel each other, whereas they attract each other when their currents are in the same direction. When, as with a loudspeaker cable, both currents are in the opposite direction, their individual magnetic fields will cancel each other out at some distance.

Section 15: Speaker Cables: Sound:

15-1 Q: When I put several loudspeaker cables in parallel, will the sound quality improve ?

A: The bass response will be more controlled due to the lower impedance between the power amplifier and the loudspeakers, and the sound will be more dynamic compared to the quality of your best cable. All paralleled cables will contribute to the final quality and I think that you will like the result. The sound quality however will never get better than that of your best cable. Also the rendering of detail will not be at top quality, because the sound harshness of all cables will take part in the detailedness of the final sound result. With harshness, the details you will hear are fundamentally Cross Crystal Distortion, (see 5-1).

15-2 Q: What comes after plain twin-lead speaker wiring in order to improve the sound quality ?

A:

A. First you start with bi-wiring: For each loudspeaker you'll need two twin-lead speaker cables. At the loudspeaker they are connected separately: One to the bass section's terminals and the other to the mid-range/tweeter section's terminals. Both speaker cables come together (are connected in parallel) at the corresponding amplifier channel's + and – binding post. So, two combined connections at the rear of your power amplifier are separately connected to the four binding posts at your loudspeaker, (also see 14-1 and 14-2). When there is some difference in the diameters of the twin-leads you have, it is best to have the thickest running to the woofer section, because the audio current for bass is always the highest.

B. When working with a three-way loudspeaker system, tri-wiring is a step better. The principle is essentially the same as with bi-wiring: With tri-wiring each speaker's woofer, mid-range and tweeter section now each have their own twin-lead connection to the corresponding amplifier channel's + and – binding post. Again, if there is a difference in the diameters of the twin-leads you have, run the thickest to the woofer section, the second thickest to the mid-range section and the thinnest to the tweeter section.

C. Bi-amping is the next step, (also see 14-3). In addition to separating each speaker's low and mid-range/tweeter sections' drive currents by using dedicated wiring (as in bi-wiring), bi-amping also involves using separate amplifiers for driving each speaker section: E.g. one stereo amplifier for the left channel and one stereo amplifier for the right channel. The stereo power amplifier used for the left channel has both inputs combined: Both its left and right channel input receive left. One of this amplifier's speaker outputs is connected to the bass section of your left loudspeaker and the other power output is connected to the mid-range/tweeter section. The same is done for the right channel with the other amplifier-speaker combination. The four leads per loudspeaker can run next to each other. If they are single-leads, twist the pairs running to each speaker section to minimise pick-up of high frequency interference, (also see 5-7). When you use lower AWG number (thicker) wiring for your bass section and higher AWG (thinner) wiring for your mid-range/tweeter section there is no risk of quality loss. Keep in mind that a part of your success is resulting from the quality of your loudspeaker cables. Instead of two stereo amplifiers you can also use four mono amplifiers. This provides an even better quality, since, by using separate amplifiers, the electrical separation in driving all speaker sections is higher.

D. Tri-amping is even a step ahead again. Especially when you work with six mono amplifiers. Keep in mind that in such a complex situation also good mains cables are important. Advise: Try e.g. our The MAINSSTREAM HYBRID.

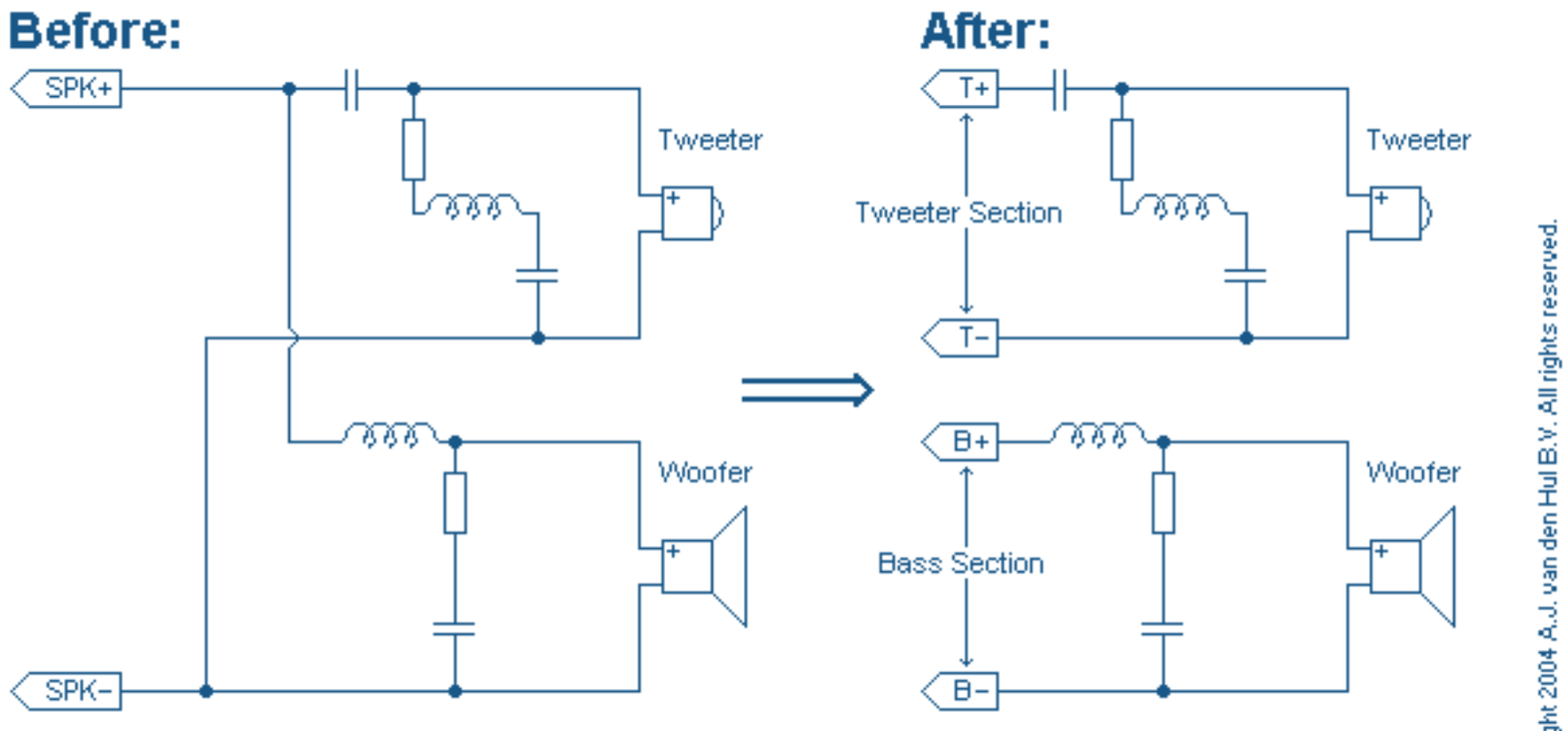
E. Instead of making use of the passive crossover circuits built inside your loudspeakers (as is done with the four above mentioned points), bi-amping and tri-amping can work even better when making use of an active crossover filter unit. This concerns another black box with one input per channel and 2 or 3 filtered outputs per channel. With an active three-way crossover, the crossover frequencies between the bass and mid-range output as well as between the mid-range and tweeter output are adjustable. Also adjustable are the filter slope and the output levels. The many adjustments to be made require some experience, but with a good active crossover unit you can reach a very high quality sound reproduction. Some units even have "Q" adjustments to match different driver requirements. Each of the three adjusted outputs per side (channel) must be connected to a separate power amplifier. So six interconnects leave your active crossover.

F. Another aspect beside the above five points is that additional quality improvements are often possible when also taking the loudspeakers' internal wiring, electrical contacts and crossover filter components into consideration, see 15-3.

15-3 Q: How do I improve my loudspeakers ?

A: In several steps:

1. First make a bi-wiring configuration (also see 14-1 and 14-2) by electrically separating/disconnecting the bass section from the rest of the filter (i.e. the mid-range/tweeter section) on the crossover's printed circuit board. See example figure below. Get help from a more experienced friend or your hi-fi dealer if you're not sure how to do this.



Example figure: Two-way loudspeaker bi-wiring modification

Please note: Your crossover's circuit plan may differ from what's shown here

2. Loudspeaker manufacturers quite often apply thinner and/or lower quality than necessary internal wiring. Replace all internal wiring by our CS - 12 HF (a good starter), our SCS - 12 (to do it well), our The WIND Mk II HYBRID or The BREEZE HYBRID (latter two to do it very well). All four products are sold on a very regular basis to well-known loudspeaker manufacturers who take their profession very serious.
3. The often flimsy thin tracks of the crossover filter's printed circuit board can be upgraded by soldering the same higher quality conductors (as used for replacing the other internal wiring) on top of them.
4. Avoid all mechanical contacts like clip-ons. Many manufacturers just use clip-ons to save time (and therefore money). Such - often cheap material based - clip-on wiring contacts can (sometimes dramatically) reduce the sound quality of your speakers by corrosion in the long run. This especially in tropical countries with high humidity and higher temperatures. It's always good practice to minimize mechanical contacts wherever possible. Direct soldering of all connections (even at input) is the best option, else at least apply some of our "The SOLUTION" contact protection fluid.
5. Have a critical look at the crossover filter's electrical components. Replacing all electrolytic capacitors by film capacitors may cost you some extra money, but the result is worth it. Avoid all coils with ferrite or iron cores. Replacing ferrite, iron or any thin wired air core coils by air chokes made of a thicker copper wire or even copper foil yields further improvements.
6. Also keep in mind that a part of the reproduction quality concerns all mechanical vibrations and resonances of the loudspeaker box itself. So don't just focus only on the electrical properties. There are also mechanical improvements possible.
7. Further quality improvements are possible when next to bi-wiring (discussed at the first point above) also bi-amping (or even tri-wiring, tri-amping and using active crossover filters) are applied, see 15-2.

When the design is ok and all has been done well, the sonic result will be a dramatic dynamic improvement with plenty of extra detail. And the common harshness you were used to is gone. Not a bad result for a rainy Saturday afternoon when the kids were boy scouting and your wife was shopping.

15-4 Q: Are speaker cable supports of great help in my listening room ?

A: A while ago it was a sales hype, but after the time that everyone who objectively or subjectively heard a difference (which not always is an improvement) had bought them, this profitable section of the audio business stopped again. It is like with many hypes: There are waves of introduction and waves of farewell. But, try for yourself and find out whether you like it or not. Especially keep an ear on spatial improvements.

Section 16: Speaker Cables: Size:

16-1 Q: Why do some loudspeaker cables have such enormous diameters? Do they therefore sound better ?

A: No, there doesn't exist a direct relation between the outer diameter and the quality of the electrical signal transfer. Manufacturers of real thick loudspeaker cables think and believe especially themselves that they can charge a higher price for a thicker cable. Helps in their business but not so much in your system. You mostly buy plenty of cheap fibres and some metal. But... a thick cable always looks impressive - when this is the effect you need for your friends.

16-2 Q: Why do so many expensive loudspeaker cables contain lots of internal filler fibers? Do they sound better or is there another reason why there is plenty of this relatively cheap material used inside ?

A: Thick cables always cost more than thin ones. So a part of the story is money. Another part is the separation of the plus & minus leads. When both leads share the same outer insulation, some separation is necessary to reduce the capacitance between the two conductors. When you work with four leads (i.e. bi-wiring cable), the capacitance reduction is not the real story.
What really counts is the quality and quantity of conductor material and not so much the quantity of insulating material / filler fibers. So, before buying, check the internal construction and draw your conclusion.
The heavy loudspeaker cables containing more than normal filling are a standard high end sales item in the USA.
European products focus more on conductor quantity.

16-3 Q: Why do I need a (relatively) thick cable to connect my speakers to the power amplifier while the total diameter of the voice coil wire is just 300 micron (0.3 mm) ?

A: The thin wire is a must for technical reasons, like a low dynamic weight of the voice coil and a strong magnetic field in the magnetic gap. (Driver efficiency among other things is related to moving mass and magnetic field strength. Strong fields furthermore require a small gap). A 1 mm thick wire for instance would simply be too heavy and would require too much space.
Being stuck with the thin voice coil wire requirement, the voice coil's connection to the power amplifier output must have the lowest electrical resistance possible. This to allow the amplifier defeat the back-EMF (counter Electro Motive Force) of the loudspeaker (i.e. to dampen its voluntary movements). So, a thicker loudspeaker cable is an electrical must to maintain maximum control over the movements of the loudspeaker cone which is directly connected to the voice coil. Any extra (thin wire) impedance in between means more coloration in the sound. And that is something you don't want.
The application of a thick loudspeaker cable does not always mean good sound quality however. In addition to having a low electrical resistance, the technical quality of the loudspeaker cable is essential to obtain or even maintain good sound. Sometimes a thinner cable will sound better when it has better conductor technology. And what is sold as "thick" does not always contain a lot of metal and have a low resistance. In many cases there are plenty filling fibres involved to impress you with the cable's size at first sight. Those fibres are insulators, whereas you thought to have bought a good (and thick) conductor.
So be suspicious when the product you intend to buy does hardly have any weight, but despite this is very impressive in size. High weight can also be misleading, so also check if you're buying sand or water contained. This is cheaper at home than in your hi-fi shop (also see 7-7).

16-4 Q: Why do loudspeaker manufacturers very often apply thinner than necessary internal wiring ?

A: Just to save money; Despite being in the profession, many manufacturers don't care about the sonic advantages of applying better quality internal wiring. So, here is a great opportunity for you to replace - the sometimes bicycle lighting quality - by a serious audiophile cable. It will produce a different and much better sounding loudspeaker, see 15-3.

16-5 Q: Your company always works with "AWG" numbers, like the CS - 122 HYBRID - which is a twin-lead AWG 12 loudspeaker cable. What is the purpose of these AWG numbers ?

A: AWG stands for American Wire Gauge. This is a world-wide accepted standard in wire dimensions. From 1980 our company has used this AWG table as a dimension reference for all conductors. A low AWG number like e.g. AWG 2 stands for a conductor with a metal cross-section area of 33.6 mm^2. When we use copper this automatically defines the DC impedance (electrical resistance) of the product: 0.513 Ohm/km.
Another example: AWG 12 concerns a conductor with a metal cross-section area of 3.31 mm^2 and a DC impedance of:

5.21 Ohm/km

The higher the AWG number, the thinner the conductor and the higher the DC impedance of the product (also see the AWG to METRIC conversion chart available on our website).
Loudspeaker cables normally run from AWG 8 (our The MAGNUM HYBRID) to AWG 14 (like our The CLEARWATER, The GOLDWATER and The SNOWLINE).
We do not advice loudspeaker cables with an AWG number higher than 14 (i.e. with a typical metal cross-section smaller than 2.08 mm² and a DC impedance higher than 8.29 Ohm/km).
As a general rule: A reduction of the metal cross-section area of 50% is equal to 3 steps up on the AWG scale; Like AWG 4 equals to a conductor cross-section of 21.1 mm². So AWG 7 equals to a conductor cross-section of 10.5 mm². At the same time the resistance is multiplied by a factor 2.
Another rule is that when the diameter of the conductor is reduced by 50%, the AWG step is 6 up. At the same time the resistance increases by a factor 4.
For home theater installations AWG numbers like 16 - 20 are applied. This is for easy mounting because it concerns thin wires. However, it also results in a lower sound quality and is in itself another reason for dynamic compression of the sound.

Section 17: AC Power Cables:

17-1 Q: How can a mains power cable have any impact on the sound quality of my equipment ?

A: A mains power cable is the connection between the noise polluted mains and your equipment which processes clean audio signals. A good separation is important: Depending on their design and quality, via your equipment's internal power supplies spurious signals can penetrate into your audio signal path and (sometimes seriously) degrade sound quality. All it takes is one entrance path. And... what gets in also gets out.
A good mains cable therefore should act as a very effective noise filter. Meaning that it should realise a fast roll-off for higher frequencies. And higher frequencies are not those above 1 MHz, but already start at 10 kHz. Our The MAINSSTREAM HYBRID power cable acts as such a high frequency filter. This cable's innovative design includes several very effective filter elements, (also see 17-2). Our company even got an official VDE approval for The MAINSSTREAM HYBRID.
The sonic result is a very clean sound and a virtual dark space behind the loudspeakers.

17-2 Q: What makes your The MAINSSTREAM HYBRID AC power cable so unique to other products and how does it filter all mains noise so well ?

A: Our AC power cable The MAINSSTREAM HYBRID is in the first place a high current product. It is easily able to handle 100 ampere surges when necessary and available. But at the power consumption of the connected load, The MAINSSTREAM HYBRID immediately and very efficiently starts a powerline noise cleaning process, brought about by a carefully designed set of electrical properties.
The MAINSSTREAM HYBRID is a complicated construction which exhibits a maximum damping effect on higher-frequency noise polluted mains. The MAINSSTREAM HYBRID's filter function is not influenced by the mains voltage but by the cable length. The longer, the better the result.
The filtering is accomplished by the combined parallel capacitance and series inductance of the conductors. The Linear Structured Carbon ® layer applied around all conductors furthermore very effectively adds to the filter function. Moreover, the heavy shield surrounding The MAINSSTREAM HYBRID avoids emission of lost high frequency energy and screens the internal leads from external electromagnetic interference. In addition, the cable incorporates a very efficient magnetic compensation arrangement which prevents the cable from radiating magnetic field noise or picking up such. And last but not least, in The MAINSSTREAM HYBRID the traditionally negative considered aspects of the skin effect have just been turned around and are applied as an additional positive effect on its noise filtering efficiency.
As a result, The MAINSSTREAM HYBRID keeps your audio system's noise floor very clean. Mains pollution (noise) is very efficiently filtered away and with it its negative effects. Sound harshness and lack of spatiality and imaging are turned into smoothness and an enlarged acoustical space with better instrument location.
Keep in mind that the application of our Linear Structured Carbon ® is essential for an effective and high quality result. Just using black PVC, as I have seen in cheap copies, is fraud. It is only incorporated for visual effects.

Summarizing The MAINSSTREAM HYBRID's features:

1. A very high continuous current capacity and a maximum transparency with regards to instantaneously drawn current surges.
2. The capacitance between its 6 current leads and the ground lead in the centre as well as the ground connected cable screen is very high. This acts as a 6 dB/octave filter.
3. The inductance of the 6 spiral wound internal current leads acts as a common-mode choke coil. This aspect of the cable forms yet another 6 dB/octave filter.
4. The Hybrid layer around the conductors especially absorbs high frequencies travelling on the outside of the conductors.
5. The conductors are a very high grade. So, thinking audiophile, no contribution to any harshness. All power conducting wires are coated with a dense layer of silver.
6. The heavy cable shield, also made of dense silver coated copper, avoids absorption or emission of spurious signals. Latter also keeps the electrical environment of your equipment very clean.
7. The cable's construction also avoids magnetic field emission by letting the current running to the equipment magnetically cancel the higher frequencies returning from the equipment connected.
8. The high capacitance of the six conductors to their ground connected cable environment (shield and central ground lead) combined with their big series inductance, produces a very healthy roll-off for higher harmonics imposed on the mains. The Hybrid configuration again helps to fasten this roll-off.
9. The embedded powerline noise suppression filter's more than 12 dB/octave roll-off starts at a lower frequency when the cable length is larger. The minimum length I advise is 2.0 meter. Produces immediate sonic results.
10. The above mentioned noise filtering features work equally effectively in both directions: I.e. the cable not only filters mains noise going towards the equipment, but also filters equipment borne (mainly power supply generated) noise

going back towards the mains.

11. The MAINSSTREAM HYBRID is VDE approved with approval nr.: 40006257. Hardly any mains product in the audio world has an official approval. For security reasons we have spent the money to have this AC power cable approved. And with success.

17-3 Q: Is your power cable The MAINSSTREAM HYBRID a save product ?

A: It is even a very save product because we passed the heavy German DIN VDE 0282-10 test. This test covers a multiple bending test and afterwards a high voltage test. And from now on at any new production run of The MAINSSTREAM HYBRID, staff of the VDE institute have to examine the production to check the quality. This to warrant the continuation of the certificate of conformity. The safety can only be maintained with proper mounting of the connectors at both ends of The MAINSSTREAM HYBRID: The mains plug and the IEC equipment side connector. There are about 16 different types of mains power connectors around the world and there is just one IEC plug up to 15 amperes. When we produce The MAINSSTREAM HYBRID, for Europe we apply the Schuco type (continental Europe) and the United Kingdom BS (British Standard) type mains plug. For the USA we mount the Wattgate power connector. For other configurations we require connectors from our local distributor that fit the 12.5 mm diameter (BS) or 15 mm wide (regular) version of The MAINSSTREAM HYBRID.

17-4 Q: Can I use your The MAINSSTREAM HYBRID also as a three phase power cable ?

A: Yes, it works well. But keep in mind that two groups (Lead and Neutral) of three parallel internal wires each - as used for regular mains connections - is different to three groups (R, S and T), each of two parallel wires, as you like to use in your three phase configuration: The cable contains three blue (Neutral) and three brown (Lead) conductors, which wiring for three phase power can easily lead to errors. So be very careful with all the connections you make (*). Please check and measure them all with an Ohm meter.

*: → Please read our disclaimer.

17-5 Q: Why is your MAINSSTREAM BS power cable thinner than the regular MAINSSTREAM ?

A: In the United Kingdom it is common to use the British Standard (BS) mains plug. The entrance opening of this plug allows cables with a diameter of maximally 12.5 mm. So we had to reduce The MAINSSTREAM HYBRID's cable diameter from 15 mm to 12.5 mm. And therefore the name is also different (The MAINSSTREAM **BS** HYBRID) to indicate the region which this product is made for. The technical function is the same. Also the price.

17-6 Q: What is the difference between your The MAINSSTREAM HYBRID and your new The MAINSSERVER HYBRID ?

A: The MAINSSERVER HYBRID is the lower power (6 Ampere) version of our 16 Ampere types The MAINSSTREAM HYBRID and The MAINSSTREAM BS HYBRID. Its 6 Ampere rating at 230 V AC mains is equivalent to a maximum power capacity of 1.4 kilowatt. Normal use would be to feed equipment with a power consumption up to 250 Watt (at 120 Volt mains) or up to 500 Watt (at 230 Volt mains). The MAINSSERVER HYBRID is VDE approved with approval nr.: 40010559. Also this mains cable cleans all spurious signals from the mains to keep the sound quality of your equipment in top condition.

17-7 Q: Are your AC power cables The MAINSSTREAM HYBRID and/or The MAINSSERVER HYBRID just for tube equipment or can I also use these cables for semiconductor amplifiers ?

A: The frequency range of semiconductor equipment is normally higher compared to what is specified for tube equipment. Therefore, the sonic benefits (see 17-1) of the technology (see 17-2) applied in our AC power cables stand out more when used in combination with semiconductor amplifiers.

17-8 Q: Can I use your THUNDERLINE HYBRID as a mains cable in combination with my low power pre-amplifier ?

A: By personal experience our THUNDERLINE HYBRID works very well (*1). However, due to its special design for power transfer, The MAINSSTREAM HYBRID sounds and performs better. Moreover, our similar type, The MAINSSERVER HYBRID

(the lower power, 6 Ampere version of The MAINSSTREAM HYBRID) is an even better performer at mains supply to lower power equipment (*2) and is recommended over our THUNDERLINE HYBRID.

*1: → Please read our disclaimer.

*2: Normal use: Feeding equipment with a power consumption up to 250 Watt (at 120 Volt mains) or up to 500 Watt (at 230 Volt mains).

17-9 Q: Thanks to very positive experiences gained with your The THIRD ® all carbon loudspeaker cable, I now also would like to use it as a mains cable. Could there be any technical problems that I am not aware of ?

A: The THIRD ® will make a superb power cable. The only problem will be making a safe connection to mains plugs at both sides of the cable (*). The best option is to construct an interface box at both sides of the cable to safely house the necessary connections, keep them wide spaced, fasten them and thoroughly insulate them. The THIRD ® comes factory terminated with Bus type Universal Speaker Connectors. Removing these and making your own connections directly to the cable's carbon fibers is not advised (see 11-7 and 11-8), but by using some high quality high current copper wire (like our 3.89 mm² Ø type SCS - 12) you can easily go from the cable ends to the mains plugs. The same heavy copper wire (e.g. SCS - 12) can be used as a ground lead between both mains plugs. To minimise the cable radiating magnetic field noise (or picking up such) keep the leads (lead, neutral and ground) twisted together. To minimise absorption or emission of electric field noise you can also add an insulated braid or foil shield surrounding all leads. Ground this shield at the wall outlet side of the cable and leave it disconnected at the other side.
With The THIRD ® you can expect a very clean sound; Comparable to using our AC power cable The MAINSSTREAM HYBRID, but better.

Please note: Regarding attempts to use her or any other brand's loudspeaker cables as a mains cable, for safety reasons A.J. van den Hul B.V. most strongly advises against direct insertion of a loudspeaker cable's banana, spade or other terminals in mains outlets. Furthermore, loudspeaker (and other non-mains) cables are not designed to be used as an AC power cable unless the manufacturer explicitly warrants them to be suitable and safe. In general the AC power cable's current rating, its insulation's voltage rating and other properties should comply with your country's electrical safety regulations and preferably be marked accordingly. Where applicable the cable should also provide a regulation compliant safety ground conductor. Any deviations from the before mentioned are at your own risk (*). When in doubt always ask the advice of a professional.

*: → Please read our disclaimer.

DISCLAIMER:
A few topics in this "Cable FAQ" section of our website give suggestions which involve working with high voltages and/or may cause harm to you and/or your equipment if you make errors or are inexperienced. Especially concerned are the suggestions mentioned at 2-1, 5-3, 17-4, 17-8 and 17-9 which explicitly refer to this disclaimer. This disclaimer however applies to all topics given in this document:

A.J. Van den Hul B.V. denies liability for damage or harm of any direct or indirect nature resulting from, or occurring through, activities triggered by this "Cable FAQ" section of our website.

- Always think twice and be very careful when working with the mains or with other high voltages (i.e. above 40 Volts)!
- Always use a voltmeter to check whether dangerous voltages are present before performing any operations.
- When in doubt regarding any tip or hint given in this document, always ask the help and advice of a professional.

A.J. van den Hul B.V.