

# WIRING THE PERFECT CUSTOM INSTALLATION

Just like the plumbing in their house, the wire and cable in your client's home can't be pulled out and replaced later (except at great expense and inconvenience), so why not do it right the first time!

**by Eric Bodley**

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Today's home theatre systems are designed to capture the awesome dynamic range and powerful, life-like impact of today's blockbuster movies. With the potential for full range digital sound, and the realism of multi-channel surround sound, and the clarity of high resolution video monitors, high quality video and audio interface cable becomes critical for the most exciting home theatre experience.

Specifying components is where all the emphasis has been placed. The wire connecting the various audio and video products is the final component, and as the saying goes, a chain is only as strong as it's weakest link. However, many custom designer/installers have focused on using the "cheapest" wire or wires that come with the components themselves. Or wire that costs little and has artificially high selling prices.

Pricing pressure also contributes to many designer/installers fearing that by specifying better cables and interconnects they will push their client "over-the-top" and lose the deal by promoting "expensive" cables.

Today's consumers are intelligent shoppers. And contrary to what many salespeople think, "intelligent" does not always mean looking for the "best" price. Intelligent means looking for the best value. That's why intelligent consumers, salespeople, and custom designer installers pay particular attention to the wire and cables specified in home theater installations. It allows the maximum value and performance.

The key to specifying the right cables and interconnects is by talking about them early in the presentation, and by pointing out how they truly are the "final component" in any installation.

## **Specifying Wire For In-Wall And On-Wall Speaker Installations**

Before the cables are in the walls, you want to make sure that they are going to last as long as your client's house does. In other words, the cables should be high quality and high performance. Like the plumbing in their house, you can't go back and change it later (except at great expense and inconvenience), so why not do it right the first time!

You must also make sure that the cables installed in the walls meet local building codes. All of the speaker cables should be CL-3 rated to conform to the National Electric Code (NEC), which means they have the proper voltage rating for higher power applications and meet safety standards for flammability of cable jackets. Video and audio interconnect wires should be at least CL-2 rated. In addition all of the cables utilized should be UL Approved—tested by Underwriter's Laboratories to meet NEC guidelines for flammability and electrical current capacities. In Canada be certain the wires meet the strict FT4 rating required in that country.

Try to prewire the home theatre (and the rest of the house) during new construction or renovation—even if you're not sure when you want to install the system. It will save your client a lot of money and headaches later.

Ideally, left, center, and right front speaker cables should all be the same length, and so should each of the surrounds. This standardizes the distance that the audio signal has to travel to each, ensuring full dynamic range

and more natural re-creation of depth.

### **Audio and Video Interconnects**

Throw away those cables that come in the box! They represent the worst possible connection you can make when hooking up a home theatre.

Let's put aside the performance improvements possible with high-quality audio cables for a moment. The lack of mechanical integrity and the long-term corrosion problems of nickel plated connectors are sure to degrade the signal. Cheap connectors also mean losses and intermittent connections. And how about those wispy wires? Skinny coax interconnects and lamp cord were obviously not designed with the audio/video components performance in mind. There's a reason why those wires are free!

In a home theatre system, there are an incredible number of connections, some of which travel long distances. Most homes theatres are a hostile environment for audio cables, which are prone to picking up noise from electromagnetic fields (AC power lines both inside and outside the walls), dimmers, and the equipment itself.

Remember that audio is more important to the experience than video and that the audio cables are as important to video as they are to audio. Try watching a big screen picture with a low powered stereo receiver and two small bookshelf

speakers. Then watch a 20-inch TV with a five channel Dolby Pro-Logic System with a Subwoofer or two. There is no question that a great audio playback system can do more for a small picture than a large picture can do for "tiny" sound. Intelligibility and clarity in speech dialogue is essential and Foley sounds which create the subtle nuances that tell our minds that "this is real" can be lost in a poor quality cable. Home theatre soundtracks are incredibly demanding with tremendous dynamic range and bandwidth which come through in explosions, action, fists and fighting. Proper cabling can preserve these sounds and produce the proper imaging and depth (time correct placement of events in space), with surround sound and pull the audience right into the action.

### **RF Cables: A Necessary Evil**

In general, avoid RF cable because it can seriously degrade sound and picture quality. No matter where your client lives, stray RF signals of all sorts—TV, FM radio, fluorescent lights, and others—bombard the video cables. These signals interact with the RF video carried in the cable. RF video occupies very high (VHF) and ultra-high (UHF) frequencies, which start in the 50-megahertz range and go up from there. All but extremely high-frequency radio waves can interact with RF video signals. This interaction can produce ghosting, as well as stripe and herringbone interference patterns. Also, RF video signals carry at

most 330 lines of horizontal resolution, so you lose the high resolution available from Laserdisc players and S-VHS VCRs.

If you only use an RF cable between the VCR and the TV, you can't get stereo sound when you play tapes. Why? Because VCRs use an RF modulator to convert the sound and picture from the tape up to radio frequencies that work with the RF connection. And all VCRs have only mono RF modulators, not stereo. In many cases, though, you have no choice but to use RF cable. Many cable TV boxes have only RF outputs, in which case you must use an RF cable. If you do have to run RF cable, use a top-quality, quadruple-shielded (quad-shield) cable with a sturdy 95 percent-coverage copper-braid shield and a 100 percent coverage foil shield to effectively block stray RF signals.

### **Composite Video Cables**

Composite baseband video suffers from RF interference to lesser degree than RF video. At baseband video's typical maximum frequency of about 5 megahertz, only low-frequency radio waves can interfere with it. Still, this interference can cause problems similar to those you experience with RF video cables. Always look for a double-shielding on composite video cables and full-bandwidth transmission. Many so-called "high-end" composite video cables suffer from reduced bandwidth which diminishes the high frequencies in the video

signal, and robs you of detail in the picture.

Unlike the inputs and outputs found on audio equipment, the characteristics of composite-video inputs and outputs are standardized. They all have an impedance (or resistance to the alternating current that makes up video signals) of 75 ohms. The video cable should also have a 75-ohm impedance. Some cable manufacturers ignore this specification, though, using audio-grade cable and connectors instead of components designed for video. The result is that the signal can be reflected back and forth in the cable. When the reflected cable is mixed with the original signal, it cancels some video frequencies, so you can lose picture detail with poor-quality cables.

### S-Video

S-Video cable differs from composite in that it carries the brightness (luminance, or Y) and color (chrominance, or C) signals on separate lines within the same cable. You can find S-video connections on S-VHS and Hi8 camcorders and VCRs, on better laserdisc players, on satellite receivers, and on better TV sets.

You may have heard that S-video connections are necessary to transmit the high-resolution signals from laserdiscs and S-VHS and Hi8 tapes, but that's not really true. The bandwidth of S-video is the same as that of composite video. The real benefit of an S-video connection is that it can

reduce dot crawl and hanging dots—crawling edges that appear on the vertical and horizontal edges (respectively) of some colored objects in the picture. Note that we said it *can* reduce these effects, not that it *will*. The fact is the Y and C signals are always split somewhere in the video chain, even if you use an old TV set. Every TV has a Y/C separator built in and using the S-video connection bypasses the TV's Y/C separator.

You should use the S-video connection if the source device has a better Y/C separator than the TV, which will almost always be the case if you're using a Hi8 or S-VHS camcorder. Laserdiscs contain a composite video signal that must be separated inside the laserdisc player to produce an S-video output. To find out if the Y/C separator in the laserdisc player is superior to the one in the TV, connect an S-video cable from the laserdisc player to the TV's video input 1, and a composite cable from the laserdisc player to video input 2. Now switch between the inputs to see which looks best.

S-VHS and Hi8 VCRs can produce perfect Y/C separation, if the signals on the tape were recorded from a cleanly separated source. The VCR must separate the Y and C to record tapes off the air, and it usually does only a fair job. Some prerecorded tapes are produced with excellent Y/C separation, some aren't. If you have a TV with a good Y/C separator, using the S-video connection

with one of these VCRs will only sometimes produce a better picture. If the TV's Y/C separator isn't very good—if you see dot crawl and hanging dots on network TV shows—you're almost always better off using an S-video connection with these VCRs. Note: Be careful of the length of S-Video cables (only the best cables can be run moderate to long distances) and pay particular attention to the termination of the S-Video connectors.

### Installation Tips

#### Audio Cable Specification Tips:

- The longer the cables are, the more likely you are to encounter performance problems. Use speaker cable that's at least 16 gauge. (Remember, the higher the number the smaller the wire.) For higher performance systems and better bass, larger gauge speaker wire is a better choice. Replace small gauge speaker wire with the best quality, highest technology speaker cable possible. It will make a substantial, audible difference in the system.

- Use "balanced" twisted pair cables, not coaxial. Balanced cables are commonly used in recording studios. They have two signal-carrying conductors, plus a separate shield. They should use high-quality twisted-pair construction to reject interference from sound-polluting AC power lines and other sources of hum.

- Look for a high-quality fit and finish in RCA

connectors. Simple gold plating is not enough. Because of the sheer number of cables in a home theatre system, cheap connectors make accidental disconnections easy and all too frequent.

- Use the highest-quality speaker cable possible. This is especially important for the front channels and subwoofer. With AC-3 and other discrete playback systems on the market today, it will pay to run the same high-quality cables to the rear channels at the same time you run the left, center, and right channels. Though heavier gauge wires are necessary for longer runs, don't look only at the cable size. There are special technologies developed for carrying high-current speaker signals that actually improve sound reproduction regardless of gauge.

#### **Cable Tips For a Great Picture:**

- For TV and VCR hookup, use one video and two audio cables, all with RCA connectors, for surround sound and the best picture (Don't use the screw-on "F-pin" type cables).
- Keep video lengths short. The less distance signal has to travel, the less loss will occur, keeping the picture vivid and sharp. Sometimes you can't avoid a long cable run. Be sure to use the best, high-resolution cable designed to carry the signal over these runs with the lowest loss.

- Don't bunch up excess wire, and keep all cable runs away from AC electrical cords. Both situations can produce increased picture interference.

- Avoid sharp bends and kinks in the video cables to help minimize signal loss and ghosting.

- Use the best possible signal splitters for the cable TV, antenna system, or Digital Satellite System (DSS). Poor quality splitters are a prime source of signal loss and noise.

#### **What To Look For in Movie-Quality Video Cables:**

- Full coverage braid plus bonded foil shielding. A necessity for rejecting video "noise" and interference for greater picture detail.

- Ultra-wide bandwidth capacity of 5 megahertz or better. For optimum performance with baseband video and Digital Broadcast Systems.

- Precision 75-Ohm, heavy gauge construction. A video cable must maintain 75-Ohm impedance throughout to ensure a clear, sharp, high resolution picture without creating ghosting or phase delays.

- High conductivity and low dielectric constant. High purity metals like silver or oxygen-free copper, carefully extruded within the proper dielectrics, are important for accelerated signal transfer and greater phase accuracy, which ensure naturally vivid, accurate color.

- 24K gold plated precision connectors. A cable is only as good as its connection. Not only do 24K gold plated precision connectors ensure the best video signal transfer for enhanced video performance, but they provide a long lasting connection that won't corrode over time or become loose from fatigue.

- Durable, flexible cable jacket. A high quality cable jacket protects its contents from temperature extremes, moisture, etc., yet should be flexible for easy installation.

- For the best picture performance, don't kink, smash, or bend video cables. Sweep all bends and avoid 90-degree bends in video cables.

- Use cable clamps and corner trims to secure cable that runs along walls and around doorframes for a neat and clean installation. Avoid hard PVC-covered wire jackets that cannot be painted or stained.

- Make sure clamps and corner trim hold the cable comfortably and don't squeeze it out of shape. Never puncture the cable with nails or staples or you'll be compromising the performance.

#### **Do it Right the First Time**

Proper home theatre speaker set-up is key for the best movie and soundtrack reproduction - so why not lay it out right the first time? By properly planning the home theatre environment, following manufacturer

recommendations for speaker placement, and using the right cables, you'll maximize the home theatre experience and your clients will hear their favorite movie soundtracks the way they were meant to be heard. As

you build your client's home theatre system, you'll find that cable management and decorator friendliness will become increasingly important. Start thinking about it before you connect the system. Not only will you

create a home theatre that performs and sounds terrific, you will have one that looks great and blends in beautifully with your client's entertainment room!

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*Eric Bodley has more than twenty-five years experience in the consumer electronics industry. His firm Bodley & Associates has consulted with dozens of retail and custom installation companies on sales, management, and operational issues. In addition, Bodley is President and Founder of Home Entertainment Design, a residential custom electronics design and installation company located in Bonita Springs, Florida. A CEDIA Past President, Bodley is a guest speaker and course lecturer at many industry events for the Consumer Electronics Manufacturers Association (CEMA), the Professional Audio/Video Retailers Association (PARA), American Society of Interior Designers (ASID) and CEDIA.*

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