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Introduction

*This is the fourth **Audio Perfectionist Journal**. In the three previous issues we have discussed home audio systems from a music lover's perspective and we have talked about how the home theater phenomenon has affected high fidelity sound reproduction. In this issue we will examine home theater components and their suitability for use in a system where musical accuracy is a primary concern.*

Today, almost everybody wants a home entertainment system that can be used for more than just stereo audio reproduction. Many serious music listeners enjoy film as an art form and may occasionally want to watch music videos so they can see the musicians perform. Uncompromised stereo reproduction can peacefully coexist with surround sound for home theater if components are carefully selected with musical accuracy as the goal.

In This Issue

The article titled *The Truth About Movie Sound* describes how film soundtracks are created and lays the groundwork for a discussion of how we can best allocate resources when assembling a multipurpose audio system.

The article titled *The Truth About Surround Sound Processors* offers advice about adding surround sound capability to a stereo system without diminishing musical accuracy and without wasting money on products that can't deliver all that they promise. It describes how you can have better sound while saving bundles of money.

The article titled *The Truth About DVD Players* discusses the common desire for a universal disc player and the sonic sacrifices you'll have to accept if you use an inexpensive DVD player to play music CDs. DVD players don't all sound alike and some of the less expensive models actually sound better than those costing far more. This article offers tips on how to choose.

Multichannel amplifiers aren't just for home theater. The review of the Theta Dreadnaught Amplifier describes how I improved the sound of my system while saving $14,000 in amplifier expense. The Theta review leads to the article titled Vertical Biamplification. This article describes why biwiring and passive biamplification may improve the sound of many systems and tells how to do both.

Coming Up

This issue discusses home theater components and how they can be integrated into a stereo audio system without diminishing the fidelity that is necessary for a satisfying musical listening experience. If you're careful when selecting components and configuring an audio system for multiple purposes, you can have it all—uncompromised stereo and great surround sound.

Audio Perfectionist Journal #5 is devoted to a subject that is dear to the hearts of every audio enthusiast—loudspeakers. You'll learn about how they work and why the sound from various models differs. Most speakers can't produce an output signal that even remotely resembles the input signal and you should know why. You should also know which speakers can.

Two channels or ten—it really doesn't matter. The last component in the signal path is the loudspeaker and it's the least understood component and the one that stimulates the most controversy. All that controversy won't be eliminated by **Journal #5** but I guarantee that you will know more about speakers than most industry salespeople (and many speaker designers) after reading it. APJ

The Truth About Movie Sound

by Richard Hardesty

The truth about movie sound is that it's not exactly high fidelity sound. It doesn't contain many "real" sounds for a playback system to faithfully reproduce—most movie sounds are artificially created—and you don't need to use a high-priced array of sophisticated audio components in order to hear all there is to hear.

Movie sound can be a lot of fun as long as there is a picture to distract attention from audio fidelity, and there is no reason why we can't enjoy what it has to offer without assembling a system that sacrifices the fidelity we need for music reproduction on the altar of home theater.

Home entertainment systems that have been assembled with musical accuracy as the primary objective work just fine to reproduce the lower-quality audio available from film soundtracks on DVD, but so-called "home theater systems" often fail miserably when trying to accurately reproduce music. (See Home Theater Myths in Journal #1.) Let's start with a discussion of how film soundtracks are made.

The Movie Business

I live in Southern California where entertainment is one of our primary industries. Many of my friends and associates work in the recording and movie making businesses, and I've had the opportunity to watch most aspects of the filmmaking craft firsthand. I don't claim to be an expert on film audio but I have been present on film sets and locations, and watched as movie scenes were photographed. I have observed the post production Foley process where sound effects are created and I have seen the Automated Dialog Recording (Replacement) or "looping" procedure where the actors repeat their lines while "lip syncing" as they watch the projected film scenes. I have watched as music scores were recorded on sound stages. I have been present on dubbing stages while the sound editors have assembled these elements into the film soundtracks that you hear in the movie theater.

Film soundtracks are digitally encoded these days but they are created in much the same way that they have been for generations. While the film scenes are being shot there are microphones present but the sound captured there is seldom used in the movie. Virtually nothing is recorded in stereo except music, and virtually all sound effects, including ambient sounds around the actors, are artificial. These sounds are created by Foley artists and they are exaggerated for a heightened effect. They are called "sound effects."

Dialog

The actors pose and speak during the filming of a scene and there is a microphone on a boom above them and a sound guy is nearby with a small open reel tape recorder to capture their dialog. Planes passing overhead and the sounds from the camera equipment and film crew are generally ignored because the dialog recorded on the film set will be used only to cue the actors when they record the actual film dialog on the looping or ADR stage in post production.

Most of the dialog you hear when you watch the completed film is recorded later in a studio in a process called looping. The actors watch the projected scene and speak their lines again while trying to synchronize their words with the lip movements they see on the screen. Additional synchronization is accomplished using Automated Dialog Replacement to insert the dialog recorded in the studio into the film soundtrack. Timing is the primary concern of ADR, not fidelity.

Replacing dialog by looping allows voices to be recorded in a studio setting where background noise can be easily controlled and distracting ambient sounds can't interfere with the actors' spoken lines. The actors can speak directly into the microphone, which is impossible when filming a scene. All real environmental sound is eliminated during looping. Artificial environmental sounds are created by Foley artists on a Foley stage and added to the scene later.

The disparity between the sound of the environment shown in the film scene and the sound around the voice of the actor speaking dialog can be easily observed when watching films at home in a high-resolution home theater incorporating an accurate audio system. The actor's voice often doesn't sound like it was recorded in the environment of the scene because it wasn't. You can't hear the disparity in the movie theater but it's clearly apparent in the smaller home environment through higher-quality home speakers and electronics. At home, subtle ambient sounds are clearly audible. In the movie theater, they're not.

Sound Effects

Sound effects include more than explosions and gun shots. Virtually every sound you hear in a film scene is artificially created on the Foley stage or is assembled from bits and pieces of actual sounds captured on tape, manipulated, and archived. The sound of a passing car is seldom the sound of the car you see in the film scene. The sound of the actor's footsteps are almost never real. The sounds of dishes and silverware clinking in a restaurant scene are actually created by Foley artists in the studio. Why? To give the scene more "atmosphere."

Real footsteps aren't usually audible and people with good manners don't make nearly that much noise when they eat. These sounds are exaggerated for effect. They're called sound effects after all. There is no real-world standard for the accuracy of a sound effect. You can't compare the sound of real horse hooves to the clip-clop sound you hear on a film soundtrack because the clip-clop sounds weren't made by horses at all. They were made by Foley artists in the studio using who-knows-what to simulate the sound of horse hooves.

The sound of gun shots, bombs, and explosions of other kinds are almost always simulated. They don't try to record the sound of real guns and explosions because the simulated ones are tailored specifically for loudspeaker reproduction and sound better in a theater. If you have ever been in a real bare-knuckles fist fight, or observed one, you know that film punches and real punches sound nothing alike.

In real life a bare-knuckled blow to the face sounds nothing like the explosive crack you hear in a cowboy movie. "Real" life doesn't sound as spectular as "reel" life. Movie sounds are enhanced to add to the cinematic experience, they're not meant to sound like real sounds and you don't need a high-end audio system to reproduce them.

Music

The music score for most films is either retrieved from previously recorded material produced for commercial CDs or is recorded on a sound stage in much the same way that music recordings are made. Film music is frequently recorded in stereo or even multichannel formats. It is usually the only material used to make the film soundtrack that didn't originate as a mono signal.

Film music could sound as good as a commercial compact disc if it weren't subjected to digital compression. Unfortunately this is never the case. Today, DVDs are our only choice as a source for high quality home theater. Virtually all film sound available on DVD-video discs is compressed digital in either the Dolby Digital or DTS Digital Surround formats. Compare the sound of a well-recorded "music from the soundtrack" CD to the sound of the same music from the DVD of the film to hear what digital compression does to audio fidelity.

Assembling the Components

The various component parts of the film soundtrack are assembled in a dubbing theater by the sound engineers who make the final product from the bits and pieces that have been previously created by other artists and technicians.

Dialog from characters visible on the screen is generally dumped into the center channel only—that's why it's called the dialog channel in the movie biz. Music is usually placed in the left and right front channels and sometimes the rear channels are used for a more enveloping effect. Occasionally music is placed only in the rear. Sound effects are placed in various channels and panned between them to add a sense of spatiality and direction. Imaging between speaker pairs is not considered important because imaging is virtually impossible in a theatrical venue (see Home Theater Myths in Journal #1).

Sometimes bass is spread across several channels to increase low-frequency dynamic range but otherwise there is seldom any common information in two or more channels. That's why a center channel speaker in a home theater system, where the front three channels may be separated by less than a wavelength, should have limited low frequency response. That subject will be covered in future Journals.

Mashing the Bits

An analog (or digital) print master is created that contains the final soundtrack for the film. A print master is usually a discrete multichannel recording made on film stock that has been coated with iron oxide like a recording tape. It is similar to a multitrack master tape and offers potential fidelity that is at least equal to the quality of the bits and pieces that have been assembled into the finished soundtrack. Then comes digital compression.

Once the film soundtrack is completed it must be encoded in a compressed digital format for distribution. Dolby Digital has a compression ratio of about 12:1. That means that about 92 percent of the original recorded data is discarded during compression. Yes, you read that correctly. What you hear is about 8 percent of what was on the original print master. It is a tribute to the sophistication of Dolby's perceptual coding system that the result sounds as good as it does, but you don't need a highly sophisticated playback system to hear all there is to hear from Dolby Digital. DTS is, perhaps, a little better.

DTS Digital Surround has a higher data rate and a better system for allocating data among the various channels, but a 4:1 compression ratio is about as good as it gets under real-world conditions and the actual ratio will be higher most of the time. With a compression ratio of 4:1, three-fourths of the information on the print master is discarded and you're left with the fourth that was deemed to be most audible and necessary. DTS has a higher data rate than Dolby Digital but that can be deceiving. Because DTS is a "forward adaptive" system, lots of side-band information is transmitted along with the signal that represents the information you want to hear. Does DTS sound better than Dolby Digital?Perhaps.

Does DTS have sound quality that is equivalent to CDs? Absolutely not. (Note: The home DTS system is completely different from the one used in theatrical venues. Theatrical DTS is actually inferior to Dolby Digital in my opinion and, yes, I have heard direct, level-matched A/B blind comparisons under ideal conditions in professional circumstances. After extensive listening experience I have come to prefer Dolby Digital to DTS in my home system, too.

High-End Audio For Film Sound?

I have reviewed a large number of surround sound processors and I can tell you that, when using film sound as a source, it is often difficult to distinguish between models that vary in price by thousands of dollars. As I have stated in my equipment reviews for Widescreen Review Magazine, I use two-channel music to evaluate the audio fidelity of surround sound processors so that I can hear some substantial differences on which to report.

Here are some questions to consider. Do you need an expensive surround sound processor to reproduce film sound with as much quality as the medium has to offer? Will you get great high fidelity music performance from an expensive surround sound processor?

The answer to both questions is probably not. Let's search for the truth about surround sound processors, which is the title of the next article. APJ

The Truth About Surround Sound Processors

by Richard Hardesty

The truth about surround sound processors—or digital controllers as they are sometimes called—is that they usually aren't very good at playing music. Even the cheap ones perform quite well for movie sound but the most expensive products can't begin to equal the sound quality of good, modestly-priced stereo components.

Surround sound processors are the receivers of the new millennium. They try to include too many things in one box and end up performing a multitude of tasks poorly. The computers that actually do the digital surround sound processing are all the same and the DSP chips inside a $10,000 controller are often exactly the same as the ones you'll find inside components that sell for one tenth that amount. Let's demystify these products and then discuss how we can use them without sacrificing musical fidelity.

All Things To All People

A surround sound processor (digital controller) is a digital computer, a digital-to-analog converter and a line-stage preamplifier—all in one box. In addition to these conflicting tasks, most processors are called upon to perform other functions as well. Many include video switching, on-screen display generators, RF demodulators (for use with AC-3 laserdisc players), multi-zone outputs and accessory triggers. Some even include radio tuners.

Surround sound receivers do all the things that separate processors do and add five or six channels of amplification to the mix. What do you suppose are the chances that all these tasks can be accomplished without sonic compromise? Do we

really want digital devices that create radio frequency interference, packed inside the same box, and sharing the same power supply with our analog preamplifier? Have we forgotten all the hard-learned lessons of the past?

Too Much in One Box

In the early days of hi-fi the stereo receiver was king. These devices contained only three basic components: an AM/FM radio tuner, a preamplifier/control unit and an amplifier with just two channels. We soon learned that the performance of each of these three components could be dramatically improved by developing specialized designs on independent chassis with independent power supplies.

Separates were born and high-end audio components have been made that way ever since. When was the last time you heard an audiophile brag about a new receiver?

When home theater came along, all this progress went right out the window. Manufacturers again tried to put all the electronic components inside a single unit in order to make the complexities of home theater appear simple to a new, unsophisticated buyer. Who cares if the various tasks the product is required to perform are in direct conflict? Home theater buyers don't care about sound quality anyway, right?

The result is that many people today are listening to music through audio systems using electronic components with sound quality equivalent to early 1970s solid-state receivers and loudspeakers designed to emulate the sound of theater speaker systems designed in the '50s. Home audio fidelity has been set back about thirty years and the surround sound processor is at the heart of the problem.

Those of us who have figured out that even movie sound is more enjoyable when played through accurate speakers may still be attracted to the idea of a single front-end component that can do it all. Many expensive high-end surround sound processors claim that they offer no-compromise audio quality, but is that really possible?

Computerized Sound

Surround sound processors decode Dolby Digital, digital ProLogic, and DTS Digital Surround sources utilizing powerful digital signal processing computers (DSPs).

These DSPs run specific software to implement the various algorithms which are utilized to turn the bitstream code that comes off the DVD discs into several discrete channels of analog audio. (See my digital controller series in Widescreen Review Magazine for a detailed discussion of how they work.) A surround sound processor is much like a home computer with a sound card.

Most of us know that all the various brands of home computers use central processing unit (CPU) chips that come from the same three or four manufacturers. If you use a Macintosh computer your CPU was made by IBM or Motorola. If you use a PC from any of a dozen makers, your CPU was probably made by Intel or AMD.

All computers need an operating system of specialized software to make them function. Mac users rely on one or another version of the Mac OS and PC users have Windows. (Yes, I'm aware that this only describes 99.9 percent of home computer users, but you get the idea.)

You can go to one of the local computer-geek stores and buy a computer case with power supply, a mother board with CPU, some memory and a couple of disc drives, and assemble your own computer. It will perform just as well as a brand name product because it will use the same internal components. You'll be hard-pressed to write your own operating system, however, and you'll have to buy one from Microsoft or another software company. Computer manufacturers do the same thing. They buy mother boards, memory, drives and other components and assemble them in cases with their own brand names on the front. There is little difference between the performance of the various brands.

Guess what? Most surround sound processors are made the same way—they're built around subassemblies which are manufactured by a few companies—and it's hard to tell the difference between the sound of the various brands when listening to film sound.

Dolby Digital, digital ProLogic, and DTS surround sound processing is accomplished by digital signal processing (DSP) chips that come from Zoran, Motorola, Cirrus Logic (Crystal) or Analog Devices. Application-specific chips and dedicated software are readily available at modest cost and more powerful, general purpose DSP processors can be utilized but may require custom software.

The software that these chips use for operation is complicated and far beyond the design capabilities of most of the manufacturers who make surround sound processors. These manufacturers could hire a team of software engineers and develop their own software but it would be very difficult to recoup this investment by selling the small quantities that most home theater product manufacturers can produce and market. Fortunately there are specialized businesses that can offer design solutions specifically tailored for surround sound processing. That way the enormous development costs can be shared by the many companies who make finished products.

Just as computer manufacturers buy chips from Intel and operating systems from Microsoft, many surround sound processor manufacturers buy "solutions," which are hardware and software packages designed to perform surround sound decoding. These digital solutions, or surround sound decoding engines, come from specialized companies like Analog Devices, Sample Rate Systems, and Momentum Data Systems. These companies package the DSP chips, the software to make the DSP chips work and the circuit boards needed to contain the support electronics.

The companies that offer solution products can provide various levels of product from simple digital processing circuit boards to complete, ready-to-sell surround sound processors that are styled and branded for individual manufacturers. Sample Rate Systems of Finland, for example, manufactures many different surround sound processors for OEM resale. These are sold under many different brand names, but there is often little or no difference between the components inside. Is it surprising that there is little or no audible difference between many different brands of surround sound processor?

Creating Analog Signals You Can Hear

DSP computers process data according to algorithms licensed by technology developers such as Dolby and DTS. There is virtually no difference in the digital-domain signals that are reconstructed by the various DSP devices from the bitstream that comes from the DVD disc. A bitstream encoded in Dolby Digital will be decoded exactly as Dolby prescribes or your product won't get a license from Dolby. From this point on in the signal path, manufacturers have some leeway to differentiate their products and differences in sound can be observed.

After the signals are reconstructed into discrete samples of multichannel digital data, that data must be converted into analog for reproduction. During the D-to-A conversion process and after the signal enters the analog domain the traditional rules for fidelity apply. Two surround sound processors using identical DSPs can sound completely different if they utilize different digital-to-analog converters to create the analog signal.

Power supply quality makes a big difference, too, as does the signal-to-noise ratio of the entire device. S/N ratio will be negatively impacted by the non-analog circuitry that is jammed into the same box, especially if this circuitry shares a common power supply with the analog components.

What Makes an Audible Difference?

The quality of the digital-to-analog converters, the component quality of the analog circuitry and the quality of the power supply are the three parts of a surround sound processor that determine, to a great extent, how it will compare sonically to others of its ilk.

You may still struggle to hear differences when listening to film sound because of the limitations of that medium described earlier. Music is a different story. The power supply and line stage analog circuitry are also used to reproduce analog music sources and the DACs may be utilized as well, if you use a CD or DVD player as a transport rather than a player, to provide a digital signal to the processor.

Should we mortgage the house in order to buy the best surround sound processor on the market so that we can also enjoy music with high fidelity sound? Is there an alternative that might allow us to continue to use the stereo audio components that we already own while adding surround sound capability for film viewing?

Advice

I have an analog turntable and phono preamp, a Wadia 860 CD player and an Audio Research line stage preamplifier for music listening. I have a CAL CL2500 DVD player, a Pioneer CLD99 laserdisc player and a CAL CL2500SSP digital controller for surround sound listening. I use the same amplifiers and speakers for both and switch the interconnect cables for the front left and right channels from the ARC preamp to the CAL controller when switching from stereo to surround sound listening. I could

wire the front channel outputs from the CAL controller through the pass-through connections (provided for that purpose) of the ARC preamp but it's easier for me just to switch cables because I'm constantly changing components as I review products and I have my stereo components and surround sound components on separate racks. I have no-compromise sound for both stereo music listening and surround sound home theater use.

[These components and the methods I use to allow surround sound listening wihout sacrificing musical fidelity have changed a lot since this was written in 2000. I no longer switch cables and have the front channels from my surround processor routed through my audio preamp's analog pass-through inputs. See **Audio Perfectionist Journals 9-12** for new information about these subjects.]

No DVD player I've heard comes close to equaling the sound from the Wadia CD player, and no surround sound processor can rival the sound from the ARC preamp. I use redundant components to achieve the sound quality that I require, but what if you can't afford that expense or don't want that hassle?

The ideal solution would be for component manufacturers to offer separate audio components for both high fidelity stereo and home theater use so we could mix and match to suit our specific purposes, but no manufacturer does right now.

Today, we must choose between an expensive surround sound processor which will still provide compromised musical performance, and expensive stereo components that can't do surround sound processing, or use a redundant combination of less expensive versions of both. [This is still the case in 2004.]

Choosing a Surround Sound Processor

If you decide to use a surround sound processor as a music preamplifier, choose very carefully or you'll be limited to mid-fi sound no matter how good the rest of your components are. Be prepared to spend at least $5,000 and to accept compromised music performance, or consider other alternatives.

Look for processors that perform the fewest functions. Built-in video switching, for example, almost always compromises picture quality and will degrade audio performance. If you have many video sources buy a professional video switcher from a manufacturer like Extron. You'll get better pictures and save money, and you won't corrupt your audio signal with noisy video signals sharing the chassis with your analog preamp. Don't buy a processor without true analog pass-through. If the processor digitizes all analog signals (most do) you can't upgrade to a better quality source like a high-end CD player, outboard DAC or SACD player. A processor that digitizes analog signals will convert the higher quality analog signal available from these devices to digital at low resolution, eliminating any sonic advantage.

Look for high quality, linear (multibit) DACs. Processors that use sigma/delta (1-bit) DACs cannot offer the resolution necessary for high-end audio reproduction. For example, the AKM sigma/delta DACs in the $6,000 Lexicon MC-1 processor offer audio performance equivalent to a $400 CD player and are clearly inferior to the Burr-Brown 1704 linear DACs found in the Denon DVD player that costs less than $1,000.

[In 2004 some of the best available DACs combine multibit and Sigma/Delta operation. See **AP Journal #9** for more information about this subject.]

A really good processor should have at least two power supplies and two power transformers to provide isolated power to analog and digital circuits. You can tell a lot about power supply quality by the weight of the product. The ten pound Lexicon doesn't have a very good power supply. The CAL CL2500 SSP has an all-aluminum chassis and cover and still weighs two and a half times as much. The CAL has excellent power supplies.

The Theta Casablanca (not the Casanova, which I don't recommend) with DAC upgrade and the California Audio Labs CL2500SSP digital controllers deliver sound quality that will satisfy most listeners and the Proceed AVP is very good, too. These three products are quite expensive. A good outboard DAC and line stage preamp from Rotel or Parasound will outperform most of the others for music and cost far less.

[See **Audio Perfectionist Journal #10** for direct comparisons of various line stage preamplifiers and the latest Theta Casablanca, used as a DAC/processor and as an analog line stage.]

Inexpensive surround sound processors, like the models from Sherwood and Marantz, do an excellent job on film sound and use the same DSP chips found in very expensive products like

the ADA Cinema Reference and the Lexicon MC-1 (both of which cost a lot and do a poor job of reproducing music). A $1,000 surround sound processor combined with a good $1,500 line stage preamplifier will sound better than most $6,000 digital controllers for music listening, if you choose a good DVD player with linear, multi-bit DACs and use the analog outputs for music listening. We'll talk about DVD players in the next article.

[See the previous note about the latest changes in DACs and read **Audio Perfectionist Journal #9** for more information about this subject. Read **Audio Perfectionist Journal #10** for the latest information about preamplifiers and surround sound processors and instructions about how to assemble a no-compromise audio system and use it to reproduce the front two channels of a surround sound system.] APJ

The Truth About DVD Players

by Richard Hardesty

The truth about DVD players is that most of them perform poorly as high fidelity CD players. Nearly all DVD players have both digital and analog outputs so the audio signal can be routed two different ways: The signal can be sent to a surround sound processor or receiver in the digital domain with a digital connection; or the signal can be sent to a stereo preamplifier or receiver in the analog domain using analog connections.

Many manufacturers consider a DVD player to be a home theater component and include audio DACs and analog outputs only as an afterthought. Why offer high quality analog stages to consumers who will be using only the digital output from the DVD player to connect to a surround sound processor or receiver?

Some DVD players may, however, perform acceptably as a CD transport if you understand how to choose and use the right model, and if you utilize a high quality, outboard digital-to-analog converter or feed the digital signal to a digital controller that contains high quality DACs. Here is some important information that you should know before investing in a DVD Player.

Player or Transport?

The word "player" is commonly used to describe a unit that offers all the components necessary for disc playback except amplification. A DVD player has digital-to-analog conversion components on board and offers a stereo analog audio output signal that needs only additional amplification for listening. A player may optionally contain the DSP processors necessary to decode Dolby Digital and DTS bitstreams into 5.1-channel analog audio signals. A player with built-in Dolby Digital and DTS processing includes six channels of analog-to-digital conversion.

A DVD transport, on the other hand, contains only the mechanical disc drive unit and the electronic components that are needed to make this mechanism work, plus video circuitry. A transport has no analog audio outputs and the signal available from the digital audio output needs to be converted to analog by another separate component—either a stand-alone DAC or a surround sound receiver or digital controller with internal digital-to-analog conversion. These distinctions refer to the audio portion of DVD components only. Video is different.

All current DVD players and transports are complete players for video. All current units convert digital video signals to analog internally and output an analog video signal that is ready for display. In the near future there will be DVD players that output a digital video signal but that is a whole 'nother bucket of worms and not a subject for a **Journal** called **Audio Perfectionist**.

A DVD player can be used as a transport by ignoring the analog audio outputs, but don't make the mistake of thinking that all transports sound alike. You can improve the sound of most DVD players by improving the quality of digital-to-analog conversion but a better quality transport will still sound better than a plastic, mass-market wonder from your local chain store.

DVD versus CD

You'll need a DVD player if you want to watch movies at home with high quality pictures and sound. DVD players also play audio CDs so you might assume that any DVD player could serve as a source for high quality music playback as well as the source for a home theater system. Unless you're very careful when you choose a player, you may be very disappointed when listening to music. Most lower priced DVD players sound worse than inexpensive CD players and there are several good reasons why.

DVD players are far more complex than CD players yet they cost little or no more. Corners have to be cut to keep prices down. Most inexpensive DVD players use cheap switching power supplies and low quality sigma/delta (1-bit) digital-to-analog converters for the audio signal. Most inexpensive DVD players are made primarily of plastic which provides little mechanical isolation for the sensitive transport mechanism. Video and digital control circuits in DVD players create noise, which degrades signal-to-noise ratio, reducing the performance potential of the audio section.

Complexity

CD players read the disc with a laser and convert the digital data to analog signals. This is not a simple task but it's far less complicated than what DVD players must do.

DVD players must be capable of reading two completely different disc types with different pit sizes, pitch and rotational speed. This requires two lasers with different focal lengths or a single laser with variable focus, and a more complex transport mechanism in either case. The player must be able to identify the disc type and if the disc is a DVD the digital data must be separated into audio and video information. MPEG video and LPCM audio data must be decoded and converted to analog for output. Dolby Digital, DTS, and MPEG audio bitstreams must be identified and passed to the digital audio outputs or decoded by internal DSP processors and converted to multichannel analog signals. Just a few years ago, describing a device that could perform all these complex tasks would have sounded like science fiction but, amazingly, the system works. How well it all works depends on the quality of the player.

Power Supplies

The video circuitry in a DVD player, including the MPEG video decoder, output format processor, and video DAC, uses lots of power compared to simpler CD players which contain none of these components. A DVD player requires much more power to operate and that means a bigger, more costly power supply. To minimize size, weight and cost, most manufacturers resort to inexpensive, but (usually) inferior, switching power supplies.

Complex video and digital control circuits often share a common power supply with the analog circuits. That raises the noise floor and degrades the audio signal. Separate power supplies for analog and digital/video circuits may improve the situation but are not a guarantee of better performance. I just reviewed a Technics DVD-Audio/Video player that was one of the worst-sounding players I've ever heard and it had dual power supplies. (It's the Technics DVD-A10 and I strongly advise that you not buy one.)

Video Circuits

Retrieving and processing the video data on a DVD disc requires complicated digital and analog circuitry and high bandwidth (at least 27MHz) video D-to-A converters. The video data that comes off the disc is compressed and unformatted. The information must be processed by an MPEG decoder to reassemble the compressed picture data and then formatted into a signal such as NTSC or PAL that can be displayed on a video monitor. The digital video signal must be converted to analog in the player.

All this video processing requires complex circuitry. Large scale integrated circuits are employed but they use lots of power and

make lots of noise at radio frequencies. High quality DVD players will utilize separate, linear power supplies and may provide separate, isolated circuit boards to keep the video circuitry from polluting the audio signal. Inexpensive players will lump everything together and power all circuits from a common supply.

Flimsy Construction

Inexpensive DVD players are constructed almost entirely of plastic. Vibration caused by loud audio signals can interfere with the retrieval of the microscopic information encoded on the disc. Error correction circuitry interpolates missing data but the more the error correction circuitry is triggered, the worse the sound.

Better DVD players are robustly built in order to provide mechanical and electrical isolation from the environment. Better players are heavier because of sturdier construction and the use of better power supplies. Better power supplies use bigger, heavier transformers and often more than one is used.

DACs

The most important reason that many DVD players sound bad when playing music CDs is the poor quality of audio digital-to-analog conversion. Many manufacturers believe that only entry-level buyers will use the analog outputs and quality-oriented buyers will use the digital output to connect to a surround sound processor or receiver. DVD players are perceived as home theater components after all. Analog outputs are included as an add-on convenience for use by the customer who hasn't yet upgraded to a surround sound receiver and little concern for sound quality is exhibited in most cases.

You'll commonly find sigma/delta (1-bit) DACs, like the ones used in $99 CD players, in DVD players costing as much as $1,200 or more. The $2,700 McIntosh DVD player uses sigma/delta DACs with cheap integrated digital filters, for instance. These cheap DACs will provide poor audio performance (from the analog outputs) regardless of the quality of the rest of the components in the player.

Of course you'll only be using the DACs in the DVD player if you use the analog audio outputs to get the signal from the player to your preamp or receiver. If you connect the player to a digital controller (surround sound processor) or receiver using the digital output, the internal DACs in the player become irrelevant.

Exceptions

There are exceptions to the general statements made in the preceding paragraphs. Denon makes a DVD player that sells for under $1,000 that has dual power supplies and utilizes Burr-Brown 1704 linear multibit audio DACs with proprietary digital filters. It's the DVM-3700 and it actually sounds quite good. On the other hand, the outstanding California Audio Labs CL 2500 DVD has 1-bit Pacific Microsonic DACs and the Theta DaVid DVD player has no DACs at all. These high-end DVD players are designed for use with external DACs or high-end digital controllers like the ones their manufacturers make. Both are outstanding products when used as DVD transports with digital connection.

If you want to use a DVD player as a CD transport you can always utilize an outboard digital-to-analog converter. An inexpensive Toshiba DVD player running through a Theta Gen 5 DAC sounds pretty good. It won't deliver sound that is the equal of what you'd get from a higher quality transport but it will cost a lot less money. If you use your DVD player as a transport and connect it via the digital output to a high-quality digital controller (surround sound processor) that uses high quality audio DACs, you can expect good performance from modestly priced players and better performance from more sophisticated designs.

What to Look For

Even the least expensive DVD players will produce an outstanding video picture that is good enough for all but the most dedicated videophiles using the very best displays. Those who own video displays with component-video inputs will want a player with component-video outputs. People with large screen, front-projection televisions will want to invest in a higher quality DVD player to get that last bit of video quality that the best players can provide. You'll want a player with progressive scan capability or a separate line doubler or video scaler if you have a video display that can accept line doubled signals. The ability of a DVD player to deliver high quality audio from music CDs will vary quite a bit from model to model, and there are clues available from the spec sheet to help you gauge that potential.

If you are shopping for a DVD player and music is important to you, here are some tips. Don't buy a cheap Toshiba or Panasonic player and expect to get good performance from music CDs. Look for players with dual power supplies and metal chassis. If you are going to use the player with a stereo

preamplifier or receiver, look for linear (multibit) audio DACs. Or invest in a high-end CD player along with an inexpensive DVD player and get the best possible music performance.

If you are concerned about the best video performance, buy a Pioneer Elite DV-09, or DV-05, or the CAL CL2500 DVD, or one of the excellent Theta DVD players. These machines will offer the very best picture quality along with excellent sound capability. Do they sound as good as a high-end CD player? Sorry, no.

The best overall product I've seen as of right now is the CAL CL 2500 DVD. (See my review in *Widescreen Review*.) It costs about $2,500.

[Since this article was written things have changed a great deal. Some of this information is dated and some is no longer applicable. There is good news for consumers—you can get much more performance for much less money today. In fact, it will be difficult to find a bad DVD player, even if you buy the least expensive model avaliable.

Digital video displays now dominate the market and displays based on the cathode ray tube (CRT) are virtually obsolete. CRT displays used analog signals and created an image using a scanning electron beam to excite phosphors on the face of a vacuum tube. Early DVD players converted the digital signal on the DVD disc to analog for output to the video display. That's history.

Displays based on LCD and DLP devices are pixel-addressed—they need digital signals and convert analog signals to digital for display. You'll get the best performance from disc players that have digital video outputs which eliminate the conversion from digital to analog and back to digital. Why not feed the digital signal from the DVD disc directly to the digital video display?.

The **Audio Perfectionist Journal** does not attempt to provide definitive video information. Readers are advised to seek other sources of information to learn about the latest developments in video. Read **Journal #9** for additional information about digital audio.] APJ

Theta Dreadnaught Amplifier

Review by Richard Hardesty

I have reviewed more than fifty amplifiers for Widescreen Review Magazine and I recently stumbled on a real gem that you should know about. Adding two of these amplifiers and changing my system to a vertical biamp configuration has greatly improved the sound in my home while reducing the cost of amplification by thousands of dollars (about $14,000 actually). The product I'm talking about is the Theta Dreadnaught and it might be the ideal amplifier for you, too.

The Theta Dreadnaught is a modular amplifier that can be configured with two to five channels, each capable of delivering more than 200 watts into 8Ω. Stereo amplifier modules are also available that provide half the power output per channel but increase the potential total number of channels to ten. Mono and stereo modules can be mixed. The amplifier can be field upgraded to add additional channels up to a maximum capacity of five modules.

The fact that the Dreadnaught can be configured as a multichannel amplifier is insignificant. It is, perhaps, the best solid-state amplifier that I've ever heard and it is, in my opinion, the best value in high-end amplifiers available today. Let me make this point perfectly clear: this isn't a less expensive amplifier that offers performance rivaling the costly offerings from Krell, Levinson and others—the Dreadnaught is a less expensive amplifier that simply embarrasses most higher priced products. I replaced the $25,000 worth of prestige amplification that I was using with two Dreadnaught amplifiers that sell for a little over $5,000 each and improved the sound of my system substantially.

Impeccable Credentials

The Dreadnaught amplifier was conceived by Theta's founder Neil Sinclair, who has been in the audio business almost as long as I have. Neil knows good sound and he knows who to turn to for designs that sound good. He enlisted two of the best amplifier designers in the industry to create a multichannel amplifier that could compete sonically with the very best, cost-no-object mono and stereo designs.

The amplifier he envisioned would have modular construction so that it could offer ultrahigh-end sound quality in a broad variety of stereo or multichannel systems. It would sell for much less than the prestige brands and sound better.

The original circuit designs were created by Charles Hansen of Ayre Acoustics. Charlie is renown for the standard-setting Ayre brand electronic components that his company makes in Bolder, Colorado, and he designed the original Avalon speakers. Hansen's initial circuit designs were massaged and refined by Theta's own David Reich, who also did the production design, making the amplifier a functional reality. Dave is also highly regarded by those of us who can hear because he has been responsible for some outstanding amplifiers from McCormack and Classé Audio.

These talented and creative designers were constrained somewhat by a target price that was well below the cost-per-channel that the prestige manufacturers like Levinson and Krell demand for ultimate-performance amplifiers. This turned out to be a bonus for those of us who have to write checks for audio equipment.

The goal of producing a multichannel amplifier with outstanding sound quality, a reasonable price tag and a modular design that could be upgraded in the field demanded the use of simple circuitry with short signal paths. By incorporating innovative design features, this team produced an amplifier that could provide higher sound quality without excessive complexity.

Refined Design

The Theta amplifier can be ordered with two to five channels of 200-watt amplification. Amplifier modules can be installed in the field so that two-channel amplifiers can become three- or four- or five-channel amplifiers as the need arises. Stereo modules with 100 watts per channel power output are also available to increase the total number of channels possible, but these will be of less interest to purists. Mono and stereo modules can be mixed. Each module is a densely-packed, complete amplifier that includes all components except a power transformer.

The main Dreadnaught chassis which accepts the individual amplifier modules contains a huge 2.2kVA E/I core transformer that is shared by the number of amplifier channels that are installed. This transformer is more than sufficient for continuous five-channel operation at up to 400 watts per channel into 4Ω and provides over capacity if fewer channels are employed.

Each amplifier module has its own rectifier bridge and 40,000μF of capacitance mounted very close to the output devices. These modules are a balanced bridge configuration and they operate in differential mode from input to output. One of the major advantages of this design is that the signal ground and the chassis ground are not common. Even the single-ended inputs route the signal ground to one side of the differential path and not to chassis ground. I believe that this is a very important aspect of a design that delivers such high sound quality.

The input stage of each amplifier module uses four JFET devices in a differential topology. The input stages are directly coupled to the MOSFET driver stages, which operate with fully regulated power. The output stage of each amplifier module contains sixteen bipolar transistors to deliver high current on demand and to achieve low output impedance for good damping without relying on the use of negative feedback. These output devices have a total rated capacity of 256 amps/3,200 watts.

Based on my listening experience with this and other amplifiers using similar components, I think that this choice of devices—JFET inputs, MOSFET drivers, and bipolar outputs—provides the best combination of accuracy and musical sound possible from solid-state amplifiers. I also believe that the extremely short signal paths are significant to the production of outstanding sound quality that I hear from this amplifier.

No global feedback is used in the Dreadnaught amplifier. Feedback causes "time smear" and transient intermodulation distortion and most experienced listeners agree that less feedback sounds better. None is better yet, in my opinion, so long as the amplifier can be made stable without it. I have been using Dreadnaught amplifiers in my review system for about six months and I can assure you that they appear to be absolutely stable regardless of the load.

The construction quality of the Theta amplifier is exemplary. All the top names in component parts are in evidence inside the Dreadnaught. WIMA polypropylene capacitors are used exclusively in the signal path and for power supply bypass. Nichicon electrolytic caps are used for power supply filtering. Circuit boards and other components are of the highest quality. These amplifiers are elegantly designed and beautifully made.

Physical beauty is in the eye of the beholder, of course, but I think the Theta Dreadnaught amplifiers are great looking. Mine are silver (Theta calls it platinum) with the panel-grade covers. A beautiful black finish is also available.

Comparisons

I had been using two Mark Levinson #33H mono amplifiers to drive my front left and right speakers for stereo music listening, and adding a Proceed HPA-3 amplifier to drive my center channel and surround speakers for home theater use. These three amplifiers have a combined retail cost of $25,000. I replaced the three Madrigal amplifiers with a single, five-channel Theta Dreadnaught amplifier for the initial product review and the sound of the system improved so much that I was dumfounded. Adding another Dreadnaught and "vertically" biamping my main speakers provided additional incremental improvement. These are strong statements that require a lot of explanation.

As stated in the introduction to this review, I have reviewed more than fifty amplifiers for Widescreen Review and listened to countless others. The Madrigal amplifiers, both the Proceed brand and those branded Mark Levinson, had consistently outperformed competing solid-state designs from other manufacturers. Strong points of both the Proceed and Levinson amplifiers include especially good bass control and impact, along with outstanding imaging and detail resolution.

The #33H monos were the imaging champs in my experience, with the Proceed HPA-3 running a close second—until I heard the Dreadnaught. The Levinson amps resolved micro detail better than others and produced a more three-dimensional, palpable image than what competing amplifiers could offer. The sound was always smooth and musical, of course. The Theta amplifier sounds even more natural and images better.

The Mark Levinson #33H monoblocks are a textbook example of reference-quality solid-state amplifier design. They are balanced from input to output, massively overbuilt, and feature built-in power regeneration. They take command of a loudspeaker like no amplifiers I've heard and provide bass control and impact that is unrivaled in my experience. But they never quite grabbed me emotionally. I was always looking for an emotional attachment to the music that I just couldn't find. No specific shortcomings could be identified. The "goose-bump factor" wasn't completely missing—there was simply a diminished emotional response to music that I couldn't write off to aging (mine, not the amplifiers').

I was a Levinson dealer for many years and was always impressed with the quality of their products. While I was a devoted tube fan then, the Levinson 20.5 monoblocks that I sold in the late 1980s and early 1990s were seductive amplifiers and were the best-sounding solid state-amps that I'd heard at that time. The 20.5s did not impede my emotional response to music a decade ago and I thoroughly enjoyed listening to them. The 33Hs were supposed to be an improvement.

The Levinson 33H mono amplifiers are an incredible design exercise. They are quite unique and offer every conceivable engineering effort to maximize the quality of the audio signal. The complexity of the design—they contain more parts than any amplifier I've ever seen—may be their undoing. I tried to like them, but my response was always lukewarm. Maybe the 33Hs are simply "too accurate," I thought. Maybe I'll have to go back to tubes to get that old feeling of musical satisfaction.

Other solid-state amplifiers couldn't measure up objectively and none sounded better to me in direct comparisons until the Theta came along. Still, something was missing with the 33Hs and I was always vaguely aware of it. After listening to the Dreadnaught for a week I knew I could never go back.

The Levinson 33H amplifiers are impeccably built and they sound very, very good. The pair of four-channel Dreadnaughts that I used to replace them sound better and give me the musical satisfaction that I had been missing.

Theta Sound

A single Dreadnaught resolves more detail, produces a more layered, three-dimensional image and a more natural, musical sound overall than the pair of 33Hs. The Theta can't control the speakers quite like the Levinsons and it can't quite equal their bass impact and slam.

In my system, I high-pass the main amplifiers and use subwoofers for impact and bass anyway so these characteristics were of little concern to me. The Levinsons cost $10,000 per channel and the Theta costs $3,500 for a stereo amp and less than $1,000 for each additional channel. This reduced per-channel cost allows me to use more channels to passively biamp my main speakers (as described in the next article) and improve sound quality even more.

I decided to use two four-channel Dreadnaughts to provide power for both my stereo system and my home theater system.

I utilize two channels in each amp to drive each of my main stereo speakers in a vertical (passive) biamp configuration, and the remaining two channels in each amplifier to drive my center front, center rear (used for review purposes only) and surround channels for home theater. Eight channels of amplification from Theta, with a total cost of less than $11,000, replaced five channels from Madrigal with a total cost of $25,000, and the sound is far better now.

Caution

The Theta Dreadnaught amplifier has an unusually long break-in period. Most amps sound bright and hard until they warm up. The Theta is different. It sounds soft and slightly veiled at first. It requires at least a week of nearly constant use before the sound opens up and begins to bloom. The sound continues to improve long after that first week is over.

Don't do any critical listening to a new Theta amplifier. If your dealer just received a new amp, let it play in the store for a week or two before you evaluate it. If you take a demo amplifier home to audition, make sure the amplifier has been used for at least a couple of weeks and let it play overnight before listening. Otherwise you may never hear what it's capable of. Many reviewers never have.

Loan or Own?

This was a very tough decision for me. You see, the Madrigal amplifiers (Levinson 33Hs and Proceed HPA-3) were on "long-term loan" and cost me nothing. Theta is a small company and can't afford to give equipment to reviewers for an indefinite period. I enjoyed listening to the Theta amplifiers so much more that I decided to bite the bullet and buy two of them.

I have purchased two Theta Dreadnaught four-channel amplifiers to drive my main reference system and I couldn't be happier. The amplifiers sound better than what I was using previously and I have passively biamped my main speakers for additional performance benefits. I'm going to tell you all about that next. APJ

Vertical Biamplification

by Richard Hardesty

Why would anyone want to use two amplifiers to drive one speaker? Why do some speakers have connections for two sets of speaker cables? Is this just a scheme to sell more cables and amplifiers or can real performance benefits be realized by biwiring and biamplification?

While there is some disagreement about these issues, I'm convinced that substantial sonic benefits can be gained by biwiring and biamping and I do both. If you count the subwoofers, my stereo speakers are actually triamplified. There are three separate amplifiers used to drive different portions of the frequency spectrum produced by each speaker. This is not done to eliminate the passive crossover networks which are necessary to provide time- and phase-accuracy and linear frequency responce.

There is a separate high-powered amplifier in my left subwoofer that provides the high current necessary to reproduce the deep bass range of frequencies for the left channel. I have an individual amplifier channel devoted to the woofer section of the left stereo speaker and this amplifier is connected to that speaker with a dedicated speaker cable that conducts only low frequency energy. There is a separate amplifier channel dedicated to the midrange/treble sections of the left speaker and this amplifier is connected to the speaker with a dedicated speaker cable that conducts only the delicate midrange and treble portions of the audio signal. All this is duplicated on the right side. Six separate amplifier channels power the front stereo speaker system in my home. This may sound complicated and expensive, but it provides better sound. This article offers a simple explanation of why the cost and complexity are justified.

Modest Range, Big Ratio

The range of human hearing starts at about 20Hz (twenty cycles per second) and extends to about 20,000Hz (twenty thousand cycles per second). The ratio of these frequencies is 1,000:1. While the range of frequencies is not huge, the ratio of lowest to highest frequencies is enormous.

The energy demand slope across this range is tilted steeply up at the lower end. Lots of energy is required to produce lower frequencies. Less energy but greater delicacy is required to reproduce the midrage and treble frequencies.
The bass region in music places the highest power demands

on amplifiers and speakers, while the delicate treble range consists mostly of harmonics that are lower in amplitude than the fundamental tones and require far less power for reproduction. These subtle high frequency sounds may require less power but they are still very important for accurate reproduction. High frequencies must be reproduced without being corrupted or obscured. Midrange tones require less energy to produce than bass, but the ear is most sensitive in this range. Finesse is the key word for accurate midrange reproduction and this is the region where most of the "detail" resides.

Loudspeaker systems separate the range of human hearing into registers that are reproduced by specialized drivers. Subwoofers play the lowest tones and subharmonics. Woofers handle most of the bass and lower midrange. Midrange drivers reproduce the majority of fundamental tones above the bass region, and tweeters handle the upper harmonics. Subwoofers and woofers require the most power. Midranges require less power, and tweeters require the least.

While speakers divide up the work, most people expect amplifiers and speaker cables to handle all frequencies at once with equal proficiency. One amplifier channel and a single speaker cable per speaker may perform acceptably in modest systems, but sonic improvements can be had by dividing up the work in cables and amplifiers, too. That's what biwiring and biamping do.

Biwiring utilizes one speaker cable to deliver the high current necessary for bass frequencies and a separate cable to deliver the subtle, lower level mid- and high frequency content. This prevents the high energy bass signal from corrupting the delicate midrange and treble information. Biamping goes a step further by providing a dedicated amplifier for lows and a dedicated amplifier for mids and highs. Sound complicated? It's really not that difficult to do as we'll see.

Biwired Speakers

Many speakers have two sets of inputs to allow biwiring. One set of inputs is connected to the low frequency section of the crossover inside the speaker and the other set is connected to the high frequency section. A speaker that is not designed for biwiring has both high- and low-pass sections of the crossover connected together inside the enclosure. A speaker that is designed for biwiring does not.

The low and high frequency sections of the speaker are not connected together inside the speaker cabinet of a biwirable speaker and, if a single speaker cable is used between the speaker and the amplifier, the two sets of input connectors must be connected together with a jumper. The purpose of all this is to allow the use of dual speaker cables, commonly called biwiring, which can provide an audible improvement in sound quality.

The low frequency cable provides a low impedance path for low frequencies only, because it is connected to the speaker's internal low-pass filter which presents a higher impedance to frequencies above the crossover point. The high frequency cable is connected to the speaker's internal high-pass filter and this cable provides a low impedance path for high frequencies only.

Both cables are connected together at the amplifier end, in parallel. High current, low frequency energy will take the path of least resistance and travel down the low frequency cable, and lower level midrange and treble energy will have a dedicated cable for conduction where subtle details cannot be corrupted by the high level, high current bass information.

Most speakers that allow biwiring divide the signal between bass and midrange/high frequencies, but some speakers combine the bass and midrange and provide separate connections for the tweeter section. Some speakers can be triwired with separate connections for each drive element. I've had the best results using speakers that provide just two connections which separate the bass from the rest of the spectrum.

Biwiring can provide much of the sonic benefit of biamping at lower cost but there are some caveats. A time- and phase-accurate speaker can be upset by cables with different propagation speed, or differences in inductive and capacitive reactance. Based on my own experience I would recommend that each cable in a biwired set be identical in design and length. Cable quality will still be a factor. A single, higher quality cable may sound better than two lower quality cables used in a biwire configuration. Don't expect to get better sound by doubling-up lower quality cables rather than using a single higher quality wire.

Biwiring divides the frequency spectrum into two sections—high-energy low frequency, and low-energy high frequency—and provides a separate path to the speaker for each range. Biamplification extends this division of work by providing a separate amplifier, as well as a separate cable, for each section of the spectrum.

Biamplification

Using separate amplifiers to drive the high frequency and low frequency sections of a pair of speakers is called biamplification. Commercial installations, like those in movie theaters, use active crossover filters before the amplifiers to minimize insertion loss and may use larger amplifiers for bass and smaller amplifiers for treble. Since the signal has been separated into high and low frequency portions before amplification, the amplifiers are connected directly to the speaker drive elements without additional filtering. These methods offer no advantage for home high fidelity. In fact, a well designed loudspeaker may sound significantly worse if you bypass the internal crossover network and use dissimilar amplifiers to drive the high frequency and low frequency sections of the speaker.

As you'll read in the next issue of the **AP Journal,** a properly designed loudspeaker will have a sophisticated crossover network that tailors the response of each drive element in both amplitude and phase in order to accurately replicate the input signal. Unless an external crossover is an integral part of the speaker design, there is little hope for high-end performance by bypassing the internal crossover in a well designed speaker. What works well in a PA system won't work worth a darn in a high-end audio system.

Time- and phase-accurate speakers will be particularly sensitive to the transfer functions of the amplifiers used to drive them and using dissimilar amplifiers for bass and treble usually will not be successful. While a tube amp may offer better midrange performance and a solid-state amp with lots of feedback may provide better bass, this combination will seldom work to drive the low and high frequency sections of a speaker that is time- and phase-correct. That's where vertical (or passive) biamping comes in.

The term "vertical biamping" was coined to describe a biamp configuration where one channel of a stereo amplifier drives the bass section of a single loudspeaker and the other channel drives the treble section of the same speaker, as opposed to the commercial biamp configuration where one channel of a stereo amplifier would drive the bass section of the left speaker and the other channel would drive the bass section of the right speaker, and another amplifier would drive the treble sections of these same speakers.
Passive biamplification means that an electronic crossover in not used and the signal is devided into frequency bands by the passive crossover within the speaker. This allows the passive crossover network to perform its job of equalizing the response of individual drive elements and correcting for phase anomolies.

You can drive a pair of time- and phase-accurate, biwireable speakers with two stereo amplifiers—one amp per speaker—and get a substantial performance boost. Conventional speakers can also benefit from biamping if they provide separate connections for bass and midrange/tweeter sections.

One channel of the left stereo amp drives the bass section of the left speaker and the other channel of the same amplifier drives the treble section of the left speaker. One channel of the right stereo amp drives the bass section of the right speaker and the other channel drives the treble section of that speaker. No external crossover is required and the internal crossover network in each speaker is still utilized. The advantages are many.

The heavy current demands of the bass sections of each speaker can now be shared by two amplifiers and two power supplies. Each midrange/tweeter section will now have a dedicated amplifier channel. This will reduce crosstalk for better imaging and provide a substantial increase in dynamic range while minimizing the potential for speaker damage caused by amplifier clipping. If the bass amplifier clips it won't deliver high energy, high frequency distortion to the tweeters—the primary cause of speaker failure.

High-end multichannel amplifiers like the Theta Dreadnaught make vertical biamp configurations even easier. A single four-channel amplifier can vertically biamp a pair of stereo speakers. A five-channel amp can biamp a pair of stereo speakers and provide power for a center channel speaker.

What I've Done

I use my audio system to listen to stereo music and to provide surround sound audio for film and music video viewing. This same system does triple duty as a work tool which I use to evaluate the sound of audio components for my magazine reviews. I have my stereo source components set up in a rack at the left side of the room and my surround sound source components set up in a rack at the right side of the room. I utilize the same amplifiers and speakers for both stereo and surround sound listening.

I have two Theta Dreadnaught amplifiers, each configured with four channels. These amplifiers are positioned close to my stereo speakers to minimize cable runs to the most important speakers.

The amplifier on the left has two channels devoted to driving my left stereo speaker and two channels connected to my center and left surround speakers. (The Theta amplifier has front panel switches to place surround channels in standby for stereo listening.) The amplifier on the right has two channels devoted to the right stereo speaker and the other two channels connected to my right surround and center rear speaker. (No, I don't think the center rear improves the sound but I have to have one because I work for a home theater magazine and must review Surround EX products.)

I am currently using passive high-pass filters only on the channels that drive the bass sections of my speakers and running the treble sections "straight in." I have not yet decided if this is the best possible course of action but I'll tell you all about it when I do.

My system illustrates one way in which multichannel amplifiers can be used to improve the sound of stereo systems and to provide amplification for additional channels for surround sound use. There are many other possible combinations and you might find another configuration better suited to your needs. A five-channel amp could provide power for a biamplified pair of stereo speakers and a center channel speaker, for instance, allowing the use of a less expensive stereo amp to provide power for the less-critical surround speakers.

What You Should Do

If you have speakers capable of being biwired and you'd like to try biwiring and/or biamping to determine whether it makes economic sense for you, here's how. Borrow a duplicate set of speaker cables (exactly like the ones you're using now) from your dealer. Compare the sound of a single speaker cable running to each speaker to the sound of a biwired set. If your dealer can't duplicate your current cables exactly, see if you can borrow a complete biwire set of cables of similar quality made by the same manufacturer as the ones you are currently using. (Switching from single to biwire and switching brands of cable at the same time will confuse the issue far too much.) Make sure you break in the new cables (very important) and then carefully listen and decide whether the investment is justified.

Evaluating the benefits of vertical biamping may actually be easier after you have a biwire set of cables. Borrow another amplifier exactly like the one you are using now and connect it as described above. After you put your socks back on, drop me an email and tell me what you think.

[Since this article was written I have heard many stories about amplifiers and speakers that don't respond well to passive biamplification. While I have sold a wide variety of amplifier types and speaker models over the years and never had any problems with biamplification, obviously my experience can't encompass every component available. Here are some caveats:

Balanced amplifiers won't like to see a common ground between channels. Speakers with balanced crossover networks (reactive components on both circuit legs) may present a difficult load to some amplifiers. Some speaker cables may provide just the right amount of reactance to some amplifiers to cause oscillation.

So what should you do if you aren't an electrical engineer? Ask your dealer or the component manufacturer (or both) about your exact configuration. Try it (at your own risk) and see what happens.

If speaker cables are going to cause an amplifier to oscillate, it would be better to find out before connecting the speakers, which may be damaged by amplifier oscillation. Connect the wires to the amplifier but not to the speaker. Be sure they don't touch at the speaker end. If the amplifier goes into oscillation a rail fuse will probably fail and no damage should occur.

A biwired or vertically biamplified system should sound better, not simply brighter. If the sound gets brighter without improvement, the amplifier may be oscillating at ultrasonic frequencies. This may work for awhile but it will ultimately cause damage to the speakers, the amplifier, or both. I urge you to confer with the amplifier and speaker manufacturers before attempting vertical biamplification.] APJ

Conclusion

by Richard Hardesty

***Journal #4** was originally composed in 2000. Nearly 5 years have passed and many things have changed. Disc players have improved and prices have come down. Video displays have improved and prices have come down. New formats, which will provide even better performance, are on the horizon and prices are likely to continue to fall.*

The home theater fad has died down and stereo music reproduction has resurfaced. "High-end" surround sound processors are still being marketed for music reproduction and they still can't live up to the performance standards of modest 2-channel audio gear.

Video Displays

The cathode ray tube (CRT) utilizes a beam of electrons to excite phosphors on the face of the tube and make them glow. The electron beam scans across the face of the tube, driven by an analog signal. Resolution is determined by the number of horizontal scans (scan rate) and the diameter of the electron beam (beam spot size).

The CRT was the basis of all analog television monitors from the past. Direct-view sets were viewed by looking directly at the glass face of the CRT. Rear-projection sets used a mirror to redirect the light from (usually) three CRTs—one for each primary color: red, green and blue—onto the back of a (usually) plastic lens that acted as the screen. Front-projection units focused the light directly on a reflective screen.

While there are still many videophiles enamored by the virtues of CRTs, the public has virtually forsaken them and stores can barely give them away today. They are big and cumbersome and require substantial power supplies and, in the case of projectors, multiple optical systems, which must be converged. For all intents and purposes, the CRT is obsolete.

Modern video displays use digital signals to address discrete pixels arranged in a grid. Resolution is determined by the number of these pixels. We still have direct-view monitors utilizing plasma or liquid crystal displays. We still have rear-projection units with mirrors and screens illuminated from the back, and front projection units that directly illuminate a reflective screen.

Modern projection monitors utilize miniature pixel-addressed devices like LCDs (liquid crystal displays) and DLPs (digital light processors, made with digital micro-mirror technology).

Video signals used to be analog but today they are digital and that calls for changes in DVD players. You can still use an older DVD player that converts the video signal to analog but why would you want to?

Disc Players

The information on a DVD disc is digital. The audio information has to be converted to analog to enable us to hear it. This conversion can take place within the disc player or in a surround processor. The video data used to have to be converted to analog to drive our analog video displays. During the transition from analog to digital video displays, the digital information on the DVD discs was converted into analog and transmitted to the display device where it was converted back into digital. The latest players have digital video outputs, which allow the signal to remain in the digital domain all the way from the disc to the display.

Transports have made remarkable leaps in performance (see the Wadia 861se review in **Journal #12**). Although we have been disappointed with the performance of the multiformat disc players we've auditioned so far, I have no doubt that it's only a matter of time until we can buy a disc player that will play any 5-inch disc and deliver excellent sound. Unfortunately, this situation is about to become even more complex with the introduction of high-definition video DVDs.

High-Definition Video Discs

As I write this we are preparing to attend the annual Consumer Electronics Show in Las Vegas, NV. High-definition video is widely available and regular DVD discs, which have already reached market saturation, don't support it. We may learn about the future of the DVD at this year's show.

There are two competing—and incompatible—high-definition DVD-video formats. We'll have a new DVD format, probably this year, that will make all DVD discs and players virtually obsolete. The **Audio Perfectionist Journa**l will not attempt to stay abreast of the video world.

Paula T. Hardesty, Publisher
Richard L. Hardesty, Editor
Edith Hardesty, Copy Editor
Rick Johnson, Art Director

You should find other reliable sources of information about this rapidly changing technology if you have an interest in video and want to get the most for your money.

Surround Sound Processors

Several companies are still trying to sell surround sound processors by advertising them as high quality music reproduction devices and attaching high prices to make them appear to be comparable to dedicated audio components. The facts tell another story. **Audio Perfectionist Journals #10 and #11** explain how high-end amplification components work and why surround sound processors and receivers can never offer equivalent performance.

You can have uncompromised audio performance and surround sound for movies but you'll never get it by using a surround sound processor as a preamplifier or a receiver as a complete amplification device. Read **Journal #10** for instructions about how to set up your system properly and the reasons why this procedure is necessary.

Multichannel Music

The bloom is off the home theater lily, which looked for a while like it would sound the death knell for high-end home music reproduction. Multichannel music has come and gone again. People weren't impressed the first time they tried to force this carnival down our throats and the second time they simply yawned.

Besides added expense and complexity, multichannel music offers no audible advantages in my opinion. You hear the real world through two ears and two channels are sufficient for accurate reproduction of real sounds.

For several years the trade shows were dominated by multichannel demonstrations but that trend seemed to evaporate last year. High-end audio at CES 2004 was almost exclusively 2-channel. Analog and high-resolution digital formats, primarily SACD, were the sources of choice. DVD-audio, which was marketed as a multichannel format, has had virtually no impact on the high-end audio segment of our industry.

SACD hasn't even been noticed by the general public but has been embraced by the high-end audio community as a true analog rival. Music videos on DVD-video discs have made serious inroads with the public and may be the actual successor to the compact disc.

The new high-resolution DVD discs will have enormous storage capacity, which could be used to provide higher quality audio along with video images, an idea I find very appealing. Only time will tell how this capacity will be allocated and market demands will dictate what we actually get.

It's a good time for consumers who keep on their toes and refuse to be fooled. Your dollars will buy more performance today and in the future than ever before possible. APJ

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