



## Home Theater: What You Need To Know

PRESENTED BY:

 ***THE AUDIO INSTALLATION CO.***  
*THE Home Theater Specialists* 

# Introduction

## Welcome to the Movies . . .

Home Theater isn't new. It began back in the 1920s and 1930s when Hollywood's elite built screening rooms in their homes so they could view the films they had just produced, directed, or starred in.

Even though they were luxurious, early "home theaters" were complex and intimidating. The moguls who enjoyed them kept technicians on staff to run the noisy and cantankerous projectors of the day.

Technology has come a long way. Today, home theater systems are far more convenient, far more accessible, and far more reliable. And, thanks to the efforts of literally thousands of engineers, designers, and installers, they're far more capable, too.

A good home theater system will provide hours of enjoyment for you and your family as it literally immerses you in sights and sounds once available only at the very finest first-run movie houses. A home theater system can also help create just the right environment to enjoy your favorite movies by adjusting lighting, closing drapes, even turning on the popcorn machine! For the music lover, a home theater system will also reproduce your favorite recordings with startling fidelity.

## How Do I Get There?

This brochure is your first step towards enjoying a home theater system. In it, you'll find questions to ask yourself before ever going into a store. We'll explain those often-obscure acronyms and the technology they represent so you'll be comfortable when looking for specific answers to your needs.

Before we begin, however, we do have a suggestion. At some point, you'll need to consult with a sales specialist at a store or showroom that sells home theater equipment. In our experience, independent dealers or custom installation specialists usually have more knowledgeable, more experienced people than do large mega-stores that sell everything from iPods to refrigerators.

Whatever your budget, the independent dealer will be more apt to listen and respond to your needs. And that's critically important as you make the decisions that will lead to enjoying a system in your home.

With that in mind, let's get started . . .

# Some Basic Questions

## The Component Advantage

Sit down for a moment and think about what kind of a home theater system you really want.

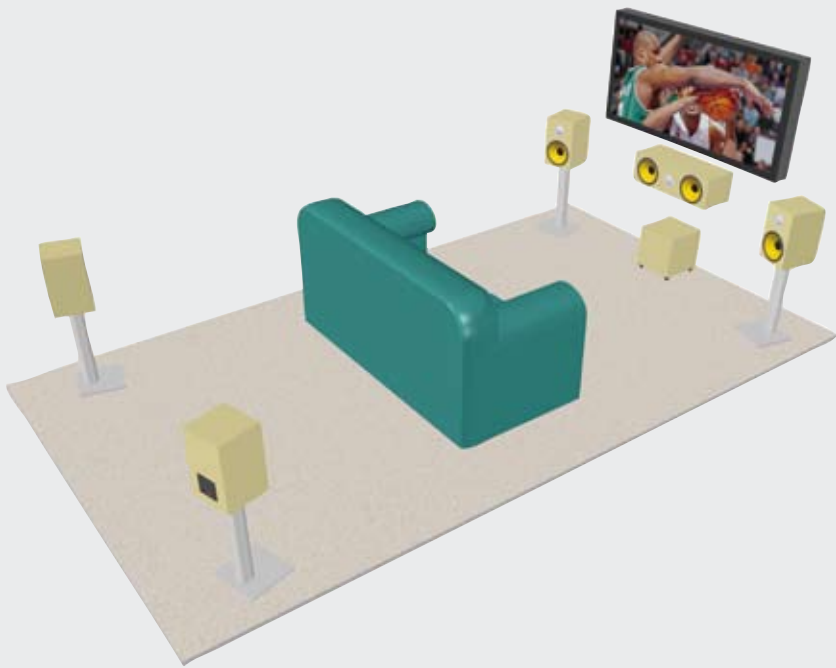
Is it a full-scale dedicated theater room with custom seating, lights that dim automatically when you press "Play", curtains that sweep into place to block distracting sunlight, an extensive loudspeaker array, and the latest "front projector"?

Or is it a generic "home theater in a box" system that you can hook up in an hour or so. After all, that's better than a DVD player connected to a TV, isn't it?

If you're like most of us, you're probably aiming at something between these extremes. After all, a dedicated room is a luxury few of us have. And the compromised performance typical of most all-in-one systems simply isn't that involving.

That leaves a component system – one composed of carefully chosen separate yet complementary pieces like a DVD player, surround processor, amplifier, etc. – as your best choice. With a component system, you can find the performance typical of the finest custom-installed theaters. And the operating convenience that is supposed to be – but often isn't – the hallmark of the all-in-one approach. In addition, separate components offer significant advantages in flexibility as well as an easier upgrade path when the time comes (as it eventually will) to improve your system even more.





## Some Basic Questions

### The Room It Goes In

Once you've reached this point, you need to think about where your new home theater is going to go. You have three things to consider.

- What you'll use the room for when you're not enjoying your new system.
- The acoustics of that room or how it will influence sound quality
- The sightlines from those preferred seats to the screen you're going to watch.

### People Live Here, Too, Don't They?

Where do you want your home theater system? In the family room? In the living room or den? How is it going to affect other family members when the volume's up? That's one reason why putting your new system in the room next to the baby's bedroom may not be such a good idea.

How will you use that chosen room when the home theater system isn't on? Will it be a reading area? A study? What kind of furniture will you have in the room? Will there be enough comfortable chairs or sofas so everyone can enjoy your new system when you put it on?

Of course, many of these questions may not apply if you're fortunate enough to have a "home theater only" space. But even here, you need to consider construction issues and acoustic isolation. After all, you don't want that subterranean explosion to flatten the soufflé in the oven, do you?

Once you've decided on the best room, you can begin to figure out what you're going to need to complete the home theater system of your dreams and just where you'll place everything.



## The Video Side of Home Theater

### What You'll See

You'll probably begin by thinking about the TV. That's natural. But you need to think about the speakers and electronics, too. After all, a great picture and mediocre sound isn't what you really want, is it?

First, decide which type of TV will best answer your needs.

There are several choices:

- 1) A "direct view" TV: This is the conventional CRT (for cathode ray tube) television most of us are used to. Bluntly speaking, they're passé, particularly for today's home theater systems. That's a shame in a way because direct view sets usually produce a great picture. They're also relatively immune to other light sources and will give you the same picture quality in a dim or brightly lighted room. But, as they say, size does matter, and direct view sets – even when you can find a good one – are simply too small to deliver the sheer visual impact you want.
- 2) "Rear projector" sets: These one-piece, large screen sets used to offer the best compromise between affordability and screen size. And for some people, they were attractive even though they gobbled an enormous amount of floor space. Today, they've all but disappeared under the onslaught of affordable flat screen TVs.
- 3) "Front projector" sets: Many people consider these two-piece sets (projector and separate screen) the ultimate in dramatic picture quality. Their main advantage? They can project a BIG image – in some cases, more than 100" measured diagonally. Disadvantages? For best picture quality, use them in rooms with very dim ambient lighting. Fan noise may be intrusive although the best of today's offerings are far quieter than older models. Just remember to pay attention to the screen you choose as it will have a major impact on picture quality.
- 4) "Flat screen" sets: Here's the "hot ticket" for home theater enjoyment. With sizes now exceeding 60" (and some sets more than 80"!), most flat screens can be hung on a wall. That's a major cosmetic advantage as well as a space saver. Picture quality is much better today than it was even a few years ago. Two technologies dominate flat screen displays today – LCD and plasma. Plasma used to have a decided edge in picture quality because it was able to reproduce much darker blacks so the rest of the picture "popped" more convincingly. However, today's LCD models are very good indeed. Our suggestion? Visit your dealer's showroom and look closely. You'll find several choices that will fit your room and your budget.



Picture - courtesy of Cimax USA



# The Video Side of Home Theater

While you're looking at flat screen sets, you'll notice that virtually none of them have screens shaped like older CRT models. (Computer monitors excepted.) Those older sets have screens that are nearly square. We say they have an "aspect ratio" (width compared to height) of 4:3 or "4 units wide by 3 units high".

Today's flat screen sets, in contrast, are much wider than they are high. Their aspect ratio is 16:9 and they resemble small movie screens – no accident there!

In addition to aspect ratio, you should understand something about resolution, or the display's ability to reveal fine details. The old (and, as of February 17, 2009, obsolete) NTSC (National Television Systems Committee) analog standard mandated that TV pictures contain 480 visible scan lines, each consisting of approximately 330 individual pixels or picture elements.

The new ATSC (Advanced Television Systems Committee) standards are very different. Once analog terrestrial broadcasts cease on 2/17/09, all over-the-air TV signals will be digital in nature. Of course, all "small dish" satellite broadcasts are digital already and even cable distribution systems have a digital option today.

Regardless of how you receive it, DTV (digital television) will come in three flavors – SDTV, EDTV, and HDTV.

SDTV, or standard definition television, won't convey any more detail than NTSC signals. However, SDTV signals will be modestly better due primarily to the fact that its digital format is less prone to signal degradation and consequent corruption than NTSC's analog-based format. SDTV is best suited for smaller screen sizes.

EDTV (enhanced definition TV) will deliver visibly better pictures than NTSC: 480 visible scanning lines, each containing 640 pixels. The additional detail will look impressive on a larger screen. (This is, incidentally, even better than DVD's potential. And we all know how good that is!)

HDTV (high definition TV) will deliver a truly stunning picture with up to 1080 scanning lines, each with a potential of up to 1920 pixels! That's far better resolution than you'll find with lower-resolution digital TV sources or even DVD. When displayed properly, HDTV signals come close to the quality of movie film.

## When Is "Big" Really "Big Enough"?

There are no hard and fast rules governing the relationship between room size and screen size. Surprisingly, bigger (screen size, that is) is not always better.

The old NTSC guideline was that you should sit at a distance 10 times greater than the screen's height. For persons with "normal" eyesight, this was far enough away so that the scan lines were not visible.

However, "hi def" (high definition) video sources changed this. Hi def sources have more – and usually far narrower – scan lines than NTSC sources. This means you can sit closer to the screen and not see them. In addition, hi def's aspect ratio (16:9 as opposed to 4:3) makes screen width more important than height. With most hi def sources, you can sit just 3 times the screen height away and enjoy a fine picture.

For these reasons, we suggest that you consult your dealer or installer before making an arbitrary decision on the screen size you "should" have. As you can see, your best choice may be very different from what a quick measurement of available wall space might indicate.

In addition to resolution, you should be aware of other considerations. Your dealer can walk you through the details but here are a few quick comments:

**Interlaced and progressive scanning:** There are two different ways a TV "draws" an image on a screen.

In the first, called "interlaced", the TV draws two halves of a complete picture separately. The first half (called a "field") consists of the odd numbered scanning lines. The second field consists of the even-numbered lines. Each field is drawn so quickly that our brain integrates these two fields into a single picture or "frame". We call this an "interlaced" image because we create it by interlacing odd and even lines to form one complete likeness. All NTSC-format and many DTV signals are interlaced.

A "progressive" image, on the other hand, is drawn all at once. There are no odd- and even-numbered "fields" to integrate, just a series of whole images continuously followed by other whole images. All computer monitors use progressive scanning. Some DTV signals are progressive also. Progressive scanning usually produces clearer pictures of fast moving events (a basketball game, for example, or the chase scene from an action movie) than interlaced scanning can. Many people prefer it for that reason.





Photo Courtesy Sound Room, St. Louis, MO.

# The Video Side of Home Theater

## **Composite, S-, and Component video signals**

These are simply different ways of getting an analog video signal from one component to another. Before outlining some of the differences between them, you should know that video information falls into two main categories – luminance (brightness) and chrominance (color).

A composite video signal combines both luminance and chrominance for transmission through a single coaxial cable. Unfortunately, this reduces the signal's ability to convey fine detail. Although convenient, composite video signals are the least desirable in a high quality home theater system. Almost every video component has composite signal connections.

An S-Video signal separates the luminance and chrominance portions of the signal. The result is improved detail and resolution. However, S-Video signals lose some of this advantage over longer distances. Many video components have S-Video connections.

Component video signals are similar to the RGB (red, green, blue) format used by video professionals. That's why component video connections are the best way to go IF your video sources AND your TV are equipped with the three-connector terminations needed to send component video signals from one piece of equipment to another.

## **HDMI: The New Digital Signal Highway**

Composite, S-, and component video signal transmission share two limitations. First, they're good for analog video signals only and, second, they make no provision to get audio signals from one component to another.

Enter HDMI (or High Definition Multimedia Interface), an outgrowth of an earlier video-only connection scheme called DVI. HDMI can carry the best high definition video signals available today and up to eight (8) channels of high definition audio over a single cable! That's impressive and makes component-to-component connections potentially simpler. HDMI's connectors are much smaller, a theoretical advantage when snaking cables through narrow openings.

Since its introduction in December of 2002, HDMI has, unfortunately, generated a lot of confusion even though it promised to end that rat's nest of cables behind an A/V system.

Some cynics opine that HDMI was introduced before it was "ready for prime time" and that it has evolved almost too rapidly for the industry to explain and promote properly.

Indeed, today's confusion about HDMI "versions" indicates that there's some merit to that view. As of this writing, the current version is 1.3. However, be assured that every version from 1.0 onwards can transmit what's commonly called "1080p" video signals (1080 progressively scanned lines of vertical resolution) and all the audio formats available of today's video broadcasts and DVDs.

Some customers may prefer HDMI's 1.3 version but even they should be aware that there's likely to be no discernable performance improvement until sources begin to incorporate new audio formats like Dolby's TrueHD or dts's Master Audio, both available only on Blu-ray discs. (For more information, please consult our technical guide to HDMI. You can find it at [www.rotel.com](http://www.rotel.com))



3-1: A composite video cable looks just like an audio cable. However, both the cable itself and the connector are optimized for video.



3-2: A single S-Video cable is actually several cables in one. That's because the S-Video format separates brightness and color information before sending it through a multi-conductor cable.



3-3: You'll need three separate signal paths to get one component video signal from your DVD player, for example, to your monitor.



3-4: A single HDMI cable can replace up to eleven separate conventional cables!



# Surrounded By Speakers

## What You'll Hear

If your display screen is the visual center of your home theater system, your favorite chair or sofa is the focus for what you'll hear. That's very important because it dictates how you need to place your loudspeakers so you can hear movie soundtracks as the directors and sound engineers intended you to. Fortunately, the same principals also apply to music so you can enjoy both films and an audio recording through the same speakers.

Home theater system usually begin with a "5.1" speaker array. This simply means five full range speakers (Left, Center, and Right in front with Left Surround and Right Surround in back) and one limited-range subwoofer for bass reproduction only.

Notice that we said ". . . begin with a '5.1' speaker array." That's important. Some new surround sound formats like Dolby Digital EX sound best with two more full range speakers in the rear of your theater space. We'll get to them shortly. For now, let's stick with 5.1.

## What You'll Need

Your dealer can show you a number of options from large floor-standing speakers through smaller stand-or shelf-mounted models to in-wall or on-wall speakers. Today, you can even choose a single "sound bar" loudspeaker that attempts to create a surround experience all by itself!

Although larger freestanding speakers have sonic advantages when compared with small in-wall or on-wall designs, they are more aesthetically intrusive. But, once again, the decision is yours to make.

Regardless of which type you choose, however, listen carefully to several models before you decide. Speakers are very democratic and treat all audio signals exactly the same way, be they Sibelius quartets or Spielberg sci-fi flicks. You want a speaker that is as neutral and faithful to the original sound as possible simply because you want to hear the source, not the speaker.

If you opt for separate speakers for your surround system, they should all come from the same manufacturer if possible. That's your best assurance that each one will have approximately the same tonal balance (sometimes called timbre – but pronounced tam'-bor) as the others. The benefit here is that you'll hear the same quality of sound regardless of which speaker is generating it.



4-1: This is the best "movie" angle as it duplicates the speaker placement on a "dubbing stage" where movie soundtracks are mixed.



4-2: If you're a music aficionado, consider moving your main speakers further away from the video display.

## Where To Put Them

Although placing six speakers in one room may seem difficult at first, it is surprisingly easy if you follow a few simple guidelines.

First, your main Left and Right speakers (we'll call them L and R from now on) should flank whatever TV you've chosen. If you plan to use your system primarily to watch movies, place them along the same wall as the display so that they'll form a 45° angle when viewed from your viewing/listening position. (Angles up to 60° may be necessary depending on room size, screen size, and distance from screen to listening/viewing position. In fact, we recommend a 60° spread if you're going to be listening to a lot of music through your system.) Ideally, both speakers will be at equal distances from each side of the screen to assure good integration of image and sound.

The Center Channel speaker (C from now on) should be as close to your TV screen as possible – either directly under or directly over it – and at the same distance from your favorite chair as the main speakers.



4-3: This is ideal but not always possible.

# Surrounded By Speakers

Placing Surround speakers (LS and RS for Left Surround and Right Surround respectively) is often surprisingly easy.

Surround speakers come in two general types: dipoles which create a very diffused and non-directional surround effect, and direct radiating speakers (sometimes called monopoles) that produce a far more specific sense of where surround information comes from.

Some movie aficionados still prefer dipoles but most experts now recommend direct radiating speakers. To be fair, dipoles were more popular in home theater's early days when Dolby Surround's single surround channel was all that was available. Now that Dolby and dts offer more advanced audio formats with up to four surround channels, dipoles no longer present the advantage they once did. There's no argument that direct radiators are far preferred by recording engineers and knowledgeable audiophiles for multi-channel music reproduction in the home. A final consideration is that placement requirements – often a point of concern for décor-conscious people – are not as restrictive for direct radiators as they are for dipoles.

The best place for direct radiating surround speakers is dependent on the shape of your room, the location of the prime seating area, and the type of enjoyment – movies or music – you consider most important.

For movie watching, side wall placement works well in some rooms, rear wall placement in others. In all cases, you should avoid aiming the surround speakers directly at your listening/viewing position. Ideally, you'll mount your surround speakers above ear level.

If you're going to listen to a lot of multi-channel music, you might consider placing the surround speakers on the rear wall closer to the room's corners. In general, mount surround-for-music speakers lower on the wall than you would mount them for movie-only use.

Dipoles work best when placed well above ear level against the side walls of your home theater room. As you can see (Diagram 4-6) they produce more sound to the front and rear of the room but not much to their sides. That's why you can't easily locate the origin of the sounds they produce.

## The Subwoofer

A subwoofer (usually called a "sub") is a loudspeaker specifically designed to reproduce only low bass sounds. One of the characteristics of bass information is that it

is difficult to identify just where it comes from. That's why some people describe bass as "non-directional". Although this isn't true in the strict sense, it's close enough to give us some choice when we're trying to place a sub in a home theater room.

Getting the most out of a sub demands a decent working knowledge of room acoustics (how rooms influence the sound you hear). If you're like most of us, you have neither the time nor the inclination to master this rather arcane topic. The good news is that you don't have to! Your dealer already has . . . and will be delighted to impress you with a few "magic tricks" – one of which is finding exactly the right spot for your sub so you can just settle back and enjoy the results.

## But Wait, There's More!

Although you now know the basics of speaker placement for the typical "5.1" home theater system, there is a bit more to cover before we move on to the electronics.

You may have noticed that some home theaters are advertised as "6.1" and "7.1" systems. Unfortunately, there is no small amount of confusion about what constitutes each. The same system, in fact, can often be termed either "6.1" or "7.1"! So don't worry about the details just yet. Just remember that these systems require more speakers than we've introduced you to already.

But don't panic!

Although some of these "6.1/7.1" systems use cutting-edge technology to provoke "o-o-o-hs" and "a-a-a-ahs" from enthusiasts, we can say for certain that a well-executed "5.1" system is so impressive that many don't need – or simply don't have room for – any more speakers. However, if you've decided to put the very best home theater system in a particularly large room, you will want to consider a "6.1/7.1" system.

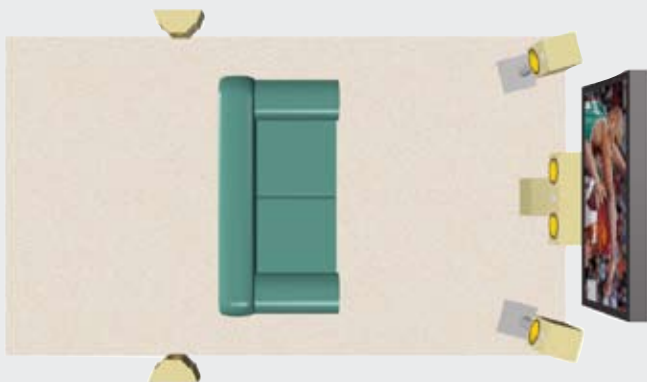
That being said, here's what you need to know. Most "6.1/7.1" systems add speakers to the rear of the room (and slightly more complex electronics, of course) to provide a "Center Surround" channel that places some surround information directly behind us in addition to that already coming from the regular surround channels of a normal "5.1" system. This can improve the sense of envelopment we normally experience from just two surround channels. In addition, the Center Surround channel gives movie directors and sound engineers a better way to add very specific spatial information to the soundtrack when they need to do so.



**4-4:** If you'll be listening primarily to movie soundtracks, place your surround speakers on the side walls just behind your main listening/viewing position.



**4-5:** Directional Surround speakers let you pinpoint the apparent origin of sounds. This particular set-up is optimized for music enjoyment.



**4-6:** Dipole speakers create a very spacious but non-specific feeling of ambience.



**4-7:** A "6.1/7.1" system adds speakers at the rear of your home theater room to reproduce "Center Surround" information contained in whatever source you are playing.

# The Electronics

## Separates Are Better!

As we mentioned previously, you can buy a generic all-in-one home theater system. Ultimately, however, most people tire of the less than stellar performance – particularly that of the speakers – sooner than they thought they would. And when you want to upgrade or add capabilities, these “home theater in a box” systems are severely disadvantaged.

That’s why we suggest separate components as a more intelligent way to go. In addition to substantially better performance, individual components allow you to upgrade or add to your system on a systematic basis to better protect your investment and to keep you at the forefront of enjoyment.

All component systems include sources – a satellite converter, disc player, cable box, etc. – that let you access a program, a movie, or a music recording of some sort.

For many people, the next component is a receiver, a single unit that includes:

- Connections for all your sources
- Switching capability so you can watch and listen to the source you want
- A built-in AM and FM tuner so you can hear your favorite radio broadcasts
- Sophisticated digital signal processing (often abbreviated DSP), to decode the various surround sound formats (more about them in a page or two)
- Finally, a multi-channel power amplifier to provide the power you need to get all of your speakers into the act when you need them.

If that sounds like a lot of “stuff” going on in one box, you’re right! In fact, a receiver is probably the single most complex piece of equipment in any home theater system. But receivers are very convenient space-savers and a number of people choose one for just this reason. The good news here is that receivers can provide excellent performance. The not-quite-so-good news is that, once again, your upgrade or add-on potential is limited simply because a receiver includes everything so changing anything means a new receiver!

There is an answer to this dilemma – the “full separates” approach. This replaces a receiver with a surround processor/preamplifier, a power amplifier, and, if you want one, a tuner.

Not only do these individual components provide even better performance than a receiver can – particularly in the power amplifier department – but they allow you to tailor a system precisely to your needs. As for future upgrades, separate components provide the easiest way by far to improve your system.

## What You’ll Need

### The Surround Processor

The nerve-center of your home theater, the surround processor/preamplifier (commonly called a “pre/pro”) connects everything in your system.

Sources plug into the pre/pro to deliver both audio and video information, some of it analog in nature but more and more of it today digital. Most of the time, the digital signals are encoded in some way. Although you have the option of telling the processor what to do with each signal, some more advanced models figure things out on their own and decode signals automatically. Once your pre/pro decodes the signal you’ve selected, it routes images to your TV, and sends the audio portion on to your amplifier and, once there, to your speakers.

Some pre/pros let you select different sources to be sent to different areas of your home. Some also give you ways to modify or enhance the audio portion of the signal in some way to make it more pleasing or more enjoyable to you.

You should know that many pre/pros even analog audio signals to digital before they send them through the active circuitry. (Digital signals are left as digital.) After the processor performs all necessary decoding, a digital-to-analog conversion stage then transitions the signal back to analog so an amplifier can use it.

Video signals often undergo substantial processing too. One of the most common is called “scaling” and it involves enhancing the apparent definition of a signal so that it best compliments your display device’s ability to present the best image.

## What To Look For:

### 1. Inputs and outputs:

Make a list of everything you're going to watch and listen to through your new home theater system. Remember to include familiar sources like AM and FM broadcasts, legacy sources like cassettes, etc. Then think of the newest digital sources you'll want to enjoy. Maybe you have two or more DVD and CD players, a satellite or cable TV "set-top" box. Some of you will add a Blu-ray player or are considering satellite radio. Then there's that video game, a computer link or Internet connection. Remember that most newer sources have HDMI connections so you'll need HDMI inputs.

Once you've listed everything you can think of, add a few more as a "fudge factor". Then look for a pre/pro with enough inputs to handle the sources you'll be enjoying.

Outputs are next. Will you be routing audio and video to more than one room? What kind of TV will you be using and will it have connections for the best picture? Will conventional "RCA-style" outputs do or will you need HDMI capability here, too?

You'll need to know just a bit about the different connectors some source components use to get signals to your processor. And your processor, in turn, will send different kinds of signals to other components. All this is simple when your dealer or installer helps you sort things out. In the meantime, here are the most common types of connectors you'll see.

Video: We've already shown you the various types of video connectors.

Relax. If this seems a bit intimidating, don't worry. Again, your dealer or installer will take care of these



RCA cables



XLR cables

**Analog Audio:** Almost everything connects with RCA-style connectors. You'll see 3-pin XLR-style connectors on occasion but these are rare.



Toslink cables

**Digital Audio:** Many components use a fiber optic connector called a Toslink. Some digital audio connections use special coaxial cables (with RCA jacks) that are optimized for digital.



RS-232 port

Will your processor be used as part of a computer-controlled "whole house" system? If so, some processors provide a computer-style terminal to make that connection easy.



Hand held keypad

**Remote Control:** Consider how you're going to "talk" to the processor. Will you use a hand-held remote controller?



12v out jacks

Will your pre/pro need to send "wake up" signals to amplifiers that might be located some distance away? If so, a number of processors can do that, too.

## The Electronics

details for you. But it doesn't hurt to begin doing a little homework here to help the process along.

### 2. Surround Sound Formats:

This is probably the most confusing thing about home theater systems. That's because there are many different formats, each claiming different advantages. A partial list includes Dolby Pro Logic, Dolby Pro Logic IIx, Dolby Digital, Dolby Digital EX, dts, dts ES, dts ES Discrete, dts Neo:6, Dolby True HD, dts HD Master Audio, and others. Confused yet? Don't worry, you're not alone. Here's brief description of the major players to ease you along.

#### Dolby Pro Logic

- This "4.0" format was the 800 pound gorilla of the analog surround world and provided (with the properly encoded sources, of course) Left, Center, and Right front channels and a single surround channel.
- Pro Logic is still used to decode the audio portions of many videotapes (remember them?) and NTSC television broadcasts.

#### Dolby Pro Logic II and Pro Logic IIx

- Are sophisticated updates of Pro Logic's matrix approach to surround sound.
- Both adds stereo surround capability so you can rightly call it a "5.0" format
- Both feature greater channel separation than Pro Logic.
- Both Pro Logic II and IIx include two modes (Movie and Music) that make them suitable for a number of surround applications that can't use Dolby Digital or a similar "discrete" technology.
- PL II provides a "5.1" experience. PL IIx adds "7.1" capability.

- Their primary purpose is to provide surround effects from older two-channel analog sources.

#### Dolby Digital

- This is the original "5.1" format.
- It is "discrete" in that channel-to-channel separation is total, an important consideration when trying to locate the origin of specific portions of a movie soundtrack.
- Dolby Digital accounts for the vast majority of all multi-channel software available today
- Is the industry's de facto standard for digital surround sound.
- Is the principal surround format for DVD
- Supports up to 6 channels (5.1 format).
- Mandatory for DVD and HDTV

#### Dolby Digital EX

- A Dolby Digital variant, EX adds a third surround channel to Dolby Digital's two.
- The extra channel (called Center Back or Surround Rear) is not discrete but matrixed onto the stereo surround information.
- Technically, Dolby Digital EX is a "5.1+" format but is commonly – though erroneously – known as "6.1". EX gives the sound engineer a more complete audio palette from which to construct a convincing sense of directionality for surround information.
- You need Dolby Digital EX encoded software, an EX decoder, and an extra rear speaker (or speaker pair) to enjoy the sonic benefits.

#### Dolby Digital Plus

- Will eventually replace Dolby Digital
- Advanced algorithm provides higher quality sound than Dolby Digital.
- Includes "dialog normalization" for better intelligibility.
- Can support up to 14 channels in 13.1 format although currently limited to 8 on Blu-ray discs.
- Now used in European satellite video delivery
- Expected use in streaming applications (at lower end of data rate).



### Dolby TrueHD

- Has higher bit rate than Dolby Digital Plus
- Data rate is more than 40 times the maximum rate of Dolby Digital.
- Supports up to 14 channels although current content formats (Blu-ray) limit number of channels to 8.
- Future applications may include height information or other configurations beyond today's 7.1 formats.

### dts and dts ES

- dts is functionally equivalent to Dolby Digital with 5.1 channel capability
- dts ES is functionally equivalent to Dolby Digital EX with 6.1/7.1 channel capability
- dts initially promised superior sound because it used less digital compression to convey sound from the dubbing stage (where movie soundtracks are made) to your home. Comparisons have proven these claims difficult to defend, especially with DVD, which uses a more compressed version of the original dts format.
- Both dts and dts ES soon to be know as dts Encore.
- dts Encore will also include dts 96/24 formats
- Newer dts formats (HD-High Resolution and HD-Master Audio) add extension data to core data to encode more information.

### dts-HD High Resolution Audio

- Falls between DTS Encore and DTS-HD Master Audio
- Will eventually replace Encore
- Optional audio format for Blu-ray discs
- Supports 8 channels at 24-bit/96 kHz resolution.
- Will be used primarily when source capacity does not allow dts-HD Master Audio.

### dts-HD Master Audio

- Mandatory audio format for Blu-ray discs
- Supports 8 channels at 24-bit/192 kHz resolution



**A Note on THX:** Strictly speaking, this isn't a surround sound format at all even though it is often confused with one. THX is a set of standards and technologies designed to make a home theater sound more like a movie theater. As such, it deals with audio signals only after they've already been decoded. While generally accepted as legitimate for movie soundtrack reproduction, THX has inspired some controversy in audiophile circles where it is said to compromise music reproduction.



## The Electronics

### What's Important

There's a lot of discussion (putting it mildly) about the sound quality of various surround sound formats. We think you'll be very happy with what you're going to hear from any of them providing your system is properly set up and calibrated. That's something your dealer or installer will be glad to help with.

### The Power Amplifier

If the processor is the nerve center of your home theater system, the power amplifier is its taskmaster. It controls the single most important component of your system – the loudspeaker.

Speakers do not just passively accept an amplifier's signal. In fact, they resist it. To complicate things further, speakers exhibit other characteristics that make them difficult to control. They even generate a signal that returns to the amplifier!

So how does an amplifier function properly under these conditions? Well, the simple answer is that some don't. Some amplifiers are actually unstable when pushed and severely distort the signal. In extreme cases, an amplifier can literally destroy itself attempting to deliver a signal to a particularly difficult speaker.

The answer to these problems lie in the balance between an amplifier's output stage and its power supply. If the power supply is the beginning of an amplifier's ultimate capability, it is the output stage that delivers this potential to "real world" loudspeakers.

Good power supplies, however, are expensive to build. They ensure that an amplifier can deliver adequate power as each channel – or all of them at once – ask for it. An inadequate supply simply results in distortion, sometimes very severe distortion.

Note that most of the comments immediately above refer to what we traditionally call "linear" amplifiers. These "Class A" or "Class AB" designs are very different from the newer "Class D" switching amplifiers. (And, no, "Class D" does not mean "digital"! Linear amps and Class D amps have very different operating characteristics. Class D designs are generally smaller and much cooler-running. You can find a detailed



explanation of switching amplifiers at [www.rotel.com](http://www.rotel.com).

Regardless of its type, any amplifier must have the ability to drive all of your speakers to levels you are comfortable with. In other words, does an amplifier have enough power and can it deliver its claimed output into many speakers at once? For some, especially those who live in apartments, power output requirements are comparatively modest. For others, those who insist on experiencing the full power of an earthquake in a large room, power needs will be far more substantial.

Unfortunately, you're in a particularly difficult position to judge what's enough. That's because most manufacturers rate amplifier power output capabilities differently and "spec comparison" is almost impossible.

Here are some things to look for:

1. "Continuous" rather than "peak" power: What you need to look for is average, long-term power rather than some specious short-term specification
2. Number of channels driven: Some manufacturers rate their multi-channel amps with only two of the channels working! This makes it easier to claim more power per channel. If you're paying for a multi-channel amplifier, it should develop its rated power into all channels at once!
3. The range of frequencies (called "bandwidth") over which an amp will produce its rated power: Some manufacturers tell you only that an amp will produce, say, 100 watts per channel at 1 kHz, a midrange tone that almost all amplifiers handle well. The real test is how much power an amplifier will develop at the so-called "frequency extremes". Ideally, an amplifier's bandwidth will extend from 20 Hz (low bass) to 20 kHz (very high treble.) This 20 Hz – 20 kHz specification is commonly accepted as being within our normal hearing range.
4. Distortion: A good amplifier should not add or detract from the signal it receives from a processor. Any deviation is called distortion and is measured as a percentage of the overall signal. Although lower distortion figures are generally better, anything under 1% is probably inaudible. Today's technology, however, allows substantially better performance. Distortion figures of 0.03% are not uncommon. Again, these distortion measurements should be

made with all channels driven.

5. Impedance: Measured in ohms, impedance simply measures a speaker's resistance to the amplifier's signal. It's important only in that different impedance ratings allow a manufacturer to rate a power amplifier differently and some do take advantage of this. For example, an amplifier that develops 75 watts per channel at 8 ohms could be advertised as a "100 watts per channel" model simply by lowering the impedance rating to 6 ohms!

The point here, obviously, is that you need to be careful when comparing amplifier specifications. Here's something to remember: A manufacturer who gives you all the information you need to make an informed decision is probably the manufacturer that spends the time designing good products in the first place.

### **Your Specialty Audio / Video Dealer**

We've covered most home theater basics in this booklet. We've intentionally left out as much jargon as we could. We've also left out a lot of detail that, while fascinating to some, is largely unnecessary as you begin to look for your ideal system. Our hope is that this book answered just enough questions so that you feel comfortable asking more.

Once again, however, we'll stress the importance of visiting a specialty audio/video dealer or custom installer. These businesses receive thorough training from many manufacturers and trade organizations. They know their craft and can help you avoid frustrating and potentially expensive mistakes.

With their help, you'll soon have a home theater system that will fulfill your needs and delight your family and friends.

**Enjoy the show!**







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