

flat panel **TV**  
**BUYER'S GUIDE**

By Alan Kraemer



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you are buying an experience...



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In the days of SDTV (Standard Definition TV) and CRT's (tubes), buying a TV was relatively easy. You decided what screen size you wanted and figured out how big a cabinet you could fit in your house and away you went. Manufacturers offered different quality levels and, towards the end, there were flat tubes versus the traditional rounded tubes, but the choices were relatively straightforward.

**THINGS HAVE CHANGED** with a traditional TV you were clearly watching a device (like a radio with pictures). Now the device is disappearing and you are experiencing the actual content. How convincing that experience is depends on a number of technical factors and personal preferences. With this guide we will try to put some of these variables and trade offs into perspective and hopefully assist you in making the most of your FPTV (Flat Panel TV) investment. As we discuss the key decision points below we will take into account each of these questions as they apply.

**THE FIRST STEP** in the decision process is to ask yourself a few key questions:

1

What type of content are you primarily interested in? Sports? Movies? General programming?

2

Do you plan to use the internal audio system of the TV?

3

Are you planning to mount the TV on the wall, or will you use a stand and or a cabinet?

4

Will you use the internal tuner to receive over the air broadcasts or will you use an external cable or satellite box?

5

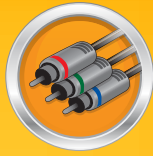
How many high definition and standard definition sources do you plan to connect?

## BUT FIRST A FEW DEFINITIONS:



### HDMI

(High Definition Multimedia Interface) HDMI is the interconnect system that permits a direct digital connection between a FDTV and devices such as set-top boxes, DVD/Blu-ray players and game consoles. An HDMI connection carries both digital audio and video and is capable of very high performance information transfer. In addition, the audio and video signals are never converted to an analog signal, always staying in the digital domain, for the best possible sound and picture.



### COMPONENT VIDEO

Before HDMI, this was the highest quality connection available to an HDTV. Component video uses a three cable analog interface to individually transfer the color channels (red, green and blue) at high bandwidth to the TV. While the quality can be very good, this interconnect requires a conversion to analog at the source and a re-conversion to digital by the TV. Component connections also do not carry audio information, however they are traditionally used with the standard analog (red and white) audio connection or with a digital optical connection to an external receiver.



### I AND P

When attached to numbers like 720 or 1080, these letters indicate either (i)nterlaced or (p)rogressive scanning while the numbers define the number of horizontal lines that make up the image. For comparison, standard definition television in the United States is 480i, while high definition is either 720p, 1080i or 1080p. Many DVD players convert 480i to 480p for higher standard definition performance.

Simply put, interlaced scanning alternates between odd and even fields to make up a video frame. This means that one field contains odd numbered lines and the next contains even numbered lines. Interlaced scanning requires less transmission bandwidth or storage, but can introduce subtle artifacts into the picture such as jagged diagonal lines or uneven sporadic motion (judder) in moving images. Progressive scanning displays the entire image (odd and even lines) all at once, producing the highest quality images with a minimum of motion artifacts. However, there is no current broadcast path today that can support the bandwidth required for 1080p transmission. This level of performance is currently available only from Blu-ray discs or some (late lamented) HD DVD players.



### 120Hz

This refers to the refresh rate of the display, which is the number of times a display's image is repainted or refreshed per second. Normal TV broadcasts in the United States use a 30Hz frame rate (standard definition actually runs at 29.97hz for very obscure reasons having to do with analog color television), which means the image is refreshed 30 times in a second. Most high definition FDTV's run at a 60Hz frame refresh rate displaying each frame twice for smoother motion. Some newer 1080p TV's now support a 120Hz refresh rate which requires them to display each frame 4 times resulting in even better motion integration, however, some people believe this can look unnatural for film content.

To complicate matters further, Blu-ray players can now display some film-based content at their native rate of 24 frames per second. All modern films run at 24fps which was determined to be the minimum frame rate required to completely eliminate the perceptions of flicker if each frame is shown twice. Most players use an option called 3:2 pull down which normalizes the 24 frame per second rate to a 30Hz frame rate, but a 120Hz capable TV does not need this as each frame of a 24fps source can be displayed exactly 5 times..

**120Hz**

NEWER 1080p HIGH-DEFINITION TELEVISIONS

**60Hz**

MOST CURRENT HIGH-DEFINITION TELEVISIONS

**30Hz**

STANDARD DEFINITION TELEVISIONS



INTERLACED



PROGRESSIVE



Now given all of this background let's answer some common questions regarding the purchase of a **HIGH DEFINITION FLAT PANEL TV**

## PLASMA OR LCD?

*This is the first question on most people's minds when they contemplate purchasing an FPTV.*

Both have their pros and cons, but in general the market is moving to LCD. PLASMA panels use more energy and run considerably hotter than LCD's and, although this problem has been reduced on newer panels, they have the potential to burn in a static image or title. They also have a finite life, but the newest panels claim up to 60,000 hours. That's a long time and probably a bit exaggerated, but even at half that number, life should not be a concern. PLASMA panels use more energy and run considerably hotter than LCD's

*On older LCD panels, slow response times could cause trails and blurring of rapidly moving objects*

The two advantages PLASMA panels have traditionally had over LCD's is response time and contrast ratio. Response time is the time it takes for a pixel to go from off to on and back again. On older LCD panels, slow response times could cause trails and blurring of rapidly moving objects, but newer panels from tier one manufacturers have reduced response time to levels that eliminate these effects.



**PLASMA** Glass display causes greater potential for glare.

Contrast ratio is the difference between full white and full black LCD's have traditionally been criticized in this area because an LCD picture element is essentially a light valve that either lets light from the backlight through or blocks it. Since it is impossible for the valve to completely block all of the light, some of the backlight sneaks through and black levels are compromised. Newer, higher quality LCD's implement backlight modulation to reduce the backlight dynamically in black areas of the picture which significantly increases contrast ratio.

One final consideration is reflectivity. PLASMA panels have a glass front and tend to be much more reflective of ambient light, (i.e. there is greater potential for glare on the screen) than LCD panels which reflect less due to the polarized nature of the display which causes them to diffuse reflected light more evenly. For this reason, PLASMA based sets will be fine in a dark home theater environment, but may have a problem with glare in a brightly lit room or a room with uncovered windows. On the other hand, some LCD's that do not have the ability to adjust (manually or automatically) the backlight may be too bright in a darkened home theater.



**LCD** Polarized display diffuses reflected light more evenly.

## THE BOTTOM LINE...

...on the PLASMA vs. LCD question is this: The higher end LCD's now perform at a level that is virtually equivalent to PLASMA, do not burn in, use significantly less power and dissipate much less heat. They are also lighter and easier to mount on the wall if you are going in that direction. At the lower end of the price range, PLASMA TVs will provide higher performance if you can control the amount of ambient light when watching them.

## SIZE

**BUYING THE LARGEST SCREEN** you can afford or fit in your allotted space is not always the best idea. The optimal screen size really depends on viewing distance. If you sit too close to a large screen, even when viewing fully resolved 1080p HD, you will begin to see distracting picture elements. If you sit too far from the screen, you will not see the fine detail that good high definition is capable of rendering.

*the critical dimension is not the diagonal measurement, but the width of the screen*

The size of a panel is the diagonal measurement of the screen in inches. Interestingly that is consistent worldwide. Even though the entire world outside the U.S. uses the metric system, TV sizes are always measured in inches.

Both the SMPTE (Society of Motion Picture and Television Engineers) and THX have made recommendations indicating that the optimum viewing distance is achieved when the screen occupies about a 30 to 36 degree field of view in the horizontal plane. This means that the critical dimension is not the diagonal measurement, but the width of the screen. To achieve this angle, your minimum viewing distance should be about twice the screen width and the maximum distance about 5 times the screen width.



Instead of trying to sort all this out manually,  
here is a link to a handy

**VIEWING DISTANCE CALCULATOR**



<http://myhometheater.homestead.com/viewingdistancecalculator.html>

Courtesy of **MY HOME THEATER**

## ▶ VIDEO PROCESSING

**THERE IS A LOT OF COMPLEX VIDEO SIGNAL PROCESSING** that goes on behind the scenes of FPTVs to make the viewed image as good as possible. All current FPTVs have a built-in scaler, which converts any arbitrary incoming signal resolution to the native pixel resolution of the screen.

*the quality of video processing and the resultant picture quality are generally related to price*

For instance, a DVD player will output 480p and the TV's scaler will upconvert the signal to the TV's native resolution, which will be something similar to either 720p, 1080i or 1080p. Since there are a number of incoming resolution formats from 480i/p to 720p to 1080i/p and more, the scaler must do an excellent job of mapping all of these to the screen's native resolution, which, on a 1080p panel is 1920 by 1080.

FPTV's must also do an excellent job of de-interlacing. This is the process that converts an interlaced signal like 480i or 1080i to a sequentially scanned signal for display on the panel since plasma and LCD panels cannot directly display an interlaced signal.

These are just two examples of video processing. There are quite a few more video processing algorithms required for good performance, many of which are proprietary to the different manufacturers. Suffice it to say that the quality of video processing and the resultant picture quality are generally related to price.



### TIPS

When shopping for a flat panel, **COMPARE THE PICTURES VERY CAREFULLY...**

#### INDICATION OF PROCESSING QUALITY:

Look for the telltale signs like motion smearing and little random blocks of color or streaking in the picture that does not belong there.

#### IN-STORE MODE:

be aware that when the televisions are shipped to retail stores for display most manufacturers, regardless of price point, set their TVs in "store" or "vivid" mode to create eye catching contrast and color in an effort to stand out among the competition. This can be extremely unnatural in the home.

#### ALTERNATE MODES:

If you are seriously considering a panel, ask the salesperson if you can try some of the other picture modes such as "cinema", "theater" or "custom". This will give you a better idea of what the set should really look like when you get it home.



## ▶ INPUTS

**THERE ARE A NUMBER OF DIFFERENT TYPES OF VIDEO INPUTS.** Which type you need depends on the equipment you currently have or intend to purchase and whether or not you plan to use an external A/V receiver that has video switching capability. For reference, the various video input types are listed below:

### COMPOSITE



This is the good old fashion yellow connector. Composite is the lowest performance video connection since all the information; chroma (color), luminance (the brightness) and sync (which tells the TV when to start scanning each frame and line) are transmitted over a single cable. Not only does all this information interfere with each other, but bandwidth is also quite limited, so it's recommended to only use this option if you have a very old legacy device such as an old video camera. The composite connection cannot support HD.

### S-VIDEO



This was the first attempt to improve on the composite connection by separating the chroma and luminance signals thereby reducing some of the interference mentioned above. While it was an improvement over composite, it still was not very good and cannot support HD. Use it if you must for those older analog video devices.

### COMPONENT



This was the first interface that used separate cables for each of the primary colors, eliminating the artifacts of composite and S-Video. Component is an analog interface capable of supporting HD.

### DVI



The digital interface predecessor to HDMI, DVI is a fully digital video interface that transfers each color separately over high speed transmission paths. While the digital video signals of DVI are compatible with HDMI, DVI does not carry sound. DVI is generally used today for computer monitors and some front screen projectors, but rarely found on FPTVs with the advent of HDMI.

### HDMI



This is the preferred method for connection to a contemporary FPTV. As discussed above, HDMI is a high performance digital audio and video interface that only requires a single cable for both types of signals. Virtually all new source devices, DVD players, Blu-ray players, cable or satellite set-top boxes and game consoles include HDMI outputs.



## INPUTS CONTINUED



### VGA

This is a single connector analog RGB interface that is found on virtually all PCs. Even PCs with a DVI connector can be adapted to VGA since the DVI standard requires analog signals on the connector as well as digital. You will want a VGA input if you plan to connect a PC as part of your system if your PC does not have an HDMI or DVI output. This is very handy for big screen YouTube® video watching and virtual fish tanks, among other applications.

*many new receivers switch HDMI video and are also capable of converting older analog sources to HDMI for transmission to the TV*

### RF



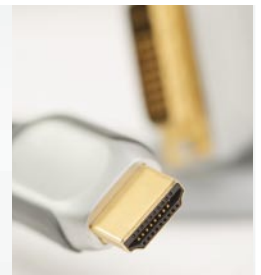
The RF input is the round threaded connector that is also found on cable and satellite boxes. All new FPTV's (and many older ones) include an ATSC (Advanced Television Standards Committee) tuner which, using this type of connector, allows them to receive digital broadcasts over the air. If you use over the air signals, this is important to you because all analog TV broadcasts in the U.S. will cease in February of 2009.

The RF input can also be connected directly to a digital cable system without a set-top box, providing access to all non-premium channels in both standard definition and high definition if the TV supports a format called QAM to demodulate the cable signals.

## HDMI ESSENTIALS

The inputs you need, again, depend on your source devices. If you are planning to use a newer A/V receiver with your TV, you may only need a single HDMI input, since many new receivers switch HDMI video and are also capable of converting older analog sources to HDMI for transmission to the TV.

If you are not using an A/V receiver, match up the output capabilities of your source devices to the TV, but remember HDMI is very important since **ALL NEW DEVICES WILL INCLUDE HDMI OUTPUTS**. HDMI also provides the highest possible performance. The current version of HDMI is 1.3 which provides extremely high video and audio performance and should be future proof for some time to come. Look for at least three HDMI inputs with one preferably on the side or the front for attachment of non-permanent devices, such as digital video cameras or game consoles.



## ▶ SOUND

Sound is obviously a critical component of the TV entertainment experience and yet, it is very often neglected or ignored as part of the buying decision. Doing this, unfortunately, often leads to buyer's remorse because a great picture with poor sound can be a big disappointment.



*as panels get thinner and more stylish, there is less and less room for speakers and their associated enclosures.*

**IRONICALLY, AS THE PICTURE GETS BETTER, THE SOUND HAS THE POTENTIAL TO GET WORSE.** This is because as panels get thinner and more stylish, there is less and less room for the speakers and their associated enclosures. In addition, for styling reasons, some manufacturers have begun to place their speakers in unconventional places and orientations such as down firing and up firing. All of these factors can contribute to reduced sound quality if they are not compensated for by advanced audio signal processing.

Audio technologies such as TruSurround XT® and WOW HD™ developed by SRS Labs are utilized in many FPTV's by most major manufacturers to overcome the physical limitations described above and provide sound quality that matches the picture quality.



These technologies are based on years of research on the human hearing system and on how the ear perceives sound. SRS WOW HD and TruSurround XT render an expansive 3D wall of sound or a full surround sound audio field and create the perception of low bass from the small speakers contained in the TV itself, delivering immersive theater-like audio

*continued on page 9*

## SOUND CONTINUED

entertainment experience. This can reduce dependency on an external A/V Receiver and all of the associated speakers and wiring. This can be a major advantage when you take into account the cost of a good receiver, the complexity of system setup, the impact on your living environment (speakers, wires) and the spouse factor.



Another possible solution to the surround problem is the **SOUNDBAR, WHICH CONTAINS SEVERAL SPEAKERS IN A SINGLE ENCLOSURE.** These devices can be placed or hung below the panel and are designed to provide a surround field even though all speaker channels are placed in the front of the room and some use techniques like those described above. Soundbars typically function like A/V receivers, with inputs for multiple devices, and some even include DVD players and will soon be available with Blu-ray players.



So, when researching what TV to purchase, don't forget the sound. A state-of-the-art FPTV is a big investment and there is no reason to settle for run of the mill sound. Audio signal processing, like that supplied by SRS, can ensure great sound to accompany a great picture.

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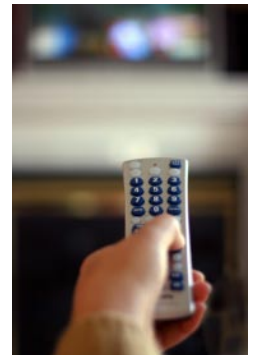
## ▶ STYLE

**OBVIOUSLY, THIS IS A MATTER OF PERSONAL PREFERENCE**, but there are a few things to look for. For example, the bezel surrounding the panel is typically either matte finish or glossy. Some people find a glossy bezel distracting because it reflects the light sources in the room. Some manufacturers even offer interchangeable color bezels to match your individual décor.

As we discussed in the section on sound, **PAY CAREFUL ATTENTION TO THE LOCATION OF THE SPEAKERS** if you intend to use the internal audio system. In the interest of style, speakers are being put in strange places and pointed in strange directions. If possible, choose a set with front facing speakers. If not, then refer to the discussion of signal processing in the sound section of this Buyer's Guide.

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Finally, don't forget the remote. How big is it? Does it fit comfortably in your hand? Is it easy to understand? Can you read the labels on the buttons? Does it light up? Can it learn or operate other devices' remote control functions.



## FINAL CONSIDERATIONS

### CABLE

After you buy an FPTV you are going to need to connect it to your source devices via cables. The one place where cable quality can make a difference is in HDMI cabling. HDMI transfers huge amounts of data at very high speeds and the quality of the cable fabrication and connector termination can make a difference.

*The one place where cable quality can make a difference is in HDMI cabling*

Also the longer the cable run the more critical cable quality becomes. HDMI cables can be very expensive so buying cables that are certified for HDMI 1.3 or 1080p transmission makes the most sense and will avoid transmission problems.

### PURCHASING

*Do your initial research on the Internet and then go to the retail location and take a careful look at the model you are interested in.*

If you decided to purchase from an online reseller rather than a local retailer, make sure you do your homework. Check the reseller's feedbacks and ratings and make sure they are in good standing with BBB (Better Business Bureau). Also, find out if there are any extra (hidden) charges such as mandatory extra insurance, excessive delivery charges, required purchase of unneeded accessory packages (like over-priced cables or cleaning kits) - which add to the total cost of the purchase - and, if available, select a "white glove" in-home delivery and set-up option to assure the new big screen TV you just ordered will not get left on the curbside. You need to also clarify the reseller's return and exchange policies in case the unit was damaged during shipping and/or did not work out of the box.

Don't buy an FPTV sight unseen. You are going to live with it for a long time and you want to be fully satisfied with your decision. It's recommended that you do your initial research on the Internet and then go to a retail location and take a careful look at the models you are interested in, evaluating the performance and styling aspects discussed here.

### WARRANTY AND SERVICE

Generally, FPTVs are pretty reliable devices. Both LCD and Plasma panels are now rated to have useful lives of about 60,000 hours which, if you watched TV 6 hours a day, 7 days a week, would last about 27 years. More than likely, you will get a new TV long before then.

As far as service goes, flat panels don't require professional setup of convergence and alignment the way the old CRTs and rear projection sets did. However, if you are a critical viewer, you may want to opt to have a professional calibrator come out and set up your screen for optimum performance. They use special tools that measure the light output of the screen to correctly set color temperature, brightness and contrast.

## FINAL WORDS



Finally, if there is one important bit of advice to consider when buying an FPTV it is this:

**DON'T SPEND ALL OF YOUR MONEY ON SCREEN SIZE.**

There are many very big screens out there that incorporate inferior audio and video processing thereby degrading the total entertainment experience. Pick the screen size that is appropriate for your viewing environment and spend any extra budget on getting the best possible panel, video processing and audio processing available. If you do that, you have an excellent chance of acquiring a TV that will satisfy for years to come.



**Alan D. Kraemer** has served as Chief Technology Officer of SRS Labs since January 2005 [and holds multiple US Patents as well as numerous foreign patents related to audio processing]. During his tenure at SRS Labs, he has also served as Executive Vice President, Technology and Business Development, Vice President of Engineering and Director of Engineering. Prior to joining SRS Labs in 1994, Mr. Kraemer served in a variety of executive and technology capacities with industry leaders such as Sierra Digital Productions, De LaRue Printrak, AST Research and Northrop Electronics.