The Consumer Guide to Plasma Television
An Ultra Fidelis Technology White Paper

Plasma displays have quickly become the most popular high-end televisions available due to their incredibly sleek, stylish, and space-saving design. The best new plasmas offer unparalleled picture quality, especially when viewing DVDs and HDTV broadcasts. Unfortunately, there are many inferior plasma designs that, while sharing many common cosmetic features, are incapable of producing a natural picture with the high resolution you are expecting. There is a lot of misinformation in the marketplace and "caveat emptor" has never been more appropriate advice than when making an investment in this fast-moving technology. The objective of this comprehensive white paper is to better enable you to make an informed purchase. In it we will address three key elements:

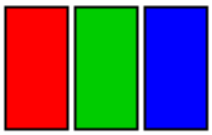
1) plasma technology and why it matters
2) recent advances in plasma technology
3) reliability, warranty, and support considerations

This is not a sales pitch and doesn't promote any particular manufacturer's features or benefits; it is intended to be a "brand neutral" educational tool. We are confident that anyone considering the purchase of a plasma display will find this information both enlightening and valuable.

Plasma Technology

Phosphors and Pixels

A phosphor is a tiny red, green, or blue rectangle on the surface of the display screen that emits light when energized. A group of three phosphors, one of each color, makes up one pixel.



Both plasma displays and cathode ray tube displays (which include traditional "tube" televisions, all CRT projectors, and all but the most recent rear projection TV's), rely upon the illumination of phosphors to create a picture. What makes plasma technology different is the way in which the phosphors are illuminated. In a plasma the phosphors are painted onto a glass screen and sealed in a chamber which is filled with neon and xenon gas. When a charge is applied to the gas, the gas discharges electrons which in turn energize the phosphors. This illumination of the three phosphors, in varying intensities, enables the creation of literally any color by each pixel. The brightness of each pixel can also be made more or less intense relative to other pixels on the screen. By varying color and intensity to different degrees across the entire screen, extraordinarily detailed images are created.

414.221.0200 | 740 N. James Lovell | Milwaukee, WI 53233 | www.ultrafi.com

Screen Resolution

The visual detail of a plasma display is commonly described in terms of its "resolution." A typical HDTV-capable model might have a resolution of 1365 x 720 which means that the screen has 1365 pixels across its horizontal axis and 720 pixels spanning the vertical axis. This is a total of 982,800 pixels and a whopping 2,948,400 individual phosphors. The more pixels you have, the higher the resolution and the more detailed the image can be. If you visually inspected, at very close proximity, a plasma displaying only a bright white image, it would look very much like the image below.

Pixel Structure of Plasma Displays

If your eyes were good enough, you could actually count every pixel and determine the exact resolution of the panel. Resolution is often touted as the only specification necessary to predict the picture quality of a plasma, but that approach is flawed. While in simplest terms it's true that the higher the resolution, the more detailed the picture, there are other equally important elements that contribute to the overall viewing experience. If you plan to enjoy the benefits of the increasing number of HDTV broadcasts, it would be important to select a plasma display with a minimum resolution of 720p (that's "progressive" which we'll explain in the next section); if DVDs are the only thing you'll ever watch, a 480p device should prove more than adequate.

Progressive vs. Interlaced Technology

As we discussed earlier, plasmas have a specific number of pixels that make up the panel (e.g. 1365 x 720) which is known as the plasma's "native resolution". A plasma with this native resolution is commonly described as a "**720p**" display. This description is based on the number of horizontal lines in the display; in this example there are 720. The "p" in the description stands for "progressive," and refers to the way an image is displayed on the screen.

The traditional cathode ray tube televisions we have all watched for years are not "progressive," but instead rely on an outdated and inferior approach called "interlaced scanning." These televisions theoretically have 525 horizontal lines, but can only display 240 at a time and deliver an image that is vastly inferior to the one produced by a plasma display. This is a direct result of the inherent shortcomings of interlaced scanning, coupled with some other factors we'll discuss in a moment.

414.221.0200 | 740 N. James Lovell | Milwaukee, WI 53233 | www.ultrafi.com

Traditional televisions “paint” an image across the screen, one pixel at a time, by starting in the top left corner of the screen, filling line 1, and then proceeding sequentially to do the same thing to each successive odd-numbered line. When line 525 has been displayed, the illuminator then jumps back to the top of the screen and “paints” the even lines (2-524) in the same manner. This process attempts to fool your eyes and your brain into believing you are seeing one coherent image, but it breaks down in comparison with progressive displays. If you have seen an old silent-era film, you will have observed the generally jumpy nature of motion in those days. This is a result of the medium not providing a sufficient number of frames of information. In the same way, interlaced displays will soon be seen to be archaic as our eyes get used to more information and grow to expect it. There was an unavoidable need to use this interlaced approach in the early days of television and today we are stuck with it in the broadcast realm, even high definition broadcasts, due to the existing infrastructure. (How HD broadcasts overcome the inherent shortcomings of their interlaced signals will be addressed in a future white paper.) Interlaced scanning is, however, no longer an acceptable way to deliver an image on a display device. Progressive images look smoother and more natural than interlaced images and once you’ve seen a plasma display, to borrow from Pete Townshend, “you won’t get fooled again” with the poor quality of an interlaced image.

At the risk of complicating this subject even further, there are different implementations of progressive technology. All “progressive” technically means is that, rather than displaying the odd lines of an image followed by the even lines, the progressive device displays them sequentially by “scanning” from the top left corner of the screen to the bottom right corner. It then starts over on the next frame. This progressive scanning creates the improved picture that you may have seen on a lot of rear projection televisions and CRT projectors, but the ultimate viewing experience is provided by a device that doesn’t “scan” at all. With a plasma, each image is created by simultaneously illuminating every single pixel on the screen with the right combination of color and intensity to create the most natural and emotionally involving image possible.

De-Interlacing and Scaling

As we mentioned earlier, standard television broadcasts have 525 vertical lines and they are transmitted in an interlaced format. High definition broadcasts use a significantly greater number of lines, but they are also interlaced. DVDs are encoded with 480 interlaced lines. Since plasma displays come in a variety of native resolutions, and none of them display interlaced images, there are two key functions that must take place in a plasma before a stunning image can be created: de-interlacing and scaling.

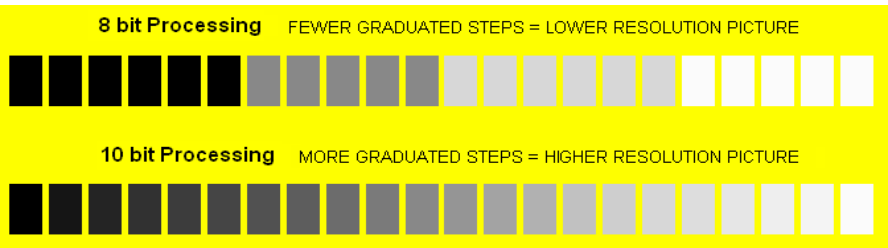
First, the complex electronics in the plasma display must “de-interlace” the signal it is receiving from the source and second, they must “scale” the image to match the plasma’s native resolution. This may be the most important point you can take away from this white paper: de-interlacing and scaling are incomprehensibly complex tasks and the quality of the picture is completely dependent on how well they are accomplished. In other words, not all plasmas are created equal. Although all scaler/de-interlacers (“scalers” in the vernacular) introduce some amount of picture distortion or “artifacts”, the very best ones introduce almost none. Processing distortion may manifest itself as jagged lines where there shouldn’t be any, unwanted dots or squares, and motion artifacts. An inferior scaler can also introduce color shift, reduce contrast and alter white balance. All of these things adversely affect picture quality and can make the image look imprecise, digitized, and grainy. A poor scaler can also make the image seem flat and two-dimensional instead of the deep and rich presentation we all experience in a movie theater.

414.221.0200 | 740 N. James Lovell | Milwaukee, WI 53233 | www.ultrafi.com

The best scalers are able to modify the image in the necessary ways while retaining the natural look of the original source and the best plasmas are the ones with the most advanced scalers. When looking at plasmas, it is critically important that you evaluate how well they de-interlace and scale. You don't need to examine the circuit design, but you should spend a lot of time looking at the picture. It is equally important that the plasma has been properly set-up and that you view appropriately detailed source material. An improper set up can mask the difference between the best plasma technology and a piece of mass-market junk and a bad DVD will produce a bad picture no matter how you look at it. Spend some time really looking at plasmas and you'll quickly develop an eye for which plasmas get scaling right and which ones don't.

Image Controllers

Another important factor in determining how good a particular plasma will look is the quality of its image controller. As you will soon see, the image controller can actually be just as important as the native resolution of the display. The intensity or brightness of each phosphor on the screen is controlled by a sophisticated computer, called the image controller, that is built into every plasma. The image controller has to do some very careful and detailed calculations in order to make the image look right. The amount of detail that can be represented has a lot to do with the number of "steps" or the degrees of brightness that the phosphors can display. The more degrees of brightness available between the phosphor being completely off (dark black) and completely on (bright white), the more detailed the image can be. The image controller responsible for this function typically uses either an 8 bit or a 10 bit processor. With an 8 bit processor, a plasma is limited to 256 levels of brightness for each colored phosphor; that may sound like a lot, but it isn't. With 10 bit processors, there are 1024 discreet levels of brightness, which produce a much more precise replication of the original image. The best plasmas all use 10 bit processors and if you're going make this kind of investment, you'll want to buy the best.



Longevity

Many consumers are under the misimpression that plasmas don't last very long, when the truth is exactly the opposite. Plasmas have greater longevity than any other type of television technology available. Longevity is measured by how long a display will take to become half as bright as it was new or LTHB (Life To Half Brightness). Traditional CRT televisions have a LTHB rating of between 10,000 and 15,000 hours. Plasmas are rated to reach half brightness in 30,000 to 60,000 hours.

That's more than double the life expectancy of the best CRTs and means you could watch 30 hours of TV a week for 20+ years before any appreciable change would occur. But plasmas have another advantage over CRTs in that a plasma is a fixed pixel device which has perfect geometry that will stay perfect for the entire life of the display. CRTs have imperfect geometry with convergence problems that get worse as the TV ages and the tube shrinks. So a plasma will look much better than a CRT over time. Also, unlike CRT and DLP televisions, plasmas have no moving parts whatsoever.

414.221.0200 | 740 N. James Lovell | Milwaukee, WI 53233 | www.ultrafi.com

Recent Advances in Plasma Technology

AVM Processing

The newest and most advanced plasmas employ a new scaling technology which uses advanced video movement processing (AVM). AVM virtually eliminates motion artifacts and flicker, while improving vertical picture resolution. The processor uses a different kind of scaling for moving as opposed to still images, yielding smoother images with more natural movement and eliminating visible scan lines.

Elongated Pixelization

Another breakthrough technology involves a completely new pixel structure and offers significant improvement in the accuracy of the plasma's image. Until now, all plasmas have employed a pixel structure like the one shown in Figure 1.

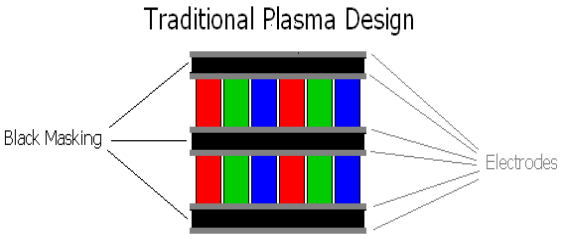


Figure 1

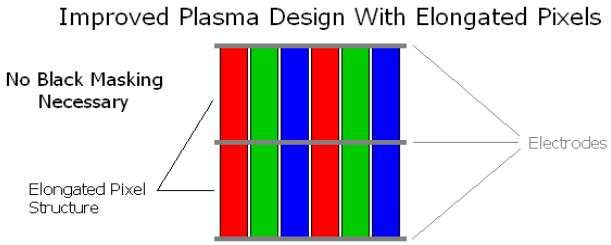


Figure 2

A new advancement in the way plasma panels are designed and electronically controlled (Figure 2) is now available in a few select models. Most plasmas still use rectangular shaped pixels of the same ratio of height to width. These pixels are surrounded by a black masking material used to artificially enhance contrast by making the area between the pixels look darker. Unfortunately, the black masking also causes the pixels to be more separated from each other, making the image look more like it is constructed out of a grid of pixels (also known as the screen door effect), without actually resolving any additional black picture detail. A few of the latest plasmas have improved upon this by using elongated pixels that are much taller than they are wide and by eliminating the black masking material surrounding the pixels. Because the taller pixels give off more light, the image will look brighter and more vibrant than any standard plasma. Also, removing the black masking means less visible separation between pixels for a much smoother and more natural image that eliminates the "screen door effect".

Reliability, Warranty, and Support

We've explained a great deal about "what" to buy when you head out to make a plasma purchase, but it is equally important to consider "how" and "from whom" to buy.

Warranty

A plasma display may be the most technically complex product most of us are ever going to own. We hope we've already convinced you that there can be enormous variation in the quality of these devices. That's why some cost a great deal more than others and, like most things in life, you get what you pay for. There are, however, equally significant differences in the reliability of these displays. All manufacturers can predict, with surprising accuracy, how well their products will perform and how quickly components will fail. The manifestation of that knowledge is in their warranty. If a manufacturer is unwilling to back its product for longer than a year, that should tell you a great deal about the compromises that have been made in the design and assembly process to reach a certain price point. If another manufacturer offers a

414.221.0200 | 740 N. James Lovell | Milwaukee, WI 53233 | www.ultrafi.com

three-year warranty and will agree to come to your home to make any necessary repairs, that should tell you something altogether different. The latter manufacturer can't be profitable doing lots of costly in-home warranty service calls, but knows with great certainty that their product isn't going to fail, so they won't have to.

Extended Warranty Options

On the topic of "extended warranty" offers we can only repeat our earlier advice of "caveat emptor". These warranties are nothing more than a vehicle for the big-box mass-merchandisers to subsidize unprofitable sales of inferior equipment. Do you really "save" money by bundling a less expensive plasma with an overpriced warranty and then living with the almost certain knowledge that you'll one day have to deal with some sub-contracted repair shop when your plasma fails? The best warranty is the one you'll get from the manufacturer of your plasma; especially if they'll come to your home in the unlikely event that a repair does become necessary. Don't buy an extended warranty, buy a plasma that won't break down.

Support Considerations

There are a number of different places to purchase a plasma display and they range from "virtual stores" on the Internet and big-box retailers all the way to boutique specialists like Ultra Fidelis. "Support" is an important element of a plasma purchase, before, during, and after the sale and it should be key in your purchase decision.

There are grave consequences to being seduced by a low price. There is an entire marketplace operating on the Internet that takes advantage of unsophisticated buyers. They offer outdated models with inferior technology and there are numerous examples of people being burned by buying radiation emitting commercial plasmas that have to be upgraded for home use and aren't safe for that application. There are also a number of "dealers" who aren't authorized by the manufacturer to sell their products; plasmas purchased through these shady sources don't have any warranty at all, irrespective of what the salesperson may tell you. Another common discounting technique is selling the "reconditioned" unit; this is not always a bad thing, but it does mean the unit is used already so you need to carefully explore the pedigree of the piece, the remaining warranty, and the willingness of your dealer to support you in the event of a service issue.

There are many considerations involved in selecting the "right" source from which to purchase a plasma display. Perhaps the most important decision you will make through the entire purchase process will be which dealer is worthy of your trust and your purchase dollar. The only prudent choice is a dealer that is, at a minimum:

a) authorized by the manufacturers they represent
b) able to clearly discuss the technology you've just learned about
c) skilled enough to set up and demonstrate the plasma properly
d) local enough to install, calibrate, and support your system
e) committed to a long-term relationship

At Ultra Fidelis, we don't pretend to be the only dealer in the Midwest with these essential prerequisites, but there are significantly fewer than you might imagine. Spend as much time getting to know the people supporting you during the sales process as you do evaluating the devices themselves and it will be surprisingly easy to separate the "wheat" from the "chaff."

Conclusion

With all of the choices available, buying a plasma display can be an intimidating proposition. We hope this white paper will greatly simplify your task. Focus your energy on getting the best image quality for the application you have in mind. Remember to look for 10 bit image processing for the most detailed and vivid picture possible. Make sure to choose a plasma with the highest quality built-in scaler you can find. This will ensure a smooth and natural looking picture instead of one that is plagued by artifacts. And, if you plan to watch a lot of HDTV material, try to select a model that has at least 1280 x720 resolution. Take advantage of the most recent advances in technology so your expensive purchase isn't outdated the minute you get it home. Be sure to buy your plasma from an authorized dealer with the necessary skills and experience to install and calibrate your new display properly; contrary to what you'll hear, plasmas should be optimized after installation. Select a model that has the longest factory warranty, with in-home service if available, and a dealer that will be there for you if there is a problem. The very best plasmas, with the very best warranties, cost only slightly more than models with dramatically inferior image quality, reliability and support. The lowest price is rarely the best value, especially for an investment of this magnitude.

414.221.0200 | 740 N. James Lovell | Milwaukee, WI 53233 | www.ultrafi.com