

Ten Easy Steps for Investing in a New Digital Display Device
(AKA How to buy a new HDTV Display)
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Step #1: Define how you will use the display.

What you need to do during this first crucial step is decide what digital content you will view during the percentage of the total time you will be viewing your display. Some of the most common uses of displays are for viewing: news, sitcoms, movie of the week, PBS, cable shows, DVD movie rentals, computer games, gaming systems(Xbox, Game Cube, PS2), everyday sports games, major sporting events (World Cup, Superbowl, FA Cup, Olympics, playoffs, World Series, etc). Write down what percentage of the time you will view each of these events (or add your own that are not on the list). Next to each of these percentages write down the time of day you expect to view the shows and how many others will view the event with you, and finally how large a screen diagonal you would like to view the event upon. An example is shown below.

Event	% of Time	Time of Day	How many viewers	Size
News	10%	10 PM	2	32"
Xbox	30	3-4 & 11-12 PM	2	61"
DVD Rental	40	7-12 PM	5	61"
College Game	20%	8PM or 1 PM	1-8	61"

With this critical information you now have defined your event viewing profile as well as some of the major factors affecting viewing conditions. The time of day is very important because of ambient lighting conditions in most rooms varies with the time of day. The number of viewers and preferred screen size, along with some of the room and viewing conditions we will discuss later, affect the type of display to be chosen.

Step #2: Where will the display be placed in your house/office/classroom?

Some of the display location questions to be answered are: What room in the house is the display going to be placed ?, How far from the viewer to the screen?, How much floor or wall space is available for the display?, What type of furniture is in the room?, Where are the windows and doors with respect to the screen?, Where is the walking path in the room (between the viewers and display)?, What is the height of the viewers eyes and what is the height of the bottom of the screen?. Having this information will enable you to decide the size and type of display that is realistic for your room. A simple sketch of the top view and side view of the room with furniture and display designated is very helpful at this step.

In the US, where the rooms in homes and businesses are, in general, larger than in Europe and Asia we might tolerate larger volume displays. In the US the TV “box paradigm” is very prevalent and many consumers, especially technology phobic types, will have a hard time with any new display device that is not offered in a conventional box format like cathode ray tube (CRT) displays and rear projection televisions (RPTV). Luckily many of these technology phobic people are now using flat screen liquid crystal display (LCD) monitors on their home and work computers. Where room size and thus viewing distance is smaller people will most likely favor thin viewing scenarios such as plasma, LCD, and front projection. Each of these display technologies offers a very thin screen, 2 to 8 inches (50 to 200mm), so that the display device fit more into the “artwork paradigm” than the box paradigm.

Step #3: Where will you sit/lie/stand to view the display?

One of the issues here is how the light from the screen is directed into the viewers’ eye. Like a piece of paper, a computer monitor, and most television viewing, the eye of the viewers is normal or perpendicular to the display. We all have seen how the viewing conditions fall off as the angle from the screen perpendicular grows in laptop computer screens or in some of the rear projection televisions. As the angle from the screen perpendicular grows the illumination falls off rapidly after a certain viewing angle threshold is reached. Some simple geometry or angles will need to be calculated to determine how far off the center certain viewers will be viewing the display. If your trigonometry is too rusty borrow your child’s protractor and estimate the horizontal and vertical angles. If there is a couch center on the display and four of five people can sit on the couch you will want to calculate the largest horizontal angle from the screen normal for the person on the end of the couch. If kids will lie on the floor to view the movie or play the Xbox game this lower vertical angle will need to be calculated. If the projector is on the ceiling and the viewers are sitting on a couch or in desks like many classroom setups these are important facts to consider for display and projection screen selection.

Step #4: Ambient light conditions

You will need to define and quantify, if possible, the magnitude of the ambient light hitting the screen and the viewer’s eyes. If most of your viewing is done during the evening hours when the sun is down with dark or minimum room lighting, then you don’t have much to worry about in terms of ambient illumination noise. If most of your viewing is done in a living room or den with large windows along two walls without curtains, blinds, or window coverings then you have some challenges and limitations on your display selections because of the large potential room illumination noise.

It is best if you can have the ambient light levels of your chosen display viewing room measured with a light meter. Most high end display stores will have one you can check out to perform your own quantitative measurements. There are several reasons that a high ambient light level are difficult to compensate for with different displays. It all comes down to signal to noise ratio. The signal is the part that you want, like the light

coming from the display into your eye, and the noise is the part you don't want, like the illumination noise coming from the diffuse reflections off of the wall behind the display or from the scattered light from the illuminated window covering on the window at the side of the room that gets into your eye. You probably realize that the display has a fixed (or slightly adjustable) light output level or signal strength. If we want to maximize the signal to noise ratio to get the best viewing conditions for a particular display then we need to work on the illumination noise part of the ratio that we have most control over or choose a display technology that provides a higher output signal or more lumens.

If you are on a budget like most of us, it will definitely be financially much easier to adjust the ambient illumination noise. Like most human factors decisions there are tradeoffs and ambient illumination noise control is often traded off against the dreaded but ever present "spouse factor" (see below). With a front projector display in a bright room during the day the choice is often to spend another \$500 to get the next brightest output level projector in the product line or to go spend \$50 at the local DIY (do-it-yourself) home store or material store to purchase some dark window covering material.

In high ambient light conditions you often need to understand and consider the type of light source such as ambient sunlight, tungsten bulbs, compact fluorescent, fluorescent tube, or high intensity discharge lighting. Each of these light source types has a color temperature and spectral distribution that can affect the viewing conditions. These light sources may directly illuminate the screen or may be direct noise into the viewers' eyes. These lights will also reflect off of walls, carpets, and furniture onto the screen adding illumination noise color that was not intended in the original signal.

Rule #5: The Spouse Factor

The often irrational, emotional, possessive, and illogical reasoning by one spouse or the other about what is and what is not allowed in the display viewing room is known as the spouse factor. Everyone has experienced the spouse factor either growing up, in college with roommates, or early in their marriage. The spouse factor happens often in garages, bedrooms, and family rooms or dens. Put my tools back on the peg board, put your socks IN the dirty clothes basket, don't put your feet on the coffee table, don't leave your fast food trash in my car etc.

The spouse factor is responsible for many display decisions being compromised or even sabotaged because of these irrational display room rules and behaviors. Don't get me wrong, some display room rules are definitely necessary and reasonable. I am sure that some leading edge psychologist will start a practice in the next year to help couples with the emotional and financially leveraged spouse factor effect on display selection and positioning in the home. You probably don't want a RPTV only 3 feet from the couch or a \$15K plasma screen on the floor where the dog and young kids can scratch, bump, kick, and ding the screen as well as practice their coloring skills with crayons upon its high tech surface. Some decisions are just based upon feelings, unfounded fears, rumors, conjecture, and modern folklore. Intelligent people discuss and research their reasons and can be persuaded by facts, understanding, listening, and logical reasoning. Then

again who said people are reasonable about their tech hobbies or passions, anybody know a good spouse factor psychologist?

A large spouse factor is a dictum by one spouse or the other that a big box like an RPTV is just not allowed in the living room or den. It may also be that a front projector is not allowed because you have to constantly move the DVD player from one side of the room to the other and draping power cords, sound cords, and cables across the floor. These cords are just not safe or visually desirable. The spouse factor varies with living style, personality, and attitudes to home use style and their past learned beliefs and habits. Make sure you talk about the spouse factor with your spouse before making your trip to the store and especially before the final display type decision and purchase. If your still not sure rent one of the final two or three choices for a long weekend and decide together prior to the large display investment.

If these simple suggestions don't help solve the spouse factor problem then be reasonable and build your own dedicated home theater room off the patio or garage.

Rule #6: The Display Budget

On average consumers keep their displays for about 8 to 10 years. As HDTV programming becomes the only source of broadcast signals, most consumers will be switching over to HDTV or digital TV in the next five years. You must decide your budget for the new display device. Factors such as lifestyle, hours of planned viewing, types of events, will affect the level of budget dedicated to home entertainment display device. Discuss it and review your budget and have a ball park range when you finally visit the stores.

Don't forget to add many of the accessories that are necessary to augment the display to your budget. These accessories can be mounts, cables, equipment racks, sound systems, screens, and screen mounts, and consumables such as replacement bulbs. Display lifetime will also come into the financial decision and getting and setting a criteria for lifetime can be one of the most difficult tasks in a display selection decision.

In the display field there are many early adopters of each type of technology and these types of people must buy the latest and greatest electronics as it is their hobby and passion to stay on the cutting edge of electronic consumerism. These people when they move on the next electronic purchase will often sell the slightly used display device at a deep discount from the original prices. You may want to also investigate the used market for these high value display electronics.

Rule #7: Visit the display store with your list and test videos

Like most successful projects the hardest work is in the planning stage where you have to actually do some thinking, and now that you have most of the tough decisions behind you it is time to finally get some visual stimulation in the display candy stores. You may want to go online and take a quick look at some of the online resources to get a general

idea of prices, lumen or nit levels, screen sizes, box volumes, warranties, bulb life and replacement cost, and other “box spec” features of the various displays under consideration. This activity will help condition you to the display sticker shock you might encounter upon entering the display candy store. This activity will also give you an idea of which companies’ product line crosses your price and performance level range.

Some of the online resources you might want to consider are www.projectorcentral.com they have a very nice feature search on front projector technologies. Sound & Vision Magazine is a good resource with more technically oriented articles and reviews that can be found at www.soundandvisionmag.com. For plasma televisions there is www.plasmatvbuing.com. Another resource is Home Theater Magazine at www.Hometheater.com. Many other can be found by doing a quick Google search at www.google.com which is an excellent internet search engine.

Over the years, home theater buffs and equipment development and testing engineers have developed some favorite movies to use to put a display through its paces. This helps to determine if the product can stand up to the consumers rigorous high fidelity viewing demands. One of the key parameters here is to take some of the same types of digital media that you typically view and view it on the display under consideration. The HDTV content that is fed to all of the digital displays in the store is interesting but how often do you sit and view colorful tropical fish swim in a high brightness coral reef? BYODVD! Some of the favorites of home theater buffs are:

The Matrix
Moulin Rouge

Star Wars
Shrek

Monsters Inc.
Toy Story

Gamers like the following games:

Madden NFL 2004
Vice City

Ghost Recon
Splinter Cell

MS Flight Simulator
NBA Street

For the more serious tech types who may or may not have photometry and colorimetric measurement instruments there are the following test videos.

Digital Video Essentials from Joe Kane Productions at www.videoessentials.com

Go forth to the candy store and view!

Rule #8: Reconcile Plan vs. New Visual Information

I have found that the two most confusing times in the digital display search process are at the beginning and just after returning from several stores having looked at all of the different display technologies. The confusion or frustration often comes down to two favorite technologies and product models. The first product model fits all your criteria including price BUT, this other product model with the other display technology has a visceral grip on your visual senses, tech weenie propeller head ideals, and has your banker drooling as it is just one step above your budget. Welcome to digital display dementia!

What you need to do next, after a little break, is to sit down and review your answers to the planning rules 1 thru 6 against your new found knowledge and viewing experiences. Are you really going to follow the percentages of time on each viewing media and the time of day? Was the showroom lit at the same level as you picture window den, or was it in a dark corner of the store or in its own dimmed room to enhance the contrast under low light level conditions? Do you really have room in your chosen room for a display that large where you can actually sit two screen widths away? Do you really want to invest that much on a display device or should you use the extra one or two kilo bucks for a vacation, gym membership, a new mounting bike, or blues guitar?

Now that you have sat down and done some really hard thinking on two occasions and refined your digital display selection plan it is probably time to go out for another viewing session. Don't go just yet, there is still one more step.

Rule #9: Find & Read Some Technical Reviews

You have probably whittled your choice down to two or three models by now and before you go out on your final viewing trip it would behoove you to find and read some technical reviews on the products you are interested in purchasing. You are going to be looking at all of the performance parameters or box specs such as: contrast, color gamut, color linearity, video testing, color temperature, bulb life, warranty, and so on. Compare each of the models box specs against each other so you know, and are familiar with the differences between each of the models.

When you venture back out for round two viewing, you will be a bit more educated on the product differences. You can look for these product attributes during your second testing session. You can compare contrast on the different displays under YOUR typical lighting conditions. You can compare the viewing angle under your lighting conditions and make sure the viewers at the end of the couch, or lying on the floor will have as good a viewing experience as someone perpendicular to the screen. Take your test movies and look at dark and bright scenes and slow motion and fast motion scenes and see visually how these perform on your chosen display.

Rule #10: Reward Valuable and Knowledgeable Service with your Purchase

After you have selected the digital display that you are going to purchase make sure you reward the store and salesperson with your business. It takes time, effort, research, training and persistence for sales professionals to stay up to speed on fast changing technology like digital displays. When you start asking the tough questions and they can answer most of your questions there is a foundation of training and knowledge behind them. Did they say, "I don't know BUT I will find out and get back to you in 8 hours", and did they follow up on their promise? Did they provide you with technical review articles and share their valuable time and knowledge with you? If so, reward them with your business. Most of the good stores will have delivery and installation and technical

setup services that come with the purchase of your display. All of these services should be considered as part of the total pre and post sale value in your purchase decision.

Happy Digital Viewing!

If you enjoyed this article and found it helpful you may be interested in technical DVD courses by Optical Short Course International. We have some current titles such as:

Optics of Digital Projectors

Color in Digital Projector

Top 10 Laws of Optics

We also have a weekly newsletter that discusses the technical details of digital displays called **In The Box**.

We also teach these courses live several times per year world wide check out or live course schedule at www.oscintl.com/live_schedule.htm.