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# AV Specifications and what they mean.

**Video Standards:**
Standards tell us how far the signal will travel and how many volts it is carrying.

NTSC = 3.58    15.75 kHz – 525 interlaced lines
R-Y & B-Y are at 3.5 gz which is the frequency at which color is modulated in the US.

In Computer domain, only VGA – 60Hz, 256 colors is the only standard, when you go beyond this, many variations occur in frequencies and color capabilities.
RGB = color information
HV = timing information

**In XGA 1024 x 768,**
Horizontal = Lines per second – expressed in thousands of Hz. Ie 48.1 kHz
Vertical = Frames/pictures per second 60Hz expressed in Hz
1024 across is your vertical synch pulses – how many pictures (frames) you can show per second.
768 = synch pulses & blanking lines expressed in kHz

**Analog Signals ( in order of best to worst) ways of sending the synch signal:**
RGBHV – separate H & V – standard output from VGA computers
RGBS – composite synch – older equipment like CRT's
RGsB(cameras), synch on green – Sun, SGI, Systems that require less cabling
RsGsBs (some SGI –silicon graphics) or Sun workstations

So when you send out a computer signal, it must be separated into RGB with the synch somewhere – either separated as HV, either as S, or RGsB where the synch is on Green OR RsGsBs where the synch has been spread out across the three colors. If it isn't such as is the case with coax or composite, it will experience chromocrawl. S-video at least breaks it up so it can experience a separate chrominance (color) C and one for luma (brightness) Y.

Component (YUV, Y'Pb'Pr, Y'Cb'Cr') Y/R-Y/B-Y) with component, brightness info is on Y.
S-Video YC (15.75 hz) Where C is all color info and Y is brightness info
Composite ( you are taking all the color info and putting it on top of the brightness info.
Modulated Video (RF)

Y=Luminance
PbPr= Hi definition video
CbCr=NTSC – this is used with traditional analog components

Every color display must have RGB & interpret it. Every analog signal must have H & V.

## Lens Configuration

EX    2.6 – 3.5:1 where the 1 = the width of the screen
IF 6' wide screen, then 2.6x6=15.6' (this is the closest you can get to the screen without going over screen edges with image on a 6' wide screen

also    7.0:1 = 70'

Throw Ratio = $\frac{\text{Distance}}{\text{Width}}$

The higher the number for F Stop on cameras, the less efficient the glass of the lens.

## Proper Display Size

Example

A typical rule for determining display width is to divide the distance from the last seat in the auditorium by six. At the same time the width of the screen should not exceed the distance to the first row of seats divided by two.

Distance to last row of seats = 60 feet
Distance to first row of seats = 20 feet
60 feet divided by 6 = 10 feet
20 feet divided by 2 = 10 feet
Screen height should equal 10 feet.
Screen width should equal 13.3 feet.

**Proper Font Size**
The font should be 1.5 inches in height for every twenty feet between the viewers and the display.

Example

Distance to last row of seats = 60 feet
60 feet divided by 20 feet = 3
3 x 1.5 inches = 4.5 inches

**Foot-lamberts**

*Determined by taking the lumens and dividing them by screen area.*

Example

ANSI lumens = 1500
Screen size = 9' x 12'
9'x12'=108 square feet
1500 divided by 108 = 13.89 foot-lamberts

**Foot Lambert Points of reference**

- Television - 30
- Home Theatre - 8
- Movie Theatre - 14

**Screens**

Understanding Gain: When a screen is said to have a gain of one, it is neither adding to nor taking away from image brightness. As gain increases so does the foot-lamberts rating.

- **Screen Gain example:**
  **Foot-lamberts = 13.89**
  **Gain = 1.8**
  **13.89 x 1.8 = 25 foot-lamberts**

**Fixed Installation Screens: Mounted & Motorized**

- Front Projection – two opposing concerns: *Screen Gain & Viewing Angle*

As screen gain increases the viewing angle typically decreases.  The screen acts as a reflection device for whatever light hits it.  A screen can be designed in such a way that it concentrates that light in one direction resulting in increased screen gain.  If the need is to provide a greater dispersion of the light resulting in wider viewing angle then gain typically suffers

■ **Optical Screens**

*Very High Gain*
*Very wide horizontal viewing angle*
*Costly*
*Very Little Vertical Viewing Angle*

Rear projection screens can be manufactured from a glass, a form of Plexiglas or a flexible material.  These materials are prepared as translucent surfaces that disperse the light from the projector to create the image.  The two most common types of rear projections screens used in fixed installations are optical and diffusion screens.  Optical screens are the equivalent to a large group of tiny lenses put together to create the screen surface.  This type of screen has very high gain while at the same time maintaining a very wide horizontal-viewing angle.  The down side is that optical screens are quite costly and offer very little vertical-viewing angleWith optical screens all of the light is dispersed horizontally and virtually none vertically – be careful with auditoriums where screens are high and people sitting underneath..

■ **Diffusion Screens**

With diffusion screens, the viewing angle remains constant in the horizontal and vertical viewing plains.
*Lower cost by comparison*
*Very wide horizontal and vertical viewing angles*
*Lower cost by comparison*
*Lower screen gain*

The proper number of displays; the size of each display; proper placement of each display; the amount of ambient light between the viewers and the display; and the brightness of the displays.
The number of displays depends on the building layout.  Some buildings may only require one screen to provide an image that can be seen clearly from any seat in the auditorium.  Others will require two or more screens of the same size but facing different directions to provide a view to the entire auditorium.  Still in other situations it is necessary to consider the display size and the distance to the viewers.  And ambient light between the displays.

**<u>Using DA's</u>**

Typically a computer signal does not carry nearly as far as a video signal and therefore is more often the source in need of amplification.  Either line amplifiers or distribution amplifiers handle the amplification.  The choice of amplifier depends once again on the application.

**Determine screen size.**

Measure the distance from the screen to the furthest seat that is in
line-of-sight to that screen. If the majority of the content is video, divide that number by 8. That is the screen height. Remember that this is just one of many possible formats that will determine which number to achieve the screen height.

The screen height will be the same if the aspect ratio is 4:3 or 16:9 as
only the width is different (if done correctly, anyway). Make sure that the closest seat is twice the distance from the screen in comparison to the screen height. Example - 6' tall = 12' away for closest viewer.

**Determine square footage of the screen surface.**

Take the screen height (in feet) and multiply it by the screen width (in
feet). Ex. 6' x 8' = 48 sq. ft.

**Determining lumens needed from a projector in an environment:**

Take the number of lumens that is estimated will be needed, for example:
Example - 1000 (lumens) divided by 48 (sq. ft.) = 20.83

ANSI specifies that 18 (+ or - 2) is the acceptable number. This is assuming NO light is hitting the screen. Pitch black area.

So we now know that 20.83 is our number for this example, and our next measurement is the screen area itself - the amount of foot-candles hitting the screen surface from lights, windows, etc.

Let's assume 8 foot-candles is hitting the screen surface. We now take our number (8) and multiply it by 5 (our next formula). The answer? 40, of course.

THAT (40) is the number we must now reach to have adequate lumens being projected onto the screen surface. In other words, we must project at least 40 lumens per square foot onto the screen.

So, going back to our first example, we have 48 sq. ft. of screen area. If we project 2000 lumens onto the screen surface, and divide that by 48, we get 41.66, which is enough to accomplish our goal.

Therefore, assuming no screen gain, we will need 2,000 lumens projected onto the screen surface from the projector *in order to overcome ambient light*.

**Calculating Light candles**

**Remember screen size must also consider the content shown where we use the following generally calculations:**

| LFV | LFV | LFV |
|---|---|---|
| 10 (for video) | 8 (Powerpoint) | 6 (NOC, EOC, fine graphics) |

What is LFV ( least favored viewing angle) and find the furthest LFV because we are determining screen size.
Take Length of room – in this example say 100’ (Let’s say ceiling is at least 20’ high so it is not a concern)
If we were going to show Powerpoint mainly, then we take divide the distance of LFV by 8. We must consider where last seat is and not just length of room – say last seat is 80’ away. Then calculate as follows:

$\frac{80}{8}$ = 10’ high screen needed

Take 10 x 1.33 (NTSC video format) = 13.3 so a 10’ x 13’ screen size is needed.

**Using a Light Meter:**

**Set light meter to 200 setting:**
**10 x 13’ = 130 feet of total screen area.**
**Light meter reading in this example: 20.4**
**20.4 x 5 (where 5 is a constant in most cases you use) = 102**
**so we need 102 foot candles per square foot of screen material**
**So 130 x 102= 13,260 lumens needed.**

**To convert the output to LUX on the meter, divide the meter reading by the factor of .0929**
**So 20.4 divided by .0929 = 219.59 LUX**

**Understanding Contrast**

To put it simply, when dark is dark and bright is bright in the same image you have contrast. Contrast is typically affected by a few things but most often by two primary factors: The projector/display characteristics and the amount of ambient light between the viewers and the display.

Contrast ratio. In a pitch-black room, lower contrast ratios are not nearly as important. But in a lit room, the better the contrast of the projector, the better the image will be. Contrast, in layman's terms, is how black the blacks are in comparison to how white the whites are. We call this *contrast ratio*.

Contrast ratios are normally listed (if at all) in one of two ways on a projector spec sheet: ANSI contrast and ON/OFF contrast. The number to pay attention to is ANSI contrast.

I'll give another example to help illustrate contrast ratio.

Let's say you have two projectors: Projector A is 2000 lumens with a 150:1 ANSI contrast ratio. Projector B is a 1400 lumen projector with a 400:1 ANSI contrast ratio. We'll also say they are using the exact same lenses projected onto the exact same size screens, side by side.

For an easy simulation, let's also assume the screens are the 4' x 6'. Now, which image will appear brighter?

If you said Projector A, take another look.

You see, the human eye *perceives* brightness in comparison to something dark. Therefore, because Projector B had a much greater contrast ratio, the whites would *seem* brighter next to those blacks. To our eye, Projector B would seem brighter.