

Selecting LCD Panel and Projector Displays

By Ron Ohlhaber

Typically when considering a display installation we ask which is better for showing images, a LCD panel, or a projector with a screen. The bottom line is which display will be more effective for the viewer to see the message? For any text message the answer primarily depends on the image size and the ambient light level.

In a movie theater where you're showing a very large screen image, the projector is always better. This is easy to accept since a lighted LCD display of the theater screen size would be enormously expensive and complex. However, in the theater lobby there may be large LCD panels showing previews or other content.

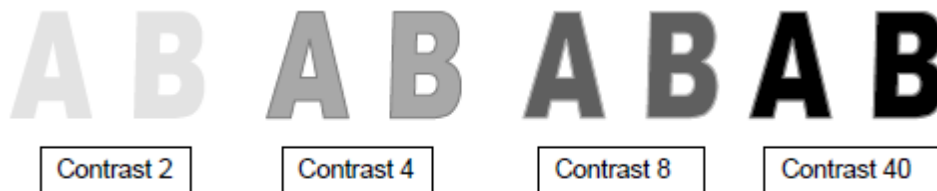
The difference between these applications is the image size and the ambient light level. In the theater the ambient light level can be reduced to almost zero. While in the lobby area there is normal room light. That room light level may be 1,000 times greater than in the darkened theater.

To understand the tradeoffs for the use of these technologies we need to consider the image properties. When we view images our ability to clearly see them and identify words is based on two factors.

For text images these two factors are the size of the text, and the distinction the text has from the background. Size is easy to understand. The way the text is distinguishable or stands out from the background, is associated with the image contrast.

Simple contrast for black text on a white page is just the ratio of the bright level of the background to the dark level of the text. We can measure the white background level and the dark area of the text. Contrast is then the ratio of the bright reading B, divided by the dark D. It is B/D .

A simple illustration of the contrast for text is the letters shown below at different contrast levels. Once the contrast exceeds 8 it is usually easy to read the text.



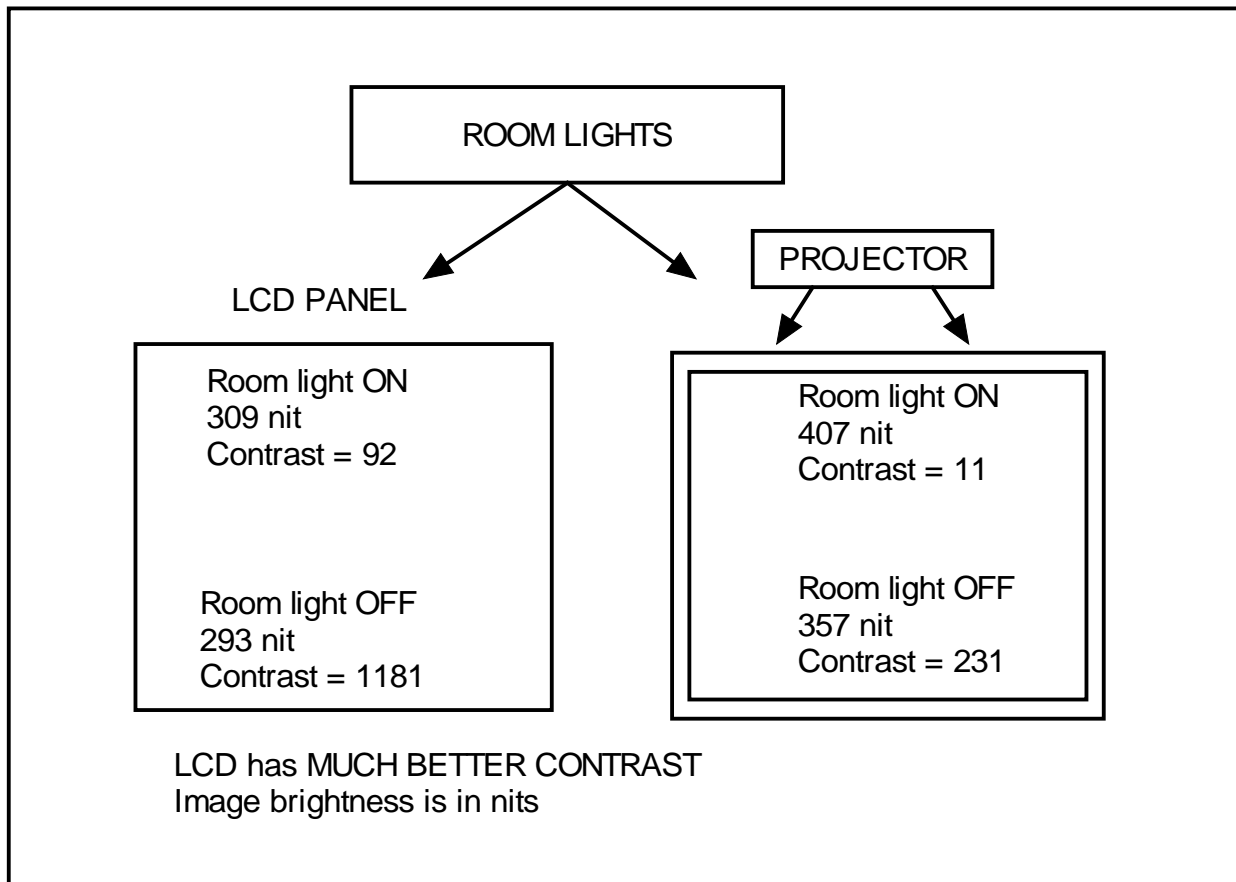
For real world images the contrast can vary from less than 1 to over 10,000. Normally images that we see as pleasing have contrast ranges over 100.

To determine the selection of LCD panels and projectors we can look at the contrast range of the image provided. This can be done by making a general prediction of the application based on the specifications of the devices and the ambient light environment. It can also be determined by a set of measurements.

For example, in one application the brightest white light level of a LCD panel was measured along with the darkest level to establish the contrast. This was done for the displayed image in a dark setting and a second time with the panel in ambient room light.

The results for a commercial 65" LCD panel compared to an ultra short throw projector with a whiteboard as the screen, are shown in the following figure. The maximum brightness as measured in nits is indicated along with the contrast. Values are given for both displays under the two conditions of room lights; On or OFF.

For brightness measurements a meter was used that provides the readings in units such as nits. The nit is just a handy unit. It is defined as one candle per square meter. It is related to the Foot Lambert, and is used to specify the peak brightness of many LCD panels.



In this case the images were about the same size. The panel was 65" and the UST projector image 73". When in a dark room the contrast is above 200 for both, however with the room lights ON, the projector image has a contrast of only 11, while the LCD panel is at 92. This is just as expected since we observe that the room lights appear to "washout" the projector image.

What is happening with the projector image is that the room lights equally illuminate the white and the black area of the image. Since the image is on a whiteboard, the board becomes brighter from the room light in the black areas which decreases the contrast.

The LCD panel also gets a little brighter in the dark image areas but since it has a black background, the room light contribution is much less. For this situation the LCD is the better choice provided the text size is sufficiently large.

This is one example of comparing the images to see what type of display should be used. However, even from this simple measurement there are some other added insights which we can be stated.

First, we can calculate that by doubling the projector light level the image contrast will change by about 2. A projector light output change from 3000 lumens to 6000 lumens would provide a contrast of 22 for the room lights ON condition. This is not much of a benefit for a major increase in the cost of the projector.

With projection a much more rewarding way for image improvement is to reduce the ambient or room light level. This could be done by turning off some lights or using shades or other light blocking devices. An ambient light rejecting screen is also an alternative that will improve the contrast. However, in this case the whiteboard is the screen and it is desirable since it can be used with dry markers.

The projector with whiteboard had a fluorescent ceiling room light almost directly overhead. If this light is dimmed the ambient light level on the whiteboard reduces significantly. Then the image contrast exceeds 40 which is a very useable level for a large interactive classroom display.

For a complete determination of the display choice other features associated with each technology are considered.

Features of LCD Panel verses a traditional Projector with Whiteboard

- No projector lamp replacement or unexpected burn outs.
- Shadowing on a projected image is eliminated.
- No chance of the projector light shinning in users eyes
- The maintenance to change filters on a projector is eliminated.
- A much higher contrast image in high ambient light
- The display will not be washed out by sun or ambient light.
- Many LCD panels are available with an optional built in PC. This makes a true "All in One" display.

Features of Projectors with an Interactive Whiteboard

- Larger size image than a LCD panel
- Lower weight than a large panel
- Lower cost for sizes over 85" diagonal
- The display surface can be used with dry markers
- Immediate use, the Whiteboard surface can be used when the projector is OFF
- A whiteboard may already be in place
- The whiteboard is easily replaced but must be flat

Both technologies are used today to provide interactive operation with a relatively large image. As the price and size of the LCD panels changes the potential for their use in display systems will increase. However, the larger size images provided by projectors are expected to still be dominant for some time.

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