



LED Technology in the Video Security Market

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Introduction

The video security industry has seen a progression of video display technologies, from cathode ray tube (CRT) used at the inception of CCTV, to Digital Light Processing (DLP) projection, to Plasma and Liquid Crystal Display (LCD). Today, there is growing interest in an emerging technology for monitors: Light Emitting Diode (LED). This whitepaper explores LED display technology and its potential application in video security.

What is an LED Monitor?

As LED displays are making their way into electronics retailers and more general availability, customers across the video security industry are asking questions about the new technology. “Is there a difference in picture quality between an LED and an LCD monitor?” “Is there a big difference in contrast?” “Can LED monitors be our standard monitor?” etc.

The first thing to know about an LED monitor is that it is nothing more than an LCD monitor with an LED backlight unit behind it. The Liquid Crystal Display (LCD) remains the same, but LEDs (Light Emitting Diodes) are used in place of traditional CCFLs (Cold Cathode Fluorescent Lamps) to illuminate the display. When electronics manufacturer Samsung introduced an LCD TV using LED to illuminate the LCD panel, Samsung called the new version display simply “LED TV”. Whatever its validity, the decision to drop “LCD” was a marketing move. After all, “LED” is the acronym du jour, a technology that is all the rage as a new, perhaps revolutionary lighting source. It is as emotive a term as “HDTV” and “digital” were in their early days.

But the distinction between LCD and LED is somewhat confusing. From a display technology viewpoint, LED is an active lighting component, while LCD is a direct-view imaging panel with a backlit unit attached behind. An LCD panel is essentially a cell structure, wherein a liquid crystal material is sandwiched between two patterned conductive substrates and isolated by a polymer ring around four edges of the panel. The cell gap, predetermined by a spacer material, micro-balls or bars, is in the range of 1 to 10 micrometers. A TFT (Thin Film Transistor) array with millions of tiny transistors to control each individual LC pixel “ON” and “OFF” is deposited inside of the conductive substrate, while a CF (Color Filter) array is fabricated on the other substrate to render the display with full color capability: each color represents a sub-pixel, and one pixel consists of three RGB sub-pixels. There are three display modes in LCD monitors: TN (Twist Nematic) mode, IPS (In Plane Switching) mode and VA (Vertical Alignment) mode. In the case of large panel displays (typically larger than 30-inches), IPS and VA modes are popular due to their superior viewing angle and contrast ratio. However, TN mode is still dominant among smaller monitors, (i.e., smaller than 24-inch models).

Traditionally, an LCD monitor uses fluorescent tubes to light the screen. Because CCFLs are always on, some light leaks through to the front of the display even when a part of the image is supposed to be black. As a result, traditional LCD monitors have trouble creating deep blacks. A lack of deep black reduces the perceived sharpness of the image. Also, fluorescent illumination lacks a wide range of colors, especially red; hence, color saturation is limited in traditional LCD displays.

The LCD monitor with LED backlight, on the other hand, can overcome some of the limitations of traditional LCD displays. Currently, LED-backlit displays come in two forms: Dynamic

RGB LED panel, which is positioned behind the LCD panel; or white edge LED bar positioned around the rim of the light guide plate, which uses a special diffuser to spread the light evenly behind the LCD panel.

RGB Dynamic LED-backlit LCD Monitor

This method of backlighting allows dimming to occur locally, creating special areas of darkness on a screen. This means the viewer sees a true black image with much higher dynamic contrast ratio. The LED lighting panel works as a very low resolution LED display, while the TFT LCD panel works as a very high-resolution display. Both displays are superimposed and synchronized together so that the black area of an image becomes true black because of both displays shutting off simultaneously.

Edge LED-backlit LCD Monitor

This method of backlighting allows for LED monitors to become extremely thin. The light is diffused across the screen by a special panel, producing a superb uniform color range across the screen. Currently available edge LED monitors use a white LED bar positioned around the rim of the light-guide plate. It should be noted that white LED is not a true white Light Emitting Diode, but rather a blue LED with yellow phosphors, which is intrinsically short of red color. Therefore, the color quality of the edge white LED is not as good as the RGB Dynamic LED.¹

True LED Display

Contrasting with LED-backlit displays, a true LED Display is one in which LEDs are not used as backlighting, but rather as individual pixels. Currently true LED displays are not small enough to be used for individual pixel in smaller format televisions or monitors, and so the use of LED TV or LED monitor is restricted to much larger screen in places such as sport stadiums and outdoor signage display.

Differences between LED-backlit and CCFL-backlit LCD Monitors

LED-backlit LCD monitors differ from conventional CCFL-backlit LCD monitors in the following:

1. LED-backlit LCD monitors can produce an image with greater dynamic contrast compared with CCFL-backlit LCD monitors.
2. With edge-LED lighting they can be extremely slim. Current models on the market can be less than one inch thick.
3. They can offer a wider color gamut, when RGB-LED backlighting is used.
4. Because no mercury is used during manufacturing, LED-lit monitors reduce environmental pollution on disposal.
5. LED-lit displays generally have 20-30% lower power consumption compared to traditional LCD displays.
6. Longer lifespan. With a proper thermo management in LED design and driver design, the useful life of LED-backlit monitors will be much longer than that of comparable CCFL-backlit monitors.

¹Edge LED is not limited to the white LED structure. RGB Edge LED technology has been developed for avionics applications, rendering superior color quality and uniformity.

Adoption of LED-backlit Monitors in Video Security

Although LED-backlit displays are gaining popularity in consumer markets, their cost makes them prohibitive for widespread adoption in video security. Right now, the cost of the LED-backlit LCD monitors is significantly higher than that of CCFL-backlit monitors (roughly 25% higher in white LED version). However, as the scale of LED-backlit monitors increases, costs are decreasing. As LED display costs continue to decline, coupled with the cost benefits of LED's lower power consumption, we foresee that, in the near future, large panel LED-backlit LCD monitors will dominate in the information display industry. Thus, LED displays will be definitely the new trend of Pelco video security monitors.



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