

LCDs Continue to Evolve

Cynthia Ferrell, President, CEO, Optrex America



LCDs have come a long way from the basic passive monochrome segmented characters used in this old clock (Figure 1) to today's high performance active matrix LED-backlit TFT LCDs and high performance-high contrast passive matrix LCDs. To coincide with Optrex America's 30th year in the LCD marketplace, this article will look at how LCD technology has evolved since this 7-segment passive matrix monochrome clock display first went into production.



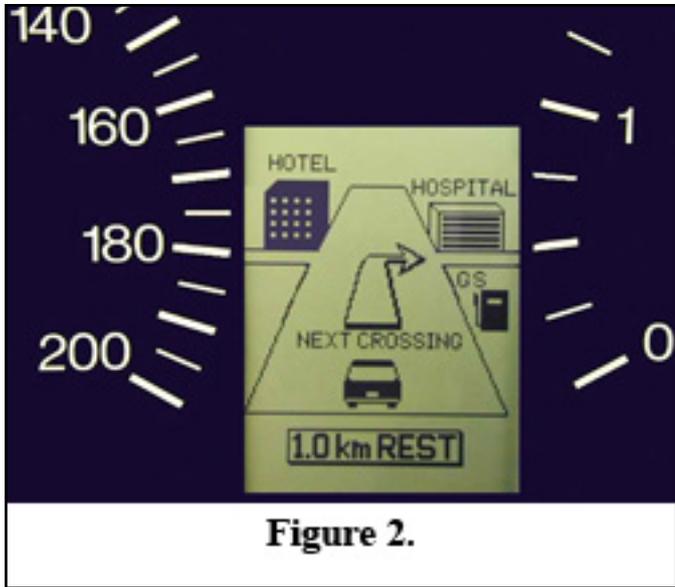
TFT LCDs

For several years (late 1990s -- early 2000s), TFT-LCDs were found only in high-end displays because they were expensive at that time. For many applications that required a full color display but needed a more moderate price/performance ratio, CSTN (Color Super Twisted Nematic) passive matrix technology provided an alternative solution. Many people might still remember the first generation Palm Treo, which used a CSTN display. But how things have changed! Flat panel display manufactures such as Optrex worked to make TFT-LCDs less expensive without sacrificing performance, and TFT LCDs --- increasingly backlit by high-brightness LEDs -- have now captured the consumer and industrial markets from cell phones to laptops to test equipment and many other applications, including LCD TVs

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Many TFT LCD suppliers now offer a complete product line of LED-backlit modules with benefits such as no warm-up time, instant on, improved EMI performance (no high voltage inverter needed), lower power consumption compared to standard CCFL backlights, wide dimming range and no mercury (environmental friendly).



Many of these are now available with anti-reflective (AR) coating and super high bright backlights with light output exceeding 1000-1500 nits (cd/m²) for optimum outdoor performance at nearly any temperature.

Ten years ago, this 120 x 160 monochrome STN (super twisted nematic) LCD (Fig. 2) offered both transmissive and reflective properties to optimize readability in applications such as automotive interiors and in other environments where the ambient light varied.

Today, designers can choose from an array of LED-backlit TFT LCDs (Fig. 3) with front of screen brightness levels ranging from 400 cd/m² to 700 cd/m² for indoor use and 800 cd/m² to 1500 cd/m² for outdoor applications. Additional features include wide viewing angles up to 160°, high contrast ratios up to 1000:1, and wide



operating and storage temperature ranges.

What about monochrome?

A common question in the industry is: When will monochrome technology go away? The reality is that passive monochrome is still a viable technology and accounts for a significant portion of the display volume globally. It's still being improved and still supported; there are many applications where it simply makes sense to use passive monochrome over active matrix.

Optrex recently introduced ABN; Advanced Black Nematic, a technology that boosts contrast ratios near 1000 to 1 combined with ultra wide viewing angles that rival

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active matrix technologies at a cost that beats many other display technologies such as vacuum fluorescent (VF). ABN is ideal for POS (point of sale) and vending applications, and is



Figure 4

so power friendly it will operate using USB. LCDs with ABN technology (Fig. 4) exhibit practically no color shift, so any backlight color can be used without compromising the contrast ratio. Passives are also well suited for applications where a custom size, limited production volume and resolution become cost prohibitive for active matrix technology.

Display manufacturers are evolving, too

Today's flat panel display manufacturer must be more than just a display vendor. The LCD display OEM must provide a diverse portfolio – such as touch screens, connectors, heaters, cables, design engineering support and quality containment

In addition to offering a breadth of product and technology solutions and ready availability of product, today's LCD OEM must add real value to the display that will last for years to come and continue to expand value added capabilities and a reliable support structure. These are keys to success in a very competitive market.

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