

## XtraView™ Wide Viewing Angle Technology

Wide viewing angle technology for the NEC Technologies' MultiSync® line of active-matrix liquid crystal display monitors

### *What is it?*

Historically a major impediment to the use of liquid crystal display (LCD) technology as a replacement for standard CRT monitor technology has been the poor viewing angles exhibited by LCDs. Previously, when users either attempted to view the screen from the sides, or even worse yet, from the top or the bottom, they would see color changes and image distortions. Unless viewed head-on, images would appear to be washed out or appear as a negative image.

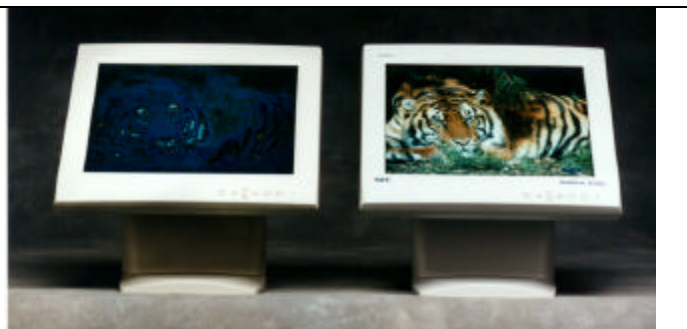
NEC Technologies has overcome this limited viewing angle problem through its XtraView technology first introduced in a commercially available desktop monitor in its MultiSync LCD2000™ and MultiSync LCD400™ monitors (June 1997). While in the past, users of conventional LCD technology were limited to viewing angles of 30° from center left to right (60° overall) and 20° from center up and down (40° overall), the new XtraView technology allows for an ultra-wide viewing angle of 160° both left to right and up and down (80° from center). Such revolutionary technology allows for the widest viewing angles in the industry.

To show the dramatic difference XtraView technology produces, the photographs below show the various viewing angles of an NEC MultiSync LCD monitor with standard LCD technology (left side of each picture) and an NEC MultiSync LCD monitor with XtraView wide viewing angle technology (right side of each picture).

### **View Head On**



### **View Looking Up**



**View Looking Down**



**View Looking Left**

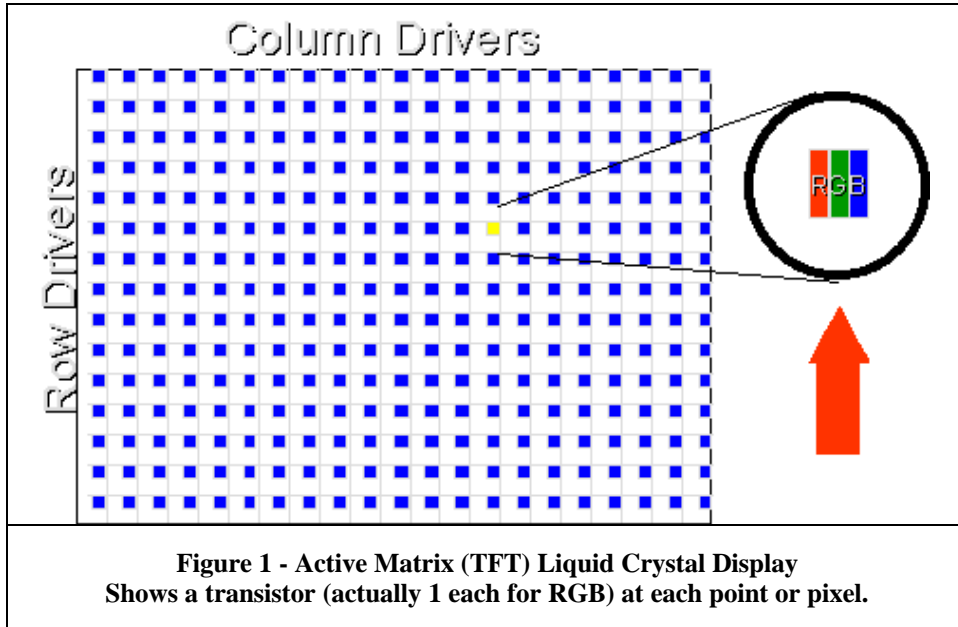


**View Looking Right**

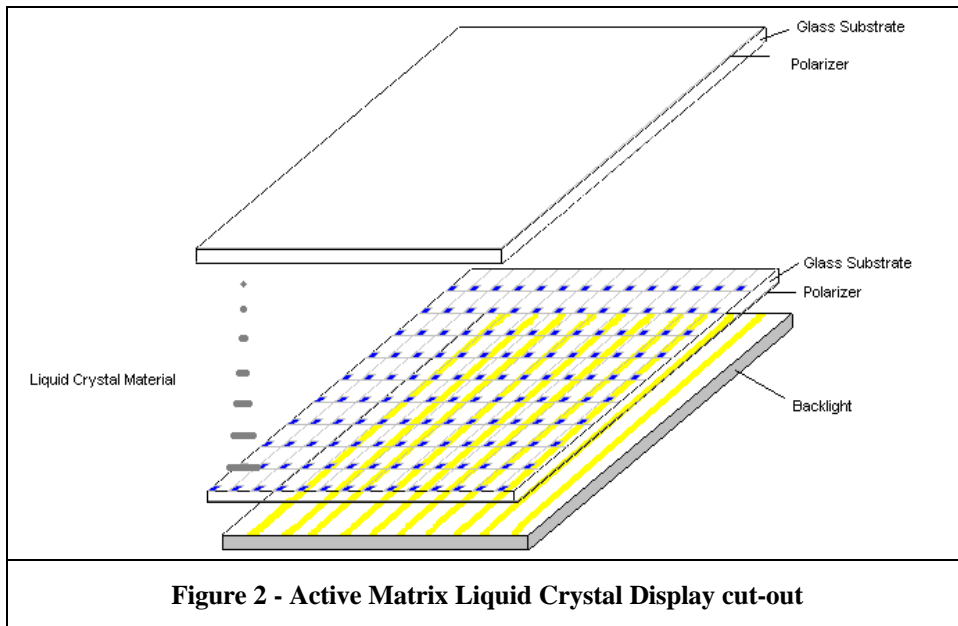


*How, exactly, does NEC accomplish this?*

Before XtraView technology can be defined, a little primer on active-matrix (TFT) technology is in order. TFT, or thin film transistor, technology uses tiny transistors to help generate an image. TFT screens are a complex matrix (or grid) of tiny transistors (see **Figure 1**). Having a transistor at each pixel (or dot) helps to control the crystals very precisely; each dot can either be "on" or "off".

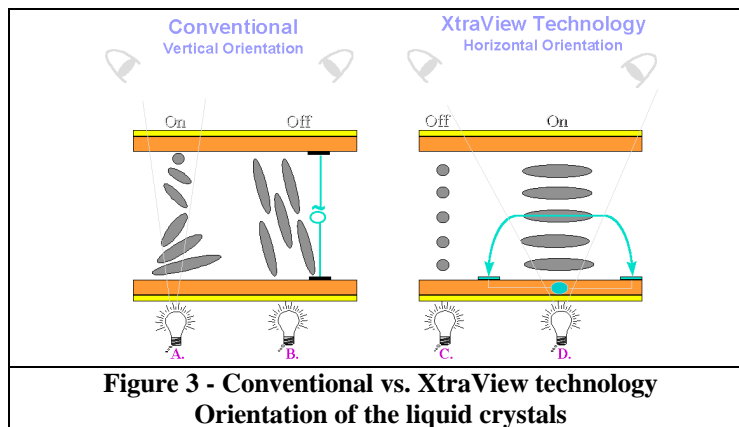


These transistors do not generate light or color, an often-made mistake. This is where the liquid crystals and their alignment come into play. Light for LCD panels used in desktop monitors comes from a light source, often referred to as a backlight. A backlight is usually a bulb or a set of bulbs that are found along the edges of a panel or behind the panel. The transistors control the orientation of the liquid crystals, thus allowing them (the liquid crystals) to pass (or not pass) light from the backlight.



Liquid crystals, by their very nature, twist in a double helix-like pattern between the two glass substrates. In conventional active-matrix technology (without XtraView technology), when a voltage is applied to the transistors, the crystals untwist from their naturally twisted state. By untwisting the crystals, light from the backlight source is not allowed to pass from the rear glass substrate through the front glass substrate, resulting in a dark dot or pixel. In this example, when the liquid crystals are untwisted, they stand on end (**Figure 3-B**) due to the electrodes being placed on the top and bottom glass substrate. Your eye is now looking down the long axis of the liquid crystal, thus causing the loss of viewing angle. When the charge is removed, the liquid crystals naturally twist back, allowing light to pass from one glass substrate through the other.

With XtraView technology, the electrodes that destroy or create the twist in the crystals actually align in an entirely different way. By having the electrodes on the same glass substrate, they allow the crystals to remain horizontal to the glass substrates in both the on and off states (**Figure 3-C, D**). By aligning the crystals in this manner, NEC is able to improve the viewing angle by passing the light through the crystals at their most efficient orientation -- a horizontal orientation -- thus dispersing the light more efficiently. In conventional TFT LCD technology, the crystals themselves actually block some of the light that they are passing because the light is being passed when the crystals are perpendicular to the glass substrates.



***Why are increased viewing angles important?***

Even with their inherent advantages (thin, light weight, reduced emissions, etc.), in order for LCD monitors to replace CRT monitors as a mainstream display technology, LCD monitors must at least have the same functionality as comparable CRT monitors. Computer users have become accustomed to information sharing (multiple users using CRT monitors) and expect that a display can be visible from a variety of angles. XtraView technology from NEC Technologies allows this for the first time with LCD monitors.

***Is XtraView technology available in Passive Matrix Displays?***

Passive Matrix is an alternate, less expensive liquid crystal display technology. To reduce cost, passive matrix displays do not have a transistor at each pixel point and are inherently designed differently. Because they do not provide precise control over individual pixels with the use of a transistor, they cannot achieve the wide viewing angles that active matrix XtraView technology can. Passive matrix technology also has deficiencies in terms of response time, ghosting and poor contrast ratios in addition to poor viewing angles.