Acer LCD Technology: Response Time

enabling crisp full-motion video

With the recent widespread use of PC and online games, and PCs equipped with DVD drives give users more opportunities to see moving images such as those in 3D games or movies on screen. This increase in motion picture content means computer monitors must be able to display not only still images, but moving ones as well. Manufacturers and IT publications often cite a fast response time as an indication that a display can play videos or games with little or no blurring. Hence, Acer would like to share with you what response time is, and how helpful it is in determining how well an Acer LCD display can portray moving images.

Response time:

Why is it increasingly important for LCD applications?

If response time is slow, the transition from one picture (or frame) to another can produce an afterimage or blurring effect. This problem occurs not only when looking at motion pictures, but also while scrolling. For this reason, panels with faster response times are typically recommended for displaying moving images.

Listed below are the calculations for the liquid crystal response times that Acer displays meet, with consistent reliability, for various application standards. Response time is measured in milliseconds (ms, 1/1000 second). The shorter the time frame, the better the display quality.

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How Acer accelerates response times and guarantees reliable products

Key parameters of faster response time

\[ T = \frac{Yd^2}{\varepsilon_0 \Delta \varepsilon V} \]

Lower rotational viscosity liquid crystal materials and reduced cell gap thickness enhance “On-Off Response Time” performance.

To rapidly improve liquid crystal on-off response time, Acer has developed products with lower rotational viscosity liquid crystal materials and reduced cell gap thickness during the first stage.

As the figures below show, using an overdriving algorithm, Acer LCD displays can reduce the deviation in the transition time and approach ideal performance. This significant improvement can be seen in the ideal time of the gray-to-gray panel, which is the most important factor in the moving-picture viewing experience.

Faster gray-to-gray response time via overdrive (OD) technology

The key benefit for Acer OD technology is the clear improvement of the gray-to-gray level, which is the most important factor in the moving-picture viewing experience. Liquid crystal molecules respond faster to the higher voltage that’s needed for black-white transitions than to the low voltage that’s needed for transitions between gray areas. Therefore, even though going from one grayscale level to another is less of a jump than going from black to white, the gray-to-gray transition time can actually take longer.

Two LCD panels with the same black-white response times but with different gray-to-gray transition times can be seen in the figures below. The panel on the left shows the time it takes for the liquid crystal to change from one gray level to another, while the panel on the right shows the time it takes for the liquid crystal to change from a color level to another.

The transition time when LC materials are rotating on either the required white/black or gray levels is called “rise time” and “fall time,” respectively. Normally, the transition time of 256 x 256 LC pixel areas needs to be measured. However, some companies don’t measure degree levels due to limitations of equipment capability.

Liquid crystals are rarely completely turned on or off. Instead, they cycle in between grayscale states. The following are two common methods Acer uses to measure response time:

- **Gray-to-Gray response time**
  - Gray-to-Gray response time is the time it takes for a liquid crystal panel to change from one gray level to another. This measurement can be used to determine how well an Acer LCD display can portray moving images.

- **Gray-to-Gray response time definition**
  - Gray-to-Gray response time is when the liquid crystal changes from the gray-to-gray transition time, allowing for a more accurate assessment of Acer displays’ suitability to portray moving images.

At present, there is no accepted standard for the calculation of Gray-to-Gray response time. However, as a company that emphasizes product reliability, Acer insists on using the average to gauge performance, delivering better value to the end user.

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<td>16 ms</td>
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<td>PAL (25 fps)</td>
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- Lower LC Rotational Viscosity (\( \gamma \))
- Lower Cell Gap (\( \delta \))
- Larger dielectric anisotropy (\( \Delta \varepsilon \))

Lower rotational viscosity liquid crystal materials and reduced cell gap thickness enhance “On-Off Response Time” performance.

Acer overcomes technical challenges such as non-uniformity and side effects caused by new LC materials in the LC-cell manufacturing process. Furthermore, new Acer products undergo strict testing before launch.

Higher voltage with overdriving technology reduces the moving image’s “Gray-to-Gray response time.”

These quick response times modeled with new LC materials and a thick cell gap have earned Acer much praise in the market in terms of capability and reliability, encouraging Acer to keep seeking new technologies for product upgrades.

Models with overdriving technology have been integrated into Acer LCD displays, accelerating response times, especially for gray-to-gray.

What is response time?

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To rapidly improve liquid crystal on-off response time, Acer has developed products with lower rotational viscosity liquid crystal materials and reduced cell gap thickness during the first stage.

Acer has been able to achieve this by using a new technology called “OverDrive” that uses higher voltage to accelerate the response time of the liquid crystals.

As the figures below show, using an overdriving algorithm, Acer LCD displays can reduce the deviation in the transition time and approach ideal performance. This significant improvement allows Acer LCDs to deliver high-quality moving pictures for 3D games and videos.