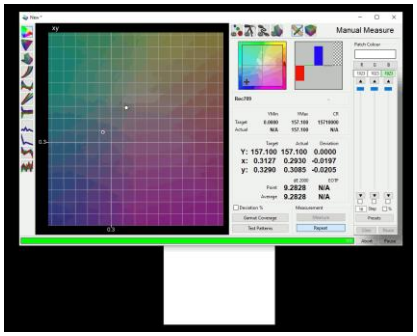
Display Contrast Ratio with LED Backlight

By Stuart Pointon

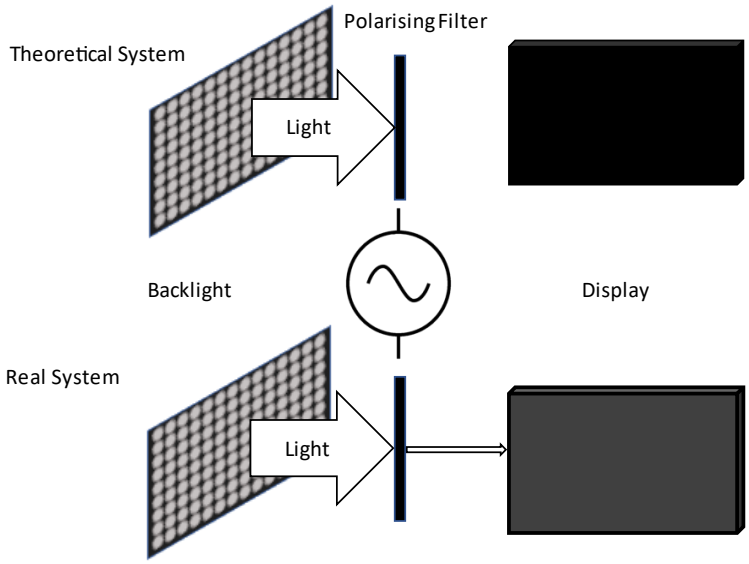
Display contrast ratio is simply the ratio of the peak white luminance to the black level. For instance, if a display had a peak luminance of 100 nit and a black level luminance of 1nit, then the contrast ratio is 100:1. Specifications for contrast ratio can vary on how they are determined and whether the contrast ratio is the display native contrast ratio or the calibrated correct colour temperature white point. To correct a display for the correct white point, then the RGB channels must be adjusted down in some ratio to correct the display white point. This means the peak luminance will be less than the native and hence the contrast ratio will also be less. For instance, if the native colour temperature is towards blue, then the blue channel gain will have to be reduced to compensate to bring the display colour temperature to D65.



ContrastRatio_1.1.22.webp

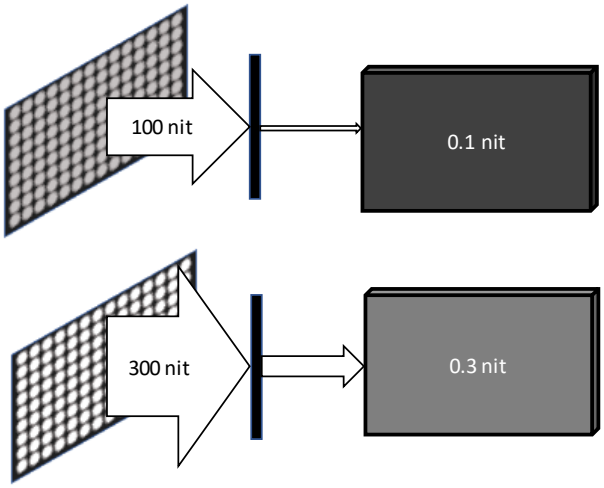
The *Very* Basics of LCD Displays

The image below shows the simplified way a display works. A backlight sends light through a polarizing filter which is controlled by a voltage proportional the picture content. So when the image is full white, all the light travels through the filter to the screen. When the image is black, the filter blocks all light going to the screen. In real systems however, the filter cannot completely block all the light to the screen. So, the screen will display some level of grey depending on the quality of the panel.



When the backlight is increased, the amount of light leaking through the filter increases proportionally.

As an example, if a display has a contrast ratio of 1000:1, then as shown in the image below, the screen black level would measure 0.1 nit. If the backlight was increased to 300 nit, then the black level would then measure 0.3nit.

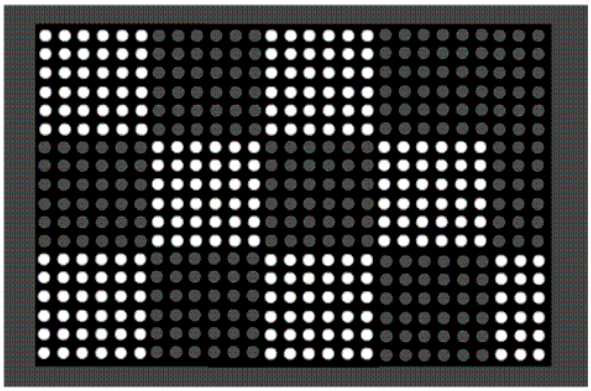


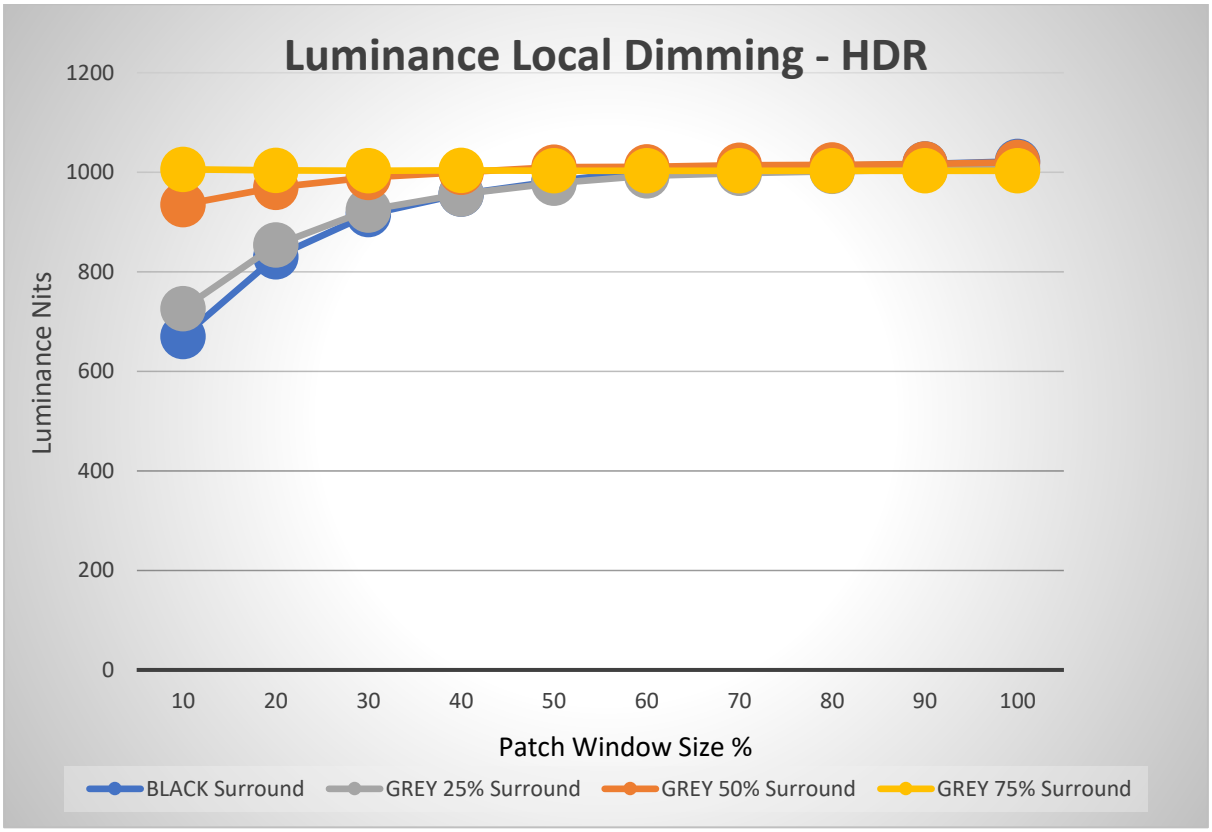
The contrast ratio for standard LCD displays is fixed. Increasing the backlight will not increase the effective contrast ratio.

Technology to Increase Contrast Ratio

Dimming is a method employed to try and increase the contrast ratio of LCD displays. There are three main methods in use: local dimming, global dimming and dual layer.

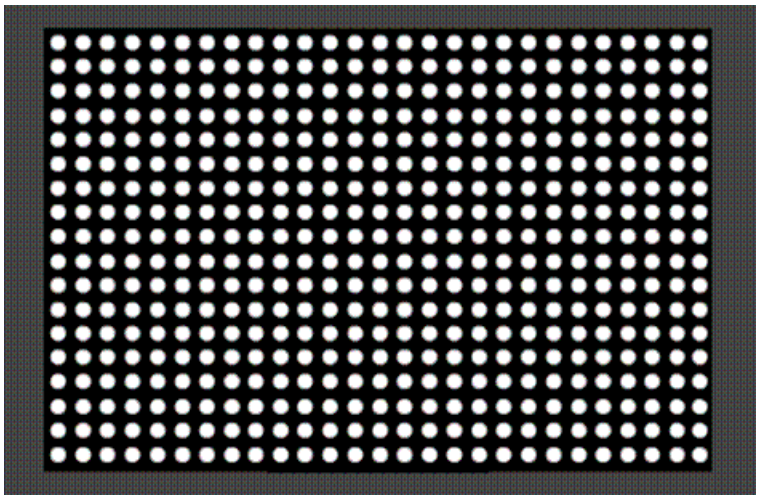
Full array local dimming uses multiple backlight zones that can be turned on and off and is the most expensive dimming technique due to its complexity. For colour grading, there are issues that need to be considered. The peak white luminance will vary depending on the image content, halo effects can be apparent, colour shifts can occur. These issues will depend on the algorithm used in the dimming.



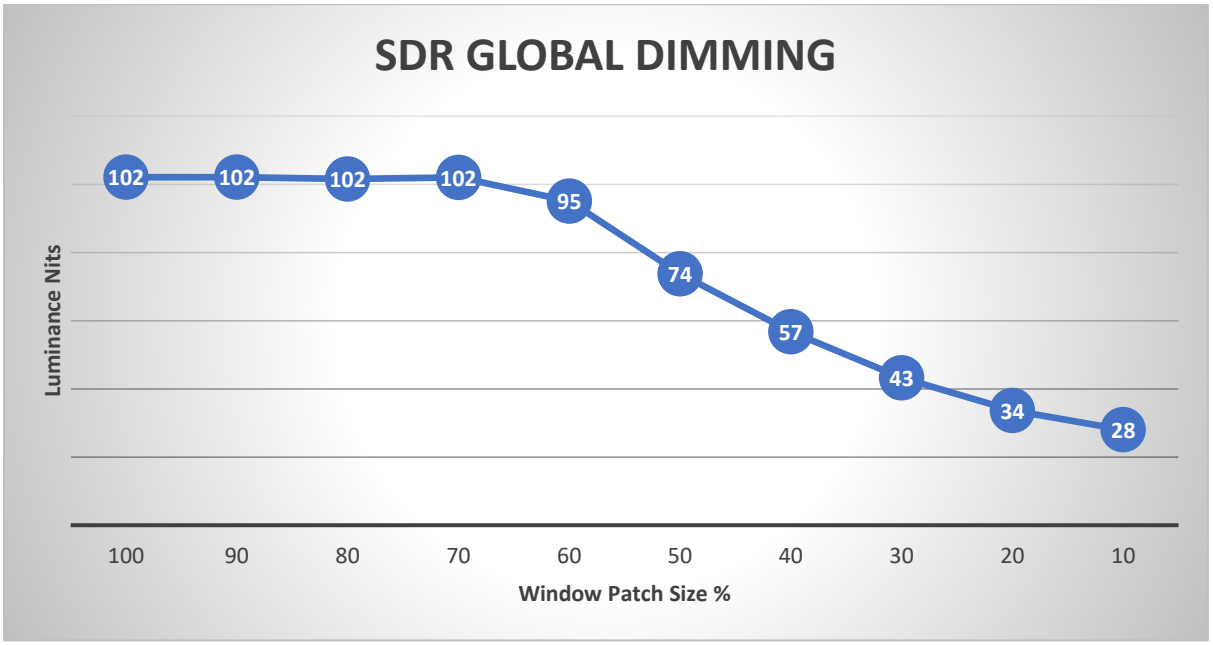


Global Dimming

Global dimming is the lowest cost and easiest form of dimming. In global dimming, the entire backlight is treated as a single zone and is dimmed for dark scenes and brighter for bright scenes. In this case a global dimming display should not be considered for any critical image viewing such as colour grading or onset exposure checking.

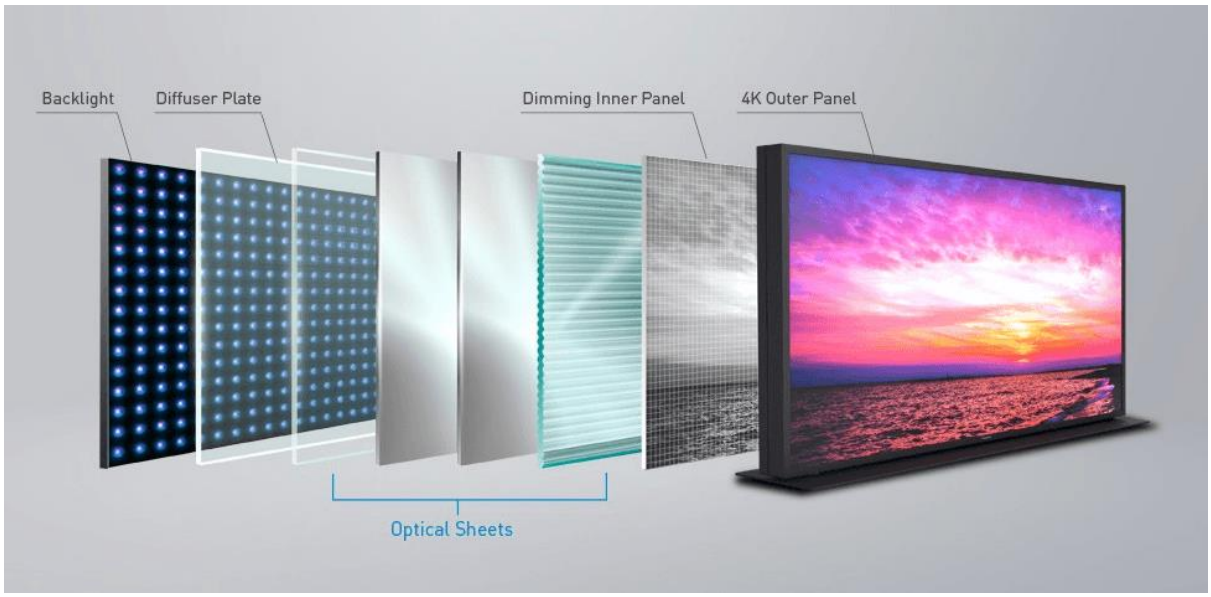


The graph below shows the effects of global dimming in an SDR mode showing at 10% patch size on a black surround the peak luminance went down to 28nit from 100nit.



Dual Layer

The EIZO CG3146 HDR monitor utilizes a high technology panel called a dual layer panel. This dual layer panel has a contrast ratio of at least 1,000,000:1 without the issues of local dimming panels. It's able to maintain peak luminance no matter the picture content without the colour shifts, halo and other artefacts associated with local dimming displays.



Contact Us

Your local EIZO team is standing by to support you.

AUSTRALIA & NEW ZEALAND

EIZO Oceania

Shop 2, 118 Princes Highway
24

ARNCLIFFE NSW 2205

+61 2 9462 7500

SINGAPORE & SE ASIA

EIZO SE Asia

Oxley Bizhub, 61 Ubi Road 1 #03-

SINGAPORE 408727

+65 6592 0135