

More Monitor Mitherings

We have tested LCD monitors extensively for high end proofing applications and the ones that generally score best are usually the most expensive ones. But does this have to be? And if so, what makes the cheaper models less suitable for high-end image evaluation and softproofing?

In our latest testing round we have looked at new models from Eizo, NEC, Quato and Viewsonic. Neither Apple nor Lacie have introduced new monitors lately but they will do so later this year. At the moment Viewsonic's monitor is the top low price challenger, and according to the specifications we expected it to score well. Ergonomic features like a pivot function and height and swivel adjustments, a claimed viewing angle of 170 degrees, plus a high brightness of 300 cd/m², boded well for it.

From Eizo we tested the new top model CG 221 but also an interesting alternative, the Color Edge 240W, the W for Widescreen. However the most radically new technology at the moment is NEC's LED (Light Emitting Diode) based Spectraview Reference 21. The LED light source offers both a high gamut and an even light distribution across the whole surface. The Spectraview Reference 21 reached the largest colour gamut we have measured so far, and was in fact larger than the ECI's entire RGB gamut!

What We Did

As in previous tests, we calibrated the monitors according to the standard for graphic arts production, ISO 12646. Unfortunately this 2003 standard still only really applies to CRT monitors, although work is underway to update the standard. As far as we can judge the main modification for LCD monitors is adoption of higher brightness. The current standard suggests 80–120 cd/m² (Candela per square meter), but most of today's LCD monitors are capable of delivering 250–300 cd/m².

However, even in a normal office's ambient light, this is far too strong a light to work at, so we suggest setting the brightness in an LCD monitor to 160–180 cd/m². It's never a good idea to have strong ambient light when working with image retouching or colour corrections, but the old recommendation of having only 32 Lux was mainly to adjust for the limited brightness of CRT monitors. What's important is to achieve a good contrast between the brightest areas and the darkest – at least a ratio of 100:1. It may sound natural to set black to zero brightness, but actually a printed paper always has a slight reflection, so the black setting of a monitor should be around 0.5 cd/m².

Having calibrated the monitors and created ICC profiles, we then displayed 24 different coloured patches and measured the average colour deviation, expressed as Delta E (CIELab). Then we measured the colour



The most expensive, but not the largest. The NEC Spectraview Reference 21 has the largest colour gamut on the market, and uses LEDs as the light source.



The second most expensive monitor, and also the monitor with the second largest colour gamut, the Eizo Coloredge CG221.

uniformity across the whole surface. For colour critical work we don't think a monitor should deviate more than Delta E4 altogether, both factors included. This is in line with Fogra's suggestion regarding hard copy proofing systems.

What We Found

We have added a new element to our testing procedure: we check if the colours change with the viewing angle. In most specifications for quality monitors, claims are made for up to 170 degree viewing angles, which means 85 degrees to the left and the right, or up and down. This is where the cheaper LCD monitors display their weaknesses. Even a slight change in viewing angle results in a very different colour appearance. This is not acceptable for high-end softproofing work.

If you want to know whether the technology used in your monitor is top notch, check the monitor's vulnerability to viewing angle. The more expensive use of IPS (In-Plane Switching) technology produces better end results than similar, but cheaper technologies such as MVA (Multi-domain Vertical Alignment), PVA (Patterned Vertical Alignment, or TN-type panels (Twisted Nematic).

We calculated the colour gamut of the monitors, comparing both with Adobe RGB and ECI RGB. While Adobe RGB is a popular standard RGB colour space, especially amongst photographers, ECI RGB is actually a slightly larger colour space, including all the printable colours in sheetfed offset, using CMYK. ECI RGB also has the correct white point assumed for proofing, 5000K, which Adobe RGB doesn't.

We compared our own test results to results achieved using a beta version of Ugra/Fogra's certification software for testing and certifying monitors. This is due for imminent launch so we won't include these results. We are however pleased that the results are in line with our own findings.

The participants

A little over a year since our first round of testing for LCD monitors, we are pleased to note that both colour gamut and colour uniformity have improved. The best scoring monitors are still the most expensive ones which perhaps doesn't come as a big surprise. It is still a little annoying for those of us harbouring a stingy bookkeeper inside us, or those of us simply wanting for once to save some money. Ever hopeful, we'll continue to test monitors in a slightly lower price bracket, like the Viewsonic VP2030, but so far they don't qualify for high-end softproofing. Neither ▶



Eizo CE240W. It may be tempting to choose this relatively low priced wide screen monitor for colour proofing, but neither useful viewing angle or colour accuracy match the more expensive monitors.



NEC 2190. This monitor replaces the older 2180, and uses the same technology as the Reference 21 to achieve uniform colours over the whole surface.

▼ does the Eizo CE240W, mainly because of its poor performance at higher viewing angles.

Eizo also participated with the CG221, the second most expensive monitor in the test, and which had the second largest colour gamut: a little larger than Adobe RGB. It's now more uniform across the surface than the precursor, the CG220. Eizo's CE240W we think has too poor a viewing angle, but otherwise it's a nice monitor for layout and it's reasonably priced.

NEC gave us two monitors to test, one with a conventional light source, the Spectraview 2190 (21") and the LED based Spectraview Reference 21. This performed best but also was the highest priced, at around €4850. For those who remember the Barco Calibrator, the "Rolls Royce" among monitors, the NEC Spectraview Reference 21 and the Eizo CG221 are the new reference monitors when it comes to high-end, wide gamut proofing. But this comes with a price tag to match.

The NEC Spectraview 2190 doesn't have LEDs, but otherwise shares the same technology as the Spectraview Reference 21 for colour stabilisation. NEC call this "Color Comp", meaning that the monitors are checked at the factory for colour deviation across the surface, and a compensation calculated which lowers overall brightness. This compensation can also be activated and deactivated by the user, but since LCD monitors in general have too high a brightness as default, we don't see this as a problem and recommend activating Color Comp. It's more important for proofing to have an even colour uniformity over the whole surface. Some instability of the colours over time was noted for the NEC Spectraview reference 21, but hopefully this was related to our test monitor, and not representative for the light source technology as such. We know that several of the other monitor manufacturers are planning to launch LED based models soon, and there is intense research underway regarding the use of LEDs as the light source in LCDs.

Quato participated with their new 23" monitor, Intelli Proof 230, characterised mainly by colour accuracy rather than wide colour gamut. In our first test round a year ago the Quato monitor scored best overall, and the Intelli Proof 230 displayed the 24 colour patches with the lowest deviation measured so far, 1.2 Delta E! With the larger screen size the uniformity wasn't so impressive, Delta E 3.2, but all in all this is a very stable and accurate proofing monitor. All Quato monitors are bundled with calibration software and the same validation tool that Ugra/Fogra will use in their certification procedure.

Viewsonic represents the underdog here. It's a much lower priced monitor than the others and we have to conclude that it's not suitable for high-end proofing. However this doesn't mean it's a poor monitor. It can be set to 5000K, it's fast (8 milliseconds response time) and has good ergonomics. The colour gamut is poor and uneven, and the viewing angle not satisfactory, but it can still be used for less critical layout work. ▶



The new Quato 230 23" LCD monitor is characterised by high colour accuracy through true hardware calibration.



The Viewsonic VP2030b is a very low priced monitor with good specifications. However it doesn't meet the demands of a high-end proofing monitor.

▼ In conclusion we find that if you want colour accuracy and uniformity, and a wide colour space, you still need to pay quite considerably for a proofing monitor. On the other hand, with softproofing more and more widely accepted, consider the cost of not having colour accurate monitors. What does a reprint cost in its expense, potential loss of future revenues and credibility, because the colours on the monitor fail to match the final print? We suspect it doesn't take many such cases for a good proofing monitor to have paid for itself.

– Paul Lindström

Table 1 – Colour Deviation

Model	24 Patches	Uniformity	Total Variance (Delta E)
Eizo CG221	1.8	1.9	3.7
Eizo CE240W	1.8	2.8	4.6
NEC Spectraview Reference 21	1.6	1.5	3.1
NEC Spectraview 2190	2.6	1.7	4.3
Quato Intelli Proof 230	1.2	3.2	4.4
Viewsonic VP2030b	1.7	4.2	5.9

Table 2 – Colour Space

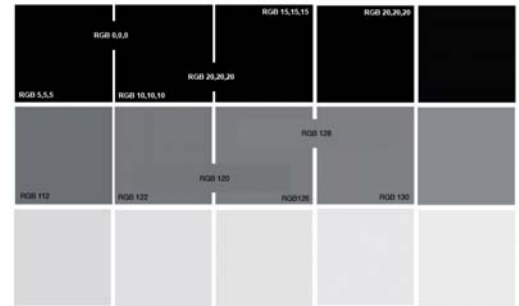
Model	% of ECI RGB	% of Adobe RGB
ECI RGB 1999	100	113
Adobe RGB 1998	89	100
Eizo CG221	96	109
Eizo CE240W	72	81
NEC Spectraview Reference 21	102	114
NEC Spectraview 2190	77	87
Quato Intelli Proof 230	75	84
Viewsonic VP2030b	70	79

Table 3 – Viewing Angle

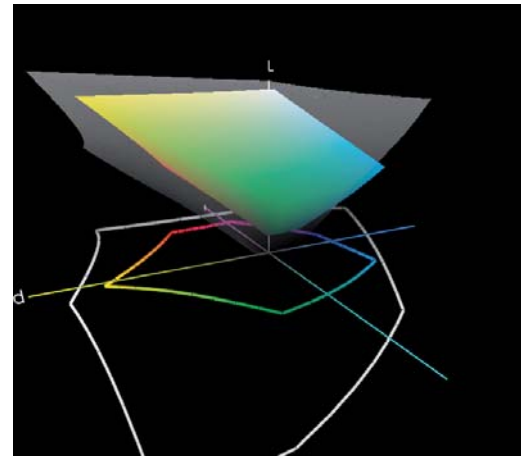
Model	Score 1-10
Eizo CG221	10
Eizo CE240W	5
NEC Spectraview Reference 21	10
NEC Spectraview 2190	10
Quato Intelli Proof 230	10
Viewsonic VP2030b	4

Table 4 – Facts

Model	Size	Price (approx) €	Info
Eizo CG221	22.2	4310	www.eizo.com
Eizo CE240W	24	1865	www.eizo.com
NEC Spectraview Reference 21	21	4850	www.nec-display-solutions.com
NEC Spectraview 2190	21	1875	www.nec-display-solutions.com
Quato Intelli Proof 230	23	3020	www.quato.de
Viewsonic VP2030b	20.1	700	www.viewsonic.com



RGB grey patches. It's important to be able to differentiate between very small tonal changes in an image. This test form helps us evaluate this and also reveals if the appearance of the monitor changes with viewing angle.



Colour gamut. It may be misleading to only calculate the total colour space achieved for a monitor. We also need to take into account how the colours are distributed. The NEC Spectraview Reference 21 has a very wide gamut, and still can't reproduce all the colours produced with sheetfed offset using CMYK.

