

Technical Developments for Widescreen LCDs, and Products Employed These Technologies

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Abstract

Following increases in widescreen representations of visual content, the launch of Windows Vista and the increase in the number of multi-display users, LCDs for IT applications are tending to shift toward the widescreen display. This paper introduces three widescreen LCD models that are leading this trend. These are the LCD2690WUXi/LCD2490WUXi pro-use models targeted at graphics display professionals and the LCD2470WNX high-end model targeted at commercial use and the general market. All of these models are compatible with widescreen signals up to WUXGA and have the capability of displaying full-HD (1080p) signals including HDCP. They also support a wide range of applications including graphics, financial and medical solutions as well as TV and DVD (Digital Versatile Disc) displays. These professional use and high-end models not only boast widescreens but also feature improved performances, including brightness, contrast and color gamut. Environmental considerations such as reduced power consumption as well as versatile functions and human interfaces are also featured.

Keywords

widescreen resolution, WUXGA, LCD, color calibration, brightness, irregularities, HDCP

1. Introduction

The market percentage of widescreen LCDs is expected to grow rapidly in FY2007. This trend will be backed by market need factors pushed by the dissemination of widescreen media such as DVD and the launch of OSs (Operating Systems) designed for widescreen display such as Windows Vista. Another influential market factor is the positive shifting of the development and production of panel makers from the traditional 4:3 and 5:4 panels to 16:10 widescreen panels.

At NEC Display Solutions, we began introduction of 20.1" widescreen LCD in 2005 to meet the new market trend, and had established a range of 19", 20.1", 22", 24.1" and 25.5" widescreen LCDs by the end of FY2006.

2. Pixels in Widescreen Signals

The number of pixels of widescreen signals is determined either based on video signals including broadcasting and DVD signals or on PC signals such as the VESA (Video Electronics Standards Association) signals.

The major widescreen signals standardized by NTSC (The National Television System Committee) include the 1080i signal that was set by the Japanese MUSE (Multiple Sub-nyquist Sampling Encoding), the 720p signal that has an equivalent

vertical resolution to the 1080i signal, and the full-HD-spec 1080p signal. The representative widescreen signals originated from PC specifications are the 16:10 (8:5) signals that use the same number of vertical pixels as SXGA+ (Super eXtended Graphics Array plus) and UXGA (Ultra eXtended Graphics Array) to facilitate pixel processing (See **Table**). Of the IT application-oriented models in our lineup, the 25.5" (64.9cm) and 24.1" (61.1cm) LCD models use the 1920 × 1200 panels with an aspect ratio of 16:10.

3. Inch Size and Pixel Pitch

The number of pixels per inch is represented in dpi units (dots per inch). A large dpi value means a high pixel density but also a small character size. On the contrary, a small dpi value means rougher pixels at the same time as large and easier-to-read characters. Therefore, our 24.1" and 25.5" models

Table Pixels of representative widescreen signals.

Widescreen	Aspect Ratio	Normal screen	Aspect Ratio
WUXGA 1920 × 1200	16:10	UXGA 1600 × 1200	4:3
WSXGA+ 1680 × 1050	16:10	SXGA+ 1400 × 1050	4:3
HDTV 720P 1280 × 720	16:9		
Full-HD 1080P 1920 × 1080	16:9		

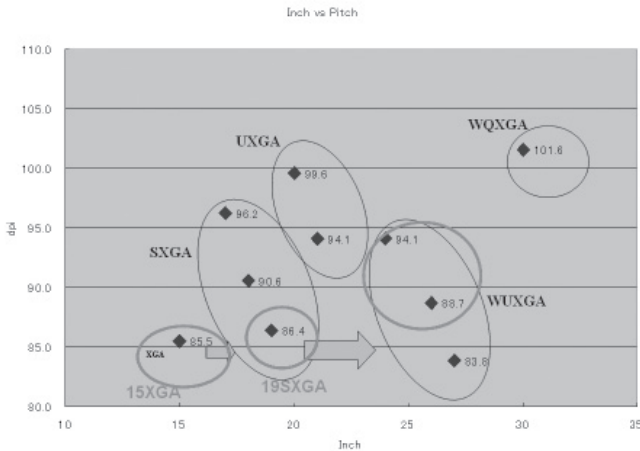


Fig. 1 Inch size and pixel pitch.

based on the WUXGA format can be regarded as models of optimum size that have inherited the pixel densities of the 15" XGA and 19" SXGA screens (Fig. 1).

4. Pro-Use Models LCD2690WUXi/LCD2490WUXi

The LCD2690WUXi with 25.5" screen size and the LCD2490WUXi with 24.1" screen size are pro-use models mainly targeted as graphics displays. However, their wide-screens are also suitable for many other display applications in the financial and medical fields as well as DVD and video games display (Photo 1).

1) Wide Color Gamut Display

The LCD2690WUXi uses an LCD panel with a wide color gamut of 91% of NTSC, thereby achieving a 95% area and 93.4 coverage compared to the color gamut of the Adobe



Photo 1 External view of the LCD2690WUXi Black Model and the LCD2490WUXi White Model.

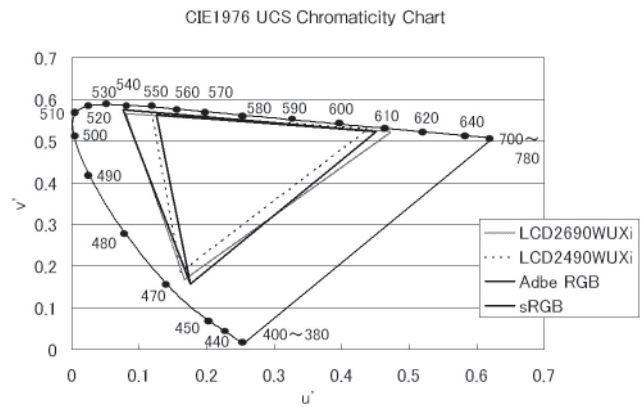


Fig. 2 Color gamut.

RGB*1 that is becoming the standard in the printing and digital camera industries. At the same time, it also meets the sRGB international standard established by IEC by using a color gamut compression matrix circuit. The LCD2490WUXi uses an LCD panel with 75% color gamut of NTSC and also meets the sRGB standard (Fig. 2).

2) Increased Brightness and Contrast

The wide color gamut described above was the result of using color filters with a wide color gamut in the LCD panels. However, widening the color gamut generally leads to a decrease in the brightness, and increasing the brightness by increasing the backlight lamp current leads to a rise in power consumption or a shortening of battery life. We solved these problems by modifying the electrode structure of the LCD to the H-IPS system in order to increase the aperture ratio (Fig. 3).

The LCD2690WUXi/LCD2490WUXi uses a directly-below lamp configuration to reduce the weight and increase the brightness, this configuration has the usual problem, which is the presence of high levels of radiating heat. However, the H-IPS system adopted with these models has increased the light emitting efficiency and thus the power supply efficiency, and has succeeded in reducing the amount of heat being radiated at a certain brightness compared to the 21" model that uses the edge light configuration (Fig. 4).

*1 Adobe RGB is the standard color space used by application software "Photoshop" of Adobe Systems, Inc., USA.

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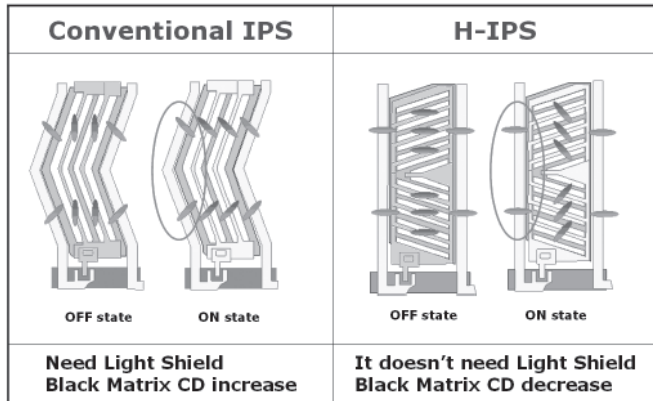


Fig. 3 Panel electrode structures.

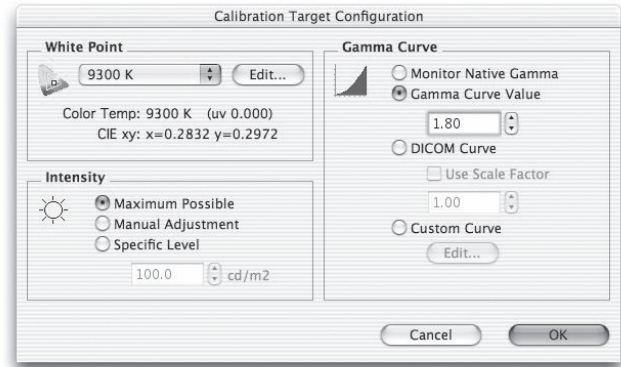


Fig. 5 Hardware calibration setup display.

LCD2190UXi(250cd/m ²)										LCD2690WUXi(250cd/m ²)															
50	50	49	49	49	49	50	50	39	39	40	40	40	40	40	41	39	38	38	38	38	38	38	38	40	
42	42	42	42	42	42	42	43	38	37	37	37	37	37	37	37	39	38	37	37	37	37	37	37	37	39
42	41	42	42	42	41	40	42	38	37	37	37	37	37	37	37	38	37	36	36	36	36	36	36	36	38
40	39	39	40	40	39	39	42	37	36	36	36	36	36	36	36	38	37	36	36	36	36	36	36	36	38
39	39	39	39	39	39	39	40	36	36	36	36	36	36	36	36	37	36	36	36	36	36	36	36	36	37
39	39	39	39	39	39	39	40	35	35	35	35	35	35	35	35	36	35	35	35	35	35	35	35	35	36
40	39	39	39	39	39	39	40																		
46	44	43	43	43	43	44	46																		

(Surrounding temperature:25°C)

Fig. 4 Front surface temperatures.

3) Hardware Calibration

Accurate calibration according to the ambient environment is possible using the EYE-ONE Display 2 (i1 Display2) manufactured by X-Rite, Inc.

Calibration of a photo or print draft requires precise adjustments of the display luminance, white point temperature and gamma characteristic as well as a wide color representation gamut (Fig. 5).

All the user needs is to set the brightness, white point temperature and gamma characteristic values using the dedicated calibration software SpectraNavi. The actual adjustments are performed automatically by the LCD and PC. The user does not need to manually adjust the RGB gain as is the case for software calibration.

The 90 series products such as the LCD2690WUXi incorporate a 12-bit LUT (Look Up Table) so that the gamma calibration may be corrected without spoiling the 8-bit data output from the PC. Whereas, the software calibration is accompanied by losses or solid painting of gradations

because it performs corrections using a graphics card with an 8-bit LUT.

As an ICC profile that is important in color management is generated at the same time as the calibration, emulation of printed materials is also possible using a CMS (Color Management System) such as Adobe® PhotoShop.

4) Other Functions

The LCD2690WUXi/LCD2490WUXi also inherits the following versatile functions from the 90 series that was released in 2006.

- The “MURACOMP” irregularity compensation function corrects both color irregularities and brightness irregularities.¹⁾
- The Response Improvement circuit that reduces residual images in movie displays.
- 12-bit gamma adjustment function for more accurate gamma correction.¹⁾
- Three input systems accepting up to 3 PCs.
- Auto Dimming function that attenuates eye stimulations.
- Auto Black Level Adjustment function for reproduction of fine gradations in dark areas.
- Position mechanism with easy installation and removal.¹⁾
- Long Cable Compensation function reducing signal degradation in long-distance connection of either analog or digital signals.¹⁾
- HDCP (High-bandwidth Digital Content Protection system) compatible.
- Full-HD (1080P) compatible.
- Screen Saver function for preventing LCD panel burns.
- Scheduling function for automated power ON/OFF management.
- Portrait Detection for automatic changing of OSD orientation.

- Tile Matrix function for high accuracy multi-screen display.
- Windows Vista Premium logo approved.

5. Multi-Use Display LCD 2470WNX

The LCD2470WNX is a multi-use display with features that make it suitable for office applications as well as for the general market (Photo 2).

1) High-Brightness, High-Resolution LCD Panel

The screen has high resolution (1920 × 1200) and the capability of representing two A4-size sheets, side by side in contributing to improvements in office work efficiency. The specifications allow full-HD video sources to be displayed and the high 500cd/m² brightness is adequate for a movie display.

2) Analog/Digital 2-System Inputs

An analog input system using the Dsub connector and a digital input system using a DVI-D connector are provided. The digital input is compatible with the HDCP copyright protection technology. It can display not only HDCP-compatible contents but when a DVI-D↔HDMI converter cable is used it can also connect equipment with HDMI output, such as a DVD recorder or video game system, enabling the display of signal formats up to 1080p.

3) Pivoting Mechanism

The pivoting mechanism allows the screen to be rotated by 90 degrees for use as a longitudinal display, which is effective in displaying a long document, photo or Internet webpage. The wide viewing angle of the LCD panel makes it possible to recognize the displayed information either from the left or



Photo 2 External view of the LCD2470WNX White Model.

right, even during longitudinal display.

4) Picture Quality Adjustment Function "DV Mode"

The DV mode function adjusts the picture quality automatically according to the properties of the displayed image. The DV mode can be switched from "Standard" to one of the four preset modes of "Text," "Movie," "Game" and "Photo" by pressing a control button. For example, the Movie mode compresses the gradation of bright parts and expands that of dark parts in a generally dark scene to improve the visibility of any particularly dark parts. Additionally, this mode can also improve the overall visibility and enrich the visual expression in a bright scene. The "Text" mode suppresses the brightness to set a display suitable for office applications, such as word processors or tabulation software.

5) Other Features

- Stand with 110mm height adjustment capability
- Integrated USB hub ver 2.0 (4 down / 1 up)
- 5W + 5W speaker options
- OSD (On-Screen Display) with intuitive operation capability using a 4-direction control key
- RoHS/PC green label (2006) approved.
- Windows Vista Premium logo approved.

6. Conclusion

The shifting of TV broadcasting to earth-station digital HD is promoting the fusion of PC and TV even further. The increased opportunities for viewing TV programs on PCs are also expected to promote the shifting of IT display screens to widescreens. In support of this trend, we have already prepared a range of widescreen displays with models from 19" to 25.5" and we are also planning to develop products with larger screens, higher resolution and higher functions in order to meet the predicted needs of the market.

*EYE-ONE Display 2 (i1 Display2) is a trademark of X-Rite, Incorporated.

*Windows Vista is a trademark or registered trademark of Microsoft Corporation in the United States and other countries

Reference

- 1) "High Value-Added IT Display – Technical Development and Actual Products," NEC Technical Journal, Vol. 1, No. 3, July 2006.

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