Display Systems for Primary Diagnostics of Medical Images
MULTI-MODALITY COLOUR DISPLAYS

A New Dimension in Visual Diagnostics

Digitalisation has long reached the healthcare sector, with productivity gains and the recent move towards a filmless PACS environment (Picture Archiving and Communication Systems).

The majority of work performed in radiology is presented as 2D information, from conventional X-ray images to the most advanced CT, NM, MRI, PET, PET-CT and Ultrasound studies. The evolution in image acquisition modalities (multi-slice CT) has led to an explosive growth in image data and new applications for post processing such as 3D rendering, Maximum Intensity Projection (MIP) and Multi-Planar Reconstruction (MPR).

NEC Display Solutions designed a new series of high brightness colour diagnostic displays to visualise the coloured segments used in these new 3D applications, as well as to highlight more easily annotations and measurements used in conventional PACS software. In addition, NEC’s MD211C2 (2MP) or MD211C3 (3MP) displays offer the highest diagnostic image quality for conventional X-ray images without compromise on brightness, DICOM conformance or contrast, incorporating UA-SFT panel technology with its characteristic viewing angle independent representation of subtle dark grey tonality differences.

NEC UA-SFT TECHNOLOGY (IPS)

NEC is the only leading medical display brand which is manufacturer of its own LCD modules. Backed by years of experience in the research and development of medical TFT displays, NEC’s latest Ultra-Advanced Super Fine TFT technology offers outstanding image quality for conventional X-ray as well as 3D reconstruction applications.

An increase in aperture between the electrodes of the basic pixel of 20%, in combination with advanced backlight technology, results in market leading brightness and contrast ratio values due to a higher transmission than SA-SFT.

BACKLIGHT STABILISATION WITH RECALIBRATABLE FRONT SENSOR

NEC’s backlight stabilization with front sensor controls and adjusts the luminance and colours via an integrated sensor and feedback system, which not only measures, but also permanently controls and re-aligns these settings to maintain the factory calibration. Any fluctuation in luminance at start-up, due to temperature changes or over the display lifetime is corrected in real-time.

The MD211C2 and MD211C3 are equipped with a state of the art front sensor, which is significantly smaller in size and recalibratable in conformance with the IEC 62563-1 and future quality assurance standards.

Compared to traditional backlight sensors, which only measure the output of the backlight, NEC’s front sensor is located in front of the screen and detects all instabilities caused by the backlight and the liquid crystal display, because it measures the combined effect of both elements.

In addition, backlight sensors cannot detect and stabilise colours because the process of colour generation happens in the LCD panel itself. The colour stabilization function on MD211C2 and MD211C3 allows the NEC’s front sensor to stabilise both luminance and colour, creating a more consistent and reliable image.

DIGITAL UNIFORMITY CONTROL (DUC)

The Digital Uniformity Control (DUC) function provides optimum backlight luminance uniformity which is considered difficult to attain due to the LCD manufacturing process.

During the manufacturing of the display, the LCD panel characteristics are measured across the surface. A three dimensional matrix (x, y, L) is created and stored in the display. During normal operation of the display, these values are used to correct luminance and color uniformity of the LCD panel. Three different levels of uniformity correction are selectable: Off, Low, High.

DISPLAYPORT CONNECTIVITY

MD211C2 and MD211C3 support various input signals for compatibility with a wide range of DisplayPort and DVI graphics boards which allow selection of the board according to budget and performance requirements.

The VESA digital video interface standard DisplayPort offers better image quality with higher bit-depth support and higher bandwidth performance, giving a particular benefit when manipulating large image datasets.
CONSTANT WHITE TINT

The MD211C2 and MD211C3 displays are shipped with a color temperature of 7.500 Kelvin, defined as “Clear Base (CB)”. In all LED backlights, a non proportional aging of the LEDs may cause a natural shift of the backlight from white to blue. Color temperature calibration alleviates this colour shift by keeping the white tint constant, while brightness remains the same – the basis for excellent diagnostic quality. The “Clear Base” definition is selectable as target color temperature for calibration with NEC GammaCompMD QA software. Individual white point calibration ensures that all displays within the hospital show a consistent image, imperative to consistent accurate diagnosis, especially when comparing images in a dual or multiple display configurations and between different workstations.

ANTI-GLARE

NEC developed a unique anti-glare coating layer in order to avoid disturbing ambient light reflections. Unlike Silica Gel substrate films the NEC Anti-Glare layer uses smaller particles (synthetic gel) to control the path of reflected light, preventing glare.

14-BIT LOOK UP TABLES (16,384 TONES)

MD211C2 and MD211C3 offer a 10-bit (1.024) colour reproduction per RGB input (out of a 14-bit (16,384) grey tones LUT), resulting in 1.073 billion total colours for accurate DICOM Part 14 GSDF compliance. The internally programmed DICOM GSDF curve optimises the display to human visual performance in compliance with DICOM Part 14 standard, drastically improving the accuracy at which images can be interpreted.

AMBIENT LIGHT COMPENSATION

MD211C2 and MD211C3 are equipped with a recalibratable ambient light sensor. The Ambient Light Compensation system compensates the DICOM compliance offset under changing lighting conditions by adapting the display contrast level (recalculating the gamma curve) to match the ambient light conditions.

HUMAN SENSOR

A unique human sensor reduces the energy consumption by switching off the LED backlight when the user is away from the monitor. The MD211C2/MD211C3 monitor resumes normal operation when detecting the Infrared (IR) beam reflection upon the users return. The detection distance can be modified in the OSD menu.

QUICK SCREEN QA

The innovative Quick Screen QA test function allows the monitor to display an internal test pattern similar to AAPM TG18-QC, without using an external signal source. A quick overall visual evaluation as well as a DICOM conformance measurement done with the front sensor is available with this built-in method.

GAMMACOMPMD QA QUALITY ASSURANCE

MD211C2 and MD211C3 can be easily integrated into NEC’s GammaCompMD QA Client (standalone) or Network Administration software, performing asset management and technical display management (DICOM conformance, display matching and assistance with Quality Control routines – AAPM TG-18, DIN V 6868-57). Automated DICOM conformance checks and calibrations using the front sensor result in worry-free DICOM compliance.

The QAXRAY™ optional module works seamlessly with the GammaCompMD QA Client and allows for high-grade Quality Assurance guaranteeing consistent image quality across the radiological imaging chain, and is available in several variants. QAXRAY™ offers QA routines for the German QS-RL (DIN V 6868-57 acceptance test, constancy test, daily/weekly visual test) and for the new international standard IEC62563-1 (acceptance test, constancy test). The QAXRAY™ modular system is so flexible that, for example the very latest regional regulations can be interpreted and incorporated within a very short period of time after publication and automatically made available to all users (if the appropriate maintenance contract is in place).

ERGONOMIC DESIGN

Dual Head configurations result in the highest display performance because LCD displays obtain their best DICOM conformance and contrast ratio when the observer looks perpendicular to the screen. The ultra narrow bezels, devoid of buttons and distracting LED lights, enhance viewing comfort in such multi-panel environment. The height, tilt and pivot adjustable stand offers wide flexibility for positioning of the monitor.
NEC High Brightness Colour LED Medical Displays

**MD211C2 MD211C3**

**MULTI-MODALITY DIAGNOSIS FROM A SINGLE DISPLAY**

<table>
<thead>
<tr>
<th>SPECIFICATIONS</th>
<th>MD211C2</th>
<th>MD211C3</th>
</tr>
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<tbody>
<tr>
<td>Panel Technology</td>
<td>UA-SFT LCD with LED Backlight</td>
<td>UA-SFT LCD with LED Backlight</td>
</tr>
<tr>
<td>Screen Diagonal [inch/cm]</td>
<td>21.3 / 54.0</td>
<td>21.3 / 54.0</td>
</tr>
<tr>
<td>Active Screen Area [cm]</td>
<td>43.3 x 32.5</td>
<td>43.3 x 32.5</td>
</tr>
<tr>
<td>Native Resolution [Megapixel]</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Pixel Pitch [mm]</td>
<td>0.270 x 0.270</td>
<td>0.2115 x 0.2115</td>
</tr>
<tr>
<td>Contrast Ratio (typ.)</td>
<td>1400:1</td>
<td>1400:1</td>
</tr>
<tr>
<td>Viewing Angle (H / V @ CR &gt; 10:1)</td>
<td>176 / 176 (typ. @ contrast ratio 10:1)</td>
<td>176 / 176 (typ. @ contrast ratio 10:1)</td>
</tr>
<tr>
<td>Luminance (calibrated)</td>
<td>400 cd/m² recommended</td>
<td>400 cd/m² recommended</td>
</tr>
<tr>
<td>Displayable Colours [Billion]</td>
<td>10-bit (1024 grey tones per R G B input) with 1.073 billion total colours</td>
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</tr>
<tr>
<td>Programmable Gamma Correction</td>
<td>14-bit (16,384 grey tones)</td>
<td>14-bit (16,384 grey tones)</td>
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<tr>
<td>Signal Inputs</td>
<td>Digital:1xDVI-D and 1xDisplayPort</td>
<td>Digital:1xDVI-D and 1xDisplayPort</td>
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<tr>
<td>Digital Uniformity Control</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>White Edge LED backlight</td>
<td>Yes</td>
<td>Yes</td>
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<td>Front Sensor</td>
<td>Yes</td>
<td>Yes</td>
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<td>GammaCompMD QA Software</td>
<td>Yes</td>
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<tr>
<td>Warranty</td>
<td>3 years warranty including backlight, optional 5 years</td>
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</tbody>
</table>

**WARRANTY**

MD211C2 and MD211C3 are offered including 3 years standard warranty. A 5 years or 30,000h*, whichever comes first, warranty extension is offered as an option. NEC Display Solutions Healthcare warranty always includes LCD panel and backlight, as well as same service level during the complete warranty period (no limited warranty statements).

* Uncalibrated. To guarantee the display performance as specified, displays must only be used in conjunction with NEC approved display controller boards. CE-MDD declarations for models are in accordance with the European Directive 93/42/EEC (Medical Device Directive). NEC MD Series Display Systems are registered as medical devices at DIMDI and succeeded pre-qualification for the German X-ray ordinance acceptance tests according to DIN V 6868-57.

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Medical device registration plays an important role in complying with mandatory EU regulations on the medical vigilance system. In addition, product registration ensures you receive the best after-sales support and warranty conditions.

Please register your NEC medical device at http://medical.nec-display-solutions.com/necregistration

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**NEC Display Solutions Healthcare Website**
medical.nec-display-solutions.com

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