

# White Paper

## 10 reasons to use a medical display system

### What's inside?

- Advantages offered by medical displays

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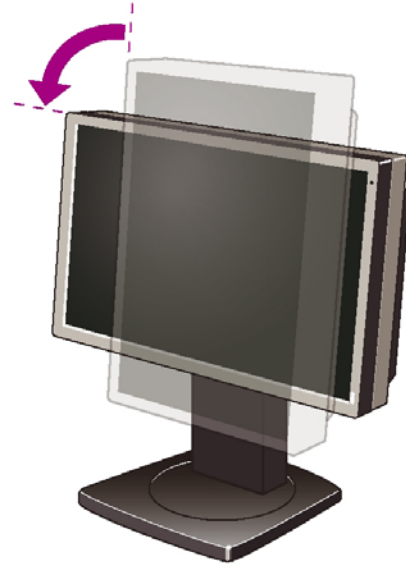
Compared to standard commercial displays, dedicated medical display systems offer significant advantages for diagnostic imaging.

## 1 DISPLAY RESOLUTION AND ORIENTATION

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Standard computer displays offer limited resolution with a form-fit factor (landscape) that is not optimized for diagnostic imaging. Medical grade displays, on the other hand, offer resolutions up to 2048 x 2560 (5 megapixel) in portrait or landscape that corresponds better with the image format of the medical images.

Higher resolution allows the radiologist to see much more detail without panning or zooming the image. As a result, image quality is higher and productivity is increased.



## 2 LUMINANCE RANGE

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Consumer grade displays typically offer a maximum luminance of 250 – 300 cd/m<sup>2</sup>. State-of-the-art medical displays by contrast achieve luminance levels of more than 1000 cd/m<sup>2</sup>, much closer to conventional film. According to DICOM 3.14, a larger luminance range results in a broader spectrum of grayscales that can be discerned by the human eye (also known as Just Noticeable Differences or JND's). As a result, subtle lesions will be easier to detect on a medical display and radiologists can reach a diagnosis faster.

To conclude: the higher luminance offered by medical displays results in higher image quality and increases productivity during diagnostic reading.

## 3 CONTRAST

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Luminance is not the only important parameter for diagnostic reading. For many applications, contrast is even more important than luminance. Medical displays offer a contrast (up to 1000:1) that is substantially better than most consumer displays, which have on average a contrast ratio of only 300:1.

Displays with better contrast ratios are capable of rendering more DICOM JNDs than their low-contrast counterparts.

## 4 VIEWING ANGLE

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We have all experienced that the perception of an image on a flat panel display substantially changes depending on the viewing angle. Flat panel displays all use different LCD technologies with viewing angle characteristics that can vary substantially.

Medical grade displays use a technology with state-of-the-art viewing angle characteristics. As medical workstations combine multiple heads, viewing inevitably happens from different viewing angles. Because of this, viewing angle characteristics are much more important than with consumer displays, where the viewer usually sits in front of the display and always looks at the image from a perpendicular angle.

## 5 GRAYSCALE RANGE

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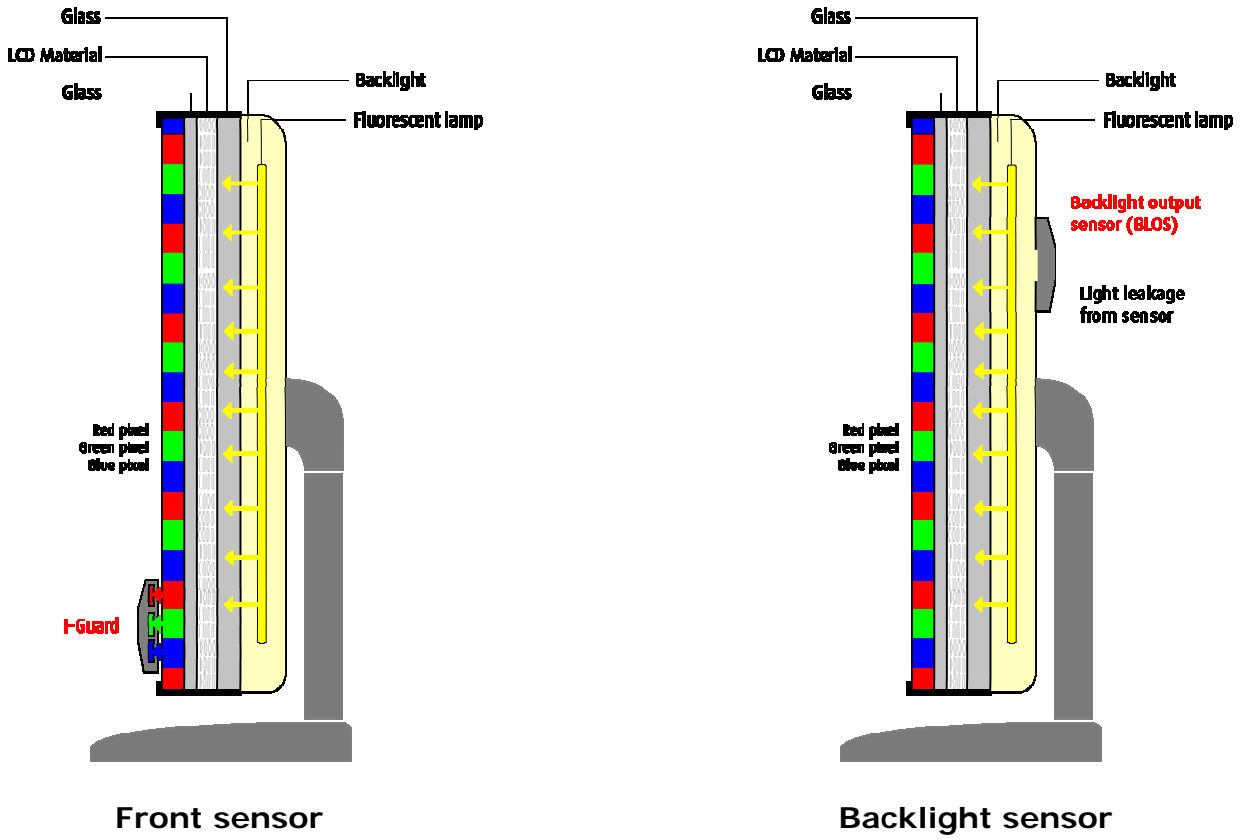
The number of available shades of gray on most consumer displays is limited to 256 (8 bit). Medical displays have a much wider grayscale range, enabling them to render every grayscale as defined by DICOM. The new Coronis grayscale display family, for instance, offers up to 4096 shades of gray (12 bit). Such an extensive range is necessary to comply with the guidelines set forward by the latest medical AAPM and EUREF guidelines. Displays with a grayscale resolution of 8 bit will fail to meet this requirement.

## 6 IMAGE CONSISTENCY

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In medical imaging, it is important that images are displayed consistently over time and across displays. Unfortunately, if no special precautions are taken, the brightness of standard displays can change substantially over time and at different temperatures. Under such conditions DICOM 3.14 compliance becomes unpredictable.

Barco's medical displays use sophisticated front- (I-Guard) and backlight sensor (BLOS) technology, which continuously measure and if necessary correct the brightness of the display.



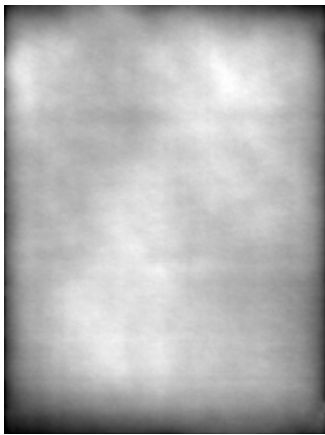
Moreover, the technology compensates for long term drift. This results in a display system radiologists can rely on.

## 7 LUMINANCE UNIFORMITY

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All LCD displays suffer from luminance non-uniformity. This means that images will appear slightly differently in the corner of the display than in the center. This luminance non-uniformity can be as much as 25-30 %.

As the bar for diagnostic image quality is continuously raised, AAPM and EUREF already proposed to limit this non-uniformity to 10%. Medical displays equipped with Barco's Uniform Luminance Technology (ULT) already achieve this level of performance. No matter where you display the image on the screen, the perception will be equal.



**Without ULT**



**With ULT**

## 8 DICOM CALIBRATION

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Most consumer displays have a luminance response function that is not suitable for viewing medical images.

That is why the DICOM 3.14 standard proposes a response function which is much better for viewing medical images. This luminance response function is calibrated on the display by means of an optical measuring device. To set the DICOM 3.14 display function accurately, the display needs much more than the standard 256 shades of gray available on a standard display.

Also, it is important to note that precise DICOM 3.14 calibration only makes sense if the display already has the proper means to keep the image consistent over time. Otherwise, there is a risk that display instabilities immediately render the calibration results invalid.

## **9 MEDICAL APPROVALS**

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As medical imaging evolves, more and more governments are implementing new regulations. The first regulations already became mandatory in some countries and others will soon take similar steps.

As a medical display vendor, Barco follows these standards and is already taking the necessary steps to make its display equipment compliant with the latest medical and safety regulations.

## **10 CONFIGURATION AND QUALITY CONTROL**

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Barco's medical display systems are supported by the proper configuration and quality control tools. These tools automatically control and track the configuration and image quality of the display systems over time. The results are kept in a central database. From the database overview reports, like JCAHO reports, can be generated automatically.

As joint commission auditors begin to check the process for quality control of diagnostic displays, having the proper JCAHO reports available will prove to be a valuable asset during hospital audits.