



KONICA MINOLTA

Application note:
ISD-APP-D-2004-01
Display measuring instruments

CS-1000T

Measurement of small LCD

LCD display technology is more and more utilized in modern product to display for example status information.

Car navigation systems use LCD to display the selected route. Digital cameras use LCD displays for previewing the images or even as view finder.

Same situation for video cameras, all modern video cameras have a LCD colour display.

Mobile phones can be used to browse the internet or lately even as digital camera.

Measuring instruments are displaying the measurement results by LCD display; even in washing machine you may find LCD display!

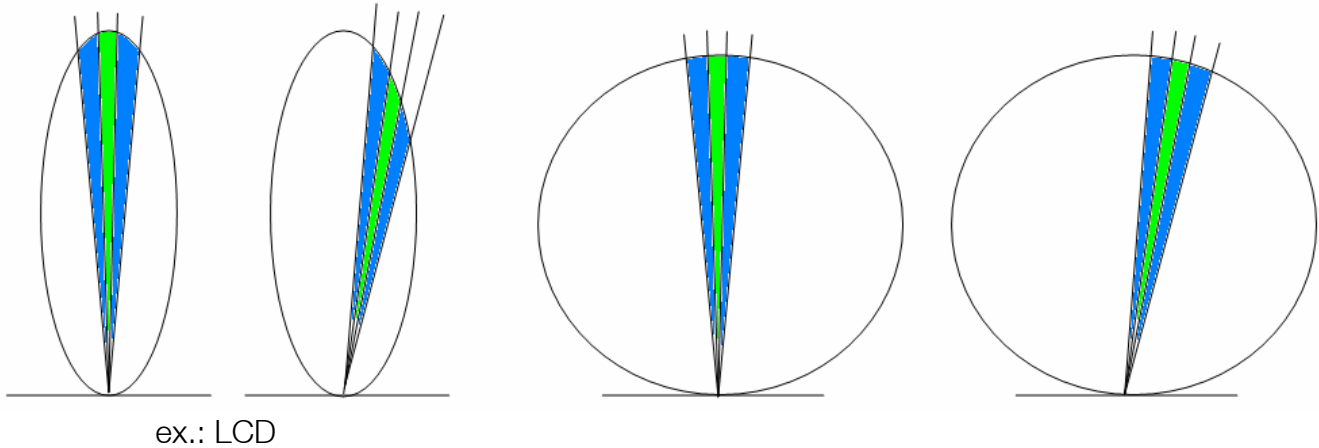
The quality of LCD display is an important criterion especially when colour images should be displayed.

As everyone may have experienced by himself already, LCD displays have a more or less strong angle dependency! One criterion in LCD development is to characterize this angle dependency.



About distribution of light

Due to the construction of LCD displays, they have non spherical light distribution characteristics.

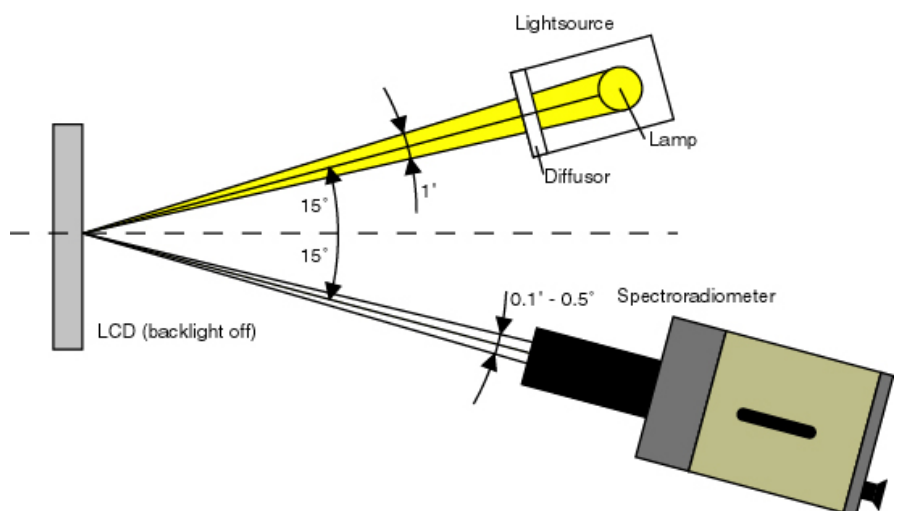


Measuring light sources with spherical distribution characteristics, the acceptance angle of the measurement device has only small influence on readings when changing the measuring angle. On the other hand, a smaller acceptance angle gives more precise readings when changing measuring angle on devices with narrow light distribution!

Due to the narrow light distribution of LCD devices instruments with a narrow acceptance angle are thus preferable for most accurate measurements and to specify angle dependency! In addition to that, a smaller measuring angle allows smaller measuring areas with bigger measuring distance and thus it is easier to set up a measurement system.

In addition, IEC-61747 also specifies measurement of specular reflectance of the display to be done by a luminance meter. Acceptance angle is specified to be $0.1^\circ < \theta_b < 0.5^\circ$, thus CS-1000T can be used for that measurement as well!

In Japan it is quite common practice to use CS-1000T for characterizing small LCD display like for example for mobile phones!

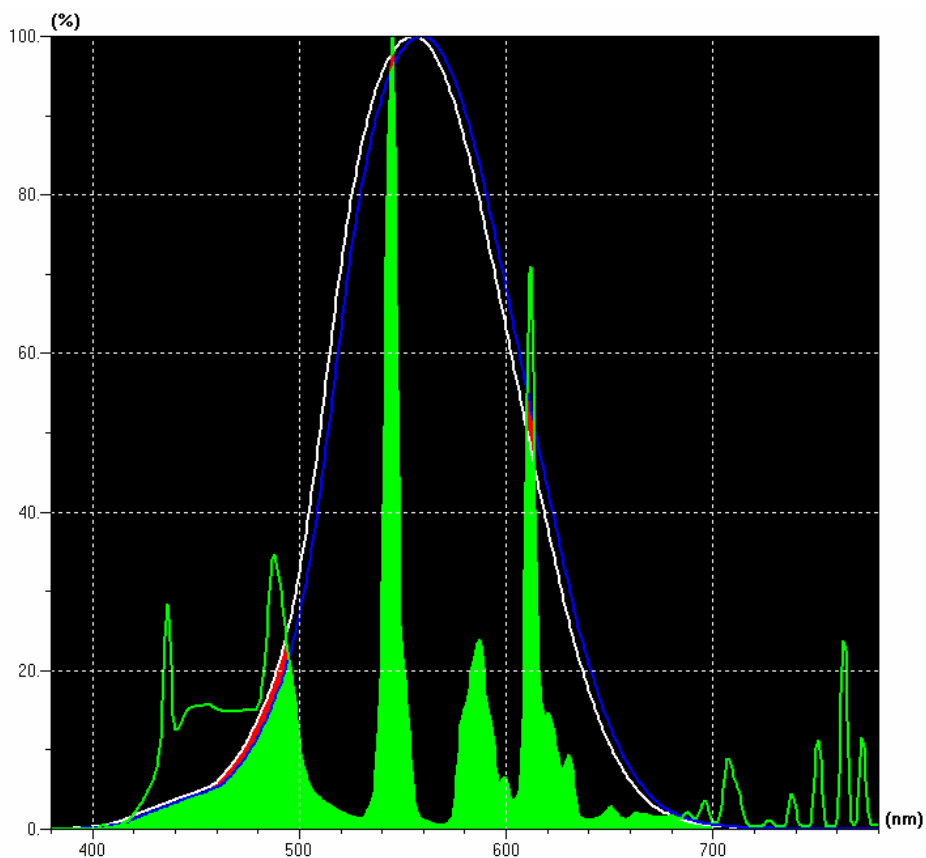


Why a Spectroradiometer is more accurate?

Of course such measurements could theoretically be done with a luminance meter like LS-110 (if only luminance is required) or with a filtered colorimeter (like for example CS-100, but measurement angle is only 1°), but due to the non continuous spectral distribution of LCD displays such instruments are less accurate than a spectroradiometer.

The following picture explains how an error due to just slightly wrong sensitivity curve can create a relative large error in luminance reading.

- V-Lambda curve defined by CIE : White
- Sensitivity example of luminance meter : Blue
- Measured spectrum of LCD : Green
- Luminance after V-Lambda adaptation : Green area
- Luminance error due to sensitivity error : Red



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