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Organic light emitting diode (OLED) displays

Part 6-3: Measuring methods of image quality

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National foreword

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Afficheurs à diodes électroluminescentes
organiques (OLED) -
Partie 6-3: Méthodes de mesure de la
qualité des images
(CEI 62341-6-3:2012)

Anzeigen mit organischen Leuchtdioden
(OLEDs) -
Teil 6-3: Messverfahren für Bildqualität
(IEC 62341-6-3:2012)

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Foreword

The text of document 110/374/FDIS, future edition 1 of IEC 62341-6-3, prepared by IEC/TC 110, "Flat panel display devices", was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62341-6-3:2012.

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- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-09-13

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Annex ZA
(normative)
**Normative references to international publications
with their corresponding European publications**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62341-1-2	2007	Organic light emitting diode displays - Part 1-2: Terminology and letter symbols	EN 62341-1-2	2009
CIE 15	2004	Colorimetry	-	-
ISO 11664-1/ CIE S 014-1	-	Colorimetry - Part 1: CIE standard colorimetric observers	-	-
ISO 11664-5 CIE S 014-5	-	Colorimetry - Part 5: CIE 1976 L*u*v* Colour space and u', v' uniform chromaticity scale diagram	-	-

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ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS –

Part 6-3: Measuring methods of image quality

1 Scope

This part of IEC 62341 specifies the standard measurement conditions and measuring methods for determining image quality of organic light emitting diode (OLED) display panels and modules. More specifically, this standard focuses on five specific aspects of image quality, i.e., the viewing angle range, cross-talk, flicker, static image resolution, and moving image resolution.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62341-1-2:2007, *Organic light emitting diode (OLED) displays – Part 1-2: Terminology and letter symbols*

CIE 015:2004, *Colorimetry, 3rd Edition*

ISO 11664-1/CIE S 014-1, *Colorimetry – Part 1: CIE standard colorimetric observers*

ISO 11664-5/CIE S 014-5, *Colorimetry – Part 5: CIE 1976 $L^*u^*v^*$ Colour space and u' , v' uniform chromaticity scale diagram*

3 Terms, definitions, symbols, units and abbreviations

3.1 Terms, definitions, symbols and units

For the purposes of this document, the terms, definitions, symbols and units given in IEC 62341-1-2 apply.

3.2 Abbreviations

CCD	Charge coupled device
CIE	International Commission on Illumination (Commission Internationale de L'Éclairage)
CFF	Critical flicker frequency
CIELAB	CIE 1976 ($L^*a^*b^*$) colour space
DUT	Device under test
HVS	Human visual system
LED	Light emitting diode
LMD	Light measuring device
OLED	Organic light emitting diode
ppf	pixels per frame

PSF	Point spread function
RGB	Red, green, blue
SLSF	Spectral line spread function

4 Standard measuring equipment and coordinate system

4.1 Light measuring devices

The system configurations and/or operating conditions of the measuring equipment shall comply with the structure specified in each item.

To ensure reliable measurements, the following requirements apply to the light measuring equipment, listed below:

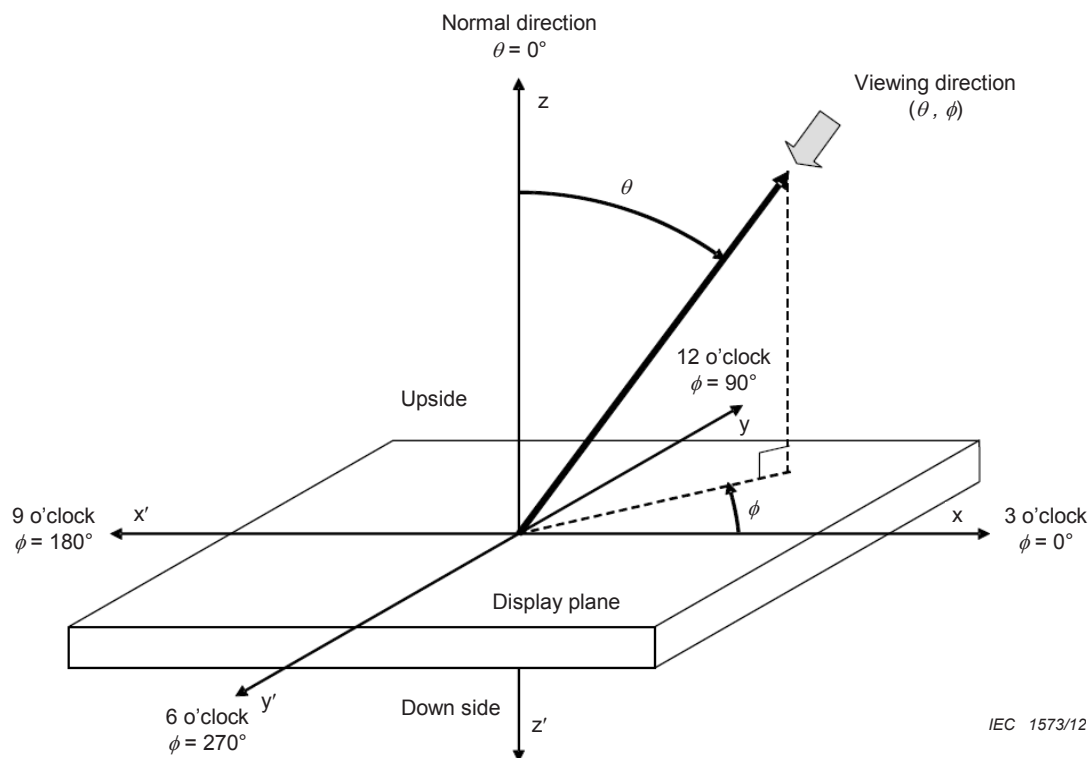
- a) Luminance meter [1]¹: the instrument's spectral responsivity shall comply with the CIE photopic luminous efficiency function with a $CIE-f_1$ value no greater than 3 % [2]; the relative luminance uncertainty of measured luminance (relative to CIE illuminant A source) shall not be greater than 4 % for luminance values over 10 cd/m² and not be greater than 10 % for luminance values 10 cd/m² and below.
- b) Colorimeter: the detector's spectral responsivity shall comply with the colour matching functions for the CIE 1931 standard colorimetric observer (as defined in ISO 11664-1/CIE S 014-1) with a colorimetric accuracy of 0,002 for the CIE chromaticity coordinates x and y (relative to CIE illuminant A source). A correction factor can be used for required accuracy by application of a standard source with similar spectral distribution as the display to be measured.
- c) Spectroradiometer: the wavelength range shall be at least from 380 nm to 780 nm, and the wavelength scale accuracy shall be less than 0,5 nm. The relative luminance uncertainty of measured luminance (relative to CIE illuminant A source) shall not be greater than 4 % for luminance values over 10 cd/m² and not be greater than 10 % for luminance values 10 cd/m² and below. Note that errors from spectral stray light within a spectroradiometer can be significant and shall be corrected. A simple matrix method may be used to correct the stray light errors, by which stray light errors can be reduced for one to two orders of magnitudes. Details of this correction method are discussed in [3].
- d) Goniophotometric mechanism: the DUT or LMD can be driven rotating around a horizontal axis and vertical axis; angle accuracy shall be better than 0,5°.
- e) Imaging colorimeter: number of pixels of the detector shall not be less than 4 for each display sub-pixel within the colorimeter's measurement field of view; more than 12 bit digital resolution; spectral responsivity complies with colour matching functions for the CIE 1931 standard colorimetric observer with colorimetric accuracy of 0,004 for the CIE coordinates x and y , and photopic vision response function with $CIE-f_1$ no greater than 3 %.
- f) Fast-response photometer: the linearity shall be better than 0,5 % and frequency response higher than 1 kHz; and photopic vision response function with $CIE-f_1$ no greater than 5 %.

4.2 Viewing direction coordinate system

The viewing direction is the direction under which the observer looks at the spot of interest on the DUT (see also IEC 62341-1-2:2007, Figure A.2). During the measurement, the LMD is replacing the observer, looking from the same direction at a specified spot (i.e. measuring spot, measurement field) on the DUT. The viewing direction is conveniently defined by two angles: the angle of inclination θ (related to the surface normal of the DUT) and the angle of rotation ϕ (also called azimuth angle) as illustrated in Figure 1. The azimuth angle is related to

¹ Numbers in square brackets refer to the bibliography.

the directions on a watch-dial as follows: $\phi = 0^\circ$ is referred to as the 3 o'clock direction ("right"), $\phi = 90^\circ$ as the 12 o'clock direction ("top"), $\phi = 180^\circ$ as the 9 o'clock direction ("left") and $\phi = 270^\circ$ as the 6 o'clock direction ("bottom").



IEC 1573/12

Key

θ	incline angle from normal direction
ϕ	azimuth angle
3 o'clock	right edge of the screen as seen from the user
6 o'clock	bottom edge of the screen as seen from the user
9 o'clock	left edge of the screen as seen from the user
12 o'clock	top edge of the screen as seen from the user

Figure 1 – Representation of the viewing direction (equivalent to the direction of measurement) by the angle of inclination, θ , and the angle of rotation (azimuth angle), ϕ in a polar coordinate system

5 Measuring conditions

5.1 Standard measuring environmental conditions

Measurements shall be carried out under the standard environmental conditions:

- temperature: $25^\circ\text{C} \pm 3^\circ\text{C}$;
- relative humidity: 25 % RH to 85 % RH;
- atmospheric pressure: 86 kPa to 106 kPa.

When different environmental conditions are used, they shall be noted in the measurement report.

5.2 Power supply

The power supply for driving the DUT shall be adjusted to the rated voltage $\pm 0,5\%$. In addition, the frequency of power supply shall provide the rated frequency $\pm 0,2\%$.

5.3 Warm-up time

Measurements shall be carried out after sufficient warm-up. Warm-up time is defined as the time elapsed from when the supply source is switched on, and a 100 % gray level of input signal is applied to the DUT, until repeated measurements of the display show a variation in luminance of no more than 2 % per minute and 5 % per hour.

5.4 Standard measuring dark-room conditions

The luminance contribution from the background illumination reflected off the test display shall be $< 0,01 \text{ cd/m}^2$ or less than 1/20 the display's black state luminance, whichever is lower. If these conditions are not satisfied, then background subtraction is required and it shall be noted in the measurement report. In addition, if the sensitivity of the LMD is inadequate to measure these low levels, then the lower limit of the LMD shall be noted in the measurement report.

5.5 Standard set-up conditions

By default, the display shall be installed in the vertical position (Figure 2a), but the horizontal alternative (Figure 2b) is also allowed. When the latter alternative is used, it shall be noted in the measurement report.

Luminance, contrast and chromaticity of the white field and other relevant parameters of the displays have to be adjusted to nominal status in the detailed specification and they shall be noted in the measurement report. When there is no level specified, the maximum contrast and/or luminance level shall be used. These adjustments shall be held constant for all measurements, unless noted otherwise in the measurement report. Additional conditions are specified separately for each measuring method.

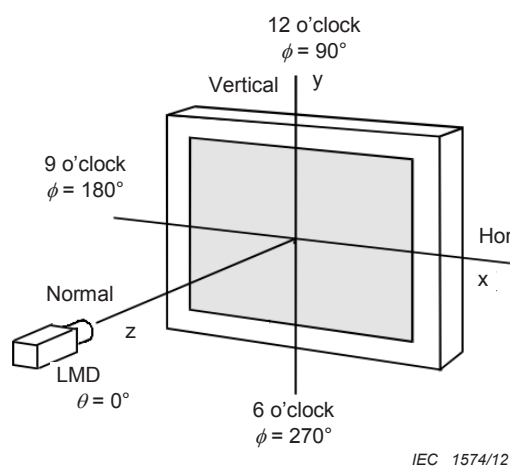


Figure 2a – Primary installation

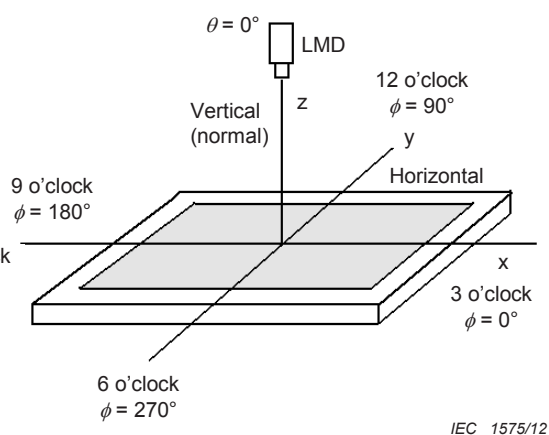


Figure 2b – Alternative installation

Figure 2 – DUT installation conditions