

## NEW ISO STANDARD 13406-2 FOR FLAT PANEL DISPLAYS

from

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ISO 13406-2 is the new International Standard with ergonomic requirements for the image quality of flat panel displays. ISO 13406-2 is the equivalent to ISO 9241-3/7/8 for cathode ray tubes.

ISO 13406-2 covers the following key issues:

- display luminance
- contrast
- reflections
- colours
- luminance and colour uniformity
- font analysis
- pixel faults
- flicker

Substantial characteristic of flat panel display is the angle of view dependent luminance / colour distribution. Therefore the measurements take place in a spherical coordinate system  $\Theta, \Phi$ :

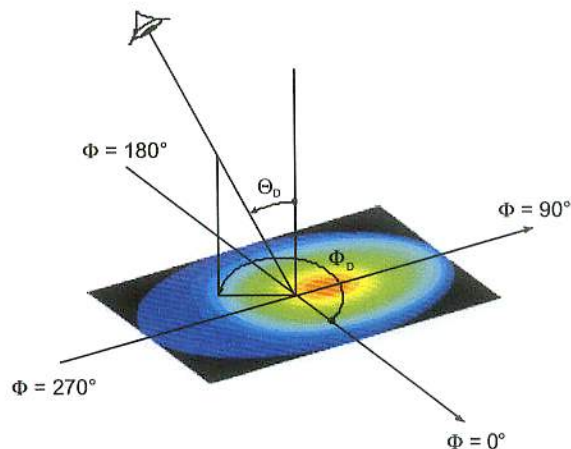


Fig. 1: Measurement geometry in the spherical coordinate system

For this kind of evaluation a particularly efficient measuring technique is necessary, which has been set up in the ergonomics laboratory of TÜV Rheinland Product Safety in Cologne. A new optical measuring technique was employed in order to meet increased requirements in terms of the measuring accuracy.

If a user looks perpendicularly on the center of the flat panel display, then he sees the corners of the picture under different angles  $\Theta, \Phi$ :

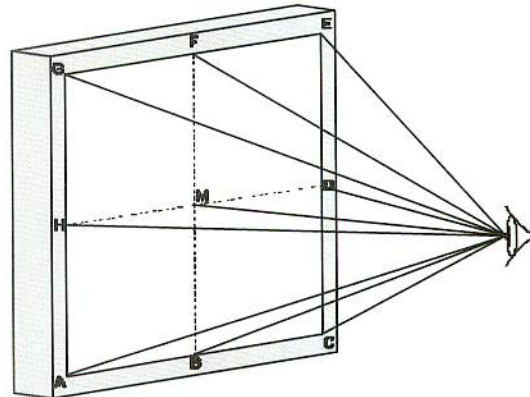


Fig. 2: Viewing angle at the flat panel display

The existing measuring technique makes it possible to measure the luminance / colour under practically every viewing angle  $\Theta, \Phi$ . The following figure shows the darkroom contrast distribution of a modern 15" LC display:

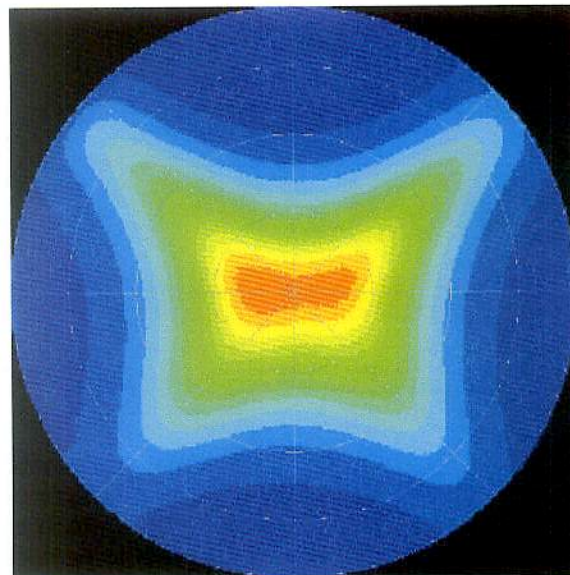


Fig. 3: darkroom contrast distribution of a LC display

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The measurements take place after an analysis of the luminance distribution on the screen within several measurement locations:

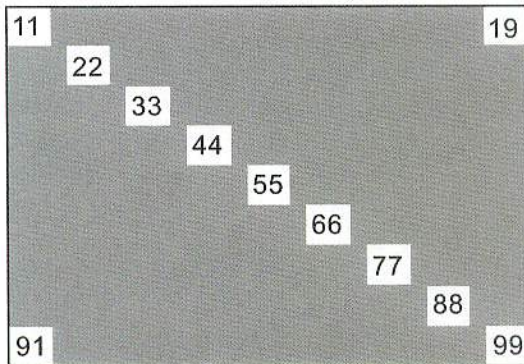


Fig 4: Standard measurement locations

Similarly to ISO 9241-7 in ISO 13406-2 also the reflection characteristics are examined. The goal is an acceptable image quality in lit office environment. Due to the optical characteristics (anisotropy) of the flat panel display the identification of image quality is substantially more complex. A flat panel display can be divided into the following classes:

Class	Environment
I	suitable for general office use
II	suitable for most, but not all, office environments
III	requiring a specially controlled luminous environment for use

In order to qualify for the mark ERGONOMICS APPROVED the flat panel display shall meet the requirements for class I and/or at least the class II.

The high-quality conoscopic measuring system within the ergonomics laboratory of TÜV Rheinland Product Safety in Cologne allows comprehensive determination of the reflection characteristics employing the measurement of the BRDF (Bidirectional Reflection Distribution Function).

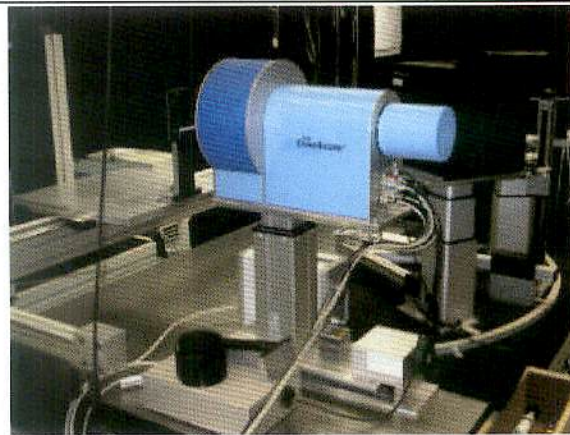


Fig 5: Conoscopic measuring system

Also pixel faults are being identified. A flat panel display should not have pixel faults, i.e. fault class I. According to ISO 13406-2 further fault classes with the following number of faults are specified. Types 1, 2 or 3 differentiate pixels, which always illuminated, never illuminated or e.g. contain subpixel faults:

fault class	Type 1	Type 2	Type 3
I	0	0	0
II	2	2	5
III	5	15	50
IV	50	150	500

### Test mark

The test mark ERGONOMICS APPROVED and ECO CIRCLE 2000 for flat panel displays integrate ISO 13406-2 from January 2000. The ergonomics laboratory of TÜV Rheinland Product Safety Cologne is accredited by DEKRA for test and certification of flat panel displays to ISO 13406-2.

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