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Liquid crystal display devices –
Part 30-4: Measuring methods for liquid crystal display modules –
Dynamic backlight units

IEC 61747-30-4:2016
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LIQUID CRYSTAL DISPLAY DEVICES –

Part 30-4: Measuring methods for liquid crystal display modules – Dynamic backlight units

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International Standard IEC 61747-30-4 has been prepared by IEC technical committee 110: Electronic display devices.

The text of this standard is based on the following documents:

FDIS	Report on voting
110/753/FDIS	110/769/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61747 series, published under the general title *Liquid crystal display devices*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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LIQUID CRYSTAL DISPLAY DEVICES –

Part 30-4: Measuring methods for liquid crystal display modules – Dynamic backlight units

1 Scope

This part of IEC 61747 specifies the standard measurement conditions and measuring methods for determining the optical performance and power consumption of active matrix liquid crystal display modules with dynamic backlight units.

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 61747-1-2, *Liquid crystal display devices – Part 1-2: Generic – Terminology and letter symbols*

IEC 61747-30-1:2012, *Liquid crystal display devices – Part 30-1: Measuring methods for liquid crystal display modules – Transmissive type*

IEC 62087, *Methods of measurement for the power consumption of audio, video and related equipment*

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

3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions, symbols and units given in IEC 61747-1-2, as well as the following apply.

3.1 Terms and definitions

3.1.1

judder

motion-dependent temporal instability of a moving pattern

Note 1 to entry: Rather than smooth motion, there may be hesitations, inconsistencies, or other interruptions of the smooth motion of the moving content.

3.2 Abbreviations

APL	average picture level
CCD	charge coupled device
CIE	Commission Internationale de l'Éclairage (International Commission on Illumination)
CIELAB	CIE 1976 (L*a*b*) colour space
DUT	device under test
HVS	human visual system

LED	light emitting diode
LMD	light measuring device
PSF	point spread function
RGB	red, green, blue
SLSF	spectral line spread function
TCSF	temporal contrast sensitivity function

4 Standard measuring equipment

The system configuration and operating conditions of the measuring equipment shall comply with the structures specified in each item.

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

- a) Luminance meter: the instrument's spectral responsivity shall comply with the relative luminance uncertainty of the measured luminance and 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) Colourimeter: the detector's spectral responsivity shall comply with the colour-matching functions for the CIE 1931 standard colourimetric observer with a chromaticity accuracy of 0,004 for x y . A correction factor can be used for the required accuracy by application of a standard source with a similar spectral distribution as the module to be measured.
- c) Imaging colourimeter: the number of pixels within the measurement field of view of the colourimeter's detector shall not be less than 4 for each display subpixel and not be less than a 12-bit digital resolution. The spectral responsivity shall comply as colour-matching functions for the CIE 1931 standard colourimetric observer with a chromaticity accuracy of 0,004 for x y .
<https://standards.iteh.ai/catalog/standards/sist/d118305d-150a-4027-9772-772bc37f65b0/iec-61747-30-4-2016>
- d) Fast-response photometer: the linearity shall be better than 0,5 % in a measured dynamic range. A –3 dB cut-off frequency shall be higher than 1 kHz.

5 Measuring conditions

5.1 Standard measuring environmental conditions

Measurements shall be carried out under the standard environmental conditions:

- temperature: 25 °C ± 3 °C,
- relative humidity: 25 % 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, ±0,5 %. The frequency of the power supply shall also provide the rated frequency, ±0,2 %.

5.3 Warm-up time

Measurements shall be carried out after sufficient warm-up. Sufficient warm-up is defined as the time elapsed from when the supply source is switched on, and a 100 % grey level of input signal is applied to the DUT, until repeated measurements of the module show a variation in

luminance of no more than 1 % per 5 min for at least 5 sampling points; the warm-up duration should be no less than 15 min.

5.4 Standard measuring dark-room conditions

The luminance contribution from the background illumination reflected off the test module in a direction perpendicular to the test module shall be less than 0,03 cd/m². If these conditions are not satisfied, then background subtraction is required and it shall be noted on the report. In addition, if the sensitivity of the LMD is inadequate to measure these low levels of luminance from the background illumination reflected off the test module, then the lower limit of the LMD shall be noted in the measurement report.

5.5 Standard set-up conditions

By default, the module shall be installed in the vertical position (Figure 1a)), but the horizontal alternative (Figure 1b)) 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 modules 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.

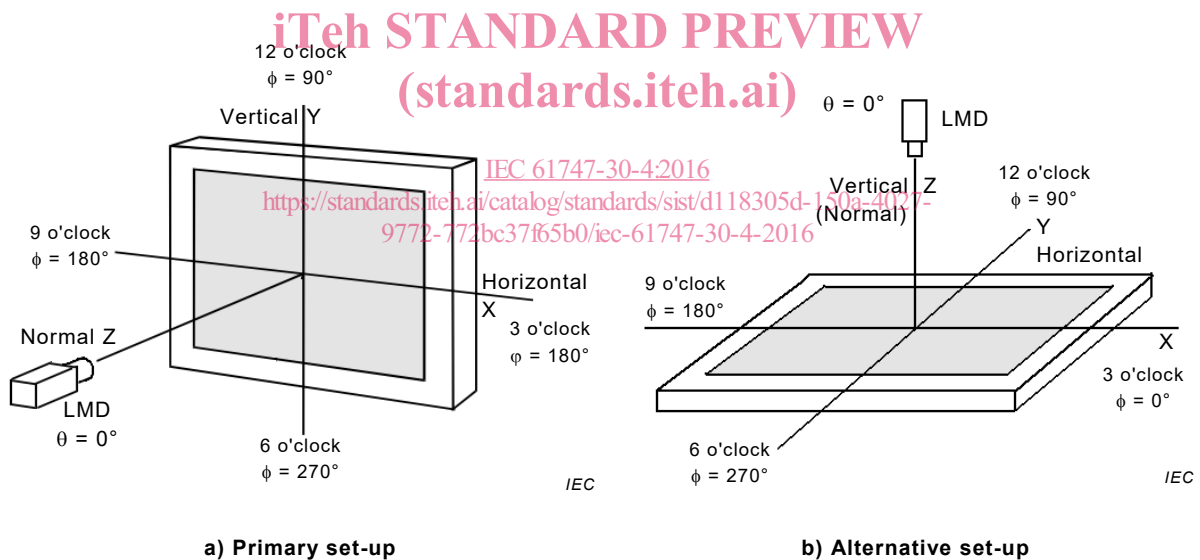


Figure 1 – DUT set-up conditions

5.6 Signal patterns

5.6.1 Full screen pattern

The pattern is applied with different grey levels or different colours on the full screen.

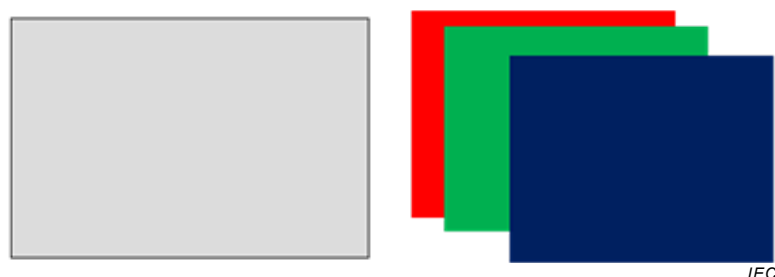


Figure 2 – Full screen pattern

5.6.2 Checkerboard patterns

There are different columns and different rows (for example 3-by-3, 5-by-5) in checkerboard patterns. For a monochromatic display, apply a signal to make the white rectangle box emit at the highest grey level and the black rectangle box emit at the lowest grey level. For a colour display, apply a white signal level of 100 % on a white rectangle box and a black signal level of 0 % on a black rectangle box.

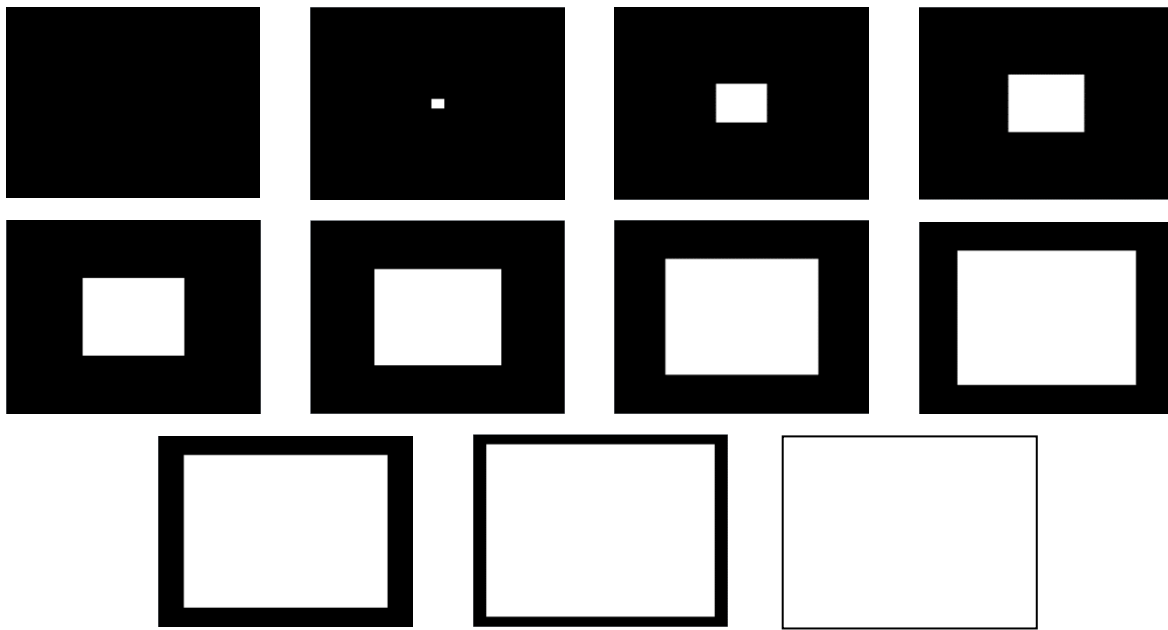


Figure 3 – Checkerboard patterns

Stray-light management should be used as indicated in the International Display Measurements Standard version 1.03:2012, Annex A, while using the checkerboard patterns.

5.6.3 Increasing window patterns

Display a full screen black (0 % grey level) background and a white (100 % grey level) window with the specified dimension in the centre of the screen. The dimensions of the windows can be $n/10$ ($n = 1$ to 10) of the full screen area. A total of 10 patterns is valid for this kind of pattern as shown in Figure 4. The APL of the area is shown in Table 1.



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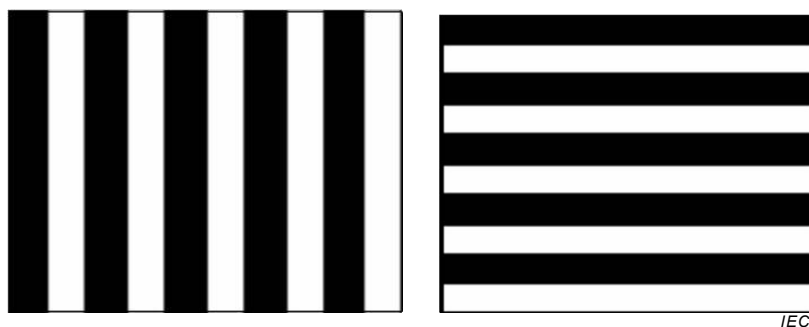
Figure 4 – Increasing window patterns

Table 1 – APL of increasing window patterns
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STEP	All black	1	2	3	4	5	6	7	8	9	10
Horizontal	0	10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	100 %
Vertical	0	10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	100 %
Area (APL)	0,0 %	1,0 %	4,0 %	9,0 %	16,0 %	25,0 %	36,0 %	49,0 %	64,0 %	81,0 %	100,0 %

5.6.4 Line patterns

Line patterns are composed of horizontal or vertical lines with n white or black pixels, where $n = 1$ to 5 as in Figure 5.



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Figure 5 – Line patterns

5.6.5 Moving image

A vertical white (100 % grey level) bar is moving from the left to the right of the screen whose background is full screen black (0 % grey level) with a specified speed as in Figure 6 a).

A vertical black (0 % grey level) bar is moving from the left to the right of the screen whose background is full screen white (100 % grey level) with a specified speed as in Figure 6 b).