



NSAI
Standards

Irish Standard
I.S. EN 61747-6-2:2011

Liquid crystal display devices -- Part 6 -2: Measuring methods for liquid crystal display modules - Reflective type (IEC 61747-6-2:2011 (EQV))

I.S. EN 61747-6-2:2011

Incorporating amendments/corrigenda issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation - recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

<i>This document replaces:</i>	<i>This document is based on:</i> EN 61747-6-2:2011	<i>Published:</i> 5 August, 2011
This document was published under the authority of the NSAI and comes into effect on: 11 August, 2011		ICS number: 31.120
NSAI 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie W NSAI.ie	Sales: T +353 1 857 6730 F +353 1 857 6729 W standards.ie
Údarás um Chaighdeáin Náisiúnta na hÉireann		

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 61747-6-2

August 2011

ICS 31.120

English version

**Liquid crystal display devices -
Part 6-2: Measuring methods for liquid crystal display modules -
Reflective type
(IEC 61747-6-2:2011)**

Dispositifs d'affichage à cristaux liquides -
Partie 6-2: Méthodes de mesure pour les
modules d'affichage à cristaux liquides -
Type réflexible
(CEI 61747-6-2:2011)

Flüssigkristall-Anzeige-Bauelemente -
Teil 6-2: Messverfahren für Flüssigkristall-
Anzeigemodule -
Reflektive Ausführung
(IEC 61747-6-2:2011)

This European Standard was approved by CENELEC on 2011-07-15. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

I.S. EN 61747-6-2:2011

EN 61747-6-2:2011

- 2 -

Foreword

The text of document 110/281/FDIS, future edition 1 of IEC 61747-6-2, prepared by IEC TC 110, Flat panel display devices, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61747-6-2 on 2011-07-15.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2012-04-15
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2014-07-15

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61747-6-2:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

- [19] IEC 61747-6 NOTE Harmonized as EN 61747-6.
 - [20] ISO 9241-7 NOTE Harmonized as EN ISO 9241-7.
 - [21] ISO 13406-2 NOTE Harmonized as EN ISO 13406-2.
 - [23] IEC 61747-1 NOTE Harmonized as EN 61747-1.
 - [24] IEC 61747-5 NOTE Harmonized as EN 61747-5.
-

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application of this document. 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>
ISO 11664-2	2007	Colorimetry - Part 2: CIE standard illuminants	EN ISO 11664-2	2011
CIE 15.2	-	CIE Recommendations on Colorimetry	-	-
CIE 17.4	-	International Lighting Vocabulary	-	-
CIE 38	-	Radiometric and photometric characteristics of- materials and their measurement	-	-
CIE 1931	-	CIE XYZ colour space	-	-
CIE 1976	-	CIE LAB colour space	-	-

This page is intentionally left BLANK.

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Illumination and illumination geometry	9
3.1 General comments and remarks on the measurement of reflective LCDs.....	9
3.2 Viewing-direction coordinate system.....	9
3.3 Basic illumination geometries	10
3.4 Realization of illumination geometries	10
3.4.1 General	10
3.4.2 Directional illumination	11
3.4.3 Ring-light illumination	11
3.4.4 Conical illumination	12
3.4.5 Hemispherical illumination.....	12
4 Standard measurement equipment and set-up.....	13
4.1 Light measuring devices (LMD)	13
4.2 Positioning and alignment	13
4.3 Standard measurement arrangements	13
4.3.1 General	13
4.3.2 Directional illumination	14
4.3.3 Ring-light illumination	15
4.3.4 Conical illumination	15
4.3.5 Hemispherical illumination.....	16
4.3.6 Other illumination conditions.....	17
4.4 Standard specification of measurement conditions	17
4.4.1 Illumination conditions	17
4.4.2 LMD conditions.....	19
4.4.3 Unwanted effects of receiver inclination.....	20
4.4.4 Control and suppression of front-surface reflections	20
4.5 Working standards and references	21
4.5.1 Diffuse reflectance standard	21
4.5.2 Specular reflectance standard	21
4.6 Standard locations of measurement field	22
4.6.1 Matrix displays	22
4.6.2 Segment displays	22
4.7 Standard DUT operating conditions	23
4.7.1 General	23
4.7.2 Standard ambient conditions	23
4.8 Standard measuring process	23
5 Standard measurements and evaluations	24
5.1 Reflectance – Photometric.....	24
5.1.1 Purpose.....	24
5.1.2 Measuring equipment	24
5.1.3 Measuring method	24
5.1.4 Definitions and evaluations.....	25
5.2 Contrast ratio	26

5.2.1	Purpose.....	26
5.2.2	Measuring equipment	26
5.2.3	Measurement method	26
5.2.4	Definitions and evaluations.....	27
5.3	Peak viewing direction / viewing angle range.....	27
5.3.1	Purpose / definition.....	27
5.3.2	Measuring equipment	27
5.3.3	Viewing angle	27
5.3.4	Viewing angle range without gray-level inversion.....	28
5.3.5	Specular reflectance from the active area surface	29
5.4	Chromaticity	31
5.4.1	Purpose.....	31
5.4.2	Measuring equipment	31
5.4.3	Measuring method	31
5.4.4	Definitions and evaluations.....	31
5.4.5	Specified conditions	32
5.5	Electro-optical transfer function – Photometric	33
5.5.1	Purpose.....	33
5.5.2	Set-up	33
5.5.3	Procedure.....	33
5.5.4	Evaluation and representation	33
5.6	Electro-optical transfer function – Colorimetric	34
5.6.1	Purpose.....	34
5.6.2	Set-up	34
5.6.3	Procedure.....	34
5.6.4	Evaluation and representation	35
5.7	Lateral variations (photometric, colorimetric)	35
5.7.1	Purpose.....	35
5.7.2	Measuring equipment	35
5.7.3	Uniformity of reflectance.....	36
5.7.4	Uniformity of white.....	36
5.7.5	Uniformity of chromaticity	37
5.7.6	Uniformity of primary colours	37
5.7.7	Cross-talk.....	38
5.7.8	Specified conditions	40
5.8	Temporal variations.....	40
5.8.1	Response time	40
5.8.2	Flicker / frame response (multiplexed displays)	43
5.8.3	Specified conditions	44
5.9	Electrical characteristics.....	45
5.9.1	Purpose.....	45
5.9.2	Measuring instruments	45
5.9.3	Measuring method	45
5.9.4	Definitions and evaluations.....	45
5.9.5	Specified conditions	46
Annex A (informative)	Standard measuring conditions	47
Bibliography.....		51

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	9
Figure 2 – Directional illumination with a flat source disk	10
Figure 3 – Realization alternatives for directional illumination	11
Figure 4 – Examples of ring-light illumination	12
Figure 5 – Examples of conical illumination with a spherical dome (left) and an integrating sphere with large aperture (right).....	12
Figure 6 – Examples of hemispherical illumination	13
Figure 7 – Side-view of the measuring set-up using directional illumination	14
Figure 8 – Side-view of the ring-light illumination measuring set-up	15
Figure 9 – Side-view of the conical illumination measuring set-up	16
Figure 10 – Side-view of the hemispherical illumination measuring set-up	17
Figure 11 – Hemispherical illumination with gloss-trap (GT) opposite to receiver inclination	18
Figure 12 – Normalized illuminance at the location of the measuring spot.....	18
Figure 13 – Lines of equal chromaticity differences $\Delta u'$ (left), $\Delta v'$ (right).....	19
Figure 14 – Shape of measuring spot on DUT for two angles of receiver inclination	20
Figure 15 – Reflections from the first surface of a transparent medium (glass substrate, polarizer, etc.) superimposed to the reflection component that is modulated by the display device	21
Figure 16 – Standard measurement positions are at the centres of all rectangles p0-p24. Height and width of each rectangle is 20 % of display height and width respectively.	22
Figure 17 – Example of standard set-up for specular reflection measurements	30
Figure 18 – Example of equipment for measurement of temporal variations	41
Figure 19 – Relationship between driving signal and optical response times	42
Figure 20 – Frequency characteristics of the integrator (response of human visual system).....	44
Figure 21 – Example of power spectrum	44
Figure 22 – Checker-flag pattern for current and power consumption measurements	45
Figure 23 – Example of measuring block diagram for current and power consumption of a liquid crystal display device.....	46
Figure A.1 – Coordinate system for measurement of the BRDF, index "i" for incident light, index "r" for reflected light. Directions are described by two angles, θ and ϕ (inclination and azimuth) in a polar coordinate system as shown.....	48
Figure A.2 – Terminology for LMDs.....	49

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LIQUID CRYSTAL DISPLAY DEVICES –

**Part 6-2: Measuring methods for liquid crystal display modules –
Reflective type**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61747-6-2 has been prepared by IEC technical committee 110: Flat panel display devices.

This standard should be read together with the generic specification to which it refers.

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

FDIS	Report on voting
110/281/FDIS	110/299/RVD

Full information on the voting for the approval on 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 the parts in the IEC 61747 series, under the general title *Liquid crystal display devices*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site 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
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

In order to achieve a useful and uniform description of the performance of these devices, specifications for commonly accepted relevant parameters are put forward. These fall into the following categories:

- a) general type specification (e.g. pixel resolution, diagonal, pixel layout);
- b) optical specification (e.g. contrast ratio, response time, viewing direction, crosstalk, etc.);
- c) electrical specification (e.g. power consumption, EMC);
- d) mechanical specification (e.g. module geometry, weight);
- e) specification of passed environmental endurance test;
- f) specification of reliability and hazard / safety.

In most of the above cases, the specification is self-explanatory. For some specification points however, notably in the area of optical and electrical performance, the specified value may depend on the measuring method.

It is assumed that all measurements are performed by personnel skilled in the general art of radiometric and electrical measurements as the purpose of this standard is not to give a detailed account of good practice in electrical and optical experimental physics. Furthermore, it must be assured that all equipment is suitably calibrated as is known to people skilled in the art and records of the calibration data and traceability are kept.

LIQUID CRYSTAL DISPLAY DEVICES –

Part 6-2: Measuring methods for liquid crystal display modules – Reflective type

1 Scope

This part of IEC 61747 gives details of the quality assessment procedures, the inspection requirements, screening sequences, sampling requirements, and test and measurement procedures required for the assessment of liquid crystal display modules.

This standard is restricted to reflective liquid crystal display-modules using either segment, passive or active matrix and a-chromatic or colour type LCDs (see Note). Furthermore, the reflective modes of transreflective LCD modules with backlights OFF and reflective LCD modules of front light type without its front-light-unit, are comprised in this standard. A reflective LCD module with combination of a touch-key-panel or a front-light-unit is out of the scope of this standard, because its measurements are frequently inaccurate. Its touch-key-panel or front-light-unit should be removed before it can be included in this scope.

NOTE Several points of view with respect to the preferred terminology on "monochrome", "achromatic", "chromatic", "colour", "full-colour", etc. can be encountered in the field amongst spectroscopists, (general-) physicists, colour-perception scientists, physical engineers and electrical engineers. In general, all LCDs demonstrate some sort of chromaticity (e.g. as function of viewing angle, ambient temperature or externally addressable means). Pending detailed official description of the subject, the pre-fix pertaining to the "chromaticity" of the display will be used so as to describe the colour capability of the display that is externally (and electrically) addressable by the user. This leads us to the following definitions (see also [19])

- a) a monochrome display has NO user-addressable chromaticity ("colours"). It may or may not be "black and white" or a-chromatic;
- b) a colour display has at least two user-addressable chromaticities ("colours"). A 64-colour display has 64 addressable colours (often made using 2 bits per primary for 3 primaries), etc. A full-colour display has at least 6 bits per primary (≥ 260 thousand colours).

The purpose of this standard is to indicate and list the procedure-dependent parameters and to prescribe the specific methods and conditions that are to be used for their uniform numerical determination.

2 Normative references

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

ISO 11664-2:2007, *Colorimetry – Part 2: CIE standard illuminants*

CIE 15.2, *CIE Recommendations on Colorimetry*

CIE 17.4, *International Lighting Vocabulary*

CIE 38, *Radiometric and photometric characteristics of materials and their measurement*

CIE 1931, *CIE XYZ colour space*

CIE 1976, *CIE LAB colour space*

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- Looking for additional Standards? Visit Intertek Inform Infostore
 - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-