

Liquid crystal and solid-state display devices —

Part 1: Generic specification

The European Standard EN 61747-1:1999, with the incorporation of amendment A1:2003 has the status of a British Standard

ICS 31.120

BS EN
61747-1:2000
IEC
61747-1:1998
Incorporating
Amendment No. 1 to
BS IEC 61747-1:1998
(renumbers the
BS IEC as
BS EN 61747-1:2000)
and incorporating
Amendment No. 2 to
BS EN 61747-1:2000

National foreword

This British Standard is the English language version of EN 61747-1:1999, including amendment A1:2003. It is identical with IEC 61747-1:1998, Edition 1.1:2003, which comprises Edition 1:1998 consolidated by the incorporation of amendment 1:2003.

The UK participation in its preparation was entrusted by Technical Committee EPL/47, Semiconductor devices, to Subcommittee EPL/47/3, Optoelectronic display and imaging devices, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 43 and a back cover.

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Sidelining in this document indicates the most recent changes by amendment.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 June 1998

© BSI 31 October 2003

ISBN 0 580 29959 7

Amendments issued since publication

Amd. No.	Date	Comments
10788	June 2000	Renumbers BS IEC 61747-1:1998 to BS EN 61747-1:2000
14623	31 October 2003	See national foreword

English version

Liquid crystal and solid-state display devices — Part 1: Generic specification

(includes amendment A1:2003)
(IEC 61747-1:1998 + A1:2003)

Dispositifs d'affichage à cristaux liquides et à
semiconducteurs —

Partie 1: Spécification générique
(inclut l'amendement A1:2003)
(CEI 61747-1:1998 + A1:2003)

Flüssigkristall- und
Halbleiter-Anzeige-Bauelemente —

Teil 1: Fachgrundspezifikation
(enthält Änderung A1:2003)
(IEC 61747-1:1998 + A1:2003)

This European Standard was approved by CENELEC on 1999-08-01; amendment A1 was approved by CENELEC on 2003-04-01. 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.

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CENELEC

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The text of the International Standard IEC 61747-1:1998, prepared by SC 47C, Flat panel display devices, of IEC TC 47, Semiconductor devices, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 61747-1 on 1999-08-01 without any modification.

This European standard supersedes EN 120000:1996.

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) 2000-08-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2002-08-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. In this standard, Annex C, Annex D, and Annex ZA are normative and Annex A and Annex B are informative. Annex ZA has been added by CENELEC.

Foreword to amendment A1

The text of document 47C/288/FDIS, future amendment 1 to IEC 61747-1:1998, prepared by SC 47C, Flat panel display devices, of IEC TC 47, Semiconductor devices, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 61747-1:1999 on 2003-04-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-01-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2006-04-01

Annexes designated “normative” are part of the body of the standard.

In this standard, Annex ZA is normative.

Annex ZA has been added by CENELEC.

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LIQUID CRYSTAL AND SOLID-STATE DISPLAY DEVICES –

Part 1: Generic specification

1 Scope

This part of IEC 61747 is a generic specification for liquid crystal and solid-state display devices. It defines general procedures for quality assessment to be used in the IECQ system and gives general rules for measuring methods of electrical and optical characteristics, rules for climatic and mechanical tests, and rules for endurance tests.

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.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050 (all parts), *International Electrotechnical Vocabulary*

IEC 60068 (all parts), *Environmental testing*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2 (all parts), *Environmental testing – Part 2: Tests*

IEC 60191 (all parts), *Mechanical standardization of semiconductor devices*

IEC 60191-1:1966, *Mechanical standardization of semiconductor devices – Part 1: Preparation of drawings of semiconductor devices*

IEC 60191-2:1966, *Mechanical standardization of semiconductor devices – Part 2: Dimensions*

IEC 60191-3:1974, *Mechanical standardization of semiconductor devices – Part 3: General rules for the preparation of outline drawings of integrated circuits*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

IEC 60617 (all parts), *Graphical symbols for diagrams*

IEC 60747 (all parts), *Semiconductor devices – Discrete devices*

IEC 60747-1:1983, *Semiconductor devices – Discrete devices and integrated circuits – Part 1: General*

IEC 60747-5:1992, *Semiconductor devices – Discrete devices and integrated circuits – Part 5: Optoelectronic devices*

IEC 60747-10:1991, *Semiconductor devices – Part 10: Generic specification for discrete devices and integrated circuits*

IEC 60748 (all parts), *Semiconductor devices – Integrated circuits*

IEC 60749:1996, *Semiconductor devices – Mechanical and climatic test methods*

IEC 61747-2-1:1998, *Liquid crystal and solid-state display devices – Part 2-1: Passive matrix monochrome LCD modules – Blank detail specification*

IEC 61747-3-1:1998, *Liquid crystal and solid-state display devices – Part 3-1: Liquid crystal display (LCD) cells – Blank detail specification*

IEC 61747-4:1998, *Liquid crystal and solid-state display devices – Part 4: Liquid crystal display modules and cells – Essential ratings and characteristics*

IEC 61747-5, — *Liquid crystal and semiconductor devices – Part 5: Environmental, endurance and mechanical test methods*

QC 001002:1986, *Rules of Procedure of the IEC Quality Assessment System for Electronic Components (IECQ)*

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units*

ISO 1101:1983, *Technical drawings – Geometrical tolerancing – Tolerancing of form, orientation, location and run-out – Generalities, definitions, symbols, indications on drawings*

ISO 2859 (all parts), *Sampling procedures for inspection by attributes*

ISO 8601:1988, *Data elements and interchange formats – Information interchange – Representation of dates and times*

3 Terminology

For the purpose of standard series IEC 61747, the following terms and definitions apply.

3.1 Physical concepts

3.1.1

alignment layer

a thin layer deposited over the patterned electrodes that determines the direction of the director at the surface. This layer produces the desired ordering. Alignment such as homeotropic alignment (3.1.14) or planar alignment (3.1.15) are achieved by the co-operative ordering of the liquid crystal molecules locally affected by the surface forces. The alignment layer is generating the pretilt angle (3.1.20)

3.1.2

chiral phase

a liquid crystal phase exhibiting a spontaneous twist

3.1.3

cholesteric phase

a liquid crystal phase that exhibits planar nematic ordering in which the directors form a helix that has its axis perpendicular to the plane

3.1.4

clearing point

the phase transition temperature of a liquid crystal for transition toward the isotropic phase

3.1.5

dichroic liquid crystal

a liquid crystal exhibiting dichroism, i.e. the property of anisotropic absorption of light

3.1.6

director

the axial unit vector describing the local axis of symmetry for the orientational distribution function of any chosen molecular axis of a liquid crystal. The director co-ordinates define the local alignment of the liquid crystal.

3.1.7

disclination

a localized alignment defect (appearing generally under the form of closed or open lines) forming the border between areas exhibiting different alignment states

3.1.8

discotic mesophase

a liquid crystal phase of disc-like shaped molecules exhibiting a long range ordering with respect to the short molecular axis

3.1.9

dynamic scattering

an electro-optical effect showing a light scattering caused by turbulent motion in a liquid crystal layer induced by an electro-hydrodynamic effect

3.1.10

electrically controlled birefringence

an electro-optical effect caused by the birefringence of a liquid crystal layer which can be modulated (varied) by an electric field. It is also called "tunable birefringence"

3.1.11

electrode layer

an electrically conductive layer, usually transparent (e.g. made of indium tin oxide, "ITO"), covering the support plates and patterned to establish the display and electrical contact configuration

3.1.12

ferroelectric liquid crystal

a liquid crystal phase exhibiting a spontaneous electric polarization

NOTE This effect is commonly exhibited in chiral smectic liquid crystal.

3.1.13

guest-host effect

an anisotropic optical absorption effect occurring in a dichroic liquid crystal layer containing a dissolved dye

3.1.14**homeotropic alignment**

the alignment state of a liquid crystal layer for which the director is everywhere nominally perpendicular to a support plate surface

3.1.15**planar alignment**

the alignment state of a liquid crystal layer for which the director is everywhere nominally parallel to a support plate surface. This alignment is also referred to as homogeneous.

3.1.16**liquid crystal**

a liquid crystal is a material that exhibits a mesophase consisting of elongated (rod-like) or disc-like (discotic) molecules and that possesses at least one long range orientational ordering with respect to one molecular axis

3.1.17**liquid crystal cell**

a flat structure consisting of a minimum of two support plates with liquid crystal contained in the space between them. These plates are usually separated by a distance of several micrometers.

3.1.18**mesophase (mesomorphic phase)**

an ordered state of matter between the crystalline and isotropic liquid phases, exhibiting some of the properties of the neighbouring phases, as for example fluidity and birefringence

3.1.19**nematic phase**

molecules in this liquid-crystalline phase possess a long range orientational ordering of one molecular axis (uniaxial nematic LC) or two molecular axes (biaxial nematic LC)

3.1.20**pretilt angle**

the angle between the plane of a support plate and the adjacent liquid crystal director

3.1.21**sealing layer**

a layer situated between the support plates and surrounding the liquid crystal to ensure the hermeticity and integrity of the liquid crystal cell

3.1.22**smectic phase**

a liquid crystalline phase characterized by at least a one-dimensional long range transitional ordering of the molecules and a long range orientational ordering for one molecular axis

3.1.23**spacer**

a material incorporated into a liquid crystal cell (e.g. calibrated spheres or cylinders) to ensure a constant distance between the support plates

3.1.24

support plate

plate, generally transparent, made of e.g. glass or plastic sheet, covered with several layers (electrodes, sealing and surface alignment layers), forming the mechanical structure of a liquid crystal cell

3.1.25

twist angle

the oriented angle between the projections of the respective surface directors at the support plates on to one of the support plates of a twisted nematic cell

3.1.26

twisted nematic structure

a nematic liquid crystal state characterized by a twisted structure

3.1.27

anti-ferroelectric liquid crystal

AFLC

type of smectic liquid crystal having no macroscopic electrical polarization at zero external field

NOTE It has a paraelectric state with layers of alternating polarity of permanent dipoles without external electric field, and it transfers to a ferroelectric state of parallel alignment by applying electric field.

3.1.28

cell gap

thickness of the liquid crystal layer between the two support plates

3.1.29

domain

region having well-defined boundary in which liquid crystal molecules have the same director orientation

3.1.30

helical pitch

chiral pitch

periodic distance needed for directors to rotate by 360° in a helically structured liquid crystal

3.1.31

polymer dispersed liquid crystal

liquid crystal polymer composites within which there exists at least two different phases

3.1.32

phase transition

phenomenon in which liquid crystal changes from one phase to another, e.g. from smectic to nematic, solid to smectic, or nematic to isotropic liquid

3.1.33

rubbing direction

rubbing axis

direction/axis of rubbing the alignment layer in order to align liquid crystal molecules

3.1.34

super twisted nematic liquid crystal

STN

nematic liquid crystal which possesses a twisted structure from 180° to 270° between the support plates

3.1.35

twisted nematic liquid crystal

TN

nematic liquid crystal which possesses a twisted structure of around 90° between the support plates

3.1.36

voltage holding ratio

ratio of holding voltage to the initially applied signal voltage at opposite facing electrodes in a liquid crystal cell

3.2 General terms

3.2.1

active area

part of a display screen area delimited by picture elements

3.2.2

active matrix-addressed display

a matrix-addressed display device in which each picture element has at least one switching element (e.g. diode or transistor)

3.2.3

alphanumeric display

a display device that is able to present a limited set of characters including at least letters and numerals

3.2.4

emissive display

a display that contains its own source(s) of light. This light can be produced by the transducer itself or provided by one or more internal light source(s) modulated by the transducer.

3.2.5

grey scale

display is said to have grey scale capability if it can display images providing more than two luminance levels

3.2.6

liquid crystal display cell

liquid crystal cell that is used to modulate light to present information

3.2.7

liquid crystal display module

a display unit combining a liquid crystal display cell with drive electronics. Additional options are possible such as backlight, mounting brackets, etc.

3.2.8

matrix display

a display device consisting of regularly distributed pixels arranged in rows and columns

3.2.9

monochrome display

a display using only one colour or black and white contrast

3.2.10

pixel

smallest element that is capable of generating full functionality of a display

3.2.11

reflective display

a display device that modulates light from an external source by reflection

3.2.12

segment

a segment is a special purpose dedicated pixel, e.g. a specific portion of an alphanumeric symbol, or a sign by itself

3.2.13

storage effect

the property of a picture element in which the visual information is retained after the activation has been removed

3.2.14

transflective display

a display device that modulates light from an external source by reflection or from another source by transmission through a semitransmissive reflector

3.2.15

transmissive display

a display device that modulates light from an external source by transmission

3.2.16

viewing angle range

the viewing angular direction range over which the visual specification is satisfied

3.2.17

viewing area

the active area (3.2.1) plus any contiguous areas that display permanent visual information or a display background

3.2.18

achromatic display

display that generates an image which is devoid of hue

3.2.19

backlight

light source system that illuminates light uniformly onto a liquid crystal display cell from behind

3.2.20

black matrix

film-like structure that shades unwanted light to pass between dot electrodes in a matrix display

NOTE Normally formed with a metal or organic film patterned on the substrate.

3.2.21

colour filter

filter that selectively transmits light of a specific wave length range in colour liquid crystal display devices

NOTE Generally, three primary colour (red, green, blue) filters are fitted onto the substrate.

3.2.22

common electrode

3.2.22.1 electrode facing segment electrodes in a segment display

3.2.22.2 scanning electrode in a passive matrix display

3.2.22.3 electrode pairing with pixel electrodes fitted with transistors in an active matrix display with thin film transistors

3.2.23

data electrode

signal electrode

electrode applied with the data signal voltage synchronized with the scanning signals in a multiplexed display

3.2.24

diffusing plate

diffuser

optical component used to diffuse light in order to illuminate it onto the display device in a uniform manner

3.2.25

direct backlight

light source system in which light tubes are placed directly underneath a display screen and illumination is made uniform using optical components such as a reflector and diffuser

3.2.26

edge light

side light

light source system in which light source tubes are mounted on one or more sides of a display or a light guide plate

3.2.27

front projection display

form of projection display whereby the display device and the observer are located on the same side of the screen on which the image is displayed

3.2.28

LCD controller

circuit that supplies necessary control signals to driver circuits or ICs for an LCD