

INTERNATIONAL STANDARD



**Electronic paper displays –
Part 2: Essential ratings and characteristics**

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**Electronic paper displays –
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ELECTRONIC PAPER DISPLAYS –**Part 2: Essential ratings and characteristics**

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International Standard IEC 62679-2 has been prepared by IEC technical committee 110: Electronic display devices.

The text of this International Standard is based on the following documents:

CDV	Report on voting
110/917/CDV	110/961A/RVC

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

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

This International Standard is to be used in conjunction with IEC 62679-1-1:2014.

A list of all the parts in the IEC 62679 series, under the general title *Electronic paper displays*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

This document provides the content of specifications for any kind of electronic paper display device specified by IEC 62679-1-1. The compliance requirements of this document are minimized to what is necessary to write specifications, such as basic specification, generic specification, sectional specification, and blank detail specification, except the terms agreed to by the parties. Such specifications are prepared to meet the requirements of the market, manufacturers, and users, to facilitate international trade and enhance user value in the field of electronic paper display.

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ELECTRONIC PAPER DISPLAYS –

Part 2: Essential ratings and characteristics

1 Scope

This part of IEC 62679 is restricted to electronic paper display (EPD) modules that show information by reflection, can hold an image, and can have an integrated lighting unit. This document specifies the essential ratings and characteristics of EPD modules for the evaluation of optical and electro-optical performances, and environmental testing.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 62679-3-1, *Electronic paper displays – Part 3-1: Optical measuring methods*

IEC 62679-3-2, *Electronic paper display – Part 3-2: Measuring method – Electro-optical*

IEC 62679-3-3, *Electronic paper displays – Part 3-3: Optical measuring methods for displays with integrated lighting units*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Headline of specification sheet

The specification sheet shall state, at least, the product name, product number (PN) or code, and name of manufacturer in its headline.

5 Electronic paper display (EPD) modules

5.1 Classification methods

There are several classifiers for EPD modules. The dominant classifiers shall state:

- a) pixel layout: segment or dot matrix
- b) driving circuit: passive or active
- c) driving circuit structure: thin film transistor (TFT), thin film diode (TFD), micro-electro-mechanical systems (MEMS), in-plane, printed circuit board (PCB), or others

- d) display mechanisms: electrophoretic, cholesteric liquid crystal, powder migration, bi-stable nematic liquid crystal, electrochromic, electrodeposition, twisting ball, electro wetting, electrofluidic, interferometric modulator, or others
- e) driving methods: current driving or voltage driving
- f) optical states of display: dichromatic (e.g., black, white, and greyscale), pure tri-colour and multi-colour (e.g., black, white, and red), full-colour (e.g. RGBW mix, or CYMK mix)

5.2 Components of electronic paper display (EPD) panel

The information on the components of an electronic paper display panel shall include:

- a) front plane: flexible or rigid, curved or flat
- b) imaging layer: electrophoretic, cholesteric liquid crystal, electrofluidic, or others
- c) backplane: flexible or rigid, curved or flat, and switching device
- d) peripheral: lighting unit and/or touch screen
- e) others

5.3 Construction of the EPD panel

5.3.1 General

The information on substrates for electronic paper display panels shall contain the elements described in 5.3.2 to 5.3.4:

5.3.2 Materials of the panel substrates

The information on the materials shall include:

- a) rigid: glass, plastics (including composite), metal, or ceramics
- b) flexible: glass, plastics, metal, or others
- c) optical properties: transparent or opaque, reflective or antireflective
- d) others: add if necessary (e.g. flammability)

5.3.3 Connection design

The information on the connection design of the panel shall include:

- a) flexible zero insertion force (ZIF) socket or electrical connector, ZIF wire-to-board connectors, or flexible flat cable
- b) low insertion force (LIF) socket or electrical connector
- c) bonding: anisotropic conductive film (ACF), chip on glass (COG), chip on film (COF), flexible printed circuit (FPC)
- d) others

5.3.4 Outline of the dimensional drawing of the panel

The information on the outline of the dimensional drawing shall include:

- a) overall dimension (mm): $L \times W \times D$ (tolerance if required)
(diagrammatic representations should be recommended)
- b) display resolution for dot matrix display (ppi)
NOTE ppi means pixel per inch.
- c) total pixel count for dot matrix display ($H \times V$)
- d) viewing area, active area, and display centre
- e) pixel pitch

f) pixel configuration

5.4 Input/output terminals

5.4.1 General

The information on input/output terminals shall contain the elements described in 5.4.2 and 5.4.3.

5.4.2 Pin identification

Examples include:

- number
- name
- description of terminals

5.4.3 Pin connection types

Examples include:

- input
- output
- high-impedance
- no connection
- power supply
- in/out, etc.

5.5 Limiting values of the module

The information on limiting values or absolute maximum rating shall include:

- minimum and maximum ambient operating temperature (T_{op})
- minimum and maximum storage temperature (T_{stg})
- minimum and maximum value of supply voltages for display driving
- minimum and maximum value of supply voltages for logic circuit
- minimum and maximum value of input signal voltage (U_{in})
- maximum soldering temperature (T_{sld}) and soldering time (t_{sld}) to the connector

5.6 Electrical and optical characteristics

The following characteristics shall be specified in Table 1.

Table 1 – Electrical and optical characteristics of electronic paper display modules

Sub-clause	Characteristics	Symbol	Requirement		Condition at $T_{op} = 25\text{ °C}$, unless otherwise specified
			Min.	Max.	
5.6.1	Supply voltages (please refer to the supplier's datasheet)	U	Min.	Max.	
5.6.2	Common voltage	U_{com}	Min.	Max.	
5.6.3	Supply currents (please refer to the supplier's datasheet)	I		Max.	
5.6.4	Reflectance (white)	ρ_w or R_w	Min.		Refer to IEC 62679-3-1 and ^a
5.6.5	Reflectance (black)	ρ_{blk} or R_{blk}	Max.		Refer to IEC 62679-3-1 and ^a
5.6.6	Contrast ratio under diffused light and/or direct light	CR_{diff} CR_{dir}	Min. Min.		Refer to IEC 62679-3-1 and ^a
5.6.7	Ambient contrast ratio – Indoor	ACR_{ind}	Min		Refer to IEC 62679-3-1 and ^a
5.6.8	Ambient contrast ratio – Outdoor	ACR_{out}	Min		Refer to IEC 62679-3-1 and ^a
5.6.9	Viewing direction contrast ratio	$VD CR_{w,\theta d}$			Refer to IEC 62679-3-1 and ^a
5.6.10	Reflectance non-uniformity	NU		Max.	Refer to IEC 62679-3-1 and ^a
5.6.11	Contrast ratio at $\pm (15^\circ, 30^\circ, 45^\circ, 60^\circ, 75^\circ)$ horizontal viewing direction	θ_{H15} θ_{H30} θ_{H45} θ_{H60} θ_{H75}	Min.		Refer to IEC 62679-3-1 and ^a
5.6.12	Contrast ratio at $\pm (15^\circ, 30^\circ, 45^\circ, 60^\circ, 75^\circ)$ vertical viewing direction	θ_{V15} θ_{V30} θ_{V45} θ_{V60} θ_{V75}	Min.		Refer to IEC 62679-3-1 and ^a
5.6.13	Chromaticity of white (x, y) Chromaticity of black (x, y) Chromaticity of red (x, y) Chromaticity of blue (x, y) Chromaticity of green (x, y)	$(x, y)_w$ $(x, y)_{blk}$ $(x, y)_R$ $(x, y)_B$ $(x, y)_G$	Min.	Max.	Refer to IEC 62679-3-1
5.6.14	Frame response time of display module	T_{frm}		Max.	Refer to IEC 62679-3-2
5.6.15	Image retention duration	T_{hld}	Min.		Refer to IEC 62679-3-2
5.6.16	Electric power of keeping the image contrast ^b	P_{hld}		Max.	Refer to IEC 62679-3-2
5.6.17	Rewriting energy	W_{rew}		Max.	Refer to IEC 62679-3-2

The illumination light source should be reported as either CEI illuminant D50 or D65, or as another stable and spectrally smooth broadband visible light source (e.g. incandescent lamp).

^a Refer to IEC 62679-3-3 for an EPD with integrated lighting unit (ILU).

^b Only applies to those display technologies that use periodical repeat driving to maintain contrast.

5.7 Supplementary information

The following specifications shall be stated:

- timing characteristics (e.g. timing of logic signals) and data interface specification
- supply voltages: power on sequence, and power off sequence
- operating voltage range, as a function of temperature at specified contrast ratio
- weight of display module
- handling and operating information
- precautions with respect to electrostatic discharges
- precautions of installation, mechanical and/or electrical
- safety information

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