

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

Plasma display panels – **STANDARD PREVIEW**  
Part 2-1: Measuring methods – Optical and optoelectrical  
(standards.iteh.ai)

Panneaux d'affichage à plasma –  
Partie 2-1: Méthodes de mesure – Mesures optiques et opto-électriques

IEC 61988-2-1:2012  
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Optical and optoelectrical**

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International Standard IEC 61988-2-1 has been prepared by IEC technical committee 110: Electronic display devices.

This second edition cancels and replaces the first edition published in 2002. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- The first edition of IEC 61988-2-1 and IEC 61988-2-2 were combined and reconstructed in this document.

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

FDIS	Report on voting
110/337/FDIS	110/352/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 61988 series, under the general title *Plasma display panels*, 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 web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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## PLASMA DISPLAY PANELS –

### Part 2-1: Measuring methods – Optical and optoelectrical

#### 1 Scope

This part of IEC 61988 determines the following measuring methods for characterizing the performance of plasma display modules (PDP modules):

- a) four per cent (4 %) window luminance;
- b) luminance uniformity;
- c) dark-room contrast ratio;
- d) bright-room contrast ratio 100/70;
- e) white chromaticity and chromatic uniformity;
- f) colour gamut in the centre box;
- g) module power and current consumption;
- h) module power consumption using video signal;
- i) module luminous efficacy, and
- j) panel luminous efficacy.

#### 2 Normative references

[IEC 61988-2-1:2012](https://standards.iteh.ai/catalog/standards/sist/07e8c6a7-0f86-491e-b1da-86630ac45f79/iec-61988-2-1-2012)

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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 60068-1, *Environmental Testing – Part 1: General and guidance*

IEC 60107-1, *Methods of measurement on receivers for television broadcast transmissions – Part 1: General considerations – Measurements at radio and video frequencies*

IEC 61988-1, *Plasma display panels – Part 1: Terminology and letter symbols*

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

CIE 15:2004, *Colorimetry*

#### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61988-1, IEC 60068-1, and IEC 60107-1, as well as the following, apply.



**3.1****4 % window panel luminous efficacy** $\eta_{p,0,04}$ 

panel luminous efficacy measured by displaying the patterns of 4 % white window and full screen black

NOTE Ohmic loss is smaller than that of full screen panel luminous efficacy (see 3.4).

**3.2****full screen panel luminous efficacy** $\eta_{p,fs}$ 

panel luminous efficacy measured by displaying the patterns of full screen white and full screen black

NOTE Ohmic loss is larger than that of 4 % window panel luminous efficacy (see 3.4).

**3.3****panel checker**

system used to drive and test plasma display panel

NOTE Panel checker includes the same or the equivalent electric circuits as a PDP module.

**3.4****panel luminous efficacy  
luminous efficacy** $\eta$ 

incremental luminous flux (measured as the luminous flux of a white display minus the luminous flux of a black display), divided by the incremental power input applied to the sustain driver for operating the panel (measured as the white display power minus the black display power)

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NOTE Expressed in lumens/watt.

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**4 Structure of measuring equipment**

The system diagrams and/or driving conditions of the measuring equipment shall comply with the structure specified in each item.

**5 Standard measuring conditions****5.1 Environmental conditions**

Measurements shall be carried out under the standard environmental conditions, i.e. at a temperature of 25 °C ± 3 °C, a relative humidity of 25 % to 85 %, and a pressure of 86 kPa to 106 kPa. When different environmental conditions are used, these shall be noted on the report.

**5.2 Set-up conditions****5.2.1 General**

The following standard set-up conditions shall be used. Each condition shall be noted on the relevant specification whenever any different conditions other than the standard set-up conditions are applied.

## 5.2.2 Measuring layout

### 5.2.2.1 General

Measurements shall be carried out at the standard measuring layout shown in Figure 1. When a different measuring layout is used, this shall be noted on the report.

### 5.2.2.2 Position of light measuring device

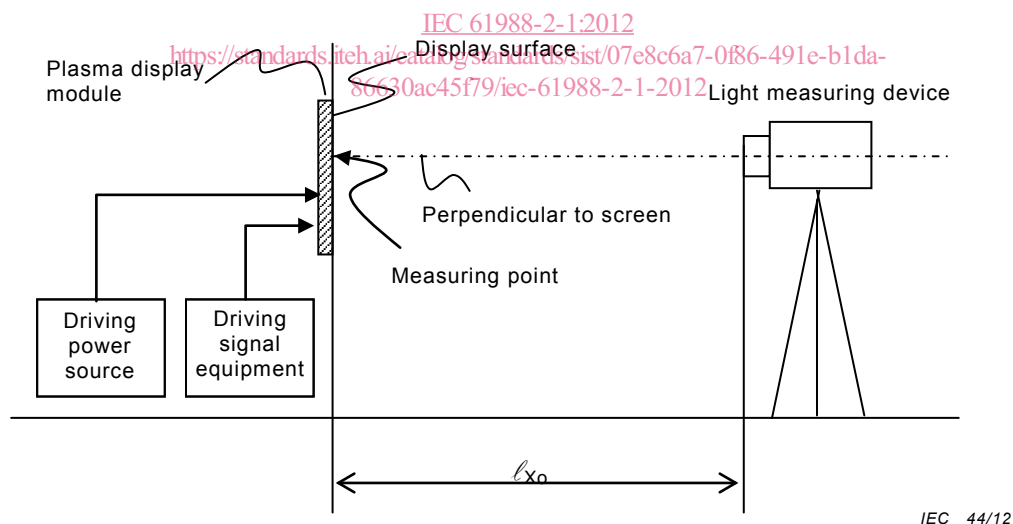
The light measuring device shall be aligned perpendicular to the area to be measured on the screen of the PDP module.

### 5.2.2.3 Standard measuring distance

The standard measuring distance  $\ell_{x0}$  is 2,5 V, where V is the screen height or the short side length of the screen. The measuring distance shall be between 1,6 V and 2,8 V. The measuring distance shall be noted on the report.

### 5.2.2.4 Aperture angle of light measuring device

The light measuring device shall be set at a proper aperture angle less than or equal to 2 degrees, and shall measure an area of at least 500 pixels which has an extent less than 10 % of the screen height. This area corresponds to including a circular measurement area of at least 26 lines in diameter in the case of a display panel having a square pixel consisting of 3 subpixels. The measuring distance and the aperture angle may be adjusted to achieve a viewing area greater than 500 pixels, which has an extent less than 10% of the screen height if setting the above aperture angle is difficult. Such deviations from standard conditions shall be noted on the report.



#### Key

$\ell_{x0}$  standard measuring distance = 2,5 V, where V is the screen height or short side length of screen.

**Figure 1 – Measuring layout (side view)**

## 5.2.3 Field frequency

The standard field frequency of the driving signal equipment shall be 60 Hz, unless the module is intended to be used at a significantly different frequency. In any case, the field frequency used shall be noted on the report.

#### 5.2.4 Adjustment of PDP modules

For contrast adjustable PDP modules, adjust the contrast to the maximum value under the standard environmental conditions.

Automatic control functions such as auto-power control (APC), image sticking prevention function, etc. by which the display luminance could change during the measurement shall be turned off or the activation of these functions shall be avoided by some measuring procedures described below.

When the displayed luminance could be changed by some automatic control functions included in the PDP module and turning off these functions is not convenient, a procedure using sequentially changing input images or a procedure using a turn-on, measure and turn-off sequence shall be applied.

For the procedure of sequentially changing input images, the input signals shall be changed just before the display luminance is changed and the measurement shall be carried out when the measured image is displayed. The input signal, except the measured image, should be any suitable signal that disables the automatic control functions mentioned above.

For the procedure of using a turn-on, measure and turn-off sequence, the PDP module shall be sequentially turned off and turned on just before the displayed luminance is changed. The measurement shall be carried out when the measured image is displayed.

The displayed luminance of both procedures mentioned above usually remains constant for several minutes which are enough for a stable measurement with a light measurement device.

#### 5.2.5 Warm-up condition of PDP modules

The warm-up time shall be longer than 30 minutes with a signal input set at 15 % grey level on full screen without gamma correction, unless other specified measuring methods are used. When different warm-up conditions are used, they shall be noted on the report.

### 5.3 Lighting conditions

#### 5.3.1 Dark-room conditions

Illuminance shall be less than 1 lx anywhere on the screen of the PDP module. When this illuminance significantly affects the measurement of the black level, the background subtraction method shall be used. When a different illuminance or the background subtraction method is used, this shall be noted on the report.

#### 5.3.2 Bright-room conditions

##### 5.3.2.1 General

The lamp shall be adjusted so that the illuminance conditions on vertical and horizontal planes are satisfied at the centre of the panel, which has been arranged vertically. The illuminance precision shall be  $\pm 5\%$  and the measured illuminance shall be clearly noted on the report. When a different illuminance is used, it shall be noted on the report.

##### 5.3.2.2 Illuminance on the panel

- a) Vertical plane illuminance: 100 lx
- b) Horizontal plane illuminance: 70 lx

##### 5.3.2.3 Illumination source

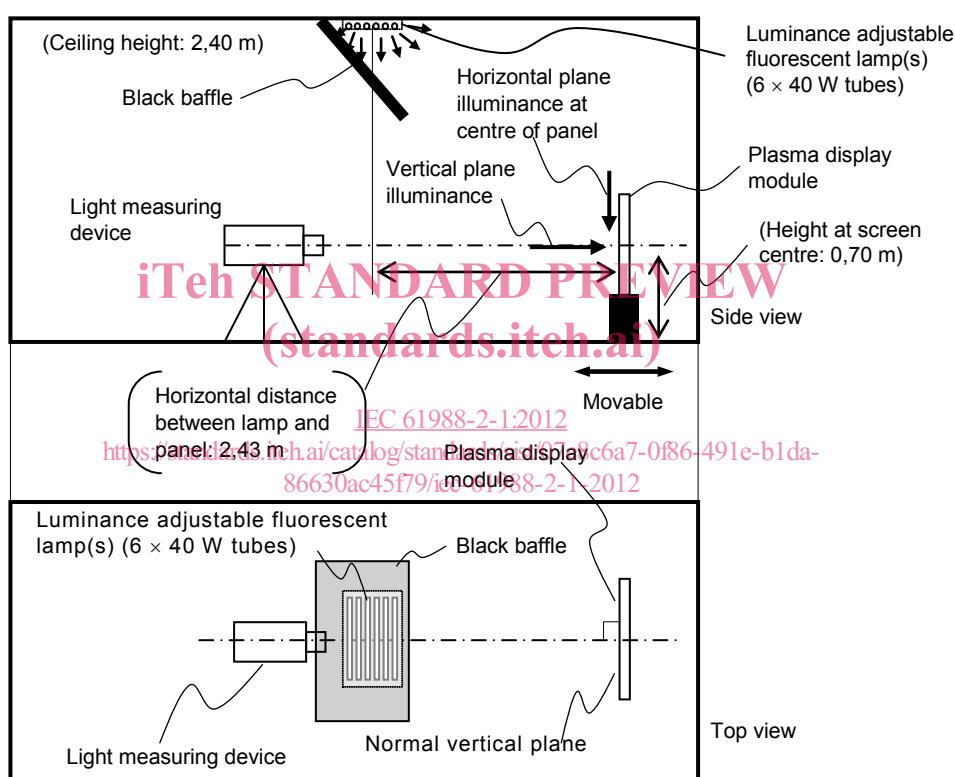
AAA colour rendering daylight white (JIS Z 9112-1990 type N-EDL) straight tube fluorescent lamp should be used. If another kind of lamp is used, it shall be noted on the report with the

detail information of the lamp. When the illuminance conditions cannot be met with one lamp, a group of lamps may be used. It is permissible to use luminance adjustable lamps.

The fluorescent lamp(s) shall be used under the recommended operation conditions: for example, after 100 hours of ageing but before they have been in use for 2 000 h. Photo spectrum of the applied lamps shall be included in the detail information.

### 5.3.2.4 Placement of illumination source and display

The panel shall be mounted in a vertical plane. The long axis of lamp shall be arranged horizontal to the floor and parallel to the plane of the panel. The centre of the lamp shall be arranged within a normal vertical plane which is normal to the panel face and intersects the centre of the panel (see Figure 2).



NOTE Details in brackets are for example only.

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Figure 2 – Example of bright-room conditions

### 5.3.2.5 Adjustment of illuminance

The illumination shall be adjusted – by adjusting the illumination source output and/or the position of the lamp(s), and/or by moving the display panel – so that the vertical plane and horizontal plane illuminance conditions are satisfied. When measuring the illuminance, the display shall be moved from the measurement position, in order to avoid the light reflection from the display.

### 5.3.2.6 Others

The walls shall be hung with black curtains, or shall be windowless and grey in colour with a reflectivity no greater than 20 %. And the floor shall be grey in colour with a reflectivity no greater than 20 %.

Consideration shall be given to the colour and placement of the measurement system, including walls, floor, ceiling and persons making the measurements, so that reflected light does not affect the measured illuminance. A black baffle plate shall be applied to reduce the reflected light, without shadowing the panel. Once the light source has been turned on, the illuminance shall be adjusted after it has reached a sufficient stability. An example of a measurement room is shown in Figure 2.

## 6 Measuring methods

### 6.1 Measuring methods of 4 % window luminance

#### 6.1.1 Purpose

The purpose of this method is to measure the luminance of a 4 % window of a PDP module.

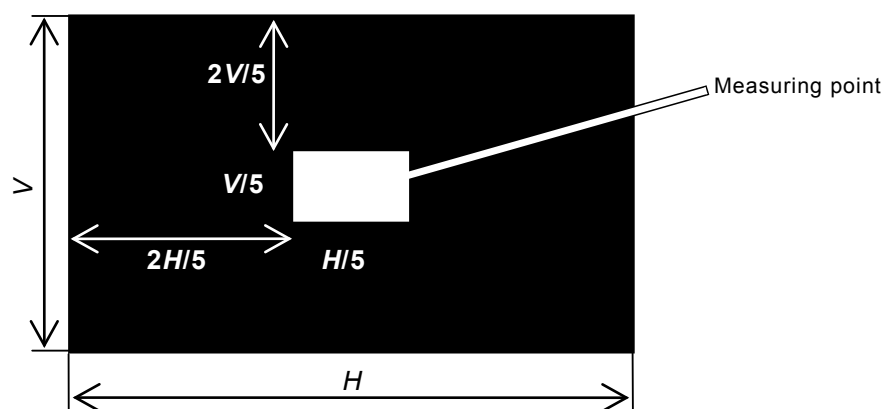
#### 6.1.2 Measuring equipment

The following equipment shall be used:

- driving power source;
- driving signal equipment; and
- light measuring device.

#### 6.1.3 Measurement

The PDP module shall be set in the standard measuring conditions and in the dark-room conditions. The measuring layout is shown in Figure 1. Apply a 4 % window ( $H/5 \times V/5$ ) white signal of level 100 % at the screen centre to the PDP module and measure the 4 % window luminance  $L_{DR0,04}$  at the centre  $P_0$  of the white window  $A_0$  as shown in Figure 3.



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Figure 3 – Four per cent (4 %) window luminance measuring pattern

## 6.2 Measuring method of luminance uniformity

### 6.2.1 Purpose

The purpose of this method is to measure the luminance uniformity of a PDP module.

### 6.2.2 Measuring equipment

The following equipment shall be used:

- a) driving power source;
- b) driving signal equipment; and
- c) light measuring device.

### 6.2.3 Measurement

The PDP module shall be set in the standard measuring conditions and in the dark-room conditions. The measuring layout is shown in Figure 1. Apply a full screen white signal of level 100 % to the PDP module and measure the luminance  $L_i$  at the specified points  $P_i$  (where  $i$  is 0 to 8 or 0 to 4) on the display screen. Measurements shall be carried out at five points or nine points. In the case of the display screen shown in Figure 4, measuring points shall be chosen from  $P_0$  to  $P_4$  or from  $P_0$  to  $P_8$  for five points or nine points, respectively. The luminance non-uniformity at  $P_i$  is:

$$\frac{\Delta L_i}{L_{av}} \times 100 (\%)$$

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Where, luminance deviation  $\Delta L_i$  is given by:

$$\Delta L_i = L_i - L_{av}$$

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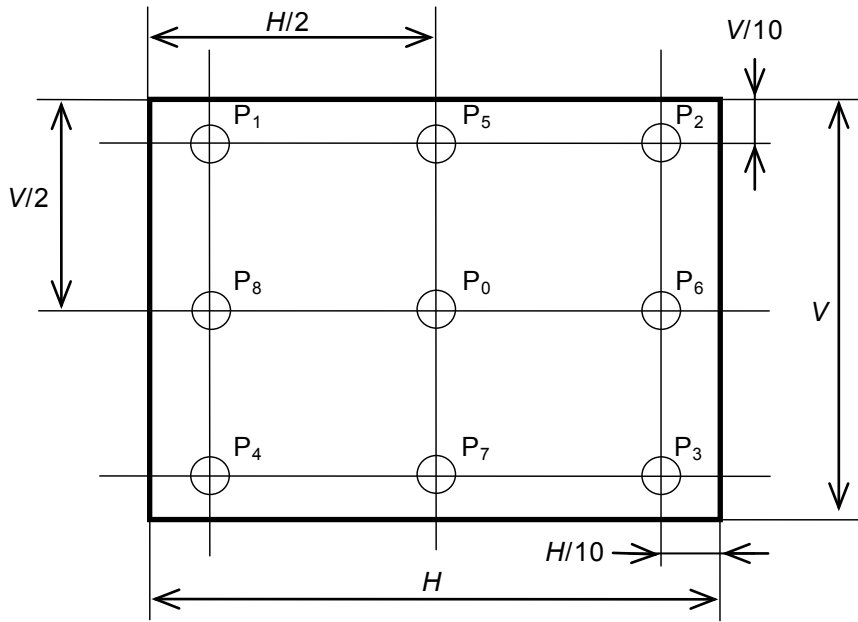
Average luminance  $L_{av}$  for five points is given by:

$$L_{av} = \frac{L_0 + L_1 + L_2 + L_3 + L_4}{5}$$

Or average luminance  $L_{av}$  for nine points is given by:

$$L_{av} = \frac{L_0 + L_1 + L_2 + L_3 + L_4 + L_5 + L_6 + L_7 + L_8}{9}$$

The measured results should be recorded as shown in Table 1.



NOTE  $P_0$  to  $P_8$ : Measuring points

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**Figure 4 – Measuring points**  
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**Table 1 – Example of luminance uniformity measurement**

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Measuring point	Luminance $L_i$ cd/m <sup>2</sup>	Luminance non-uniformity $\Delta L_i / L_{av} \times 100$ %
$P_0$	110	+1,6
$P_1$	107	-1,1
$P_2$	109	+0,7
$P_3$	106	-2,1
$P_4$	104	-3,9
$P_5$	111	+2,6
$P_6$	113	+4,4
$P_7$	105	-3,0
$P_8$	109	+0,7
Average luminance $L_{av}$ : 108 cd/m <sup>2</sup>		

**6.3 Measuring method of dark-room contrast ratio**

**6.3.1 Purpose**

The purpose of this method is to measure the dark-room contrast ratio of a PDP module.

**6.3.2 Measuring equipment**

The following equipment shall be used:

- a) driving power source;
- b) driving signal equipment; and