

Luminance meters — Requirements and test methods

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Committees responsible for this British Standard

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- GAMBICA (BEAMA Ltd.)
- Institution of Civil Engineers
- Institution of Electrical Engineers (IEE)
- Institution of Lighting Engineers
- Lighting Industry Federation Ltd.
- National Physical Laboratory
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Foreword

This British Standard has been prepared by Subcommittee CPL/34/5. Together with BS EN 13032-1:2004, it supersedes BS 7920:1998, which is withdrawn.

Luminance meters are used for measurements relating to many varied applications, such as:

- road lighting;
- road tunnel entrances;
- cathode ray tubes and other display screens;
- light boxes for examining X-ray and other transparencies;
- road and advertising signs;
- signal lamps such as traffic lights.

In many of these applications luminance levels are specified.

The approach of this standard is similar to that used for BS 667:2005 on illuminance meters. This British Standard specifies the requirements for two types of luminance meter: Type L: laboratory instruments and Type F: field instruments. The error tolerances have been considered in a similar manner to that used in CIE Publication 69 [1], and the definitions are based on CIE Publication 17.4 [2].

Error tolerances for Type L meters have been aligned with those given in BS EN 13032-1:2004, Table 4.

BS EN 13032-1 specifies laboratory luminance meters for testing luminaires only. It does not cover luminance meters for other laboratory purposes or for field use.

This new edition of BS 7920 incorporates changes necessitated by the publication of BS EN 13032-1:2004. It does not reflect a full review or revision of the standard which will be undertaken in due course.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages 1 to 15 and a back cover.

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Introduction

As lighting levels reduce, the response characteristics of the human eye change from photopic during the day through an intermediate mesopic region at dusk to a scotopic response at night time.

At present, eye response functions have not been defined in the mesopic region; research work is still in progress on this subject. Although photopic measurements are generally only applicable at lighting levels above about $2 \text{ cd} \cdot \text{m}^{-2}$, in practice lighting levels for installations are specified at values significantly below this. It is therefore necessary to make luminance measurements with known accuracy at these lower levels to check performance against such specifications whilst accepting that the measurements do not accurately represent the visual response.

Photometric measurements, even under laboratory conditions, are more difficult to determine precisely than many other kinds of physical measurement, and in the case of luminance meters, liability to error is increased by the fact that many of the essential components of such instruments are susceptible to variation with time and use. These errors can be minimized by care in the design of the instrument as a whole, and also by the user in not exposing it to deleterious conditions of temperature, illumination or atmosphere.

1 Scope

This British Standard specifies performance requirements for luminance meters for the measurement of photopic luminance for applications other than the measurement of luminaires. It specifies the performance requirements for two types of luminance meter, Type L (laboratory instruments) and Type F (field instruments). This standard is intended for use by meter manufacturers and users.

NOTE The requirements specified for a Type L meter in this standard are identical to the requirements specified for a luminance meter in BS EN 13032-1. However, BS EN 13032-1 specifies additional requirements which are not specified in this standard.

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.

BS ISO 10526:1999, *CIE standard illuminants for colorimetry*.

PD 6461-3:1995, *General metrology — Part 3: Guide to the expression of uncertainty in measurement (GUM)*.

CIE Publication 18.2:1983, *The basis of physical photometry*. Second edition.

3 Terms and definitions

For the purposes of this British Standard the following terms and definitions apply.

3.1

luminance

(in a given direction, at a given point of a real or imaginary surface) (L_v ; L)
quantity defined by the formula:

$$L_v = \frac{d\Phi_v}{dA \cdot \cos\theta \cdot d\Omega}$$

where

- $d\Phi_v$ is the luminous flux transmitted by an elementary beam passing through the given point and propagating in the solid angle $d\Omega$ containing the given direction;
- dA is the area of a section of that beam containing the given point;
- θ is the angle between the normal to that section and the direction of the beam;
- unit: $\text{cd} \cdot \text{m}^{-2} = \text{lm} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$

[CIE 17.4:1987, definition 845-01-35]

3.2

luminance meter

instrument for measuring luminance

3.3

photoelectric detector

detector of optical radiation in which the absorption of photons results in the generation of an electric current or voltage, or causes a change in electrical resistance

NOTE 1 Referred to in the text as a “detector”.

NOTE 2 The term “photoelectric cell” is also in use.

3.4

selective or coloured filter

medium which changes the spectral distribution of radiation by transmission

3.5

colour temperature

temperature of the full radiator which emits radiation of the same (or nearly the same) chromaticity as the radiation considered

3.6

photometer head

photoelectric detector the spectral response of which is weighted (usually by means of coloured filters) to approximate the CIE spectral luminous efficiency function $V(\lambda)$ of the human eye for photopic vision, as defined in CIE 18.2; with either a variable-focus optical system or a fixed focus system in front of the detector

NOTE More information on the spectral response is given in C.2.

3.7

measurement field

projected area of the object being measured, from which light is received by the detector

NOTE 1 The measurement field is generally circular. It can, however, have other shapes (e.g. trapezoidal, square or irregular).

NOTE 2 For circular fields, the measurement field is determined by the measurement field angle (see 3.8). Differently shaped measurement fields can have the measurement field angle expressed in various ways.

3.8

measurement field angle

angle subtended by the measurement field at the optical centre of the luminance meter (see Figure 1)

NOTE The measurement field angle corresponds to the ten percent measurement angle (see 3.11).

3.9

effective range

that portion of the range over which the instrument conforms to the accuracy requirements of this specification

3.10

field of view

area seen through the eyepiece of the photometer head

3.11

fifty percent, ten percent and one percent measurement angles, of a photometer head

($\varepsilon_{1/2}$, $\varepsilon_{1/10}$ and $\varepsilon_{1/100}$)

angles measured in a plane through the optical axis of the photometer head at the optical centre, within which the responsivity of the luminance meter is equal to or greater than one-half, one-tenth, or one-hundredth, respectively, of the responsivity to incident light in the direction of the optical axis

NOTE Further definitions related to photometry are given in CIE Publication 17.4 [2].