

Photographic density measurements —

Part 1: Guide for terms, symbols and notations

[ISO title: Photography — Density measurements —
Part 1: Terms, symbols and notations]

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- British Institute of Non-destructive Testing
- British Kinematograph, Sound and Television Society
- British Photographic Association
- College of Radiographers
- Institute of Physics
- Ministry of Defence
- Photogrammetric Society
- Royal Photographic Society

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National foreword

This British Standard is one of a series of Parts which together constitute a revision of BS 1384, first published in 1947 and confirmed in 1962, and has been prepared under the direction of the Cinematography and Photography Standards Committee. This Part is identical with the English-language portion of ISO 5-1:1984 “*Photography — Density measurements — Part 1: Terms, symbols and notations*” published by the International Organization for Standardization (ISO).

BS 1384:1947 defines terms and symbols and provides a method for measuring photographic transmission density only. The complete revision of this standard in four Parts will in addition cover reflection density.

Terminology and conventions. The English text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

Wherever the words “International Standard” appear, referring to this standard, they should be read as “British Standard”.

Cross-references

International Standards	Corresponding British Standards
	BS 1384 <i>Photographic density measurements</i>
ISO 5-3:1984	Part 3:1985 <i>Specification for spectral conditions</i> (Identical)
ISO 5-4:1983	Part 4:1985 <i>Specification for geometric conditions for reflection density</i> (Identical)
ISO 31-6:1980	BS 5775 <i>Specification for quantities, units and symbols</i> Part 6:1982 <i>Light and related electromagnetic radiations</i> (Identical)

ISO 5-2 and the identical corresponding Part of BS 1384 are in course of preparation.

CIE Publications No. 17 and No. 38, referred to in the text, are published by the International Commission on illumination (Commission Internationale de l’Eclairage).

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

0 Introduction

The measurement of the transmission and reflection characteristics of objects and photographs is essential to the science of photography and optics. When light or other radiant energy strikes an object, it is either absorbed or propagated. Propagation may involve reflection, transmission, refraction, diffraction, scattering, fluorescence, and polarization. The propagated light is distributed in various directions about the object. In most practical applications it is neither necessary nor desirable to consider the light distributed in every direction; but only that which leaves the object in the direction for which there is response by a receiver, such as the eye.

The object modulates the flow of radiant energy from the source to the receiver. The time rate of flow of radiant energy is called radiant flux, or simply flux. This International Standard provides methods of describing the measurements of the flux modulation in any system. To specify such a system accurately, geometric characteristics of the system, the spectral distribution of the flux incident on the specimen to be measured, and the spectral sensitivity of the receiver must be given. If the reflection characteristics of the source or the receiver affect the measurement, as they do in transmission measurements by the opal glass method, they must be specified.

The specimen area under consideration is defined by a sampling aperture, the dimensions of which may be important in some applications and must be specified if the sample has appreciable non-uniformity. If the measurement is to quantify the way the specimen would modulate flux in a given practical application, such as viewing or contact printing, the geometric and spectral conditions of measurement must simulate those conditions in the practical application.

In most practical cases, the flux of interest is propagated by transmission or reflection, but at times some combination of these or other modes of propagation may be involved. In this case, the process is referred to by the general term "propagation".

Modulation is measured and expressed as a dimensionless modulation factor which is equal to a ratio of fluxes; that is, the flux propagated in the directions and that part of the spectrum of interest divided by some reference flux. The reference flux may be the incident flux, the flux propagated through the system with the specimen removed, or the flux propagated through the system when the sample is replaced by a reference standard. For some purposes, a logarithmically scaled measure of modulation is more useful than the measured arithmetic ratio. In such cases, it is customary to use optical density defined as the negative logarithm to base 10 of the modulation factor.

Since this International Standard identifies three modes of propagation (one of which is the general mode "propagation"), three kinds of reference flux and two mathematical forms, there are 18 different measures of modulation. Each of these quantities is given a name and symbol. Each is defined as a ratio of fluxes or a logarithm of a ratio. Each kind of flux required for these definitions is given a name and a symbol.

Previous standards have defined various types of optical density and have provided symbols for a few easily specified types. Certain arrangements, which may be regarded as geometrically extreme cases, were specified in simple terms, such as diffuse or specular. These idealized extreme cases are never fully realized in practice, although they are often approximated. There has long been a need for a standard method of specifying geometric conditions closer to practice, as well as the extreme cases. The system of specification in this International Standard provides for all cases, and permits a precise description of them [6].

Most geometric arrangements used in photographic and other optical systems can be conveniently and adequately described in terms of uniform pencils of flux bounded by right circular cones. A point on the specimen is often irradiated by such a conic distribution, and the geometric form of the pencil of rays reaching the sensor is generally conic. The pupil of the eye, for example, subtends a conic solid angle at a specimen point. In projection systems, the projection lens subtends a conic solid angle at the specimen point. This International Standard specifies a conic distribution by the half angle of the cone and the direction of its axis.

A working knowledge of radiometry is generally required to obtain primary standard measurements of transmittance and reflectance. In good radiometric practice, for example the effects of stray light are minimized by the use of appropriate baffles and proper blackening of certain surfaces. Because the principles and practice of radiometry are well known and are fully described in the literature [1], it is considered unnecessary to provide a detailed specification of radiometric procedures in this International Standard.

1 Scope and field of application

This International Standard establishes terms, symbols, notations and a coordinate system to describe geometric and spectral conditions for the measurement of the degree to which a specimen modulates radiant flux, for applications in photography and radiometry. It primarily provides a system for describing methods of measuring or specifying the transmission and reflection properties of photographic materials.