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MICROCOPY

MEASUREMENT OF THE SCREEN LUMINANCE OF MICROFILM READERS

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BRIEF HISTORY

The ISO Recommendation R 782, *Microcopy – Measurement of the screen luminance of microfilm readers,* was drawn up by Technical Committee ISO/TC 46, *Documentation*, the Secretariat of which is held by the Deutscher Normenausschuss (DNA).

Work on this question by the Technical Committee began in 1954 and led, in 1967, to the adoption of a Draft ISO Recommendation.

In March 1967, this Draft ISO Recommendation (No. 1056) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Belgium	Hungary	Portugal
Brazil	India	Romania
Canada	Ireland	Sweden
Chile	Israel	Switzerland
Czechoslovakia	Italy	Spain
Denmark	Japan	U.A.R.
France	Netherlands	United Kingdom
Germany	Norway	U.S.A.
Greece	Poland	

No Member Body opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in July 1968, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 782 July 1968

MICROCOPY

MEASUREMENT OF THE SCREEN LUMINANCE OF MICROFILM READERS

INTRODUCTION

The screen luminance of a microfilm reader is an essential factor of eye comfort. However, while certain essential requirements of the human eye as regards luminance can be defined physiologically, it is more difficult to characterize a microcopy reader screen simply by one or more luminance values corresponding to these physiological requirements.

The experts hesitated in particular between two very different methods of measurement of screen luminance. A first method could consist in taking luminance measurements perpendicularly to the screen and over its entire surface; a second method could consist in fixing the measuring instrument opposite the centre of the screen and taking the luminance measurements by swivelling the instrument.

In practice, and especially with translucent screens, the results obtained with each of these two methods are fundamentally different. Moreover, the first one is not always practicable, owing to the geometrical layout of the apparatus.

To approximate as closely as possible to the actual conditions of use of the readers, it seemed necessary to combine the two methods by splitting the surface of the screen into separate areas and examining each area according to precisely stated rules.

The width of 21 cm given to these areas was not fixed at random. Physiologically it represents, margins included, the expanse which can normally be scanned by the eye of an observer glancing at a written text.*

The distance of 33 cm between screen and measuring instrument corresponds to the normal reading distance for a text of the width specified above.

Finally, it was not deemed essential to reproduce the exact conditions of binocular reading because the method adopted covers slanting measurements. While involving a far smaller complication, this feature permits indirectly analysing the differences in luminous perception which may be experienced by the two eyes when observing a single point from different angles.

The proposed method of measurement cannot alone solve the problem of adapting the luminance of microcopy reader screens to the physiological requirements of the human eye. At a later stage, minimal luminance values will have to be determined, as well as the maximal values of the luminance logarithmic differences (see clause 4.2.1) on one and the same screen.

The results obtained with both opaque and translucent screens are comparable within each category but differ more from one category to the other.

However, the method will allow comparison of the performance of various readers available on the market and should lead to improved equipment.

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* See ISO Recommendation R 216, *Trimmed sizes of writing paper and certain classes of printed matter*, standardizing a width of 210 mm for writing paper and some types of printed matter.

1. SCOPE

This ISO Recommendation describes a method of measurement associating with various points of a microcopy reader screen

(*a*) data representing luminance values and expressing the impression of luminance produced on an observer facing the screen;

(*b*) data representing luminance logarithmic differences and expressing the impression of luminance uniformity produced on an observer facing the screen.

2. FIELD OF APPLICATION

2.1 This ISO Recommendation applies to microfilm reading apparatus having translucent or built-in opaque screens. It does not apply to apparatus using virtual (aerial) images, nor to apparatus in which the conditions of clauses 3.4 and 3.5 cannot be followed. Moreover, this ISO Recommendation does not apply to apparatus for reading microcards.

2.2 If the screen is not built into the apparatus, the measurements described in this ISO Recommendation should be made only on a screen the characteristics and position of which conform to normal conditions of use, as specified by the manufacturer.

2.3 In particular, apparatus known as *office apparatus*, in which the image is formed on a sheet of white paper laid on a table, may be either classed with built-in opaque-screen readers or assessed by measuring the intensity of illumination they can provide, under conditions which have to be agreed by the parties concerned. If the method of likening the apparatus to a built-in opaque-screen reader is used, it is the manufacturer's responsibility to supply, in support of performance claims for his apparatus, the sheets of paper which enable them to be verified.

3. METHOD OF MEASUREMENT

3.1 Measuring instrument

Whether the screen be opaque or translucent, the measurements should be made with a luminance-meter.The angle of acceptance β of the luminance-meter is the angle between the two straight lines EF and EG, E being the point on the screen located in the luminance-meter axis, F and G two points of the luminance-meter aperture (see Fig. 1).

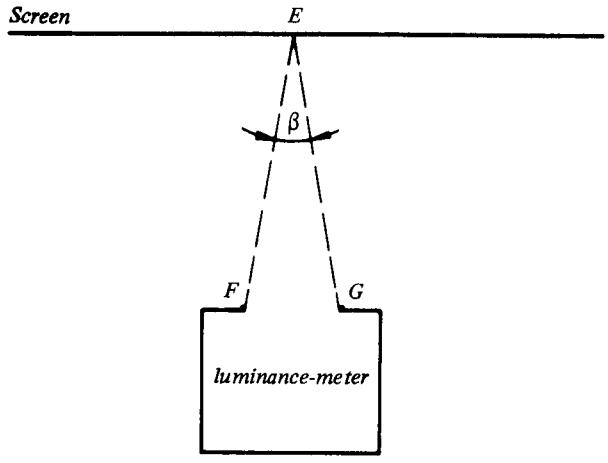

FIG. 1 – **Diagram showing the definition of the angle of acceptance**

3.1.1 The angle of acceptance of the luminance-meter should preferably be 2° 45′. If the luminance-meter used has a greater acceptance angle, up to 6° 45′ at most, a possible deviation of 5 % from the measurements made should be allowed for.

3.1.2 The luminance-meter should be graduated and calibrated in order that the measurements can be expressed in candelas per square metre, or nits.*

3.2 Surroundings

The measurements should be made in complete darkness.

3.3 Screen division into squares

3.3.1 For luminance measurement purposes, the screen should consist of five areas (see Fig. 2) as follows :

(*a*) a centre square with 21 cm sides, having a centre O, and four points O_2, O_3, O_4, O_5 marked on the diagonals near the corners at 2.5 cm from the edges;

(*b*) four squares with 21 cm sides, having their centres A, B, C, D so arranged that one of the corners of each square is at the meeting point of one of the diagonals of the rectangle circumscribed on the screen (which may have rounded or cut-off corners) with the actual edge of the screen. In each square a point should be marked at 2.5 cm from two sides, near the corner located on the screen outline. These four points are designated A_2, B_3, C_4, D_5.

3.3.2 In the case of a very large screen specially intended to be examined at a greater distance, wall projection for instance, a square larger than 21 cm can be accepted while taking into account clause 3.4.1.1.

3.3.2.1 Other 21 cm squares may be added in the areas inadequately covered by the above-mentioned square.

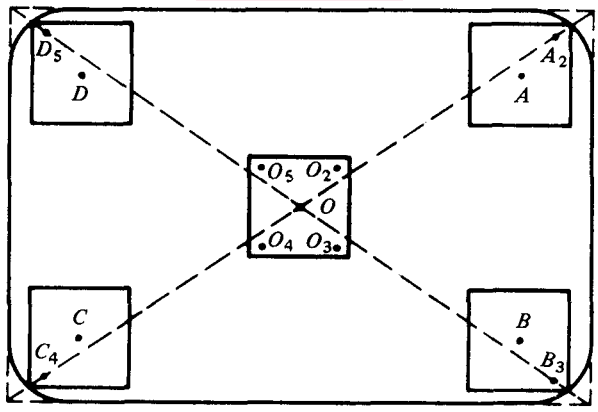

FIG. 2 – **Points of the screen where the luminance is measured**

KEY

O	is the centre of middle square having sides of 21 cm (or more);
A, B, C, D	are the centres of squares placed in the corners of the screen and having sides of 21 cm (or more);
$O_2, O_3, O_4, O_5,$ A_2, B_3, C_4, D_5	are the points which are located near a corner of a square at 2.5 cm (or more) from two corresponding edges.

* The candela per square metre is the unit of luminance recommended by the International Commission on Illumination (C.I.E.). A nit-meter is a luminance-meter calibrated directly in candelas per square metre, or nits.

3.4 Position of luminance-meter during measurements

3.4.1 The luminance-meter should be placed 33 cm from the screen, on the perpendicular to the screen at the centre of each square successively.

3.4.1.1 If the screen is very large, a distance from the luminance-meter greater than 33 cm can be agreed upon, taking into account clause 3.3.2 and preserving unchanged the proportionality ratio between, on the one hand, the distance of the luminance-meter from the screen and, on the other hand, the sides of the squares and the distances of points such as O_2 and A_2 from the neighbouring sides.

3.5 Points where the luminance should be measured on the screen

The luminance of the following points or areas of the screen are successively measured (see Fig. 2).

(*a*) The centre O of the central square, the measurement being made perpendicularly to the screen.

(*b*) The four corners of the central square (see clause 3.3.1); for this measurement the luminance-meter, swivelling around the same point of the perpendicular to the screen at point O, is directed towards the points O_2, O_3, O_4, O_5 of the central square.

(*c*) The four corners of the screen, the luminance-meter being directed, perpendicularly to the screen, successively towards the four centres A, B, C, D of the squares (see clause 3.3.1).

(*d*) The four ends of the screen diagonals. For the first of these measurements the luminance-meter, swivelling around a point of the perpendicular to the screen at the centre A of the first square (see clause 3.3.1), is directed towards the point A_2 of the same square. The same measurement is made again, by setting the luminance-meter successively opposite the three other centres B, C, D, perpendicularly to the screen and directing it respectively towards the points B_3, C_4, D_5.

4. EXPRESSION OF RESULTS

4.1 The luminance measured as indicated in clause 3.5 should be expressed in candelas per square metre or nits and noted by the symbol of the corresponding point O, A_2, etc.

4.1.1 Calculate the common logarithms of the luminance values noted by the symbol of the corresponding point in parenthesis (O), (A_2), etc.

4.2 Calculate the logarithmic differences of the luminance values of couples of points as follows :

(*a*) Express these logarithmic differences for the following couples of points of the central square :

$$(O) - (O_2)$$
$$(O) - (O_3)$$
$$(O) - (O_4)$$
$$(O) - (O_5)$$

(*b*) Express similarly these logarithmic differences for the couples of points of the other squares :

$$(A) - (A_2)$$
$$(B) - (B_3)$$
$$(C) - (C_4)$$
$$(D) - (D_5)$$

(*c*) Express also the logarithmic differences between the perpendicular measurements for the following couples of points :

$$(O) - (A)$$
$$(O) - (B)$$
$$(O) - (C)$$
$$(O) - (D)$$

4.2.1 It will be observed that, by adding the differences such as

$$\left[(O) - (A)\right] + \left[(A) - (A_2)\right]$$

and the three other analogous expressions from clause 4.2, four values of some importance are obtained :

$$(O) - (A_2)$$
$$(O) - (B_3)$$
$$(O) - (C_4)$$
$$(O) - (D_5)$$

4.3 The luminance properties of the screen are thus characterized by

(*a*) the luminance, in candelas per square metre or nits, of centre *O* of the central square (see clause 4.1);

(*b*) the four logarithmic differences referred to in clause 4.2 (*a*), and the four logarithmic differences referred to in 4.2 (*b*) substantially corresponding to the differences in physiological sensation of the eye looking, while the head remains motionless, at the centre and at a corner of one of the squares defined in clause 3.3.1;

(*c*) the four logarithmic differences (referred to in clause 4.2 (*c*) which correspond to the differences in physiological sensation of the eye looking perpendicularly first at the centre of the screen and then at one of the outside points A_2, B_3, C_4, D_5, obliquely from the positions *A, B, C, D.*

(*d*) the four logarithmic differences referred to in clause 4.2.1 which correspond to the differences in physiological sensation of the eye looking first perpendicularly at the centre of the screen and then at one of the outside corners A_2, B_3, C_4, D_5, obliquely from the positions *A, B, C, D.*

5. TEST REPORT

The test report should include

(*a*) the type of apparatus tested, opaque or translucent screen; if the former, state whether the screen forms an integral part of the apparatus;

(*b*) the scale of magnification of the apparatus tested;

(*c*) the distribution on the screen of 21 cm squares with centres *A, B, C, D* and of the other points where the measurements were taken, with a dimensioned sketch and guiding letters and figures conforming to the indications of Figure 2;

(*d*) the luminance in the centre of the screen (see clause 4.1), the three series of four logarithmic differences (see clause 4.2);

(*e*) all necessary remarks on the measurement conditions or on certain features of the apparatus.