INTERNATIONAL STANDARD

ISO 7565

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Micrographics — Readers for transparent microforms — Measurement of characteristics

Micrographie — Appareils de lecture de microformes — Mesurage des caractéristiques

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Contents

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Annexes

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 7565 was prepared by Technical Committee ISO/TC 171, *Micrographics and optical memories for document and image recording, storage and use.*

Annexes A and B of this International Standard are for information only.

Micrographics — Readers for transparent microforms — Measurement of characteristics

1 Scope

This International Standard specifies methods and instruments for measuring the characteristics for readers specified in ISO 6198. It applies to magnification, resolution, distortion, screen luminance, screen contrast and film gate temperatures.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5-1:1984, *Photography — Density measurements — Part 1: Terms, symbols and notations.*

ISO 5-2:1991, *Photography — Density measurements — Part 2: Geometric conditions for transmission density.*

ISO 5-3:1984, *Photography — Density measurements — Part 3: Spectral conditions.*

ISO 5-4:1983, *Photography — Density measurements — Part 4: Geometric conditions for reflection density.*

ISO 446:1991, *Micrographics — ISO character and ISO test chart No. 1 — Description and use.*

ISO 3334:1989, *Micrographics — ISO resolution test chart No. 2 — Description and use.*

ISO 6196-1:1980, *Micrographics — Vocabulary — Section 01: General terms.*

ISO 6196-2:1982, *Micrographics — Vocabulary — Section 02: Image positions and methods of recording.*

ISO 6196-3:1983, *Micrographics — Vocabulary — Part 03: Film processing.*

ISO 6196-4:1987, *Micrographics — Vocabulary — Part 04: Materials and packaging.*

ISO 6196-5:1987, *Micrographics — Vocabulary — Part 05: Quality of images, legibility, inspection.*

ISO 6196-6:1992, *Micrographics — Vocabulary — Part 06: Equipment.*

ISO 6196-7:1992, *Micrographics — Vocabulary — Part 7: Computer micrographics.*

ISO 6198:—[1], *Micrographics — Readers for transparent microforms — Performance characteristics.*

CIE Publication No. 17.4:1987, *International lighting vocabulary.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 6196 apply.

4 Magnification

4.1 Apparatus

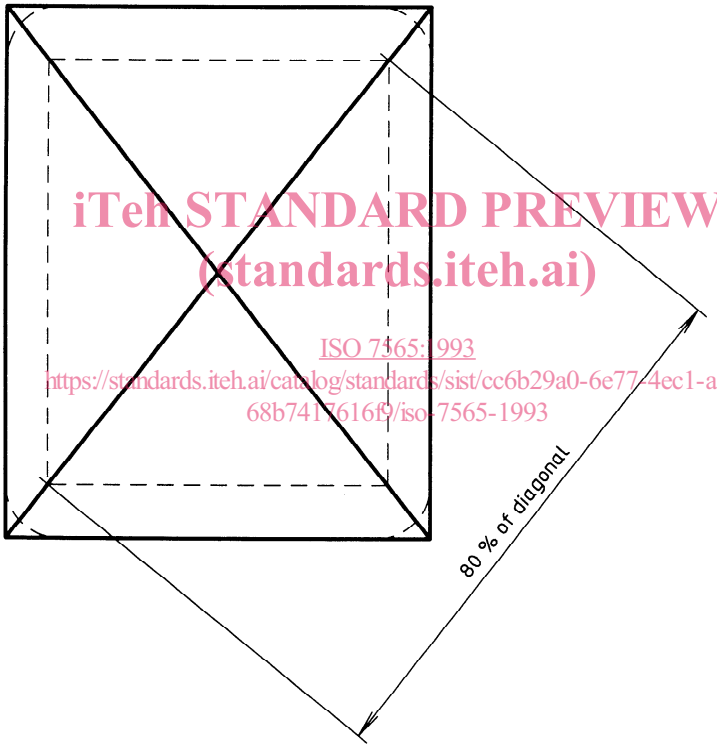
4.1.1 Magnification test target, consisting of a transparent stable material upon which is marked a graduated scale with an overall accuracy of ± 0,5 % and which, when projected on the screen, will cover at least 80 % of the reader screen width or height of

1) To be published.

the measurement area as shown in figure 1. The distance between graduations shall be not greater than 0,2 mm. The magnification test target may be included with other test objects within the image frame.

4.1.2 Graduated reference scale, of at least 200 mm in length, graduated in millimetres, having an overall accuracy of ± 0,5 %, for measuring the image of the test target on the screen.

4.1.3 Magnifier, if necessary, having a magnification between × 3 and × 12, for comparing the image length on the screen with the divisions on the graduated reference scale. A hand-held magnifier may be used on rear-projection readers and a mounted telescope may be used on front-projection readers.



NOTE — Measurement area of the screen is defined as the central area formed by connecting the points of the diagonals that are located from the corners at a distance of 10 % of the screen diagonal lengths and is shown as the area within the dashed rectangle. If the corners of the screen are rounded, the length of the diagonal and the points from which readings are taken are calculated from the intersection of the extrapolated edges of the screen. The screen may be square or a vertical or horizontal rectangle.

Figure 1 — Measurement area of reader screen

4.2 Procedure

Insert the magnification test target in the reader film gate with the scale in the horizontal position so that when at best focus, the image appears at the centre of the reader screen. The best focus is the setting of the focusing control that is judged to produce the best overall level of screen image resolution within the measurement area. This setting is found experimentally and will usually be somewhere between the setting which produces the highest resolution at the centre of the screen and the settings which produce the highest resolution at the corner.

Using the graduated scale, measure the length of the projected image using the magnifier if required. The magnification, M, is calculated as follows:

$$M = \frac{\text{length of image}}{\text{length of object}}$$

Repeat with magnification test target inserted in the film gate so that it appears in the vertical position on the reader screen.

Take measurements at other locations and orientations in the measurement area of the screen to determine the uniformity of magnification. This also aids in evaluating screen image defects such as keystoning, pincushion and barrel distortions.

5 Resolution

5.1 Test charts

Use either ISO No. 1 or ISO No. 2 microtest chart to determine resolution.

5.1.1 ISO No. 1 microtest chart

This is a microimage of the ISO No. 1 test chart. The values given in ISO 6198:—, table 1, are the minimum values of the characters to be read at the appropriate reader magnification.

5.1.2 ISO No. 2 test chart

As there is, at present, no standard specifying the ISO No. 2 microtest chart, use a microimage of an ISO No. 2 test chart at a known reduction to evaluate the pattern resolved on the screen at the known magnification of the reader being evaluated. Then use the ratio to determine the true value of the pattern resolved before comparing it with values in ISO 6198:—, table 2. Until certified microimage test targets are available, the test image used shall be capable of resolving at least four patterns higher than those specified in ISO 6198:—, table 2, for the appropriate magnification.

5.2 Magnifier

Use a magnifier to determine the character or pattern resolved on the screen (see 4.1.3).

5.3 Procedure

Measure the resolution in accordance with ISO 446 (No. 1 test chart) or ISO 3334 (No. 2 test chart). Once best focus (see 4.2) has been achieved, do not alter it during the reading. Operate at the rated voltage as specified in 7.1.2.

6 Geometric distortion

6.1 Test film

The test film carries a grid pattern with 0,25 mm squares made by lines with a thickness of 0,025 mm or less (see figure 2). The grid pattern shall be at least equal in size to the gate of the reader being tested. The thickness of the film shall not be greater than 0,18 mm. The test film shall be presented in a form that can be loaded in the reader and projected on the screen in the same manner as the microforms for which the reader is designed, i.e. in sheet form for readers for microfiche or image cards and in roll form for readers for roll film. If the test film is in roll form, the grid pattern shall extend across the full width of the film with its horizontal lines parallel to the edge of the film.

6.2 Procedure

Load and position the test film in the reader so that the lines of the grid pattern, as imaged on the screen, run horizontally and vertically across the screen. If the reader is fitted with an image rotating prism, rotate the prism to give an image that is upright and right-reading on the screen. Then set the reader lens at best focus. Locate the image of the rectangle so that its corners are as close as possible to the four screen corner positions, A, B, C and D of the measurement area (see figures 1 and 2).

For readers with flat screens, either rear- or front-projection, attach a sheet of dimensionally stable, translucent (can be opaque with front-projection readers) material (e.g. polyester drafting film), which is slightly larger than the rectangle projected on the screen, to the front of the screen in such a way that it is held taut and in contact with the surface of the screen. Then trace the four corners of the rectangle A, B, C and D on the material. Then trace the midpoints of the four sides of the rectangle similarly.

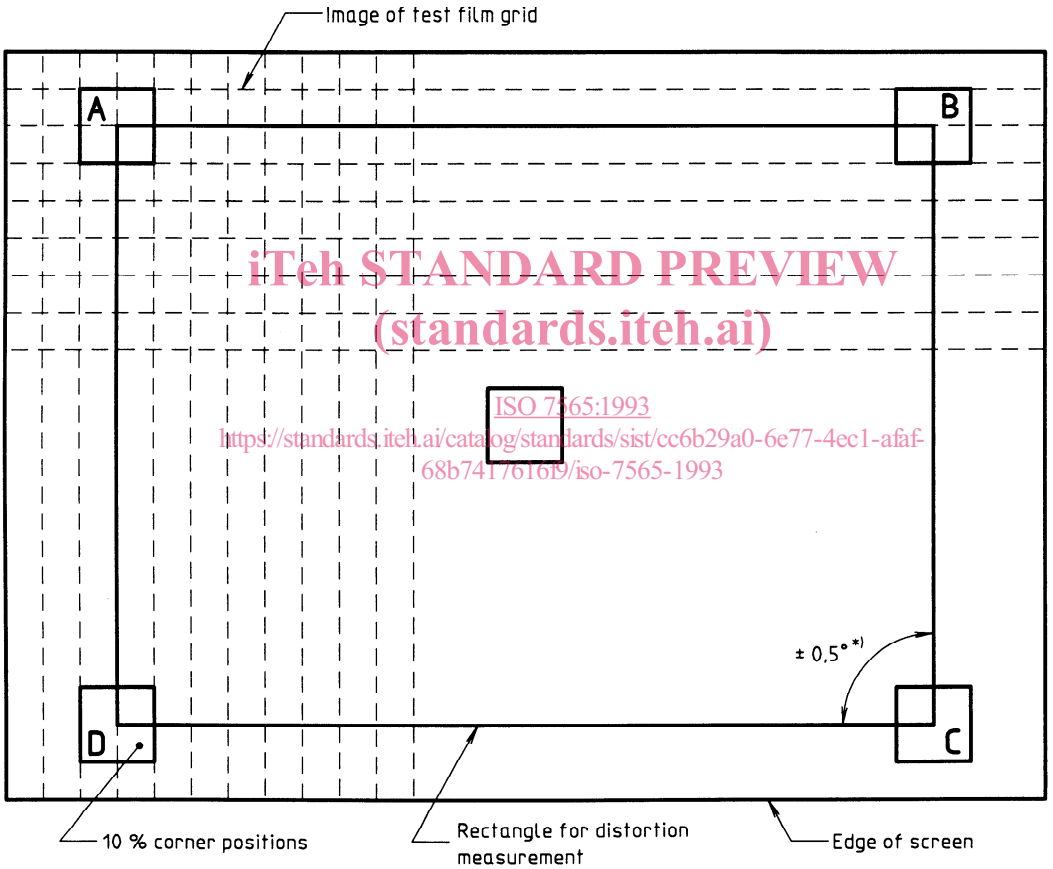
Remove the tracing material from the screen and, using a straightedge and a fine-pointed pencil (or similar device), draw straight lines between the four corner points to form a rectangle.

6.2.1 Curvilinear distortion (barrel, pincushion)

Measure the displacement of each of the marks representing the mid-points of the four sides of the rectangle, as imaged on the screen, from the mid-point of the adjacent straight line drawn on the tracing material. Express the displacement as a percentage of the length of the straight line. The greatest of the four values is taken as the measure of curvilinear distortion (see figure 3).

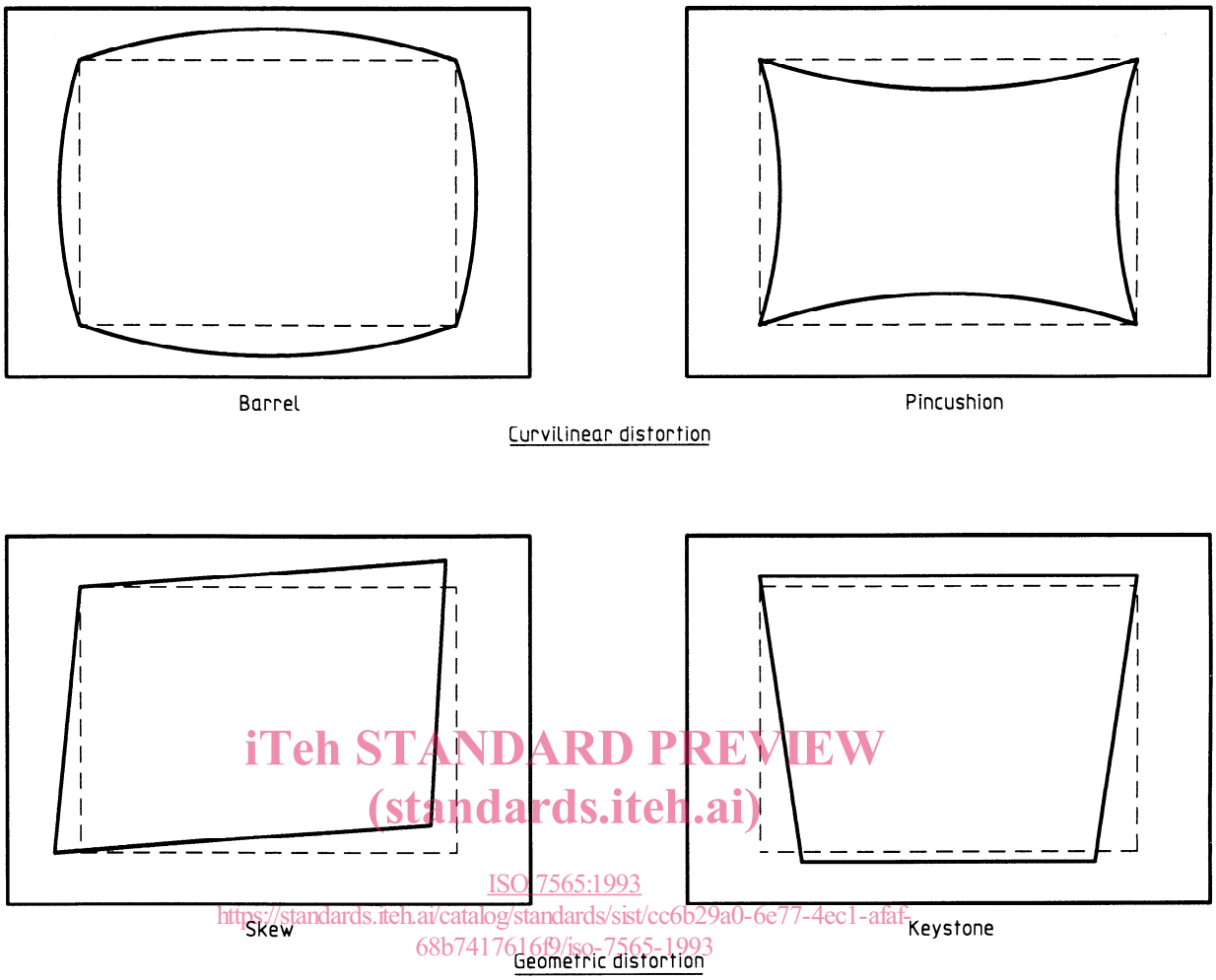
6.2.2 Geometric distortion (keystone)

Measure the lengths of the four sides of the rectangle drawn on the tracing material. If opposite sides of the rectangle differ in length, keystone distortion is present. Express the distortion as a percentage for both pairs of sides by dividing the difference in length between the two sides by the mean length and multiplying by 100 (see figure 3).



*) All four corners shall conform to this tolerance.

Figure 2 — Illustration of image distortion test pattern



NOTE — Dashed line represents ideal image area.

Figure 3 — Distortion patterns

6.2.3 Geometric distortion (skew)

Measure the lengths of the two diagonals of the rectangle drawn on the tracing material. If these differ in length, skew is present. Express the distortion as a percentage by dividing the difference between the two lengths by the mean length and multiplying by 100 (see figure 3).

NOTE 1 In the case of readers with curved screens, it may not be possible to get the sheet of tracing material to lie against the surface of the screen without wrinkling. In this case, four separate 10 mm wide strips of tracing material are placed, one at a time, in contact with the screen so that the side of the rectangle being measured lies approximately along the centre of the strip. The two end points and the centre point of the side are then traced in the manner described. Each strip is identified with the appropriate screen position, viz. top, left, right and bottom. For skew measurement, additional strips can be placed across the diagonals of the rectangle and the two end points marked in each case.

7 Screen luminance

7.1 General conditions

Measure the screen luminance from a single eyepoint, located nominally perpendicular to the centre of the screen. It is not necessary to reproduce the exact conditions of binocular viewing since the method, although attempting to simulate a typical observer, is at best an approximation. If the screen diagonal is not greater than 380 mm, the eyepoint is nominally 380 mm from the screen. If the screen diagonal is greater than 380 mm, the eyepoint is at a distance nominally equal to the diagonal (see figure 4 and annex A).

7.1.1 Apparatus

7.1.1.1 Meter for measuring ambient illuminance

Measure the ambient illuminance with an illuminance meter that is cosine-corrected and accurate to ± 10 %. Its sensitivity shall match the International Commission on Illumination photopic luminosity curve for the standard observer (see CIE Publication No. 17.4).

NOTE 2 The SI unit of illuminance is the lux (lx).

7.1.1.2 Meter for measuring screen luminance

Measure the screen luminance with a meter of the type known as a luminance meter, luminance spot meter or telephotometer where an objective lens focuses a discrete area of the test surface (screen) being measured onto the photosensitive element of the meter. Provide means to view and indicate the specific area of the test surface that is being measured, as shown in figure 4. The measuring angle of the meter shall be between 0,5° and 2,5°, preferably 1°.

The spectral sensitivity of the meter shall match the luminosity curve for the standard observer's photopic response. The accuracy of the meter shall be ± 5 % (such accuracy can only be obtained by regular calibration by a competent laboratory).

NOTE 3 The SI unit of luminance is the candela per square metre (cd/m^2).

The luminance spot meter is mounted on a sturdy stand (for example, a tripod) with a swivel to allow the meter to be easily directed at different areas of the screen.

The swivel point S shall be located approximately 75 mm behind the viewing centre E on a straight line passing through X and E (see figure 4).

7.1.2 Operation of reader being measured

Measure the luminance with the light source in the reader operated as recommended by the manufacturer. The reader shall be operated at ± 5 % of the voltage recommended by the manufacturer or at the mean voltage if a voltage range is stated (for instance, if the range is 110 V — 130 V, operate at 120 V).

Use a voltage regulator to avoid drift and instabilities that would affect the measurement reliability. To ensure stability of the different components, allow the reader to operate for 60 min before taking measurements. Find best focus on the screen with a microform in the carrier, then remove the microform and measure the luminance. The stray light incident upon the screen shall not exceed 10 lx.

7.1.3 Location of screen measurement positions

Measure screen luminance at positions X, A, B, C and D (see figures 1 and 4). For large screens (screens with a diagonal greater than 540 mm) or when more data are required, measurements may be taken in mid-areas (not shown in figure 4) on each diagonal (H, I, J and K) which are centred halfway between the centre, X, and centre of the corner areas A, B, C and D.

7.2 Procedure

7.2.1 Rear-projection readers

Measure the luminance at the centre, X, of the screen by placing the lens of the luminance meter at point E on a line that crosses through the centre and is perpendicular to the screen; or if the screen is curved, place the meter at point E on a line that is perpendicular to a plane tangent to the centre of the screen. The distance between X and E shall be 380 mm or equal to the screen diagonal, whichever is greater. Measure screen luminance at other positions specified in 7.1.3 if required.

7.2.2 Front-projection readers

The design of front-projection readers does not always allow the luminance meter to be placed on a line perpendicular to the screen. The meter shall, therefore, be placed at a point that is normally used by the observer and the reading taken from this location. This location should be documented.

8 Screen contrast

Screen contrast is the ratio of the luminance of the light areas to the dark areas of an image projected onto the screen.

8.1 Apparatus

8.1.1 Meters

Use the same type of meters for measuring ambient illumination and screen luminance as described in 7.1.1.

Dimensions in millimetres

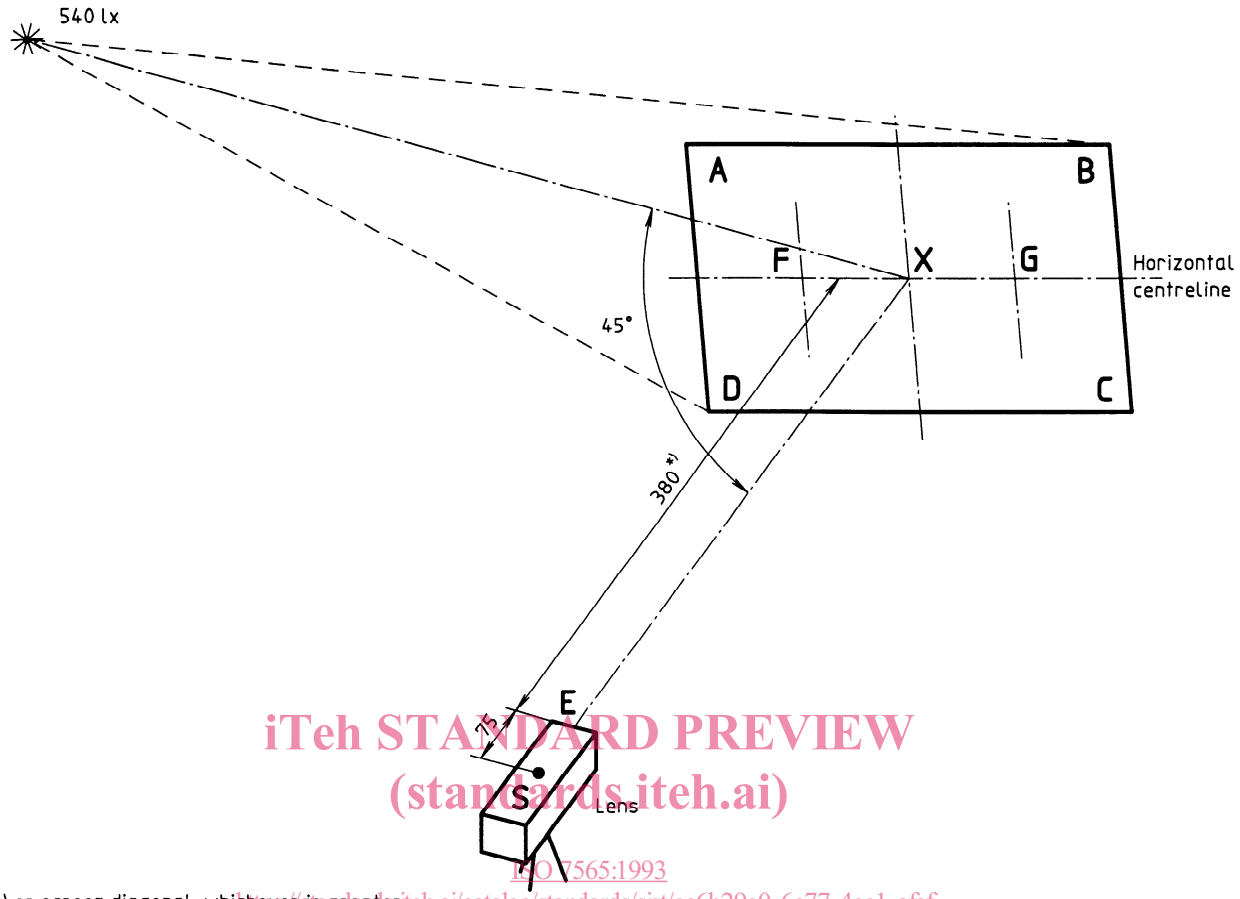


Figure 4 — Arrangement of measuring equipment and location of measurement positions

8.1.2 Test mask

For determining screen contrast, use a square or rectangular sheet of opaque material larger than the projection or film gate area of the microform holder and not greater than 0,18 mm thick. The four edges of the test mask shall be clean and smooth. Suitable test masks can be produced from black card stock, black plastic sheet (such as a film with a minimum density of 2,0) or blackened metal foil.

8.1.3 Location of contrast measurement points

Measure the contrast at positions F and G as shown in figure 4. The centres of these positions are located to the left and right of the centre of the screen on the horizontal centreline, and midway between the centre and side boundaries of the screen.

8.2 Screen contrast measurements

8.2.1 Operation of reader

Operate the reader at the voltage specified in 7.1.2 and with the reader at best focus. Locate a tungsten light source simulating ambient illumination on a line which passes through the centre of the screen, and is normal to the horizontal centreline of the screen and is elevated at an angle approximately 45° from the normal to the plane of the screen (see figure 4).

Place the light source 2 m or more from the centre of the screen to provide an incident illumination of 540 lx ± 20 lx with a colour temperature between 2 800 K and 3 200 K when measured normal to the incident light rays. Take measurements at the centre of the screen, or at the closest possible point which is not shadowed by hoods, cabinet projections or other portions of the reader itself. All other ambient illumination shall produce less than 10 lx illumination incident upon the screen.

If necessary, the direction of the light source, as viewed from the screen may be varied sufficiently in