IEC 62496-2-2

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Optical circuit boards –
Part 2-2: Measurements – Dimensions of optical circuit boards

Cartes à circuits optiques –
Partie 2-2: Mesures – Dimensions des cartes à circuits optiques

IEC 62496-2-2:2011

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62496-2-2 has been prepared by IEC technical committee 86: Fibre optics.

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

FDIS	Report on voting
86/378/FDIS	86/385/RVD

Full information on the voting for the approval of 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 parts of the IEC 62496 series, published under the general title *Optical circuit boards*, 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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OPTICAL CIRCUIT BOARDS –

Part 2-2: Measurements – Dimensions of optical circuit boards

1 Scope

This part of IEC 62496 specifies the measurement procedures for dimensions related to interface information of optical circuit boards (OCB), defined in IEC 62496-4.

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.

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

IEC 60793-1-45, *Optical fibres – Part 1-45: Measurement methods and test procedures – Mode field diameter*

IEC 61189-2, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 2: Test methods for materials for interconnection structures*

IEC 62496-2-1, *Optical circuit boards – Part 2-1: Measurements – Optical attenuation and isolation*[1]

IEC 62496-4, *Optical circuit boards – Part 4: Interface standards – General and guidance*

ISO 10360-2, *Geometrical product specifications (GPS) – Acceptance and reverification tests for coordinate measuring machines (CMM) – Part 2: CMMs used for measuring linear dimensions*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
optical position adjusting system
consists of a light source, fibre position adjustment stage, OCB holder, input/output fibre and a power meter. The optimum fibre launch position, at which the optical output power is maximised, is determined through alignment of the input/output fibres to the OCB and monitoring the output power from the OCB

3.2
dimensional drawing
illustration, including dashed lines, which defines classified OCB or OCB body shape accuracy using the origin point or alignment mark as the standard point

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1 To be published.

4 Measurement condition

All the measurements are made under the conditions specified in IEC 60068-1, unless otherwise specified. Measurements may be made under different conditions to the standard conditions if the standard conditions are difficult to achieve, as long as the actual measurement condition does not give rise to any doubt as to the result of the measurement.

5 Objects to be measured and their procedures

Objects to be measured as dimensions of OCB are stated in IEC 62496-4. The objects and their methods are summarized in Table 1. This standard specifies mainly mechanical procedures using observation systems for dimensions of OCBs.

Table 1 – Objects to be measured and their methods

	Method 1 (reference)	Method 2 (alternative)			
	Observation system	Optical position adjustment	Dimensional drawing	Confocal microscope	Laser scanning
Core shape	O				
Coordinates of I/O port	O	O			
Outer shape of OCB	O		O		
Misalignment angles of I/O	O				
Mirror	O			O	
Hole	O				O

6 Measurement procedures for dimensions

6.1 Core shape

6.1.1 Measuring equipment

6.1.1.1 General

The measuring equipment consists of observation, shape measuring and data processing systems. The measurement system shall give reproducible results. An example of a total measuring system is illustrated in Figure 1. Structural parameters for circlar core shape are obtained by near field pattern observation of cross section specified in IEC 60793-1-45.

6.1.1.2 Observation system

The observation system detects a core shape by an optical microscope with resolution of less than 1 % of designated dimension. It is necessary to select appropriate lighting, magnification, detection system and fibre positioning system to obtain sufficient measurement accuracy, but x10 to x80 for the object lens and x10 for the eyepiece seem appropriate. A camera is also used for the observation of large core shape. An example of sample set-up for the observation is illustrated in Figures 2 and 3. A light is launched in the vicinity of one of I/O ports. The output light from the sample is detected from the other one by the observation system. A movable stage or the observation system can have the measuring function. The movable stage should be controllable in x, y and z axes and vertical and horizontal rotations, independently.

6.1.1.3 Data processing system

The data processing system has the capability of analyzing image information taken from the observation system and calculates structural parameters of core shape.

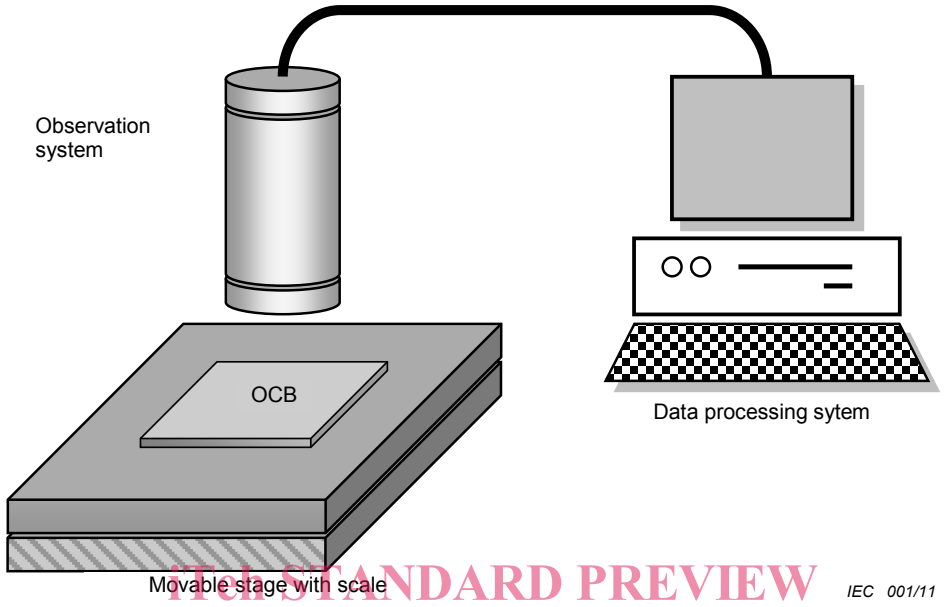

Figure 1 – Example of measuring equipment capable of observing core shape

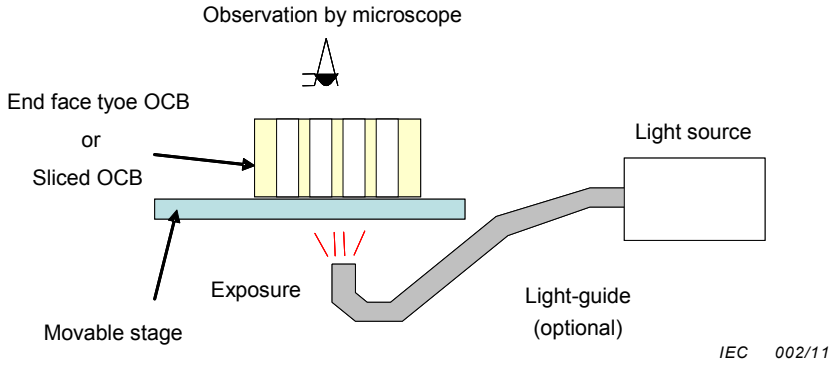

Figure 2 – Example of sample set-up for observation of core shape (end face I/O type OCB or a sliced sample)

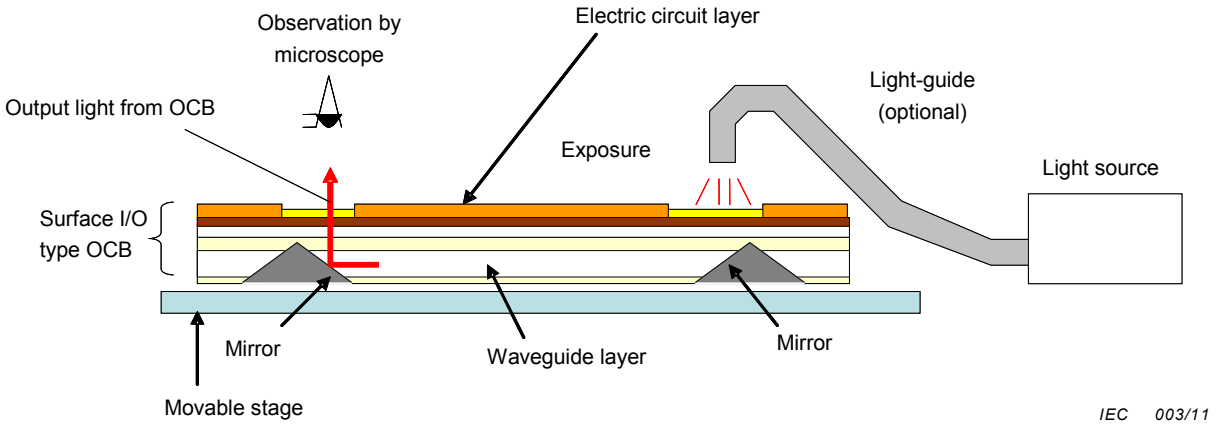

Figure 3 – Example of sample set-up using a halogen lamp house with light-guide fibre for observation of core shape (surface I/O type OCB)

6.1.2 Procedure

a) Preparation

When the core shape which is not an I/O port is measured, an OCB is cut with a blade to a smooth surface at a right angle to the core pattern. The OCB is set-up to observe I/O ports or a sliced surface, as illustrated in Figures 2 and 3. The magnification of an optical microscope is calibrated before measurement.

b) Measurement

Adjust the focus of the optical microscope at the position where the core shape can be observed by moving the movable stage or the optical microscope. The core shape is determined by processing of image information coming from the observation system. It is possible to confirm the distance to the object under measurement if the optical microscope has a distance measuring capability. The six structural parameters for a square core shape are obtained by data analysis of the core shape according to definitions of their parameters in IEC 62496-4.

6.2 Coordinates of I/O ports

6.2.1 Measurement procedure for end face I/O type OCB

6.2.1.1 Method 1 (reference) – Use of observation system

6.2.1.1.1 Measuring equipment

The measuring equipment stated in 6.1.1 shall be used.

6.2.1.1.2 Procedure

One example of measurement procedure is described below.

a) Preparation

The sample is fastened to the movable stage using a jig to attain flatness and to prevent it from moving while measuring.

b) Measurement

Align the direction of the coordinate axis and that of the movement of the movable stage to obtain horizontal reference. Move the microscope to the coordinate origin to define its coordinate to origin point. The origin point should be selected to the centre of the origin point structure for an external coordinate system, and to the core centre when the origin is specified by a coordinate of a specific core centre for internal coordinate system. Then measure the coordinates of the core centres as I/O ports. There are some cases where the observation of the I/O ports by a microscope is difficult, especially for surface I/O type. A light is launched to the opposite port of the object of the OCB, and the image of exiting light is observed.

6.2.1.2 Method 2 (alternative) – Use of optical position adjusting system

6.2.1.2.1 Measuring equipment

An optical position adjusting system consists of a light source, automatic fibre position adjustment stage, OCB holder, input/output fibre and a power meter. A schematic of the system illustrated in Figure 4 is a typical example of measurement systems for optical attenuation of an OCB stated in IEC 62496-2-1.

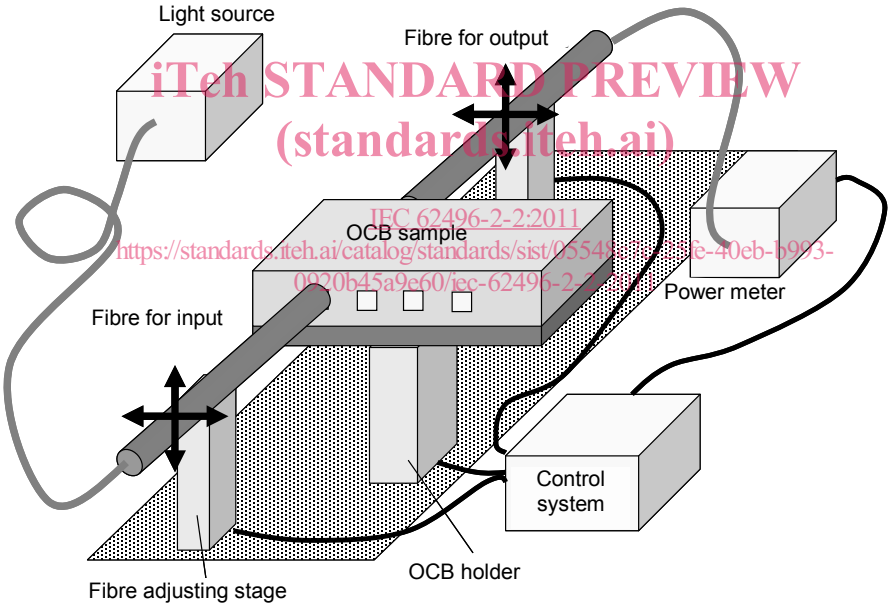

Figure 4 – Example of optical position adjustment system for end face I/O type OCB

a) Light source

Prepare a light source as stated in IEC 62496-2-1.

b) Fibre position adjustment stage

Fibre position adjustment stage consists of a jig for fixing an input/output fibre near an OCB and a movable stage. The movable stage should be controllable in x, y and z axes and vertical and horizontal rotations, independently. The preferred resolutions of the micromanipulators operated by stepping motors are ≤0.1 μm and ≤1.5 μm for the single mode and the multimode measurements, respectively. The repeatablilty of measurement is less than 1 % of designated dimension.

c) OCB holder

The OCB holder is to fix an OCB and should be provided with a rotation control stage for alignment of coordinate axes.

d) Input/output fibres

Select appropriate optical fibres for introduction and detection of input into and output from, respectively, I/O ports, according to IEC 62496-2-1. The input light should be stabilized in its mode using a mode filter according to IEC 62496-2-1. It is recommended that the core diameters and numerical aperture (NA) of input/output fibres are similar to those for optical circuit of interest.

e) Power meter

Prepare a power meter according to IEC 62496-2-1. Measure the power of an optical output and feed-back to the fibre position adjustment stage in order to obtain the position where the maximum optical power output is available in a short time.

6.2.1.2.2 Procedure

a) Preparation

Preparation of measurement is as described in 6.2.1.1.

b) Measurement

1) Internal coordinate system

An OCB is placed on the OCB holder and input and output fibres are brought close to the I/O port which is origin point. A light is launched in one port and detects from the corresponding port by output fibre. Input fibre is moved in order to search the position where the output power is the maximum value. Measure the coordinate of input fibre as an origin point. Then input and output fibres are moved to I/O ports which are to be measured. The position where the output power is maximum value is obtained as coordinates in this way for other cores. These positions should be calculated as the coordinate of I/O ports based on origin point measured in advance.

2) External coordinate system

The input fibre is moved to obtain the coordinate of externally formed origin point by an observation system. Input and output fibres are brought close to the optical I/O port of interest. A light is launched in one port and detects from the corresponding port by output fibre. Input fibre is moved in order to search the position where the output is the maximum. The position where the output power is maximum value is obtained in this way for other cores. These positions should be calculated as the coordinate of I/O ports based on externally formed origin point measured in advance.

6.2.2 Measurement procedure for surface I/O port type OCB

6.2.2.1 Method 1 (reference) – Use of observation system

6.2.2.1.1 Equipment

Measuring equipment is illustrated in 6.2.1.1.

6.2.2.1.2 Procedure

a) Preparation

The magnification of the optical microscope to be used is calibrated in advance. The sample is fastened to the measuring stage using a jig to attain flatness and to prevent it from moving while measuring.

b) Measurement

Align the direction of the coordinate axis and that of the movement of the movable stage to obtain horizontal reference. Move the microscope to the coordinate origin to define its coordinate to origin point. The origin point should be selected to the centre of the origin point structure for an external coordinate system, and to the core centre when the origin is specified by a coordinate of a specific I/O port for an internal coordinate system. Measure the coordinate of each I/O port. There are cases where the direct observation of the plane by a microscope is difficult. A light may be launched in the port on the other side of the board and the near field pattern of the exiting light may be observed.

6.2.2.2 Method 2 (alternative) – Use of optical position adjusting system

6.2.2.2.1 Equipment

An optical position adjusting system consists of a light source, automatic fibre position adjustment stage, OCB holder, input/output fibre and a power meter. A schematic of the system illustrated in Figure 5 is one of measurement systems for optical attenuation of an OCB specified in IEC 62496-2-1.

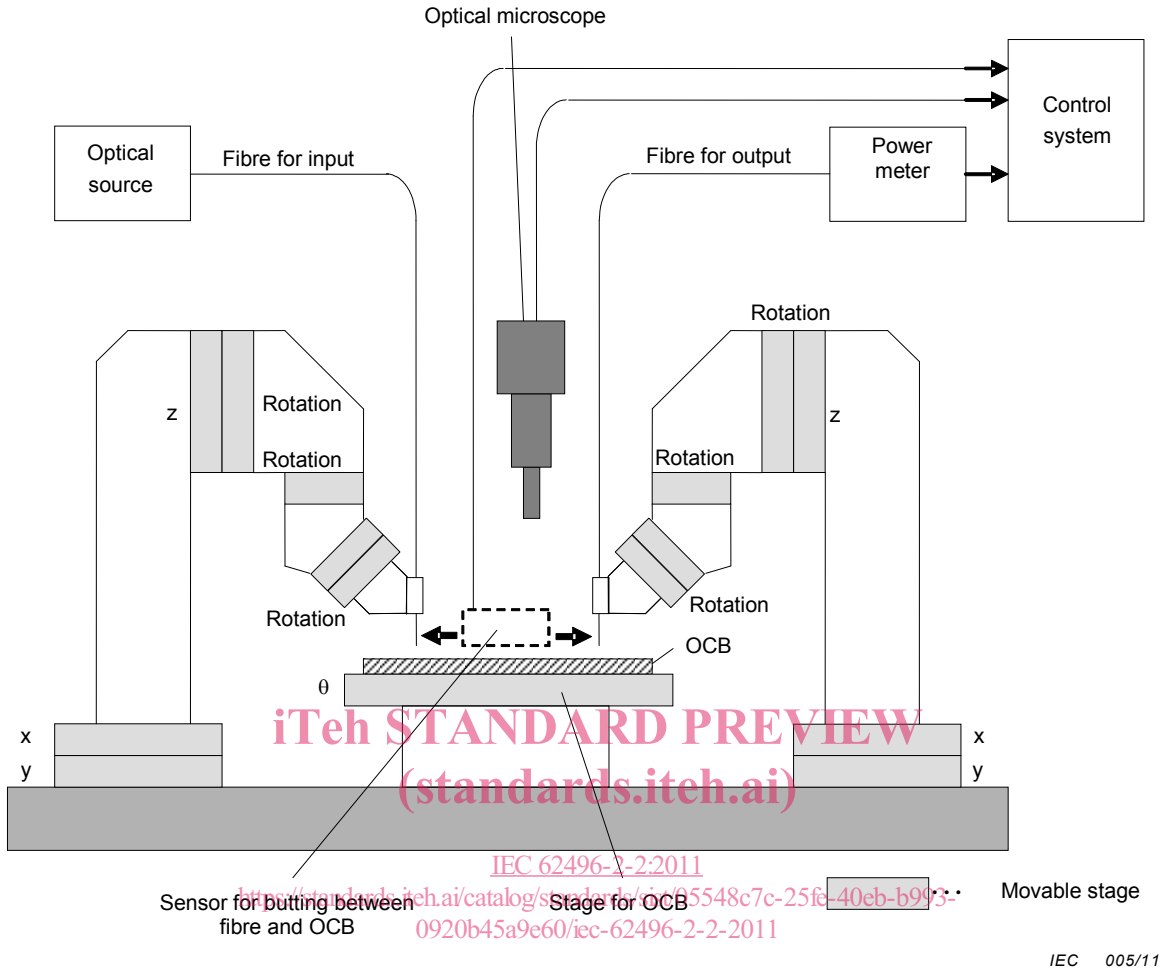

Figure 5 – Example of optical position adjustment system for surface I/O type OCB

a) Light source

Prepare a light source as stated in IEC 62496-2-1.

b) Observation optics

The system can capture images of I/O ports, references of coordinate origin and the direction of the axis and can display an image on a screen (not shown in Figure 5).

c) Movable stage

The movable stage should be controllable in x, y and z axes and vertical and horizontal rotations. The stage should be controlled automatically in all four parameters of x, y and z axes and rotation, θ, for an automatic driving stage. The preffered resolutions of the micromanipulators operated by stepping motors are ≤0.1 μm and ≤1.5 μm for the single mode and the multimode measurements, respectively. The sample stage should be provided with a rotation control stage for coordinate axes alignment. The repeatability of measurement is less than 1 % of designated dimension.