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STN	**Optické vlákna** **Časť 1-49: Metódy merania a skúšobné postupy** **Oneskorovanie skupinového módu**	**STN** **EN IEC** **60793-1-49** 35 9213

Optical fibres - Part 1-49: Measurement methods and test procedures - Differential mode delay

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 04/19

Obsahuje: EN IEC 60793-1-49:2018, IEC 60793-1-49:2018

Oznámením tejto normy sa od 19.09.2021 ruší
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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 60793-1-49

November 2018

ICS 33.180.10

Supersedes EN 60793-1-49:2006

English Version

Optical fibres - Part 1-49: Measurement methods and test procedures - Differential mode delay (IEC 60793-1-49:2018)

Fibres optiques - Partie 1-49: Méthodes de mesure et procédures d'essai - Retard différentiel de mode (IEC 60793-1-49:2018)

Lichtwellenleiter - Teil 1-49: Messmethoden und Prüfverfahren - Gruppenlaufzeitdifferenz (IEC 60793-1-49:2018)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN IEC 60793-1-49:2018 E

European foreword

The text of document 86A/1812/CDV, future edition 3 of IEC 60793-1-49, prepared by SC 86A "Fibres and cables" of IEC/TC 86 "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60793-1-49:2018.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2019-06-19
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2021-09-19

This document supersedes EN 60793-1-49:2006.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60793-1-49:2018 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60793-2-10 NOTE Harmonized as EN 60793-2-10

IEC 60793-1-42 NOTE Harmonized as EN 60793-1-42

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60793-1-1	2017	Optical fibres - Part 1-1: Measurement methods and test procedures - General and guidance	EN 60793-1-1	2017
IEC 60793-1-22	-	Optical fibres - Part 1-22: Measurement methods and test procedures - Length measurement	EN 60793-1-22	-
IEC 60793-1-41	-	Optical fibres - Part 1-41: Measurement methods and test procedures - Bandwidth	-	-
IEC 60793-1-45	-	Optical fibres - Part 1-45: Measurement methods and test procedures - Mode field diameter	EN IEC 60793-1-45	-
IEC 60825-1	-	Safety of laser products - Part 1: Equipment classification and requirements	EN 60825-1	-
IEC 60825-2	-	Safety of laser products - Part 2: Safety of optical fibre communication systems (OFCS)	EN 60825-2	-
IEC 61280-1-4	-	Fibre optic communication subsystem test procedures - Part 1-4: General communication subsystems - Light source encircled flux measurement method	EN 61280-1-4	-

IEC 60793-1-49

Edition 3.0 2018-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Optical fibres –
Part 1-49: Measurement methods and test procedures – Differential mode delay

Fibres optiques –
Partie 1-49: Méthodes de mesure et procédures d'essai – Retard différentiel de mode

IEC 60793-1-49:2018-08(en-fr)

IEC 60793-1-49

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Part 1-49: Measurement methods and test procedures – Differential mode delay

FOREWORD

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International Standard IEC 60793-1-49 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2006. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) better alignment with original intent by filling some omissions and therefore improving measurement rigor;

b) the measurement of fibres with smaller differential mode delay (and higher modal bandwidth) such as type A1a.3 fibres of IEC 60793-2-10 [1][1] that are used in constructing OM4 performance category cables; new requirements on specifying detector amplitude and temporal response, specimen deployment conditions, four-quadrant scanning, and uniformity of radial locations for calculating bandwidth.

The text of this International Standard is based on the following documents:

CDV	Report on voting
86A/1812/CDV	86A/1860/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This International Standard is to be used in conjunction with IEC 60793-1-1:2017.

A list of all parts in the IEC 60793 series, published under the general title *Optical fibres*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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

[1] Numbers in square brackets refer to the Bibliography.

OPTICAL FIBRES –

Part 1-49: Measurement methods and test procedures – Differential mode delay

1 Scope

This part of IEC 60793 applies only to multimode, graded-index glass-core (category A1) fibres. The test method is commonly used in production and research facilities, but is not easily accomplished in the field.

This document describes a method for characterizing the modal structure of a graded-index multimode fibre. This information is useful for assessing the bandwidth performance of a fibre especially when the fibre is intended to support a range of launch conditions, for example, those produced by standardized laser transmitters.

With this method, the output from a probe fibre that is single-moded at the test wavelength excites the multimode fibre under test. The probe spot is scanned across the end-face of the fibre under test at specified radial positions, and a set of response pulses are acquired at these positions.

Three specifiable parameters can be derived from the collected set of data.

- The first parameter, differential modal delay (DMD), is the difference in optical pulse delay time between the fastest and slowest mode groups of the fibre under test. DMD specifications place limits on modal delay over a specified range of probe fibre radial offset positions. DMD specifications are determined by modeling and experimentation to correspond to a minimum effective modal bandwidth (EMB) for the expected range of transmitters used in a link at a given performance level.
- The second specifiable parameter is derived by combining the pulses using sets of specific radial weights to determine an approximation of a set of pulses from typical transmitters. Using Fourier transforms, the calculated effective modal bandwidth (EMB_C) is determined for each weight set. The minimum of these EMB_C values ($minEMB_C$) is the specifiable parameter.
- The third specifiable parameter, the computed overfilled launch bandwidth, OMB_C, is determined in a manner similar to EMB_C, but by applying just one weight set to the set of pulses; this weight set corresponds to the overfilling condition, where all mode groups are equally excited.

The test's intent is to quantify the effects of interactions of the fibre modal structure and the source modal characteristics excluding the source's spectral interaction with fibre chromatic dispersion. Adding the effects of fibre chromatic dispersion and the source spectral characteristics will reduce the overall transmission bandwidth, but this is a separate calculation in most transmission models. In this test, the contribution of chromatic dispersion is controlled by limiting the spectral width of usable test sources. Practical test sources will have non-zero spectral width and will thus slightly distort the DMD, $minEMB_C$ and OMB_C values. These chromatic dispersion effects are considered in Annex A.

NOTE Comparison between IEC 60793-1-49 and ITU recommendations: ITU-T Recommendation G.650.1 [2] contains no information on how to measure the DMD of a graded-index multimode fibre.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60793-1-1:2017, *Optical fibres – Part 1-1: Measurement methods and test procedures – General and guidance*

IEC 60793-1-22, *Optical fibres – Part 1-22: Measurement methods and test procedures – Length measurement*

IEC 60793-1-41, *Optical fibres – Part 1-41: Measurement methods and test procedures – Bandwidth*

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

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 60825-2, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)*

IEC 61280-1-4, *Fibre optic communication subsystem test procedures – Part 1-4: General communication subsystems – Light source encircled flux measurement method*