
Optična zaznavala - 2-1. del: Merjenje deformacij - Zaznavala deformacij na podlagi vlakenskih braggovih rešetk (IEC 61757-1-1:2016)

Fibre optic sensors - Part 2-1: Strain measurement - Strain sensors based on fibre Bragg gratings (IEC 61757-1-1:2016)

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 61757-1-1

February 2017

ICS 33.180.99

English Version

**Fibre optic sensors - Part 1-1: Strain measurement - Strain sensors based on fibre Bragg gratings
(IEC 61757-1-1:2016)**

Capteurs à fibres optiques - Partie 1-1: Mesure de déformation - Capteurs de déformation basés sur des réseaux de Bragg à fibres
(IEC 61757-1-1:2016)

LWL-Sensoren - Teil 1-1: Zugmessungen - Zugsensoren basierend auf Faser-Bragg-Gatter
(IEC 61757-1-1:2016)

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

EN 61757-1-1:2017**European foreword**

The text of document 86C/1322/CDV, future edition 1 of IEC 61757-1-1, prepared by SC 86C "Fibre optic systems and active devices" of IEC/TC 86 "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61757-1-1:2017.

The following dates are fixed:

- latest date by which the document has to be (dop) 2017-08-17
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2020-02-17
standards conflicting with the
document have to be withdrawn

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This publication is to be read in conjunction with EN 61757-1:2012.

Endorsement notice

The text of the International Standard IEC 61757-1-1:2016 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 60793-1-30	NOTE Harmonized as EN 60793-1-30.
IEC 60793-1-31	NOTE Harmonized as EN 60793-1-31.
IEC 60793-1-33	NOTE Harmonized as EN 60793-1-33.
ISO 527-4	NOTE Harmonized as EN ISO 527-4.
ISO 7500-1	NOTE Harmonized as EN ISO 7500-1.
ISO 14125	NOTE Harmonized as EN ISO 14125.

Annex ZA

(normative)

**Normative references to international publications
with their corresponding European publications**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When 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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050	series	International Electrotechnical Vocabulary - Part 102: Mathematics - General concepts and linear algebra	-	series
IEC 60068-2	series	Environmental testing -- Part 2: Tests	EN 60068-2	series
IEC 60793-2	-	Optical fibres - Part 2: Product specifications - General	EN 60793-2	-
IEC 60874-1	-	Fibre optic interconnecting devices and passive components - Connectors for optical fibres and cables -- Part 1: Generic specification	EN 60874-1	-
IEC 61300-2	series	Fibre optic interconnecting devices and passive components - Basic test and measurement procedures -- Part 2-1: Tests	-	series
IEC 61757-1	2012	Vibration (sinusoidal) Fibre optic sensors -- Part 1: Generic specification	EN 61757-1	2012
IEC 62129-1	-	Calibration of wavelength/optical frequency measurement instruments - Part 1: Optical spectrum analyzers	EN 62129-1	-
IEC 62129-2	-	Calibration of wavelength/optical frequency measurement instruments -- Part 2: Michelson interferometer single wavelength meters	EN 62129-2	-
IEC/TR 61931	-	Fibre optic - Terminology	-	-
IEC/TS 62129-3	-	Calibration of wavelength/optical frequency measurement instruments - Part 3: Optical frequency meters using optical frequency combs	-	-
ISO/IEC Guide 99	-	International vocabulary of metrology - Basic and general concepts and associated terms (VIM)	-	-

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IEC 61757-1-1

Edition 1.0 2016-02

INTERNATIONAL STANDARD



Fibre optic sensors –
Part 1-1: Strain measurement – Strain sensors based on fibre Bragg gratings

STANDARD PREVIEW
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SIST EN 61757-1-1:2017
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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.99

ISBN 978-2-8322-3188-3

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC SENSORS –

**Part 1-1: Strain measurement –
Strain sensors based on fibre Bragg gratings**

FOREWORD

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International Standard IEC 61757-1-1 has been prepared by subcommittee SC 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

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

CDV	Report on voting
86C/1322/CDV	86C/1353/RVC

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 in the IEC 61757 series, published under the general title *Fibre optic sensors*, can be found on the IEC website.

This International Standard is to be used in conjunction with IEC 61757-1:2012.

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.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

It has been decided to restructure the IEC 61757 series, with the following logic. From now on, the sub-parts will be renumbered as IEC 61757-*M-T*, where *M* denotes the measure and *T*, the technology.

The existing part IEC 61757-1:2012 will be renumbered as IEC 61757 when it will be revised as edition 2.0 and will serve as an umbrella document over the entire series.

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FIBRE OPTIC SENSORS –

Part 1-1: Strain measurement – Strain sensors based on fibre Bragg gratings

1 Scope

This part of IEC 61757 defines detail specifications for fibre optic sensors using one or more fibre Bragg gratings (FBG) as the sensitive element for strain measurements. Generic specifications for fibre optic sensors are defined in IEC 61757-1:2012.

This standard specifies the most important features and characteristics of a fibre optic sensor for strain measurements based on use of an FBG as the sensitive element, and defines the procedures for their determination. Furthermore, it specifies basic performance parameters and characteristics of the corresponding measuring instrument to read out the optical signal from the FBG. This standard refers to the measurement of static and dynamic strain values in a range of frequencies.

A blank detail specification is provided in Annex B.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org>)

IEC 60068-2 (all parts), *Environmental testing – Part 2: Tests*

IEC 60793-2, *Optical fibres – Part 2: Product specifications – General*

IEC 60874-1, *Fibre optic interconnecting devices and passive components – Connectors for optical fibres and cables – Part 1: Generic specification*

IEC 61300-2 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2: Tests*

IEC 61757-1:2012, *Fibre optic sensors – Part 1: Generic specification*

IEC 62129-1, *Calibration of wavelength/optical frequency measurement instruments – Part 1: Optical spectrum analyzers*

IEC 62129-2, *Calibration of wavelength/optical frequency measurement instruments – Part 2: Michelson interferometer single wavelength meters*

IEC TS 62129-3, *Calibration of wavelength/optical frequency measurement instruments – Part 3: Optical frequency meters using optical frequency combs*

IEC TR 61931, *Fibre optic – Terminology*

ISO/IEC Guide 99, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)* Terms and definitions

3 Terms and definitions

For the purposes of this document, the definitions given in IEC 61757-1:2012, the IEC 60050 series, IEC TR 61931, ISO/IEC Guide 99 (VIM), as well as the following apply.

NOTE Long period gratings, non-uniform gratings, angled gratings, and FBG in polarization maintaining fibre are not considered.

3.1

FBG

fibre Bragg grating

phase diffraction grating integrated in optical single-mode silica-based fibres, according to category B of IEC 60793-2, to selectively reflect a very narrow range of wavelengths while transmitting others

Note 1 to entry: To achieve this characteristic, periodically spaced zones in the fibre core are altered to have different refractive indexes slightly higher than the core.

3.2

FBG strain sensor

device that uses one or more fibre Bragg gratings (3.1) as a sensitive element for strain measurements

Note 1 to entry: Different configurations are possible (see 5.2).

3.3

λ_B

Bragg wavelength

wavelength of the FBG (3.1), generally corresponding to the Bragg reflection peak or transmission minimum, without applied strain under reference ambient conditions

Note 1 to entry: If referred to as an FBG strain sensor (see 3.2), it refers to the configuration prior to its installation.

3.4

λ_0

reference wavelength

wavelength response of an FBG after installation or at the beginning of measurement to the affecting loading and ambient conditions

3.5

R_{FBG}

FBG reflectivity

ratio of the incident optical power P_0 to the reflected optical power P_{λ_B} at Bragg wavelength λ_B

Note 1 to entry: The power transmitted to the FBG strain sensor is less than the incident (input) optical power due to losses in the fibre at the connector and even in the grating. The definition of the FBG reflectivity should therefore use the incident optical power P_0 (see formulas in 7.4.2.) that represents the measurable part at the connector of a fibre optic sensor.

Note 2 to entry: P_0 depends on the measurement device and has no absolute characteristic value. From the user's point of view, the reflectivity is important if operational or installation conditions exist that influence the reflective characteristic.

3.6

transmission loss of an FBG sensor

loss of power of the transmitted optical signal passing along the optical fibre, the fibre Bragg grating and the components to connect an FBG strain sensor outside the FBG spectrum