



**NSAI**  
Standards

Irish Standard  
I.S. EN ISO 11145:2016

# Optics and photonics - Lasers and laser-related equipment - Vocabulary and symbols (ISO 11145:2016)

## I.S. EN ISO 11145:2016

*Incorporating amendments/corrigenda/National Annexes issued since publication:*

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## National Foreword

I.S. EN ISO 11145:2016 is the adopted Irish version of the European Document EN ISO 11145:2016, Optics and photonics - Lasers and laser-related equipment - Vocabulary and symbols (ISO 11145:2016)

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**EUROPEAN STANDARD**

**EN ISO 11145**

**NORME EUROPÉENNE**

**EUROPÄISCHE NORM**

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Supersedes EN ISO 11145:2008

English Version

## **Optics and photonics - Lasers and laser-related equipment - Vocabulary and symbols (ISO 11145:2016)**

Optique et photonique - Lasers et équipements  
associés aux lasers - Vocabulaire et symboles (ISO  
11145:2016)

Optik und Photonik - Laser und Laseranlagen - Begriffe  
und Formelzeichen (ISO 11145:2016)

This European Standard was approved by CEN on 19 September 2015.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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## **European foreword**

This document (EN ISO 11145:2016) has been prepared by Technical Committee ISO/TC 172 "Optics and photonics" in collaboration with Technical Committee CEN/TC 123 "Lasers and photonics" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2016, and conflicting national standards shall be withdrawn at the latest by September 2016.

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

This document supersedes EN ISO 11145:2008.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

### **Endorsement notice**

The text of ISO 11145:2016 has been approved by CEN as EN ISO 11145:2016 without any modification.

**Annex ZA**  
(informative)  
**Relationship between this European Standard and the Essential  
Requirements of EU Directive 2006/42/EC on machinery**

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

**Table ZA.1 — Correspondence between this European Standard and EU Directive 2006/42/EC on machinery**

| Clauses and subclauses of this European standard | Essential Requirements (ERs) of EU Directive 2006/42/EC | Qualifying remarks/Notes |
|--------------------------------------------------|---------------------------------------------------------|--------------------------|
| 3                                                | 1.5.10                                                  |                          |
| 3                                                | 1.5.12                                                  |                          |
|                                                  |                                                         |                          |
|                                                  |                                                         |                          |

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.



# INTERNATIONAL STANDARD

**ISO  
11145**

Fourth edition  
2016-03-01

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## **Optics and photonics — Lasers and laser-related equipment — Vocabulary and symbols**

*Optique et photonique — Lasers et équipements associés aux lasers  
— Vocabulaire et symboles*



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## ISO 11145:2016(E)

### 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Electro-optical systems*.

This fourth edition cancels and replaces the third edition (ISO 11145:2006) which has been technically revised with the following changes:

- a) in [3.5.3](#), a formula for beam ellipticity has been added;
- b) in [3.5.3](#), the definition of relative intensity noise has been revised and a formula was added.

# Optics and photonics — Lasers and laser-related equipment — Vocabulary and symbols

## 1 Scope

This International Standard defines basic terms, symbols, and units of measurement for the field of laser technology in order to unify the terminology and to arrive at clear definitions and reproducible tests of beam parameters and laser-oriented product properties.

NOTE The laser hierarchical vocabulary laid down in this International Standard differs from that given in IEC 60825-1. ISO and IEC have discussed this difference and agree that it reflects the different purposes for which the two standards serve. For more details, see informative [Annex A](#).

## 2 Symbols and units of measurement

**2.1** The spatial distribution of power (energy) density of a laser beam does not always have circular symmetry. Therefore, all terms related to these distributions are split into those for beams with circular and those with non-circular cross-sections. A circular beam is characterized by its radius,  $w$ , or diameter,  $d$ . For a non-circular beam, the beam widths,  $d_x$  and  $d_y$ , for two orthogonal directions have to be given.

**2.2** The spatial distributions of laser beams do not have sharp edges. Therefore, it is necessary to define the power (energy) values to which the spatial terms refer. Depending on the application, different cut-off values can be chosen (for example  $1/e$ ,  $1/e^2$ ,  $1/10$  of peak value).

To clarify this situation, this International Standard uses the subscript  $u$  for all related terms to denote the percentage of the total beam power (energy) taken into account for a given parameter.

NOTE For the same power (energy) content, beam width  $d_{x,u}$  and beam diameter  $d_u (= 2w_u)$  can differ for the same value of  $u$  (for example, for a circularly symmetric Gaussian beam  $d_{86,5}$  is equal to  $d_{x,95,4}$ ).

[Table 1](#) lists symbols and units which are defined in detail in [Clause 3](#).

**Table 1 — Symbols and units of measurement**

| Symbol                                 | Unit             | Term                          |
|----------------------------------------|------------------|-------------------------------|
| $A_u$ or $A_\sigma$                    | m <sup>2</sup>   | Beam cross-sectional area     |
| $d_u$ or $d_\sigma$                    | m                | Beam diameter                 |
| $d_{x,u}$ or $d_{\sigma x}$            | m                | Beam width in x-direction     |
| $d_{y,u}$ or $d_{\sigma y}$            | m                | Beam width in y-direction     |
| $d_{0,u}$ or $d_{\sigma 0}$            | m                | Beam waist diameter           |
| $d_{\sigma 0} \cdot \theta_\sigma / 4$ | rad m            | Beam parameter product        |
| $E_u$ or $E_\sigma$                    | W/m <sup>2</sup> | Average power density         |
| $f_p$                                  | Hz               | Pulse repetition rate         |
| $H_u$ or $H_\sigma$                    | J/m <sup>2</sup> | Average energy density        |
| $K$                                    | 1                | Beam propagation factor       |
| $l_c$                                  | m                | Coherence length              |
| $M^2$                                  | 1                | Beam propagation ratio        |
| $p$                                    | 1                | Degree of linear polarization |
| $P$                                    | W                | Cw-power                      |

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