



SLOVENSKI STANDARD
oSIST prEN IEC 62998-1:2026
01-april-2026

Varnost strojev - Varnostni senzorji, ki se uporabljajo za zaščito oseb

Safety of machinery - Safety-related sensors used for the protection of persons

Ta slovenski standard je istoveten z: prEN IEC 62998-1:2026

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21.020	Značilnosti in načrtovanje strojev, aparatov, opreme	Characteristics and design of machines, apparatus, equipment

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44/1078/CDV

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OF INTEREST TO THE FOLLOWING COMMITTEES: TC 65, SC 65A	HORIZONTAL FUNCTION(S):
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TITLE:

Safety of machinery - Safety-related sensors used for the protection of persons

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

Safety of machinery - Safety-related sensors used for the protection of persons

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IEC 62998-1 has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects. It is an International Standard.

This first edition of the International Standard cancels and replaces the first edition of the Technical Specification, published in 2019. This edition constitutes a technical revision.

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

- a) addition of requirements for the control of radiation hazards of specific sensor technologies in [4.2.2.2](#);
- b) addition of requirements for the control of hazards related to security vulnerabilities in [4.2.2.4](#);
- c) addition of the [practical use \(3.4.10\)](#) option in [4.2.3](#);

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- d) clarification of the influence of other relevant objects in relation to IEC TS 62998-3 in 5.8.3.3
- e) the appliance and relationship of this generic product standard with standards on functional safety of safety-related control systems and product specific standards in Annex A;
- f) addition of provisions for the generation and application of models during design and development (3.3.4) phase, integration and installation phase, operation, maintenance and modification phases in Annex D.

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

FDIS	Report on voting
44/XX/	44/XX/

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this document is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described greater detail at www.iec.ch/publications.

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, or
- revised.

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Introduction

Safety-related sensors are used on [machinery \(3.3.9\)](#) that presents a risk of personal injury. They provide protection by ensuring that the machine is reverted to a safe condition before a person can be placed in a hazardous situation.

[IEC 61496 \(all parts\) \[1\]](#) provides design and performance requirements for [electro-sensitive protective equipment \(3.3.16\)](#) ([ESPE \(3.3.16\)](#)). It provides clear, though limited, guideline on:

- specific sensor technologies (such as optical sensors) or sensing functions (such as the capability to detect a specified object);
- typical conditions representative of indoor use in industrial environments;
- the [detection \(3.1.5\)](#) of objects representing parts of the body of adults using the properties of geometry and reflectivity;
- the design, functional requirements and tests to be conducted in accordance with [ESPE \(3.3.16\)](#) specific safety performance classification in types (2,3 and 4).

Autonomous systems such as automated guided vehicles (AGV), service robotics or human-machine interaction in industries are showing an increased demand, for example for:

- new sensor technologies (e.g. radar, ultrasonic sensors);
- new kinds of sensor functions (e.g. classification of objects, position of an object); and
- combinations of different sensor technologies in a sensor system.

In such cases, sensor manufacturers or integrators use standards on functional safety of safety-related control systems as a guideline for the safety-related product design. Standards on functional safety of safety-related control systems, such as IEC 61508 (all parts), IEC 62061 or ISO 13849 (all parts) are generic and allow product design without specific, inappropriate limitations. Applying these standards would require a dedicated analysis of the [systematic capability \(3.1.4\)](#) of a sensor or sensor system (e.g. [dependability \(3.2.2\)](#) of the [detection capability \(3.1.6\)](#) under tolerance conditions and environmental influences). These standards do not provide sufficient guidance to prevent design failures in safety-related sensors or insufficient [systematic capability \(3.1.4\)](#) to detect the specified object under certain environmental conditions. This can result in an intolerable risk to persons.

This document fills the gap for the examination of [systematic capability \(3.1.4\)](#) between product specific standards and generic standards on functional safety of safety-related control systems.

NOTE 1 Examples for the examination of [systematic capability \(3.1.4\)](#) by using different product standards are given in [Annex A](#).

This document is addressed to [safety-related sensor \(3.3.14\)](#) manufacturers and integrators of safety-related sensors into a [safety-related sensor system \(3.3.15\)](#).

NOTE 2 Examples for addressed [user \(3.8.3\)](#) groups are given in [Annex B](#).

1 Scope

This document set out the requirements for the development and integration of [safety-related sensors \(3.3.14\)](#) (SRS) and [safety-related sensor systems \(3.3.15\)](#) (SRSS) used for the protection of persons with particular attention to [systematic capability \(3.1.4\)](#).

This generic product standard applies if protection of persons is to be performed by using sensors.

NOTE 1 The appliance and relationship of this generic product standard with standards on functional safety of safety-related control systems and product specific standards is described in [Annex A](#).

This generic product standard can be applied also for other protective goals like protection of the environment or prevent production goods damages.

The examination of [detection capability \(3.1.6\)](#) as part of the [systematic capability \(3.1.4\)](#) using different product standards is described in [Annex A](#).

The requirements and methods set out in this document are intended for the purpose of protection of persons by:

- [detection \(3.1.5\)](#) of potentially hazardous objects;
- [detection \(3.1.5\)](#) of a body, parts of a body and objects associated to parts of a body entering a hazardous area; or
- classification and/or discrimination of these against other objects.

NOTE 2 The application of [SRS/SRSS](#) in a public setting can require the [detection \(3.1.5\)](#) of not only persons, but also their associated equipment, such as wheelchairs, walking sticks or infusion stands.

Performance classes of SRS/SRSS are defined in accordance with existing standards on functional safety of safety-related control systems (e.g. IEC 62061, IEC 61508 (all parts), and ISO 13849 (all parts)).

NOTE 3 By correlating to existing [PL](#) or [SIL](#), we have achieved simplification for end users.

Specific attention is devoted to the evaluation of the [detection capability \(3.1.6\)](#) and [dependability \(3.2.2\)](#) of the [detection capability \(3.1.6\)](#) . Environmental conditions and limits for indoor and outdoor use are defined that influence the sensing function and the [dependability \(3.2.2\)](#) of the [detection capability \(3.1.6\)](#).

NOTE 4 Environmental influences, their classification and [test \(3.7.10\)](#) procedures are primarily specified in accordance with generic environmental standards. In the absence of respective standards, more specific requirements and tests are described.

This document can be relevant for applications other than the protection of persons in [industry \(3.3.17\)](#), such as agriculture or public transportation (e.g. metro stations).

This document does not consider or address proven in-use (e.g. processes or elements) as defined in [IEC 61508-2 \[2\]](#).

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 60068 (all parts), *Environmental testing*

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IEC 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60721 (all parts), *Classification of environmental conditions*

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

IEC 61000-6-7, *Electromagnetic compatibility (EMC) - Part 6-7: Generic standards - Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61784-3, *Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions*

IEC 62061, *Safety of machinery - Functional safety of safety-related control systems*

IEC 62311, *Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz to 300 GHz)*

IEC 62471, *Photobiological safety of lamps and lamp systems*

IEC TS 62998-3, *Safety of machinery - Safety-related sensors used for the protection of persons - Part 3: Sensor technologies and algorithms*

IEC TS 62998-3:2023, *Safety of machinery - Safety-related sensors used for the protection of persons - Part 3: Sensor technologies and algorithms*

ISO 7250 (all parts), *Basic human body measurements for technological design*

ISO 13849 (all parts), *Safety of machinery – Safety-related parts of control systems*

ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 19014-2, *Earth-moving machinery — Functional safety — Part 2: Design and evaluation of hardware and architecture requirements for safety-related parts of the control system*

ISO/IEC/IEEE 24641:2023, *Systems and Software engineering - Methods and tools for model-based systems and software engineering*

ISO 25119-2, *Tractors and machinery for agriculture and forestry — Safety-related parts of control systems — Part 2: Concept phase*

ISO 26262 (all parts), *Road vehicles – Functional safety*

CEN/CENELEC Guide 14, *Child safety – Guidance for its inclusion in standards*

IEC 62443 series, *Security for industrial automation and control systems*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Characteristics and performance criteria

3.1.1

automation-related zone

part of the [sensing zone \(3.1.3\)](#) (IEV 428-06-21) within which specified objects are detected in order to perform an automation-related function

3.1.2

safety-related zone

part of the [sensing zone \(3.1.3\)](#) (IEV 428-06-21) within which specified safety-related objects are detected

3.1.3

sensing zone

zone defined by length, area or volume within which objects are detected and a function is performed

3.1.4

systematic capability

measure (expressed on a scale of [SC 1](#) to [SC 4](#)) of the confidence that the systematic safety integrity of an element meets the requirements of the specified [SIL](#), in respect to the specified element safety function, when the element is applied in accordance with the instructions specified in the compliant safety manual for the element

Note 1 to entry: [systematic capability \(3.1.4\)](#) is determined with reference to the requirements for the avoidance and control of systematic faults (see [IEC 61508-2 \[2\]](#) and [IEC 61508-3 \[4\]](#)).

Note 2 to entry: What a relevant systematic [failure \(3.2.5\)](#) mechanism is, will depend on the nature of the element. For example, for an element comprising solely software, only software [failure \(3.2.5\)](#) mechanisms will need to be considered. For an element comprising hardware and software, it will be necessary to consider both systematic hardware and software [failure \(3.2.5\)](#) mechanisms.

Note 3 to entry: A [systematic capability \(3.1.4\)](#) of [SC N](#) for an element, in respect to the specified element safety function, means that the systematic safety integrity of [SIL N](#) has been met when the element is applied in accordance with the instructions specified in the compliant item safety manual for the element.

[SOURCE: [IEC 61508-4:2010 \[3\]](#)]

3.1.5

detection

<of safety-related sensors> determination of the presence and/or value of a [physical property \(3.1.8\)](#) (IEV 428-06-17)

Note 1 to entry: As an example, classification can be a step of [detection \(3.1.5\)](#) containing other steps such as reception of physical signal and filtering.

3.1.6

detection capability

<of safety-related sensors> ability to perform the [detection \(3.1.5\)](#) (IEV 428-06-08) within the [limits of use \(3.4.9\)](#) as specified by the manufacturer

3.1.7**loss of detection capability**

event when [detection \(3.1.5\)](#) (IEV 428-06-08) is not achieved within the [limits of use \(3.4.9\)](#) as specified by the manufacturer

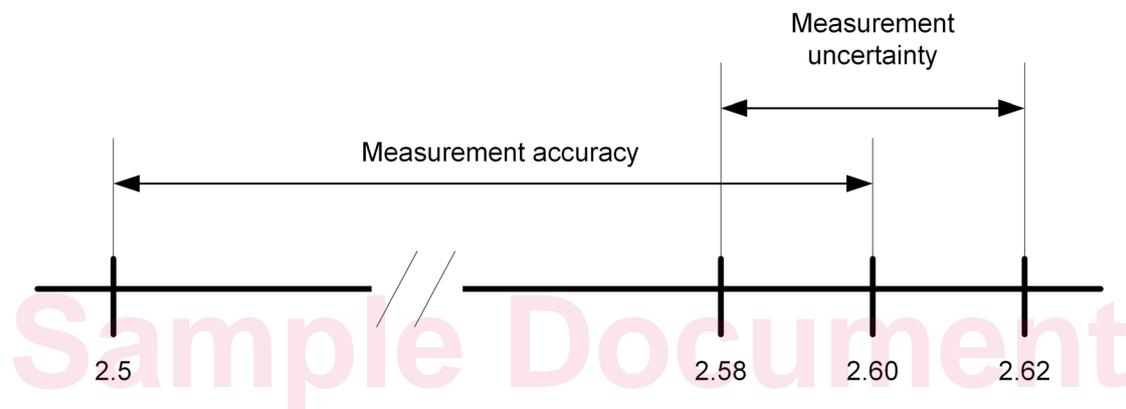
Note 1 to entry: A loss of [detection \(3.1.5\)](#) could result from a deterioration of [detection capability \(3.1.6\)](#). A deterioration could be of interest for analysis of reduced integrity of [detection \(3.1.5\)](#) resulting in a dangerous state.

3.1.8**physical property**

individual measurable property of an object being observed

3.1.9**measurement accuracy**

<of safety-related sensors> closeness of agreement between a measured quantity value and a true quantity value of a measurand, see [Figure 1](#).

**Key**

- 2,5 Example value of a true quantity value
- 2,6 Example value of a measured quantity values

Figure 1 – Measurement accuracy and measurement uncertainty

[SOURCE: IEV 428-06-14:2024-12]

3.1.10**measurement uncertainty**

<of safety-related sensors> non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used, see [Figure 1](#)

[SOURCE: IEV 428-06-16:2024-12]

3.2 Dependability**3.2.1****availability**

ability to be in a state to perform as required

Note 1 to entry: [availability \(3.2.1\)](#) depends upon the combined characteristics of the [reliability \(3.2.3\)](#) (192-01-24), [recoverability \(192-01-25\)](#), and [maintainability \(192-01-27\)](#) of the item, and the [maintenance support performance \(192-01-29\)](#).

Note 2 to entry: [availability \(3.2.1\)](#) may be quantified using measures defined in Section 192-08, *Availability related measures*.

[SOURCE: [IEC 60050-192:2015 \[5\]](#), 192-01-23]