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

Part 3: Sensor technologies and algorithms

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National foreword

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SAFETY OF MACHINERY – SAFETY-RELATED SENSORS USED FOR THE PROTECTION OF PERSONS

Part 3: Sensor technologies and algorithms

FOREWORD

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IEC TS 62998-3 has been prepared by IEC technical committee TC 44: Safety of machinery – Electrotechnical aspects. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
44/981/DTS	44/1002/RVDTS

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

The language used for the development of this International Standard 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 in greater detail at www.iec.ch/standardsdev/publications.

This document is intended to be used in conjunction with IEC TS 62998-1.

A list of all parts in the IEC 62998 series, published under the general title *Safety of machinery – safety-related sensors used for the protection of persons*, can be found on the IEC website.

Future documents in this series will carry the new general title as cited above. Titles of existing documents in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under 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- withdrawn,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.

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INTRODUCTION

Applications of automated guided vehicles, service robotics used in public areas or human machine interaction in industries show an increasing demand and use of new sensor technologies and new kinds of sensor functions with respect to hazard exposure of persons. A rapidly increasing number of sensors, with different sensor technologies, are used in these applications to achieve a high degree of automation up to autonomy. The systematic capabilities of such sensors are relevant to reduce the risk of personal injury. Other aspects of functional safety related to sensors as part of control systems are covered by e.g. IEC 61508 (all parts), IEC 62061 or ISO 13849 (all parts).

Existing design specific sensor standards set requirements on systematic capabilities for a selected sensor technology and how these can be assessed by analysis and test. The specific requirements are derived from products with limited classes of safety performance and already well-known sensor technology.

IEC TS 62998-1 sets general requirements for the development, integration and maintenance of safety related sensors (SRS) and safety related sensor systems (SRSS) applicable to all sensor technologies with special attention to systematic capabilities. IEC TS 62998-1 is appropriate for the risk reduction in accordance with all classes of safety performance in an identified application.

First assessments of SRS/SRSS in accordance with IEC TS 62998-1 identified the need for additional guidance for the required analysis of sensor technologies and use of algorithms.

Sensor technology is defined by the wavelength range, the measurement method and the arrangement of the sensing unit in an SRS, respectively arrangement of SRS in an SRSS. This document gives guidance for sensor technologies without setting requirements for a specific design or limiting the class of safety performance. If applicable to the sensor technology, additional information is given for physical properties of the objects to be detected or relevant objects that interfere with the detection of such objects.

Algorithms are a core element to achieve safety related functions in an SRS/SRSS, such as signal processing to extract peaks in analogue signals, localization or classification of objects that are important to guide an autonomous or highly automated system in a more or less known surrounding. Platforms such as cloud services provide e.g. algorithms or measures for their automated generation that can be implemented by different integrators of SRS into an SRSS or by the manufacturer of such sensors. This document gives guidance on the correct implementation of algorithms to prevent intolerable risk for persons.

SAFETY OF MACHINERY – SAFETY-RELATED SENSORS USED FOR THE PROTECTION OF PERSONS

Part 3: Sensor technologies and algorithms

1 Scope

This part of IEC 62998, which is a technical specification, gives guidance on:

– analysis of sensor technologies of different wavelength ranges, measurement methods, and the sensing unit arrangement in an SRS, respectively the arrangement of SRSs in an SRSS;
– representative physical properties of safety-related objects with due consideration of their material characteristics and the sensor technology/technologies used in an SRS/SRSS to achieve the detection capability and comparable results during verification and validation;
– analysis of the interference of objects present in the surrounding on the safety related objects and thereby the influence on the dependability of the detection capability;
– use of algorithms during design, development and maintenance to achieve appropriate detection capability and dependability of detection;
– appropriate use of algorithms during the integration of SRS or SRSS by the integrator to improve execution of measurement information or provide decision information derived from measurement information.

If an SRS/SRSS uses sensor technologies not stated in this document, then the generic approach in accordance with IEC TS 62998-1 applies.

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 60079-29 (all parts), *Explosive atmospheres - Part 29 - Gas detectors*

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

IEC TS 62998-1:2019, *Safety of machinery - Safety-related sensors used for the protection of persons*

EN 50402, *Electrical apparatus for the detection and measurement of combustible or toxic gases or vapours or of oxygen – Requirements on the functional safety of fixed gas detection systems*