



**SLOVENSKI STANDARD**  
**oSIST prEN IEC 62541-15:2024**  
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**Enotna arhitektura OPC - 15. del: Varnost**

OPC Unified Architecture - Part 15: Safety

Architecture unifiée OPC - Partie 15: Sécurité fonctionnelle

**Ta slovenski standard je istoveten z: prEN IEC 62541-15:2024**

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<input checked="" type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING <b>Attention IEC-CENELEC parallel voting</b> The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	<input type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

**OPC Unified Architecture - Part 15: Safety**

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NOTE FROM TC/SC OFFICERS:

NC comments on this CDV will be addressed during the SC65C/WG12 virtual meeting on July 1st-4th, 2024 (four Zoom sessions from 13:00 to 16:00 Geneva time, 11:00 to 14:00 UTC). Meeting details will be sent at a later date by the convenor.

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## OPC UNIFIED ARCHITECTURE –

## Part 15: Safety

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

Draft	Report on voting
65C/XX/FDIS	65C/XX/RVD

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 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



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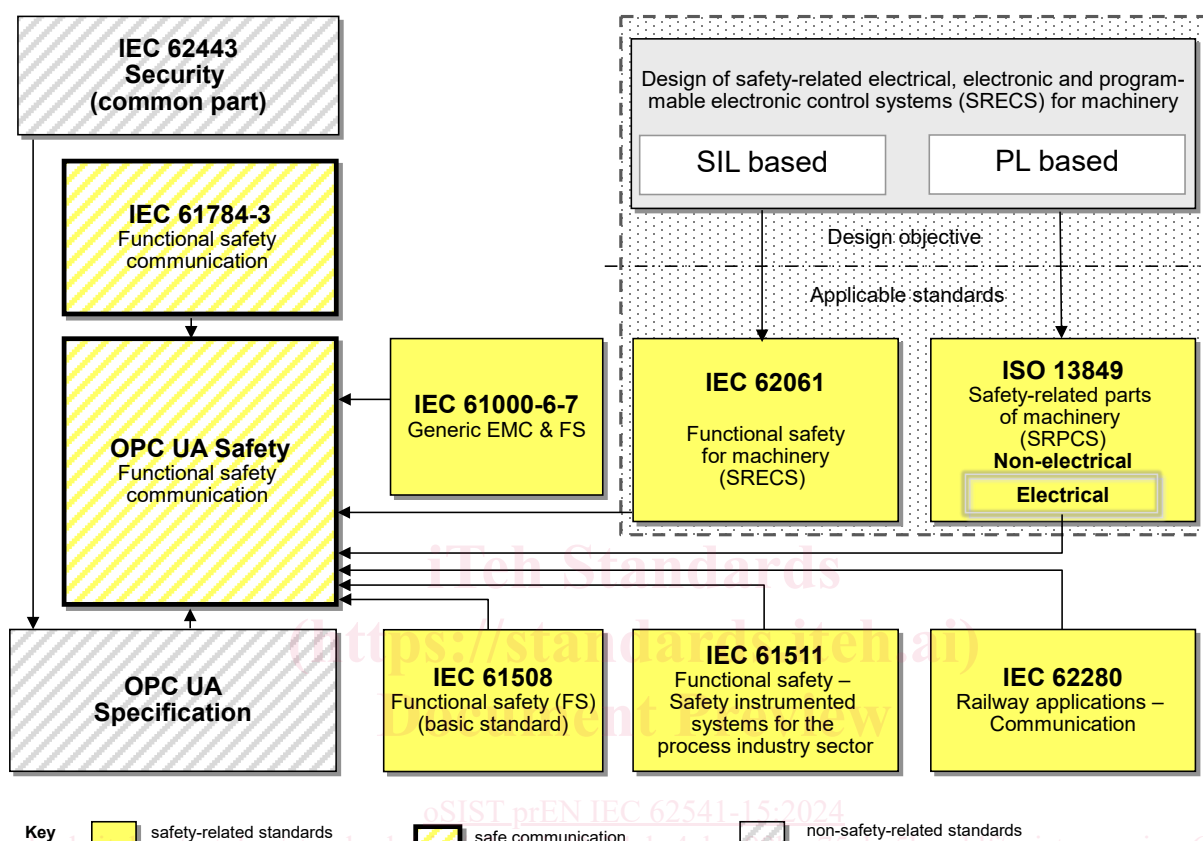
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## INTRODUCTION

OPC UA Safety extends OPC UA to fulfill the requirements of functional safety as defined in the IEC 61508 and IEC 61784-3 series of standards.

Figure 1 shows the relationship between this document and the relevant safety and OPC UA standards in an industrial environment. An arrow from Document A to Document B means “Document A is referenced in Document B”. This reference can be either normative or informative. Not all of these standards are applicable/required for a given product.



**Figure 1 (informative) – Relationships of OPC UA Safety with other standards**

Implementing this document allows for detecting all types of communication errors encountered in the lower network layers. In case an error is detected, this information is shared with the safety applications in the user layer which can then act in an appropriate way, e.g. by switching to a safe state.

The document describes the behavior of the individual endpoints for safe communication, as well as the OPC UA information model which is used to access these endpoints.

This document is application-independent and does not pose requirements on the structure and length of the application data. Application-specific requirements are expected to be described in appropriate companion specifications.

This document can be used for applications requiring functional safety up to the safety integrity level (SIL) 4.

## OPC UNIFIED ARCHITECTURE –

### Part 15: Safety

#### 1 Scope

This document describes a safety communication layer (services and a protocol) for the exchange of safety data using IEC 62541 mechanisms. It identifies the principles for functional safety communications defined in IEC 61784-3 that are relevant for this safety communication layer. This safety communication layer is intended for implementation in safety devices only.

NOTE 1 This document targets controller-to-controller communication. However, easy expandability to other use-cases (e.g. OPC UA field level communication) has already been considered in the design of this document.

NOTE 2 This document does not cover electrical safety and intrinsic safety aspects. Electrical safety relates to hazards such as electrical shock. Intrinsic safety relates to hazards associated with potentially explosive atmospheres.

This document defines mechanisms for the transmission of safety-relevant messages among participants within a network using OPC UA technology in accordance with the requirements of IEC 61508 series and IEC 61784-3 for functional safety. These mechanisms may be used in various industrial applications such as process control, manufacturing, automation, and machinery.

This document provides guidelines for both developers and assessors of compliant devices and systems.

NOTE 3 The resulting SIL claim of a system depends on the implementation of this document within the system – implementation of this document in a standard device is not sufficient to qualify it as a safety device.

#### 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 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 61511 (all parts), *Functional safety – Safety instrumented systems for the process industry sector*

IEC 61784-3:2021, *Industrial communication networks – Profiles – Part 3: Functional safety fieldbuses – General rules and profile definitions*

IEC 62061, *Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*

IEC 62541-1, *OPC Unified Architecture – Part 1: Overview and Concepts*

IEC 62541-2, *OPC Unified Architecture – Part 2: Security*

IEC 62541-3, *OPC Unified Architecture – Part 3: Address Space Model*

IEC 62541-4, *OPC Unified Architecture – Part 4: Services*

IEC 62541-5, *OPC Unified Architecture – Part 5: Information Model*

IEC 62541-6, *OPC Unified Architecture – Part 6: Mappings*

311 IEC 62541-7, *OPC Unified Architecture – Part 7: Profiles*

312 IEC 62541-8, *OPC Unified Architecture – Part 8: Data Access*

313 IEC 62541-14, *OPC Unified Architecture – Part 14: PubSub*

314 ISO/IEC 9834-8, *Information technology — Procedures for the operation of object identifier  
315 registration authorities — Part 8: Generation of universally unique identifiers (UUIDs) and their  
316 use in object identifiers*

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

319 ISO 13849-2, *Safety of machinery – Safety-related parts of control systems – Part 2: Validation*

### 320 **3 Terms, definitions and conventions**

#### 321 **3.1 Terms and definitions**

322 For the purposes of this document, the terms and definitions given in IEC 62541-1, IEC 62541-3,  
323 IEC 62541-6, IEC 61784-3 and the following apply.

324 ISO and IEC maintain terminology databases for use in standardization at the following  
325 addresses:

- 326 • IEC Electropedia: available at <https://www.electropedia.org/>
- 327 • ISO Online browsing platform: available at <https://www.iso.org/obp>

328 NOTE This document uses concepts of IEC 62541 information modeling to describe the concepts in this document.

#### 329 **3.1.1 Terms and definitions from IEC 61784-3**

##### 330 **3.1.1.1**

##### 331 **Cyclic Redundancy Check**

##### 332 **CRC**

333 <value> redundant data derived from, and stored or transmitted together with, a block of data  
334 in order to detect data corruption

335 <method> procedure used to calculate the redundant data

336 Note 1 to entry: Terms “CRC code” and “CRC signature”, and labels such as CRC1, CRC2, may also be used in  
337 this document to refer to the redundant data.

338 [SOURCE: IEC 61784-3:2021, 3.1]

##### 339 **3.1.1.2**

##### 340 **error**

341 discrepancy between a computed, observed or measured value or condition and the true,  
342 specified or theoretically correct value or condition

343 Note 1 to entry: Errors may be due to design mistakes within hardware/software and/or corrupted information due  
344 to electromagnetic interference and/or other effects.

345 Note 2 to entry: Errors do not necessarily result in a failure or a fault.

346 [SOURCE: IEC 61508-4:2010, 3.6.11]

##### 347 **3.1.1.3**

##### 348 **failure**

349 termination of the ability of a functional unit to perform a required function or operation of a  
350 functional unit in any way other than as required

351 Note 1 to entry: Failure may be due to an error (for example, problem with hardware/software design or message  
352 disruption).

353 [SOURCE: IEC 61508-4:2010, 3.6.4, modified – notes and figures deleted]

**3.1.1.4****fault**

abnormal condition that may cause a reduction in, or loss of, the capability of a functional unit to perform a required function

Note 1 to entry: IEC 191-05-01 defines “fault” as a state characterized by the inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources.

[SOURCE: IEC 61508-4:2010, 3.6.1, modified – figure reference deleted]

**3.1.1.5****message**

<information theory and communication theory> ordered sequence of characters (usually octets) intended to convey information

[SOURCE: ISO/IEC 2382:2015, 2123205, modified – insertion of “(usually octets)”, deletion of notes and source]

**3.1.1.6****performance level**

PL

discrete level used to specify the ability of safety-related parts of control systems to perform a safety function under foreseeable conditions

[SOURCE: ISO 13849-1:2023, 3.1.5]

**3.1.1.7****residual error probability**

probability of an error undetected by the SCL safety measures

[SOURCE: IEC 61784-3:2021 3.1]

**3.1.1.8****residual error rate**

statistical rate at which the SCL safety measures fail to detect errors

[SOURCE: IEC 61784-3:2021, 3.1]

**3.1.1.9****safety communication layer**

SCL

communication layer above the IEC 62541 communication stack that includes all necessary additional measures to ensure safe transmission of data in accordance with the requirements of IEC 61508

Note 1 to entry: The SCL provides several services, the most important ones being the SafetyProvider and the SafetyConsumer.

[SOURCE: IEC 61784-3:2021, 3.1 modified – “FAL” replaced by “IEC 62541 communication stack”]

**3.1.1.10****safety function response time**

worst case elapsed time following an actuation of a safety sensor connected to a fieldbus, until the corresponding safe state of its safety actuator(s) is achieved in the presence of errors or failures in the safety function

Note 1 to entry: This concept is introduced in IEC 61784-3, 5.2.4 and is addressed by the functional safety communication profiles defined in the IEC 61784-3 series of documents.

[SOURCE: IEC 61784-3:2021, 3.1]

**3.1.1.11****safety integrity level**

SIL

discrete level (one out of a possible four), corresponding to a range of safety integrity values, where safety integrity level 4 has the highest level of safety integrity and safety integrity level 1 has the lowest level of safety integrity

Note 1 to entry: The target failure measures (see IEC 61508-4:2010, 3.5.17) for the four safety integrity levels are specified in Tables 2 and 3 of IEC 61508-1:2010.

Note 2 to entry: Safety integrity levels are used for specifying the safety integrity requirements of the safety functions to be allocated to the E/E/PE safety-related systems.

Note 3 to entry: A safety integrity level (SIL) is not a property of a system, subsystem, element or component. The correct interpretation of the phrase "SILn safety-related system" (where n is 1, 2, 3 or 4) is that the system is potentially capable of supporting safety functions with a safety integrity level up to n.

[SOURCE: IEC 61508-4:2010, 3.5.8]

**3.1.1.12****safety measure**

measure to control possible communication errors that is designed and implemented in compliance with the requirements of IEC 61508

Note 1 to entry: In practice, several safety measures are combined to achieve the required safety integrity level.

Note 2 to entry: Communication errors and related safety measures are detailed in IEC 61784-3, 5.3 and 5.4.

[SOURCE: IEC 61784-3:2021, 3.1]

**3.1.1.13****safety PDU**

SPDU

PDU transferred through the safety communication channel

Note 1 to entry: The SPDU may include more than one copy of the safety data using differing coding structures and hash functions together with explicit parts of additional protections such as a key, a sequence count, or a time stamp mechanism.

Note 2 to entry: Redundant SCLs may provide two different versions of the SPDU for insertion into separate fields of the IEC62541 frame.

[SOURCE: IEC 61784-3:2021, 3.1]

**3.1.2 Additional terms and definitions****3.1.2.1****fail-safe**

ability of a system that, by adequate technical or organizational measures, prevents from hazards either deterministically or by reducing the risk to a tolerable measure

Note 1 to entry: Equivalent to functional safety

**3.1.2.2****fail-safe substitute values**

FSV

values which are issued or delivered instead of process values when the safety function is set to a fail-safe state

Note 1 to entry: In this document, the fail-safe substitute values (FSV) are always set to binary "0".

**3.1.2.3****flag**

one-bit value used to indicate a certain status or control information.

**3.1.2.4****Globally Unique Identifier**

GUID

128-bit number used to identify information in computer systems

Note 1 to entry: The term universally unique identifier (UUID) is also used.

Note 2 to entry: In this document, UUID version 4 is used.