

TECHNICAL REPORT



**Industrial communication networks – Profiles –
Assessment guideline for safety devices using IEC 61784-3 functional safety
communication profiles (FSCPs)**

IEC/TR 62685:2010

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

U

ICS 13.160; 35.100.05

ISBN 978-2-88912-250-9

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Assessment guideline for safety devices using IEC 61784-3 functional safety communication profiles (FSCPs)

FOREWORD

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IEC 62685, which is a technical report, has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
65C/610/DTR	65C/626/RVC

Full information on the voting for the approval of this technical report 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.

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- withdrawn,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
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INTRODUCTION

During the development of IEC 61784-3:2010, the need was recognized for a separate document covering environmental tests, proofs and information checks, which were currently specified in the German document GS-ET-26 [37]¹. This document has been one of the starting points for IEC 61784-3 and most of its contents have been already taken into account in IEC 61784-3. The material related to environmental tests, proofs and information checks has been transformed, updated and supplemented into this new document.

NOTE IEC 61784-3 explains the relevant principles for functional safety communications with reference to IEC 61508 series and specifies several safety communication layers (profiles and corresponding protocols) based on the communication profiles and protocol layers of IEC 61784-1, IEC 61784-2 and the IEC 61158 series.

The combination of the IEC 61508 series², with its new view on complete safety functions, and of the FSCPs in the IEC 61784-3 series, eases the implementation of safety functions. Further benefits can be achieved, if the environmental conditions can be defined and harmonized for FSCP devices.

The objective of this document is to specify the requirements for FSCP devices on how to fulfill environmental and deployment conditions. It addresses the needs of designers, manufacturers, assessment bodies, and test laboratories.

Figure 1 provides a basic overview on safety functions, FSCP devices and the impact of the environment. It demonstrates the necessity of harmonized environmental requirements.

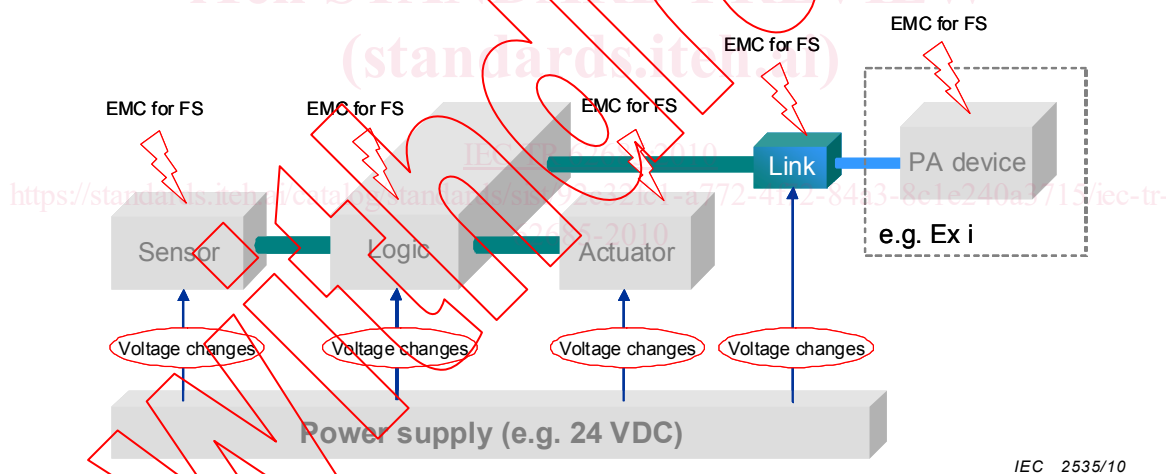


Figure 1 – Environmental view on safety functions

¹ Numbers in square brackets refer to the Bibliography.

² In this Technical Report, "IEC 61508" is used for "IEC 61508 series".

INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Assessment guideline for safety devices using IEC 61784-3 functional safety communication profiles (FSCPs)

1 Scope

This Technical Report provides information about the assessment aspects of safe communication such as test beds, proof of increased interference immunity (EMC for functional safety), electrical safety, and other environmental requirements.

This document is only applicable to safety devices for functional safety communication which are developed according to IEC 61508 and IEC 61784-3.

NOTE This document does not cover the more complex aspects of preserving existing devices and applications in the field and migration from safety rules before IEC 61508.

The scope covers general industrial environments such as defined in IEC 61131-2 or IEC 61000-6-2 and process automation environments such as those covered in the IEC 61326 series.

Reference is made to the ERS (Equipment Requirements Specification) and/or SRS (Safety Requirements Specification) of a particular safety application to verify the necessary immunity of devices and systems according to IEC 61508.

2 Normative references

The following referenced documents are indispensable for the application 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 60068-2 (all parts)³, *Environmental testing – Part 2-x: Tests*

IEC 60079 (all parts)³, *Explosive atmospheres*

IEC 60300-3-2, *Dependability management – Part 3-2: Application guide – Collection of dependability data from the field*

IEC 60721-3 (all parts)³, *Classification of environmental conditions – Part 3 Classification of groups of environmental parameters and their severities*

IEC 60721-3-1, *Classification of environmental conditions – Part 3 Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

³ Relevant parts of the series depend on the context – see detailed requirements in the following clauses.

IEC 60721-3-3, *Classification of environmental conditions – Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use at weatherprotected locations*

IEC/TS 61000-1-2, *Electromagnetic compatibility (EMC) – Part 1-2: General – Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated radio-frequency electromagnetic field immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61010 (all parts)⁴, *Safety requirements for electrical equipment for measurement, control, and laboratory use*

IEC 61131-2:2007, *Programmable controllers – Part 2: Equipment requirements and tests*

IEC 61241 (all parts)⁴, *Electrical apparatus for use in the presence of combustible dust*

IEC 61326 (all parts)⁴, *Electrical equipment for measurement, control and laboratory use – EMC requirements*

IEC 61326-1, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

IEC 61326-3-1, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications*

IEC 61326-3-2, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 3-2: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – Industrial applications with specified electromagnetic environment*

IEC 61496-1, *Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests*

IEC 61496-1, Amendment 1 (2007)

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

IEC 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems*

IEC 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements*

⁴ Relevant parts of the series depend on the context – see detailed requirements in the following clauses.

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

IECEX 61779-x (all parts), *IECEX Test Report for IEC 61779-x (1998) ed 1.0 – Electrical apparatus for the detection and measurement of flammable gases*

IEC 61784-3 (all parts)⁵, *Industrial communication networks – Profiles – Functional safety fieldbuses*

IEC 61784-3:2010, *Industrial communication networks – Profiles – Part 3: Functional safety fieldbuses – General rules and profile definitions*

IEC 62013 (all parts)⁵, *Caplights for use in mines susceptible to firedamp*

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

IECEX 62086-1, *IECEX Test Report for IEC 62086-1 (2001) ed 1.0 – Electrical apparatus for explosive gas atmospheres – Electrical resistance trace heating – Part 1: General and testing requirements*

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

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

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

3.1.1

communication system

arrangement of hardware, software and propagation media to allow the transfer of *messages* (ISO/IEC 7498 application layer) from one application to another

3.1.2

error

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

[IEC 61508-4:2010], [IEC 61158]

NOTE 1 Errors may be due to design mistakes within hardware/software and/or corrupted information due to electromagnetic interference and/or other effects.

NOTE 2 Errors do not necessarily result in a *failure* or a *fault*.

3.1.3

failure

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

NOTE 1 The definition in IEC 61508-4 is the same, with additional notes.

[IEC 61508-4:2010, modified], [ISO/IEC 2382-14.01.11, modified]

⁵ Relevant parts of the series depend on the context – see detailed requirements in the following clauses.

NOTE 2 Failure may be due to an *error* (for example, problem with hardware/software design or message disruption).

3.1.4

fault

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

NOTE IECV 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.

[IEC 61508-4:2010, modified], [ISO/IEC 2382-14.01.10, modified]

3.1.5

fieldbus

communication system based on serial data transfer and used in industrial automation or process control applications

3.1.6

hazard

state or set of conditions of a system that, together with other related conditions will inevitably lead to harm to persons, property or environment

3.1.7

message

ordered series of octets intended to convey information

[ISO/IEC 2382-16.02.01, modified]

3.1.8

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

[ISO 13849-1]

3.1.9

risk

combination of the probability of occurrence of harm and the severity of that harm

NOTE For more discussion on this concept see Annex A of IEC 61508-5:2010.

[IEC 61508-4:2010], [ISO/IEC Guide 51:1999, definition 3.2]

3.1.10

safety communication layer (SCL)

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

3.1.11

safety data

data transmitted across a safety network using a safety protocol

NOTE The safety communication layer does not ensure safety of the data itself, only that the data is transmitted safely.

3.1.12

safety device

device designed in accordance with IEC 61508 and which implements the functional safety communication profile