TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CLC/TR 62685

October 2011

ICS 13.160; 35.100.05

English version

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

(IEC/TR 62685:2010)

Réseaux de communications industrielles - Profils - Recommandations d'évaluation pour les équipements de sécurité utilisant les profils de sécurité de communication (FSCP) de la CEI 61784-3 (CEI/TR 62685:2010)

Industrielle Kommunikationsnetze - Profile - Beurteilungsleitfaden für Sicherheitsgeräte, die funktional sichere Übertragung nach den Profilen der IEC 61784-3 verwenden (IEC/TR 62685:2010)

This Technical Report was approved by CENELEC on 2011-10-03.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Ref. No. CLC/TR 62685:2011 E

Foreword

This document (CLC/TR 62685:2011) consists of the text of IEC/TR 62685:2010 prepared by SC 65C, "Industrial networks", of IEC TC 65, "Industrial-process measurement, control and automation".

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

Endorsement notice

The text of the International Standard IEC/TR 62685:2010 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

[2]	IEC 60204-1	NOTE Harmonized as EN 60204-1.
[3]	IEC 60947-5-1	NOTE Harmonized as EN 60947-5-1.
[4]	IEC 61000-4-2	NOTE Harmonized as EN 61000-4-2.
[5]	IEC 61000-4-4	NOTE Harmonized as EN 61000-4-4.
[6]	IEC 61000-4-5	NOTE Harmonized as EN 61000-4-5.
[7]	IEC 61000-4-8	NOTE Harmonized as EN 61000-4-8.
[8]	IEC 61000-4-11	NOTE Harmonized as EN 61000-4-11.
[9]	IEC 61000-4-16	NOTE Harmonized as EN 61000-4-16.
[10]	IEC 61000-4-29	NOTE Harmonized as EN 61000-4-29.
[12]	IEC 61508-1:2010	NOTE Harmonized as EN 61508-1:2010.
[13]	IEC 61508-4:2010	NOTE Harmonized as EN 61508-4:2010.
[14]	IEC 61508-5:2010	NOTE Harmonized as EN 61508-5:2010.
[15]	IEC 61508-7:2010	NOTE Harmonized as EN 61508-7:2010.
[16]	IEC 61158 series	NOTE Harmonized in EN 61158 series.
[17]	IEC 61784-1	NOTE Harmonized as EN 61784-1.
[18]	IEC 61784-2	NOTE Harmonized as EN 61784-2.
[19]	IEC 61800-3	NOTE Harmonized as EN 61800-3.
[20]	IEC 61800-5-2	NOTE Harmonized as EN 61800-5-2.
[21]	IEC 61918	NOTE Harmonized as EN 61918.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60068-2	Series	Environmental testing - Part 2: Tests	EN 60068-2	Series
IEC 60079	Series	Explosive atmospheres	EN 60079	Series
IEC 60300-3-2	-	Dependability management - Part 3-2: Application guide - Collection of dependability data from the field	EN 60300-3-2	-
IEC 60721-3	Series	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities	EN 60721-3	Series
IEC 60721-3-1	-	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 1: Storage	EN 60721-3-1	-
IEC 60721-3-2	-	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 2: Transportation	EN 60721-3-2	-
IEC 60721-3-3	-	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 3: Stationary use at weatherprotected locations	EN 60721-3-3	-
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	EN 61000-4-3	-
IEC 61000-4-6	-	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	-
IEC 61000-6-2	-	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments	EN 61000-6-2	-
IEC 61010	Series	Safety requirements for electrical equipment for measurement, control and laboratory use	EN 61010	Series

Publication	Year	Title	EN/HD	Year
IEC 61131-2	2007	Programmable controllers - Part 2: Equipment requirements and tests	EN 61131-2	2007
IEC 61241	Series	Electrical apparatus for use in the presence of combustible dust	EN 61241	Series
IEC 61326	Series	Electrical equipment for measurement, control and laboratory use - EMC requirements	EN 61326	Series
IEC 61326-1	-	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements	EN 61326-1	-
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	EN 61326-3-1	-
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	EN 61326-3-2	-
IEC 61496-1 + A 1	-	Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests	EN 61496-1 + A 1	-
IEC 61508	Series	Functional safety of electrical/electronic/programmable electronic safety-related systems	EN 61508	Series
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	EN 61508-2	2010
IEC 61508-3	2010	Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 3: Software requirements	EN 61508-3	2010
IEC 61511	Series	Functional safety - Safety instrumented systems for the process industry sector	EN 61511	Series
IEC 61779	Series	Electrical apparatus for the detection and measurement of flammable gases	EN 61779	Series
IEC 61784-3	Series	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions	EN 61784-3	Series
IEC 61784-3	2010	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions	EN 61784-3	2010

Publication	Year	Title	EN/HD	Year
IEC 62013	Series	Caplights for use in mines susceptible to firedamp	EN 62013	Series
IEC 62061	-	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems	EN 62061	-
IEC 62086-1	-	Electrical apparatus for explosive gas atmospheres - Electrical resistance trace heating - Part 1: General and testing requirements	EN 62086-1	-
ISO 13849-1	-	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design	EN ISO 13849-1	-

CONTENTS

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 series[2], 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.

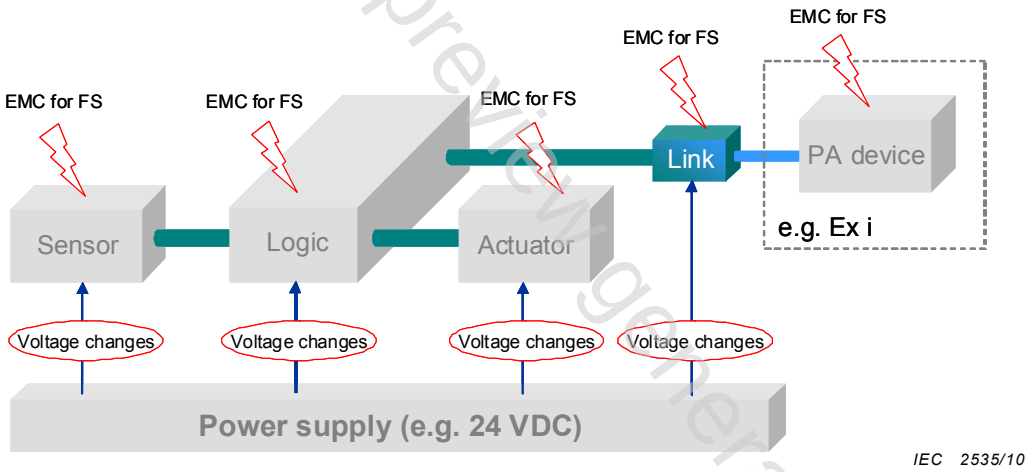

Figure 1 – Environmental view on safety functions

[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*

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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*

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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]

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