

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

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EN IEC 61784-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2021

ICS 25.040.40; 35.100.05

Supersedes EN 61784-3:2016 and all of its amendments
and corrigenda (if any)

English Version

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

Réseaux de communication industriels - Profils - Partie 3:
Bus de terrain de sécurité fonctionnelle - Règles générales
et définitions de profils
(IEC 61784-3:2021)

Industrielle Kommunikationsnetze - Profile - Teil 3:
Funktional sichere Übertragung bei Feldbussen -
Allgemeine Regeln und Festlegungen für Profile
(IEC 61784-3:2021)

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European foreword

The text of document 65C/1067/FDIS, future edition 4 of IEC 61784-3, prepared by SC 65C "Industrial networks" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61784-3:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2021-12-23
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2024-03-23

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IEC 61158-3-1	NOTE	Harmonized as EN 61158-3-1
IEC 61158-3-2	NOTE	Harmonized as EN 61158-3-2
IEC 61158-3-3	NOTE	Harmonized as EN 61158-3-3
IEC 61158-3-8	NOTE	Harmonized as EN 61158-3-8
IEC 61158-3-12	NOTE	Harmonized as EN IEC 61158-3-12
IEC 61158-3-13	NOTE	Harmonized as EN 61158-3-13
IEC 61158-3-14	NOTE	Harmonized as EN 61158-3-14
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IEC 61158-3-21	NOTE	Harmonized as EN IEC 61158-3-21
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IEC 61158-4-14	NOTE	Harmonized as EN 61158-4-14
IEC 61158-4-18	NOTE	Harmonized as EN 61158-4-18
IEC 61158-4-19	NOTE	Harmonized as EN IEC 61158-4-19

IEC 61158-4-21	NOTE	Harmonized as EN IEC 61158-4-21
IEC 61158-4-22	NOTE	Harmonized as EN 61158-4-22
IEC 61158-5-2	NOTE	Harmonized as EN IEC 61158-5-2
IEC 61158-5-3	NOTE	Harmonized as EN 61158-5-3
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IEC 61158-5-8	NOTE	Harmonized as EN 61158-5-8
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IEC 61158-5-10	NOTE	Harmonized as EN IEC 61158-5-10
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IEC 61158-6-23	NOTE	Harmonized as EN IEC 61158-6-23
IEC 61496 (series)	NOTE	Harmonized as EN IEC 61496 (series)
IEC 61496-1	NOTE	Harmonized as EN IEC 61496-1
IEC 61508-4:2010	NOTE	Harmonized as EN 61508-4:2010 (not modified)
IEC 61508-5:2010	NOTE	Harmonized as EN 61508-5:2010 (not modified)
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ISO 10218-1	NOTE	Harmonized as EN ISO 10218-1
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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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	EN 61000-6-7	-
IEC 61010-2-201	-	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-201: Particular requirements for control equipment	EN IEC 61010-2-201	-
IEC 61158	series	Industrial communication networks - Fieldbus specifications	EN IEC 61158	series
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 IEC 61326-3-2	-
IEC 61508	series	Functional safety of electrical /electronic/programmable electronic safety-related systems	EN 61508	series

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61508-1	2010	Functional safety of electrical /electronic/programmable electronic safety-related systems - Part 1: General requirements	EN 61508-1	2010
IEC 61508-2	-	Functional safety of electrical/ electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems	EN 61508-2	-
IEC 61784-1	-	Industrial communication networks - Profiles Part 1: Fieldbus profiles	EN IEC 61784-1	-
IEC 61784-2	-	Industrial communication networks - Profiles - Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC/IEEE 8802-3	EN IEC 61784-2	-
IEC 61784-3	series	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses	-	-
IEC 61784-3-1	-	Industrial communication networks - Profiles - Part 3-1: Functional safety fieldbuses - Additional specifications for CPF 1	EN 61784-3-1	-
IEC 61784-3-2	-	Industrial communication networks - Profiles - Part 3-2: Functional safety fieldbuses - Additional specifications for CPF 2	EN 61784-3-2	-
IEC 61784-3-3	-	Industrial communication networks - Profiles - Part 3-3: Functional safety fieldbuses - Additional specifications for CPF 3	EN 61784-3-3	-
IEC 61784-3-6	-	Industrial communication networks - Profiles - Part 3-6: Functional safety fieldbuses - Additional specifications for CPF 6	EN 61784-3-6	-
IEC 61784-3-8	-	Industrial communication networks - Profiles - Part 3-8: Functional safety fieldbuses - Additional specifications for CPF 8	EN 61784-3-8	-
IEC 61784-3-12	-	Industrial communication networks - Profiles - Part 3-12: Functional safety fieldbuses - Additional specifications for CPF 12	EN 61784-3-12	-
IEC 61784-3-13	-	Industrial communication networks - Profiles - Part 3-13: Functional safety fieldbuses - Additional specifications for CPF 13	EN 61784-3-13	-
IEC 61784-3-14	-	Industrial communication networks - Profiles - Part 3-14: Functional safety fieldbuses - Additional specifications for CPF 14	EN 61784-3-14	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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IEC 61784-3-18	-	Industrial communication networks - Profiles - Part 3-18: Functional safety fieldbuses - Additional specifications for CPF 18	EN 61784-3-18	-
IEC 61784-5	series	Industrial communication networks - Profiles - Part 5: Installation of fieldbuses	EN 61784-5	series
IEC 61918	2018	Industrial communication networks - Installation of communication networks in industrial premises	EN IEC 61918	2018
-	-		EN IEC 61918:2018 /AC:2019-03	2019
IEC 62443	series	Security for industrial process measurement and control - Network and system security	-	-

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**Industrial communication networks – Profiles –
Part 3: Functional safety fieldbuses – General rules and profile definitions**

**Réseaux de communication industriels – Profils –
Partie 3: Bus de terrain de sécurité fonctionnelle – Règles générales et
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INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Industrial communication networks – Profiles –
Part 3: Functional safety fieldbuses – General rules and profile definitions**

**Réseaux de communication industriels – Profils –
Partie 3: Bus de terrain de sécurité fonctionnelle – Règles générales et
définitions de profils**

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ICS 25.040.40; 35.100.05

ISBN 978-2-8322-9268-6

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
PROFILES –****Part 3: Functional safety fieldbuses –
General rules and profile definitions**

FOREWORD

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International Standard IEC 61784-3 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This fourth edition cancels and replaces the third edition, published in 2016 and its Amendment 1, published in 2017. This edition constitutes a technical revision.

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

- Contents of previous Annex F were corrected based on feedback from peer review and subsequent analysis (in particular deletion of RP_U for data integrity, reduction of the Equation for RR_A , and clarifications on the values of RP_I and R_T).
- Additional assumptions for residual error rate calculations, clarification of assumption a).

- After correction, contents of previous Annex F were exchanged with the contents of previous Subclause 5.8.
- Contents of Subclause 5.9 on security replaced by a simple reference to IEC 62443 in accordance with Guide 120.
- Changes in Annex B: Dependency of this Annex B with the BSC model has been highlighted. First two paragraphs and figure in Clause B.2 have been deleted because of little relevance. The approximation Equation (B.4) has been deleted due to obsolescence, based on the observations that the CRC shall be anyway explicitly calculated in order to prove properness, and that it may produce optimistic results. Guidance for calculation of R_{CRC} in B.4.2 has been reviewed.
- Changes in Annex D: Formula D.1 was changed from an approximation to a proper Equation, with some adjustments, and contents of D.4.3 were clarified (default safety action).
- New informative Annex H, providing additional guidance for the calculation of RCRC.

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

FDIS	Report on voting
65C/1067/FDIS	65C/1072/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61784-3 series, published under the general title *Industrial communication networks – Profiles – Functional safety fieldbuses*, can be found on the IEC website.

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,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

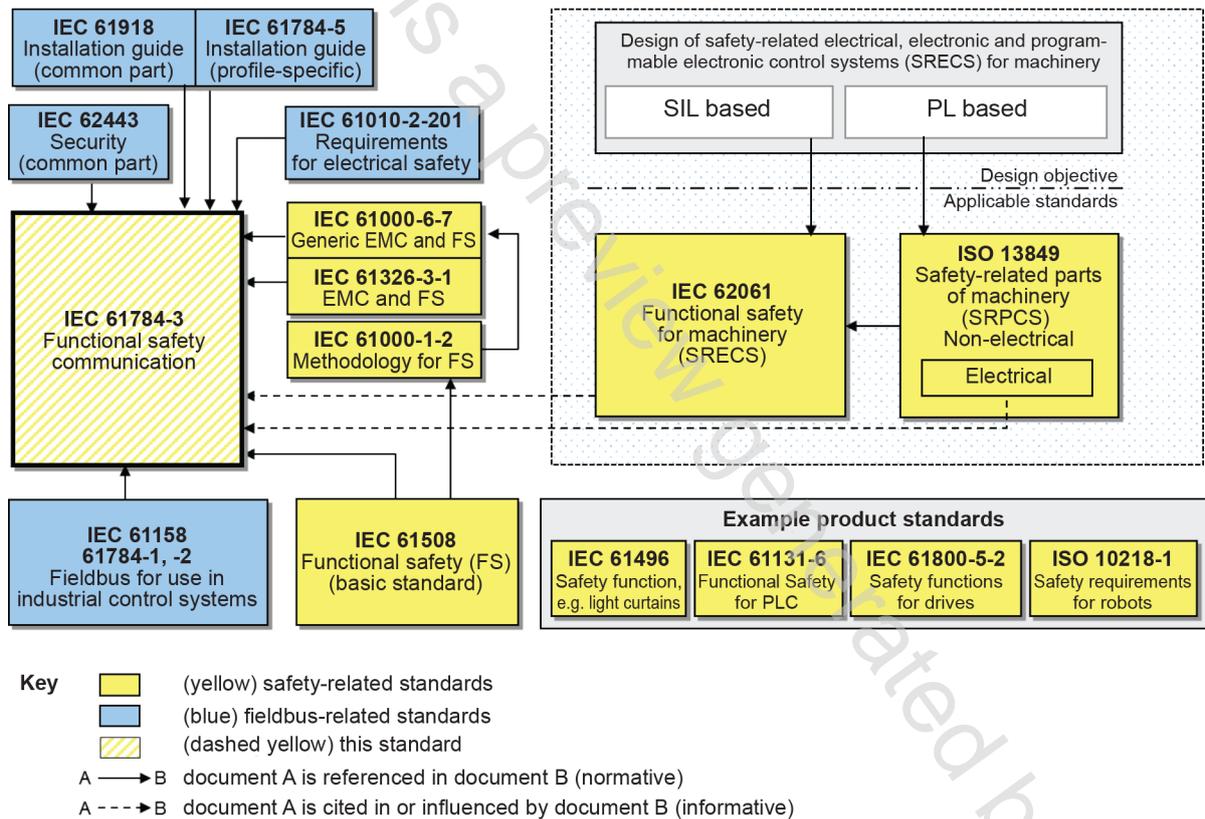
0 Introduction

0.1 General

The IEC 61158 (all parts) fieldbus standard together with its companion standards IEC 61784-1 and IEC 61784-2 defines a set of communication protocols that enable distributed control of automation applications. Fieldbus technology is now considered well accepted and well proven. Thus, fieldbus enhancements continue to emerge, addressing applications for areas such as real time and safety-related applications.

IEC 61784-3 (all parts) explains the relevant principles for functional safety communications with reference to IEC 61508 (all parts) 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 IEC 61158 (all parts). It does not cover electrical safety and intrinsic safety aspects. It also does not cover security aspects, nor does it provide any requirements for security.

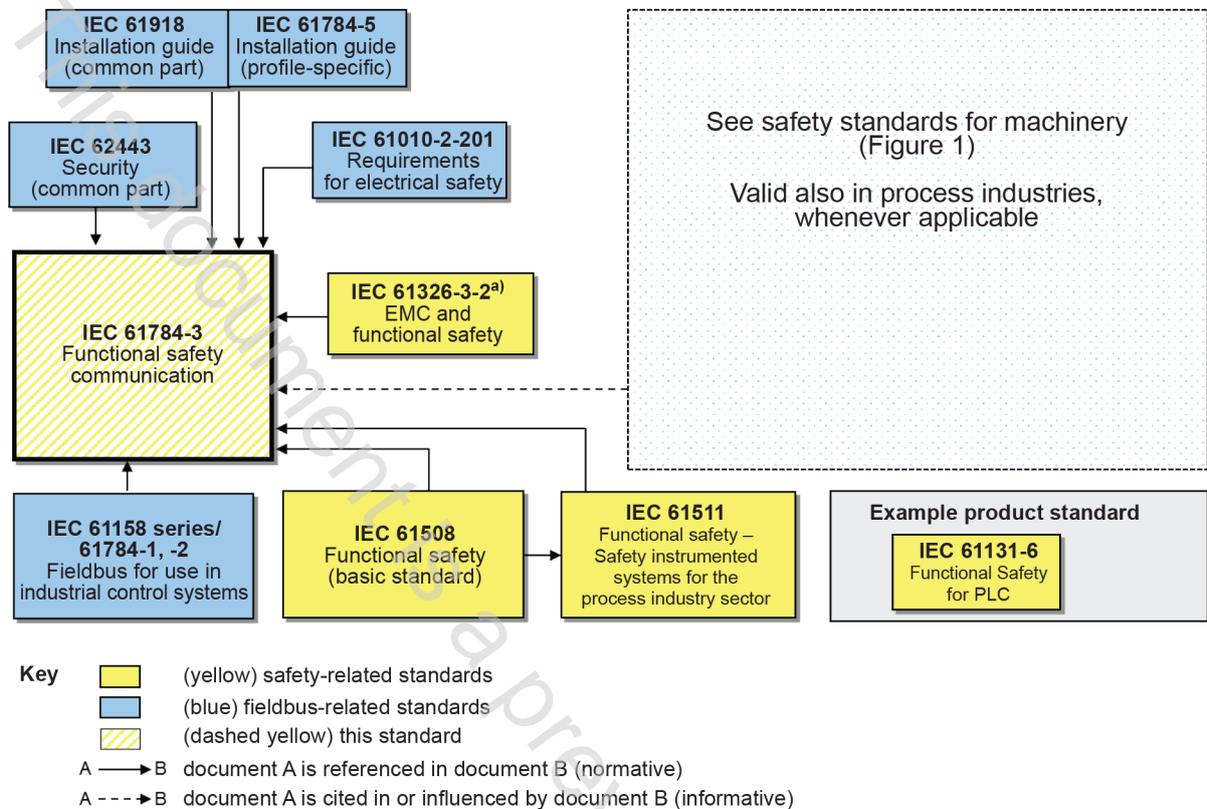
Figure 1 shows the relationships between IEC 61784-3 (all parts) and relevant safety and fieldbus standards in a machinery environment.



NOTE IEC 62061 specifies the relationship between PL (Category) and SIL.

Figure 1 – Relationships of IEC 61784-3 with other standards (machinery)

Figure 2 shows the relationships between IEC 61784-3 (all parts) and relevant safety and fieldbus standards in a process environment.



IEC

^a For specified electromagnetic environments; otherwise IEC 61326-3-1 or IEC 61000-6-7.

Figure 2 – Relationships of IEC 61784-3 with other standards (process)

Safety communication layers which are implemented as parts of safety-related systems according to IEC 61508 (all parts) provide the necessary confidence in the transportation of messages (information) between two or more participants on a fieldbus in a safety-related system, or sufficient confidence of safe behaviour in the event of fieldbus errors or failures.

Safety communication layers specified in IEC 61784-3 (all parts) do this in such a way that a fieldbus can be used for applications requiring functional safety up to the Safety Integrity Level (SIL) specified by its corresponding functional safety communication profile.

The resulting SIL claim of a system depends on the implementation of the selected functional safety communication profile (FSCP) within this system – implementation of a functional safety communication profile in a standard device is not sufficient to qualify it as a safety device.

IEC 61784-3 (all parts) describes:

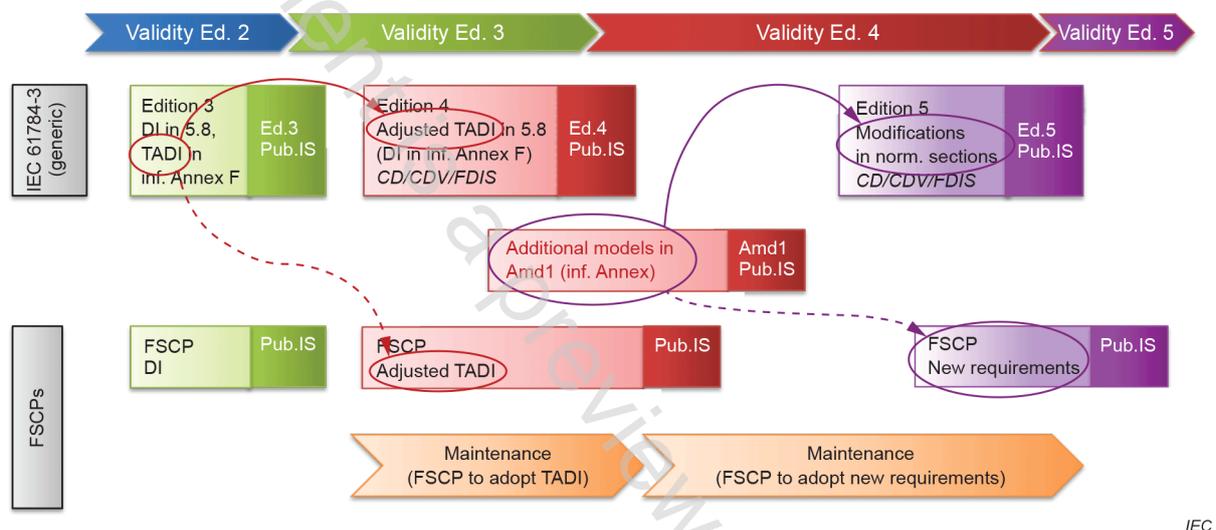
- basic principles for implementing the requirements of IEC 61508 (all parts) for safety-related data communications, including possible transmission faults, remedial measures and considerations affecting data integrity;
- functional safety communication profiles for several communication profile families in IEC 61784-1 and IEC 61784-2, including safety layer extensions to the communication service and protocols sections of IEC 61158 (all parts).

0.2 Use of extended assessment methods in Edition 4

This edition of the generic part of IEC 61784-3 (all parts) includes extended models for use when estimating the total residual error rate for an FSCP. This value can be used to determine if the FSCP meets the requirements of functional safety applications up to a given SIL. These extended models for qualitative and quantitative safety determination methods are detailed in Annex E and 5.8.

Upon publication of this new edition of the generic part, FSCPs shall be assessed using the methods from this Edition 4, based on the extended models specified in 5.8 (derived from a modified version of Annex F of Edition 3). The informative Annex F contains the legacy models for reference purpose only.

Figure 3 shows the transitions from original assessment methods of Edition 2 to extended assessment methods in this Edition 4 and the future Edition 5.



Key

DI Data Integrity

TADI Timeliness, Authenticity, Data Integrity

Figure 3 – Transitions from Ed. 2 to Ed. 4 and future Ed. 5 assessment methods

0.3 Patent declaration

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning functional safety communication profiles for families 1, 2, 3, 6, 8, 12, 13, 14, 17 and 18 given in IEC 61784-3-1, IEC 61784-3-2, IEC 61784-3-3, IEC 61784-3-6, IEC 61784-3-8, IEC 61784-3-12, IEC 61784-3-13, IEC 61784-3-14, IEC 61784-3-17 and IEC 61784-3-18.

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