IEC 61784-3-19

Edition 1.0 2024-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Industrial communication networks – Profiles – Part 3-19: Functional safety fieldbuses – Additional specifications for CPF 19

Réseaux de communication industriels – Profils – Partie 3-19: Bus de terrain de sécurité fonctionnelle – Spécifications supplémentaires pour CPF 19

IEC 61784-3-19:2024-10(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 25.040.40, 35.100.05

ISBN 978-2-8322-9802-2

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 3-19: Functional safety fieldbuses – Additional specifications for CPF 19

FOREWORD

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IEC 61784-3-19 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

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

Draft	Report on voting
65C/1276/CDV	65C/1298/RVC

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 at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

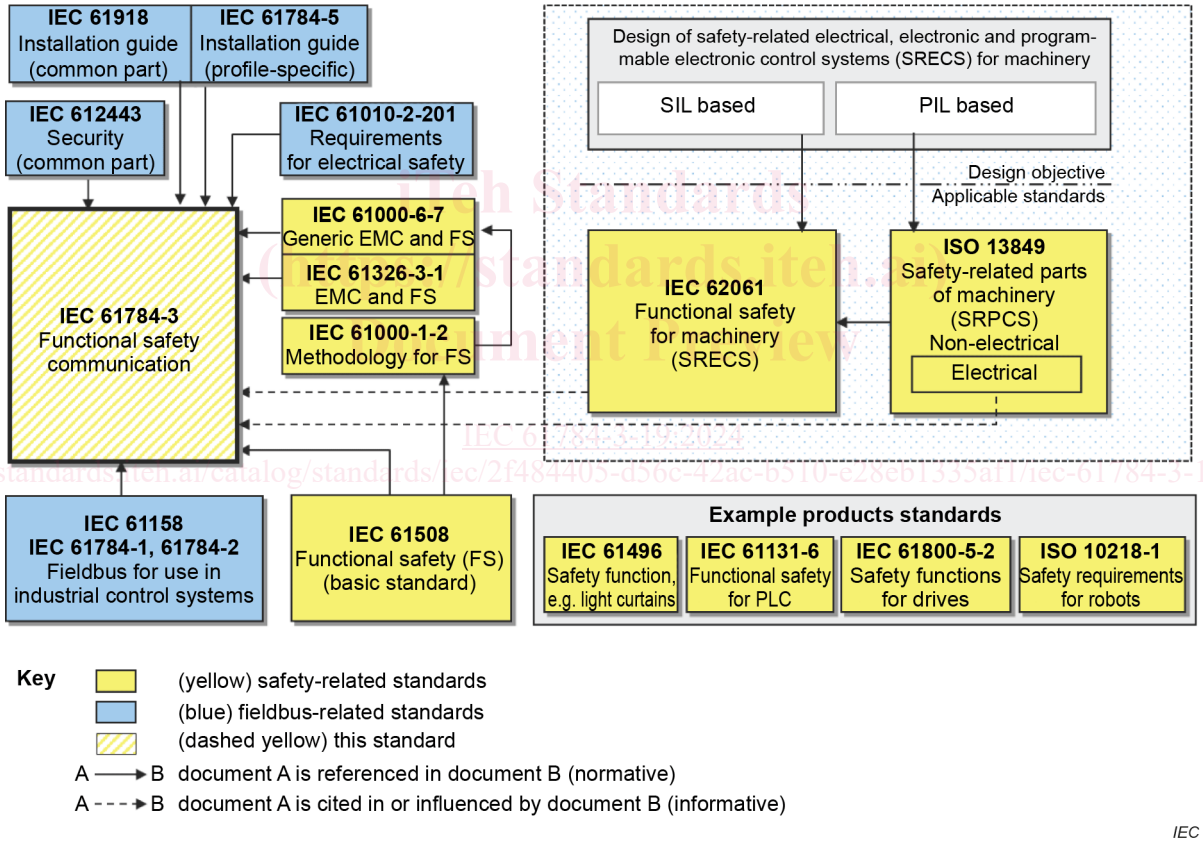
IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The IEC 61158 fieldbus standard series together with its companion standards series 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.

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

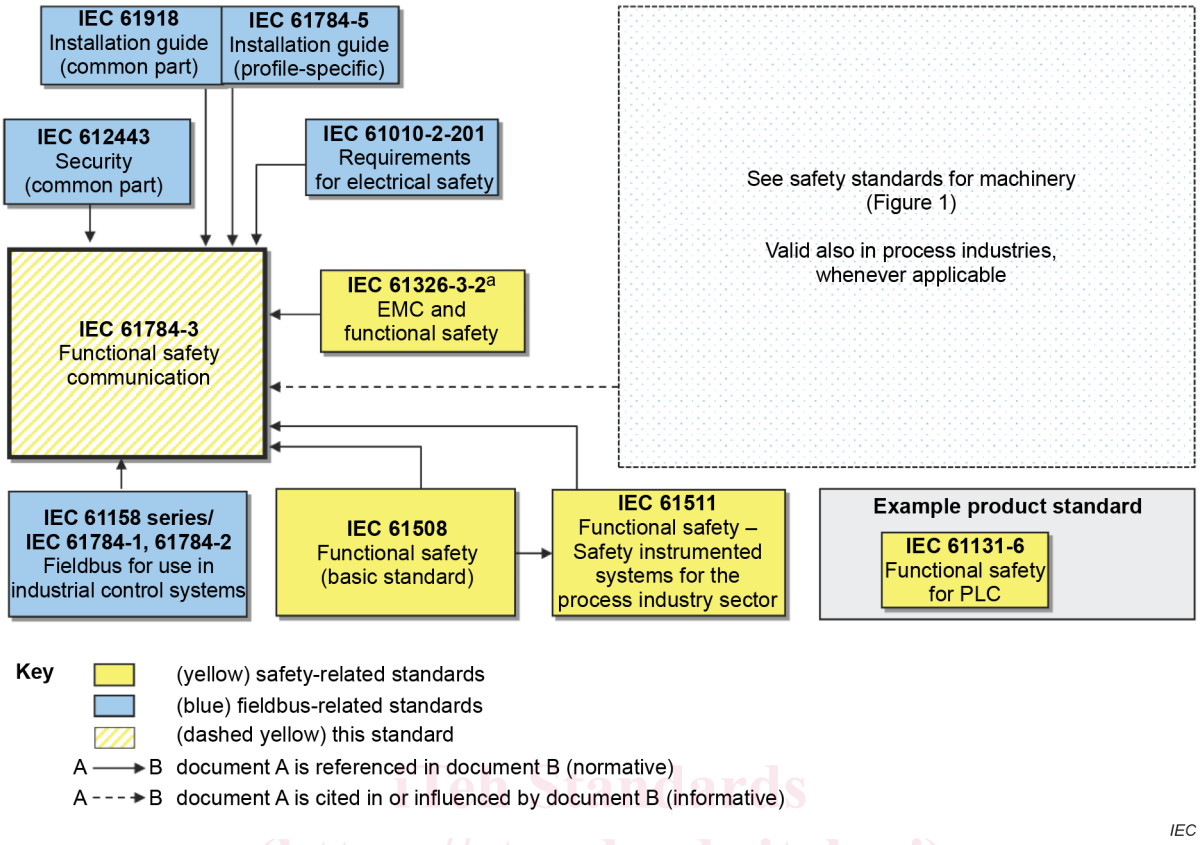
Figure 1 shows the relationships between the IEC 61784-3 series and relevant safety and fieldbus standards in a machinery environment.



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 the IEC 61784-3 series and relevant safety and fieldbus standards in a process environment.



[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 the IEC 61508 series 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 the IEC 61784-3 series 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.

The IEC 61784-3 series describes:

- basic principles for implementing the requirements of the IEC 61508 series 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 the IEC 61784-1 and IEC 61784-2 series, including safety layer extensions to the communication service and protocols sections of the IEC 61158 series.

INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 3-19: Functional safety fieldbuses – Additional specifications for CPF 19

1 Scope

This part of IEC 61784-3 specifies a safety communication layer (services and protocol) based on IEC 61784-1-19, IEC 61784-2-19 and the IEC 61158 series (Type 24 and Type 27). 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 It 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 distributed network using fieldbus technology in accordance with the requirements of the IEC 61508 series[1] for functional safety. These mechanisms can 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 2 The resulting SIL claim of a system depends on the implementation of the selected functional safety communication profile within this system – implementation of a functional safety communication profile according to 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 61131-2, *Industrial-process measurement and control – Programmable controllers – Part 2: Equipment requirements and tests*

IEC 61158 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 61158-6-24, *Industrial communication networks – Fieldbus specifications – Part 6-24: Application layer protocol specification – Type 24 elements*

IEC 61158-6-27, *Industrial communication networks – Fieldbus specifications – Part 6-27: Application layer protocol specification – Type 27 elements*

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*

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[1] In the following pages of this document, "IEC 61508" will be used for "the IEC 61508 series".

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 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 61784-1-19:2023, *Industrial networks – Profiles – Part 1-19: Fieldbus profiles – Communication Profile Family 19*

IEC 61784-2-19:2023, *Industrial networks – Profiles – Part 2-19: Additional real-time fieldbus profiles based on ISO/IEC/IEEE 8802-3 – CPF 19*

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

IEC 61784-5-19, *Industrial networks – Profiles – Part 5: Installation of fieldbuses – Installation profiles for CPF 19*

IEC 62061, *Safety of machinery – Functional safety of safety-related control systems*

3 Terms, definitions, symbols, abbreviated terms and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61784-3 and the following apply.

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

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

NOTE Italics are used in the definitions to highlight terms which are themselves defined in 3.1.

3.1.1 Common terms and definitions

NOTE These common terms and definitions are inherited from IEC 61784-3:2021.

3.1.1.1
communication channel
logical *connection* between two end-points within a *communication system*

3.1.1.2
communication system
arrangement of hardware, software and propagation media to allow the transfer of *messages* (ISO/IEC 7498-1 application layer) from one application to another

3.1.1.3
connection
logical binding between two application objects within the same or different devices

3.1.1.4
CRC
Cyclic Redundancy Check
<value> redundant data derived from, and stored or transmitted together with, a block of data in order to detect data corruption

3.1.1.5
CRC
Cyclic Redundancy Check
<method> procedure used to calculate the redundant data

Note 1 to entry: Terms "CRC code" and "CRC signature", and labels such as CRC1, CRC2, can also be used in this document to refer to the redundant data.

3.1.1.6
error
discrepancy between a computed, observed or measured value or condition and the true, specified or theoretically correct value or condition

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

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

[SOURCE: IEC 61508-4:2010, 3.6.11, modified – Notes to entry have been added.]

3.1.1.7
failure
termination of the ability of a functional unit to provide a required function or operation of a functional unit in any way other than as required

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

[SOURCE: IEC 61508-4:2010, 3.6.4, modified – Notes and figures have been replaced.]

3.1.1.8
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 60050-191:1990, 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 has been deleted.]

3.1.1.9
frame
denigrated synonym for DLPDU

3.1.1.10
master
communication entity able to initiate and schedule communication activities by other stations which may be masters or *slaves*