

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Industrial communication networks – Profiles –  
Part 3-1: Functional safety fieldbuses – Additional specifications for CPF 1**

**Réseaux de communication industriels – Profils –  
Partie 3-1: Bus de terrain à sécurité fonctionnelle – Spécifications  
complémentaires pour le CPF 1**

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# INTERNATIONAL ELECTROTECHNICAL COMMISSION

## INDUSTRIAL COMMUNICATION NETWORKS – PROFILES

### Part 3-1: Functional safety fieldbuses – Additional specifications for CPF 1

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US 6,999,824	[FF]	System and method for implementing safety instrumented systems in a fieldbus architecture
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International Standard IEC 61784-3-1 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial process measurement, control and automation.

This bilingual version (2014-12) corresponds to the English version, published in 2007-12.

The text of this standard is based on the following documents:

FDIS	Report on voting
65C/470/FDIS	65C/481/RVD

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

The French version of this standard has not been voted upon.

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

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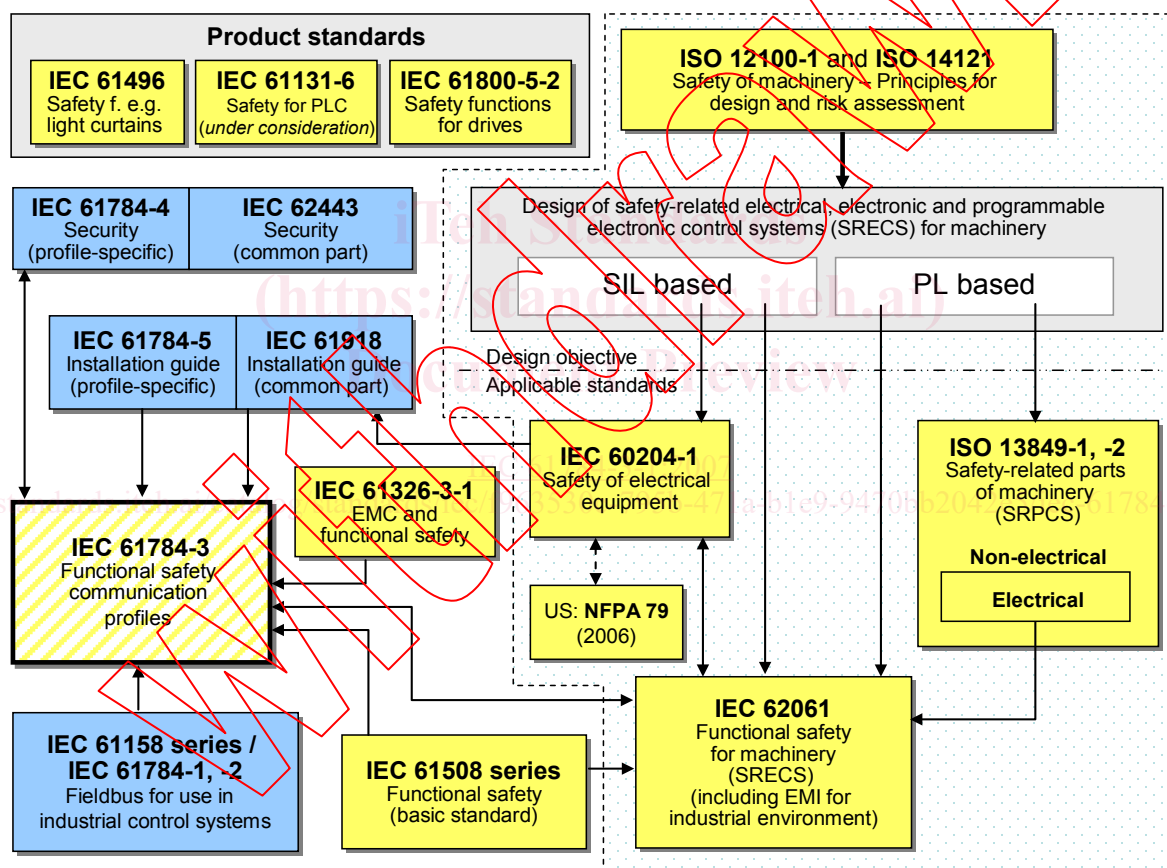
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## INTRODUCTION

The IEC 61158 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 many fieldbus enhancements are emerging, addressing not yet standardized areas such as real time, safety-related and security-related applications.

This standard 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. It does not cover electrical safety and intrinsic safety aspects.

Figure 1 shows the relationships between this standard and relevant safety and fieldbus standards in a machinery environment.

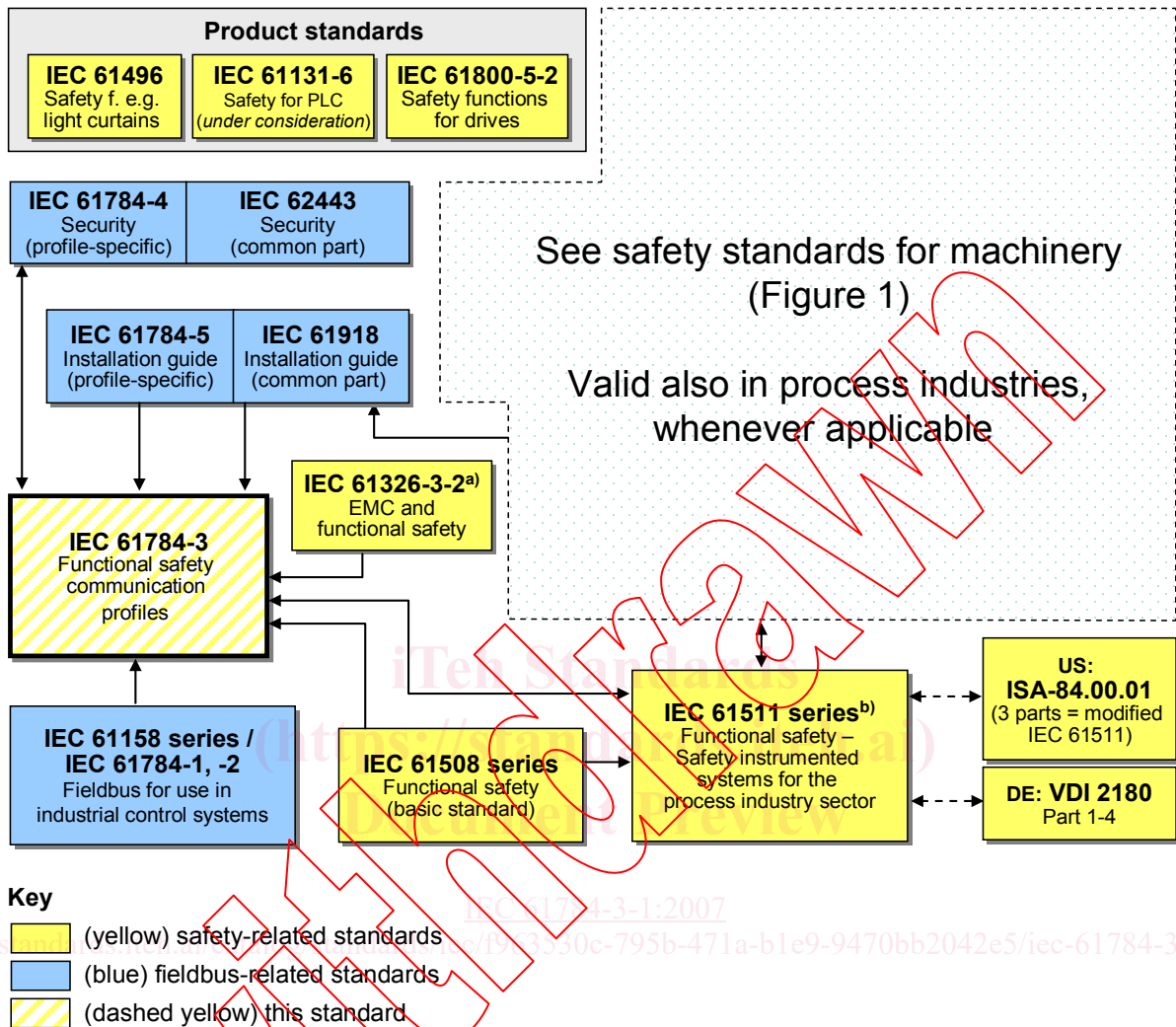


### Key

- (yellow) safety-related standards
- (blue) fieldbus-related standards
- (dashed yellow) this standard

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

Figure 2 shows the relationships between this standard and relevant safety and fieldbus standards in a process environment.



**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 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 this standard 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 within this system – implementation of a functional safety communication profile in a standard device is not sufficient to qualify it as a safety device.

This standard describes

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

Withdrawing

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## INDUSTRIAL COMMUNICATION NETWORKS – PROFILES

### Part 3-1: Functional safety fieldbuses – Additional specifications for CPF 1

#### 1 Scope

This part of the IEC 61784-3 series specifies a safety communication layer (services and protocol) based on CPF 1 of IEC 61784-1 and IEC 61158 Type 1 and 9. It identifies the principles for functional safety communications defined in IEC 61784-3 that are relevant for this safety communication layer.

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 part<sup>1</sup> defines mechanisms for the transmission of safety-relevant messages among participants within a distributed network using fieldbus technology in accordance with the requirements of IEC 61508 series for functional safety. These mechanisms may be used in various industrial applications such as process control, manufacturing automation and machinery.

This part 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 part in a standard device is not sufficient to qualify it as a safety device.

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

IEC 61158-2, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-3-1, *Industrial communication networks – Fieldbus specifications – Part 3-1: Data-link layer service definition – Type 1 elements*

IEC 61158-4-1, *Industrial communication networks – Fieldbus specifications – Part 4-1: Data-link layer protocol specification – Type 1 elements*

IEC 61158-5-5, *Industrial communication networks – Fieldbus specifications – Part 5-5: Application layer service definition – Type 5 elements*

IEC 61158-5-9, *Industrial communication networks – Fieldbus specifications – Part 5-9: Application layer service definition – Type 9 elements*

IEC 61158-6-5, *Industrial communication networks – Fieldbus specifications – Part 6-5: Application layer protocol specification – Type 5 elements*

<sup>1</sup> In the following pages of this standard, “this part” will be used for “this part of the IEC 61784-3 series”.

IEC 61158-6-9, *Industrial communication networks – Fieldbus specifications – Part 6-9: Application layer protocol specification – Type 9 elements*

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, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

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

IEC 61918, *Industrial communication networks – Installation of communication networks in industrial premises*

IEC 62280-1:2002, *Railway applications – Communication, signalling and processing systems – Part 1: Safety-related communication in closed transmission systems*

### **3 Terms, definitions, symbols, abbreviated terms and conventions**

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

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

##### **3.1.1 Common terms and definitions**

###### **3.1.1.1 availability**

probability for an automated system that for a given period of time there are no unsatisfactory system conditions such as loss of production

NOTE Availability depends on MTBF (mean time between failure) and MDT (mean down time):  
Availability =  $MTBF / (MTBF + MDT)$ .

###### **3.1.1.2**

###### **black channel**

*communication channel* without available evidence of design or validation according to IEC 61508 series

###### **3.1.1.3**

###### **bridge**

abstract device that connects multiple network segments along the data link layer

###### **3.1.1.4**

###### **communication channel**

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

###### **3.1.1.5**

###### **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

###### **3.1.1.6**

###### **connection**

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