

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Industrial communication networks – Profiles –
Part 3-12: Functional safety fieldbuses – Additional specifications for CPF 12**

**Réseaux de communication industriels – Profils –
Partie 3-12: Bus de terrain de sécurité fonctionnelle – Spécifications
supplémentaires pour CPF 12**



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CONTENTS

FOREWORD.....	6
0 Introduction	8
0.1 General.....	8
0.2 Patent declaration	10
1 Scope.....	11
2 Normative references	11
3 Terms, definitions, symbols, abbreviated terms and conventions	12
3.1 Terms and definitions	12
3.1.1 Common terms and definitions	12
3.1.2 CPF 12: Additional terms and definitions	17
3.2 Symbols and abbreviated terms.....	17
3.2.1 Common symbols and abbreviated terms	17
3.2.2 CPF 12: Additional symbols and abbreviated terms	18
3.3 Conventions	18
4 Overview of FSCP 12/1 (Safety-over-EtherCAT™)	18
5 General	20
5.1 External document providing specifications for the profile.....	20
5.2 Safety functional requirements	20
5.3 Safety measures	21
5.4 Safety communication layer structure	21
5.5 Relationships with FAL (and DLL, PhL)	22
5.5.1 General	22
5.5.2 Data types	22
6 Safety communication layer services	22
6.1 FSoE Connection	22
6.2 FSoE Cycle	22
6.3 FSoE services	23
7 Safety communication layer protocol	24
7.1 Safety PDU format	24
7.1.1 Safety PDU structure	24
7.1.2 Safety PDU command.....	25
7.1.3 Safety PDU CRC	25
7.2 FSCP 12/1 communication procedure.....	29
7.2.1 Message cycle.....	29
7.2.2 FSCP 12/1 node states.....	29
7.3 Reaction on communication errors	39
7.4 State table for FSoE Master	40
7.4.1 FSoE Master state machine.....	40
7.4.2 Reset state	44
7.4.3 Session state.....	45
7.4.4 Connection state	48
7.4.5 Parameter state.....	52
7.4.6 Data state.....	55
7.5 State table for FSoE Slave	58
7.5.1 FSoE Slave state machine.....	58
7.5.2 Reset state	62

7.5.3	Session state.....	64
7.5.4	Connection state	68
7.5.5	Parameter state	73
7.5.6	Data state.....	78
8	Safety communication layer management.....	81
8.1	FSCP 12/1 parameter handling.....	81
8.2	FSoE communication parameters	81
9	System requirements.....	82
9.1	Indicators and switches	82
9.1.1	Indicator states and flash rates	82
9.1.2	Indicators	83
9.2	Installation guidelines.....	84
9.3	Safety function response time	84
9.3.1	General	84
9.3.2	Determination of FSoE Watchdog time	85
9.3.3	Calculation of the worst case safety function response time	86
9.4	Duration of demands	87
9.5	Constraints for calculation of system characteristics.....	87
9.5.1	General	87
9.5.2	Probabilistic considerations	87
9.6	Maintenance.....	89
9.7	Safety manual	89
10	Assessment.....	89
Annex A (informative) Additional information for functional safety communication profiles of CPF 12 https://standards.iteh.ai/catalog/standards/sist/f1187123-ae12-414f-9a02-cde8531e3277/iec-61784-3-12-2010		
A.1	Hash function calculation.....	90
A.2	94
Annex B (informative) Information for assessment of the functional safety communication profiles of CPF 12.....		
		95
Bibliography.....		
		96
Table 1 – State machine description elements		18
Table 2 – Communication errors and detection measures		21
Table 3 – General Safety PDU		24
Table 4 – Shortest Safety PDU		25
Table 5 – Safety PDU command		25
Table 6 – CRC_0 calculation sequence.....		26
Table 7 – CRC_i calculation sequence (i>0)		26
Table 8 – Example for CRC_0 inheritance		27
Table 9 – Example for 4 octets of safety data with interchanging of octets 1-4 with 5-8.....		28
Table 10 – Safety Master PDU for 4 octets of safety data with command = Reset after restart (reset connection) or error		31
Table 11 – Safety Slave PDU for 4 octets of safety data with command = Reset for acknowledging a Reset command from the FSoE Master		31
Table 12 – Safety Slave PDU for 4 octets of safety data with command = Reset after restart (reset connection) or error		32

Table 13 – Safety Master PDU for 4 octets of safety data with command = Session.....	32
Table 14 – Safety Slave PDU for 4 octets of safety data with command = Session.....	33
Table 15 – Safety data transferred in the connection state.....	33
Table 16 – Safety Master PDU for 4 octets of safety data in Connection state	34
Table 17 – Safety Slave PDU for 4 octets of safety data in Connection state	34
Table 18 – Safety data transferred in the parameter state.....	35
Table 19 – First Safety Master PDU for 4 octets of safety data in parameter state	35
Table 20 – First Safety Slave PDU for 4 octets of safety data in parameter state	36
Table 21 – Second Safety Master PDU for 4 octets of safety data in parameter state	36
Table 22 – Second Safety Slave PDU for 4 octets of safety data in parameter state	37
Table 23 – Safety Master PDU for 4 octets of ProcessData in data state	37
Table 24 – Safety Slave PDU for 4 octets of ProcessData in data state	38
Table 25 – Safety Master PDU for 4 octets of fail-safe data in data state	38
Table 26 – Safety Slave PDU for 4 octets of fail-safe data in data state	39
Table 27 – FSoE communication error	39
Table 28 – FSoE communication error codes.....	40
Table 29 – States of the FSoE Master.....	40
Table 30 – Events in the FSoE Master state table.....	42
Table 31 – Functions in the FSoE Master state table.....	42
Table 32 – Variables in the FSoE Master state table.....	43
Table 33 – Macros in the FSoE Master state table.....	43
Table 34 – States of the FSoE Slave.....	58
Table 35 – Events in the FSoE Slave state table.....	60
Table 36 – Functions in the FSoE Slave state table.....	60
Table 37 – Variables in the FSoE Slave state table.....	61
Table 38 – Macros in the FSoE Slave state table.....	61
Table 39 – FSoE Communication parameters	82
Table 40 – Indicator States	82
Table 41 – FSoE STATUS indicator states.....	83
Table 42 – Definition of times	85
Figure 1 – Relationships of IEC 61784-3 with other standards (machinery).....	8
Figure 2 – Relationships of IEC 61784-3 with other standards (process).....	9
Figure 3 – Basic FSCP 12/1 system.....	19
Figure 4 – FSCP 12/1 software architecture.....	21
Figure 5 – FSoE Cycle.....	23
Figure 6 – FSCP 12/1 communication structure	23
Figure 7 – Safety PDU for CPF 12 embedded in Type 12 PDU.....	24
Figure 8 – FSCP 12/1 node states	30
Figure 9 – State diagram for FSoE Master	41
Figure 10 – State diagram for FSoE Slave	59
Figure 11 – Indicator flash rates	83

Figure 12 – Components of a safety function	84
Figure 13 – Calculation of the FSoE Watchdog times for input and output connections	85
Figure 14 – Calculation of the worst case safety function response time	86
Figure 15 – Safety PDU embedded in standard PDU	88
Figure 16 – Residual error rate for 8/16/24 bit safety data and up to 12 144 bit standard data.....	89

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[IEC 61784-3-12:2010](https://standards.iteh.ai/catalog/standards/sist/fl187123-ae12-414f-9a02-cde8531e3277/iec-61784-3-12-2010)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
PROFILES –**

**Part 3-12: Functional safety fieldbuses –
Additional specifications for CPF 12**

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International Standard IEC 61784-3-12 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial process measurement, control and automation.

This bilingual version (2012-02) corresponds to the monolingual English version, published in 2010-06.

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

FDIS	Report on voting
65C/591A/FDIS	65C/603/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.

This publication 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 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

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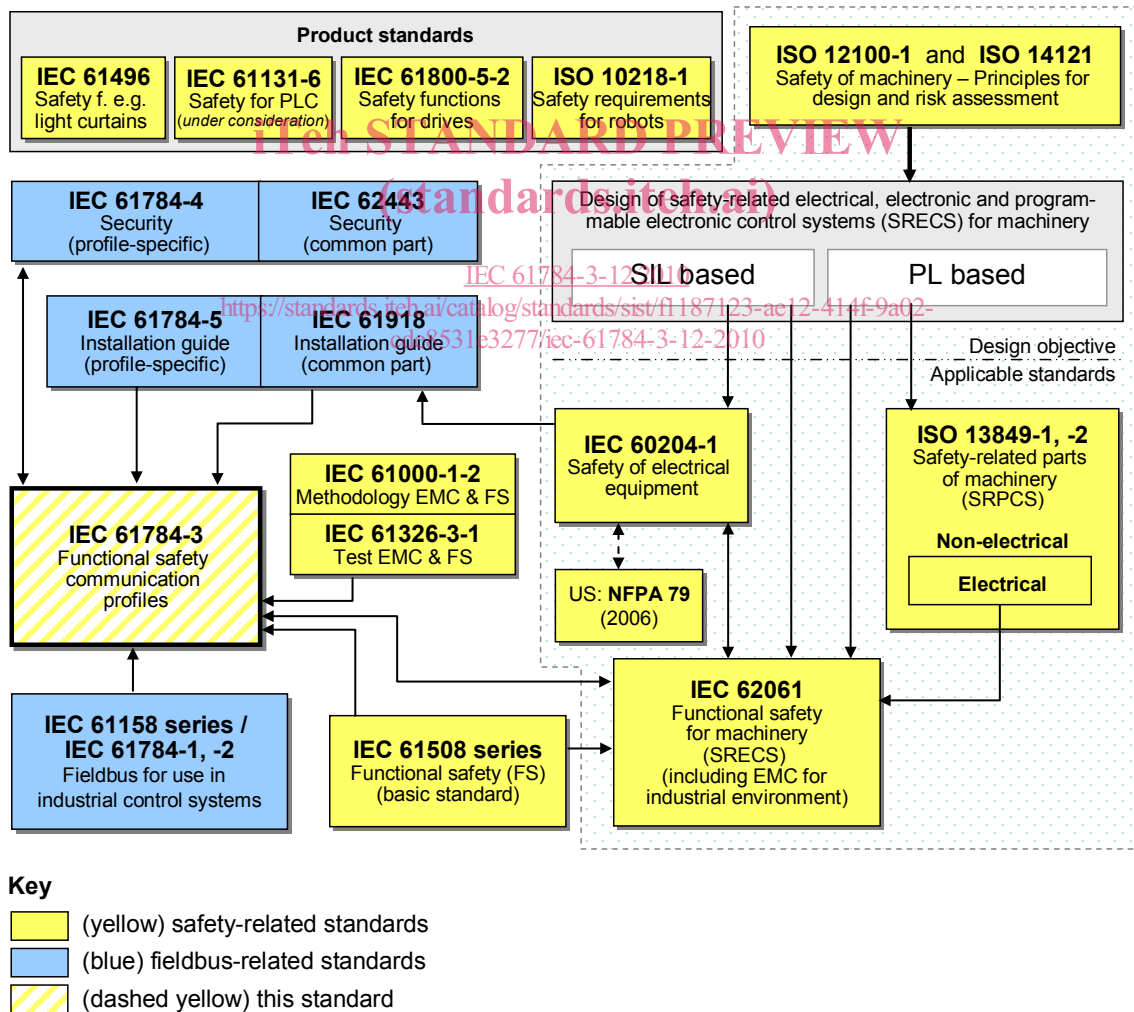
0 Introduction

0.1 General

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.

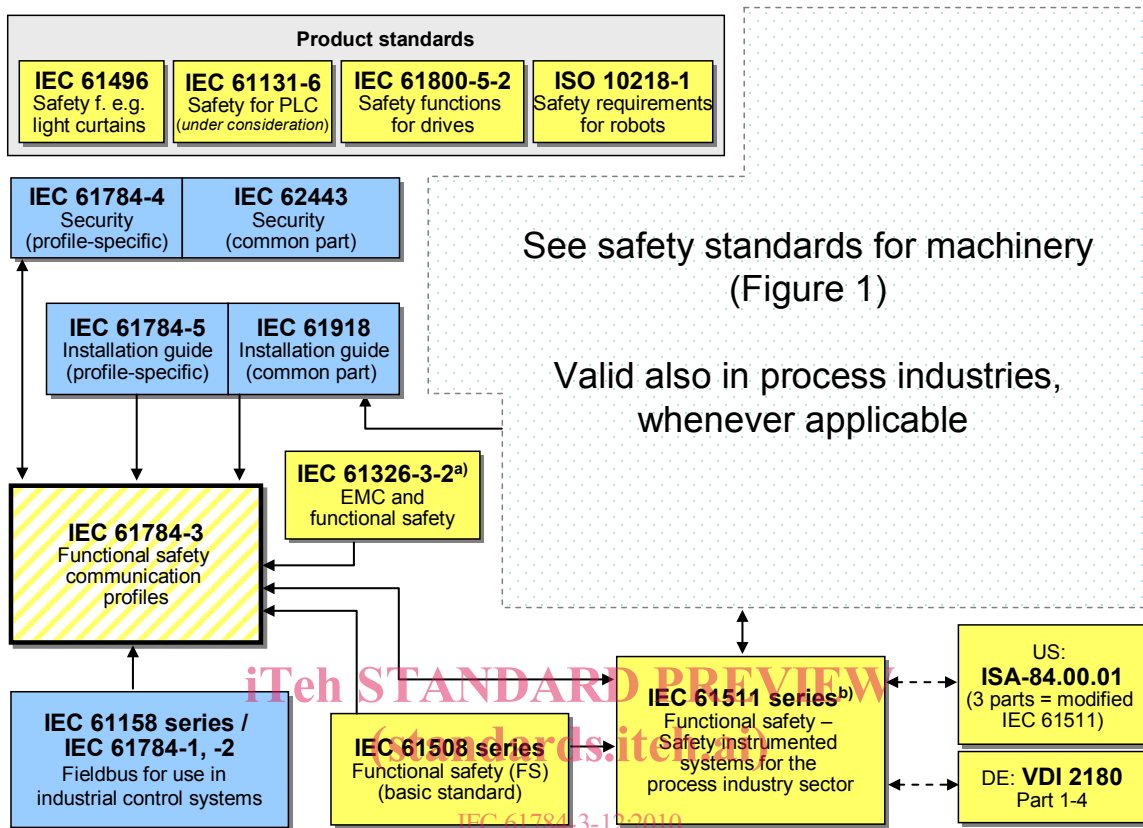
Figure 1 shows the relationships between this standard and relevant safety and fieldbus standards in a machinery environment.



NOTE Subclauses 6.7.6.4 (high complexity) and 6.7.8.1.6 (low complexity) of IEC 62061 specify the relationship between PL (Category) and SIL.

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.



<https://standards.iteh.ai/catalog/standards/sist/fl187123-ae12-414f-9a02-cde8531e3277/iec-61784-3-12-2010>

Key

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

^a For specified electromagnetic environments; otherwise IEC 61326-3-1.
^b EN ratified.

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.

0.2 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 the functional safety communication profiles for family 12 as follows, where the [xx] notation indicates the holder of the patent right:

DE 10 2004 044 764.0 [BE] Datenübertragungsverfahren und Automatisierungssystem zum Einsatz eines solchen Datenübertragungsverfahrens

EP 05 733 921.0 [BE] Sicherheitssteuerung

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INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 3-12: Functional safety fieldbuses – Additional specifications for CPF 12

1 Scope

This part of the IEC 61784-3 series specifies a safety communication layer (services and protocol) based on CPF 12 of IEC 61784-2 and IEC 61158 Type 12. 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 part¹ 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 series² 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 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

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

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 61158-3-12, *Industrial communication networks – Fieldbus specifications – Part 3-12: Data-link layer service definition – Type 12 elements*

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

² In the following pages of this standard, “IEC 61508” will be used for “IEC 61508 series”.

IEC 61158-4-12, *Industrial communication networks – Fieldbus specifications – Part 4-12: Data-link layer protocol specification – Type 12 elements*

IEC 61158-5-12, *Industrial communication networks – Fieldbus specifications – Part 5-12: Application layer service definition – Type 12 elements*

IEC 61158-6-12, *Industrial communication networks – Fieldbus specifications – Part 6-12: Application layer protocol specification – Type 12 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*

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 61784-2, *Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3*

IEC 61784-3:2010³, *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*

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

3.1.1.2

black channel

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

3.1.1.3

communication channel

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

³ In preparation.

3.1.1.4**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

3.1.1.5**connection**

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

3.1.1.6**Cyclic Redundancy Check (CRC)**

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

<method> procedure used to calculate the redundant data

NOTE 1 Terms "CRC code" and "CRC signature", and labels such as CRC1, CRC2, may also be used in this standard to refer to the redundant data.

NOTE 2 See also [34], [35]⁴.

3.1.1.7**error**

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

[IEC 61508-4:2010⁵, [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*.
<https://standards.iteh.ai/standards/iec-61784-3-12-2010>
<https://standards.iteh.ai/standards/iec-61784-3-12-2010>

3.1.1.8**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]

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

3.1.1.9**fault**

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

NOTE IEV 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]

⁴ Figures in square brackets refer to the bibliography.

⁵ To be published.