

INTERNATIONAL STANDARD

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**Industrial communication networks – Profiles –
Part 3-17: Functional safety fieldbuses – Additional specifications for CPF 17**

**Réseaux de communication industriels – Profils –
Partie 3-17: Bus de terrain de sécurité fonctionnelle – Spécifications
supplémentaires pour CPF 17**



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INTERNATIONAL STANDARD

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CONTENTS

FOREWORD.....	5
0 Introduction	7
0.1 General.....	7
0.2 Patent declaration	9
1 Scope.....	10
2 Normative references.....	10
3 Terms, definitions, symbols, abbreviated terms, and conventions.....	11
3.1 Terms and definitions	11
3.1.1 Common terms and definitions	11
3.1.2 CPF 17: 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 17: Additional symbols and abbreviated terms.....	18
3.3 Conventions.....	18
4 Overview of FSCP 17/1 (RAPIEnet Safety™).....	18
5 General	20
5.1 External documents providing specifications for the profile	20
5.2 Safety functional requirements	20
5.3 Safety measures	20
5.3.1 General	20
5.3.2 (Virtual) sequence number	21
5.3.3 Time expectation with watchdog	21
5.3.4 Connection authentication	21
5.3.5 Feedback message	21
5.3.6 Data integrity assurance.....	21
5.4 Safety communication layer structure	22
5.4.1 Principle of FSCP 17/1 safety communications	22
5.4.2 CPF 17 communication structures	22
5.5 Relationships with FAL (and DLL, PhL).....	22
5.5.1 General	22
5.5.2 Data types	23
6 Safety communication layer services.....	23
6.1 Overview.....	23
6.2 Functional Safety connection.....	23
6.2.1 General	23
6.2.2 Initiator class specification	23
6.2.3 Responder-class specification	24
6.2.4 Sender class specification	25
6.2.5 Receiver class specification	27
6.3 Functional Safety data transmission service.....	29
6.4 Functional Safety connection relation	29
7 Safety communication layer protocol	30
7.1 Safety PDU format	30
7.1.1 General	30
7.1.2 FSPDU command.....	31

7.1.3	Authentication key.....	31
7.1.4	FSPDU CRC	31
7.2	FSCP 17/1 communication procedure	34
7.2.1	FSCP 17/1 device states	34
7.3	Response to communication errors.....	42
7.3.1	General	42
7.4	State table for SCL of CPF 17	42
7.4.1	General	42
7.4.2	Events	43
7.4.3	State table for Initiator.....	44
7.4.4	State table for Responder.....	53
8	Safety communication layer management.....	62
8.1	FSCP 17/1 parameter handling.....	62
8.2	Functional Safety communication parameters	62
9	System requirements	62
9.1	Indicators and switches	62
9.2	Installation guidelines.....	62
9.3	Safety function response time.....	62
9.4	Duration of demands	65
9.5	Constraints for calculation of system characteristics	65
9.5.1	General	65
9.5.2	Number of devices	65
9.5.3	Probabilistic consideration.....	65
9.6	Maintenance	66
9.7	Safety manual	66
10	Assessment.....	66
Annex A (informative) Additional information for functional safety communication profiles of CPF 17.....		67
A.1	Hash function calculation.....	67
A.2	68
Annex B (informative) Information for assessment of the functional safety communication profiles of CPF 17		69
Bibliography		70
Figure 1 – Relationships of IEC 61784-3 with other standards (machinery).....		7
Figure 2 – Relationships of IEC 61784-3 with other standards (process)		8
Figure 3 – Communication relationships among FSCP 17 devices.....		19
Figure 4 – Safety layer architecture		22
Figure 5 – Functional Safety Cycle		29
Figure 6 – Connection relationships among FSCP 17/1 devices		30
Figure 7 – Functional Safety PDU for CPF 17 over type 21 PDU		30
Figure 8 – FSPDU CRC code generation process		32
Figure 9 – Example of sequence number changing		33
Figure 10 – CRC comparison operation		34
Figure 11 – FSCP 17/1 device states		35
Figure 12 – State diagram for Functional Safety device		43
Figure 13 – State diagram for Initiator		44

Figure 14 – State diagram for Responder	53
Figure 15 – Safety function response time	63
Figure 16 – Residual error rate of FSCP 17/1	66
Table 1 – Deployed measures to manage errors	21
Table 2 – General FSPDU	31
Table 3 – FSPDU command	31
Table 4 – FSPDU with 4 octets of safety data and RESET command after restart (reset connection) or error	36
Table 5 – FSPDU with 4 octets of safety data and RESET command to acknowledge a reset command from the Initiator	36
Table 6 – Connection request PDU for the Initiator in CONNECTION state	37
Table 7 – Connection response PDU for the Responder in CONNECTION state	37
Table 8 – Safety data transferred in the SET_PARA state	38
Table 9 – Sending FSPDU with 6 octets of safety data from the Initiator in SET_PARA state	38
Table 10 – Expected FSPDU with 6 octets of safety data from the Responder in SET_PARA state	39
Table 11 – Safety data from the Initiator in the WAIT_PARA state	39
Table 12 – Sending FSPDU with 6 octets of safety data from the Initiator in the WAIT_PARA state	40
Table 13 – Receiving FSPDU with 6 octets of safety data from the Responder in the WAIT_PARA state	40
Table 14 – FSPDU of Safety data in the DATA state	41
Table 15 – Example of 4 octets of safety data from a Sender	41
Table 16 – Example of ACK PDU from the Receiver with 4 octets of safety data	41
Table 17 – Functional Safety communication errors	42
Table 18 – Functional Safety communication error codes	42
Table 19 – States of the Functional Safety Initiator	43
Table 20 – States of the Functional Safety Responder	43
Table 21 – Events in the Functional Safety state	44
Table 22 – Functional Safety communication parameters	62
Table A.1 – the lookup table for FSCP 17/1	68

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INDUSTRIAL COMMUNICATION NETWORKS –
PROFILES –

**Part 3-17: Functional safety fieldbuses –
Additional specifications for CPF 17**

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International Standard IEC 61784-3-17 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

FDIS	Report on voting
65C/851/FDIS	65C/854/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.

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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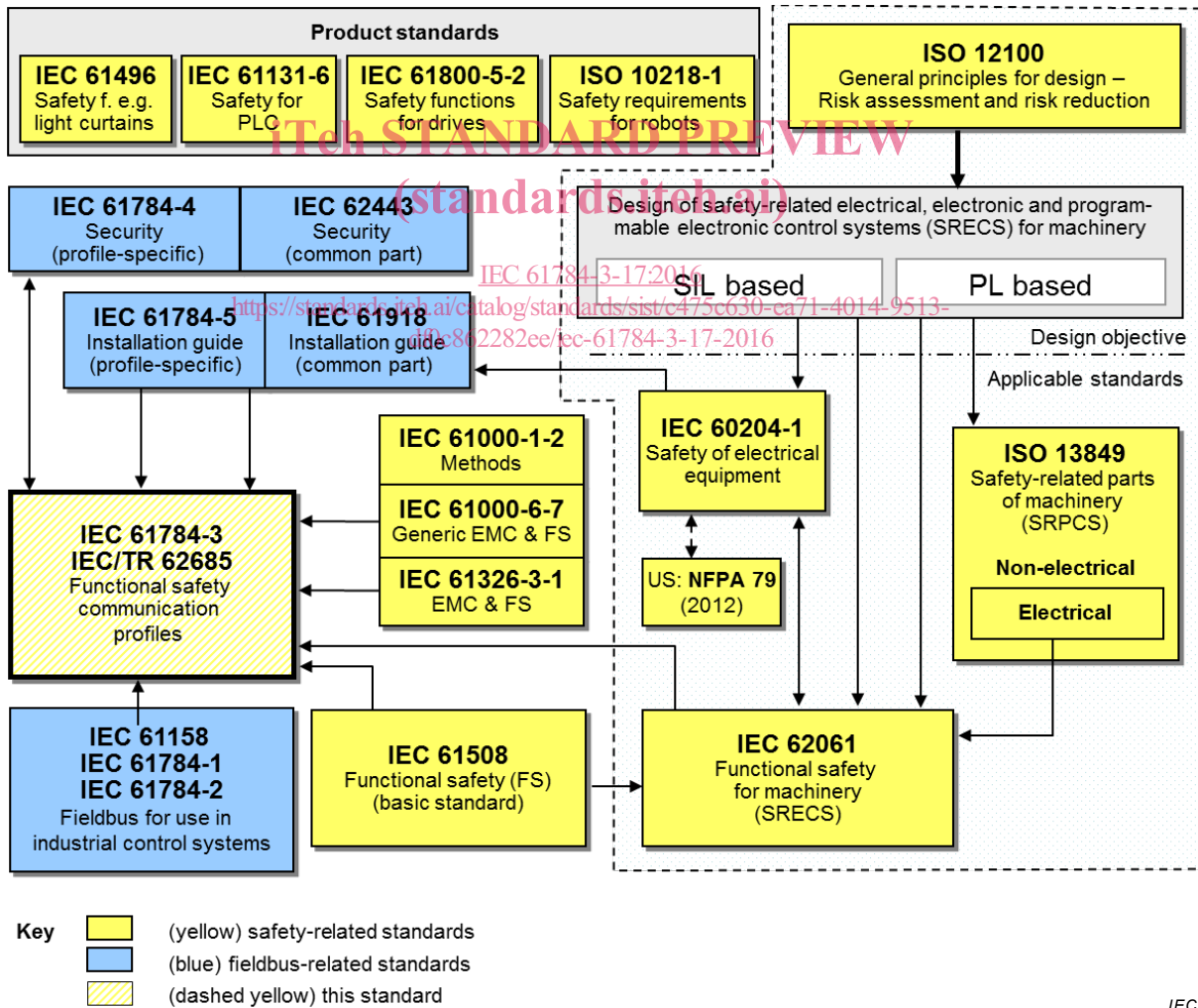
0 Introduction

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 fieldbus enhancements continue to emerge, addressing applications for 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 61784-2 and the IEC 61158 series. It does not cover electrical safety and intrinsic safety aspects.

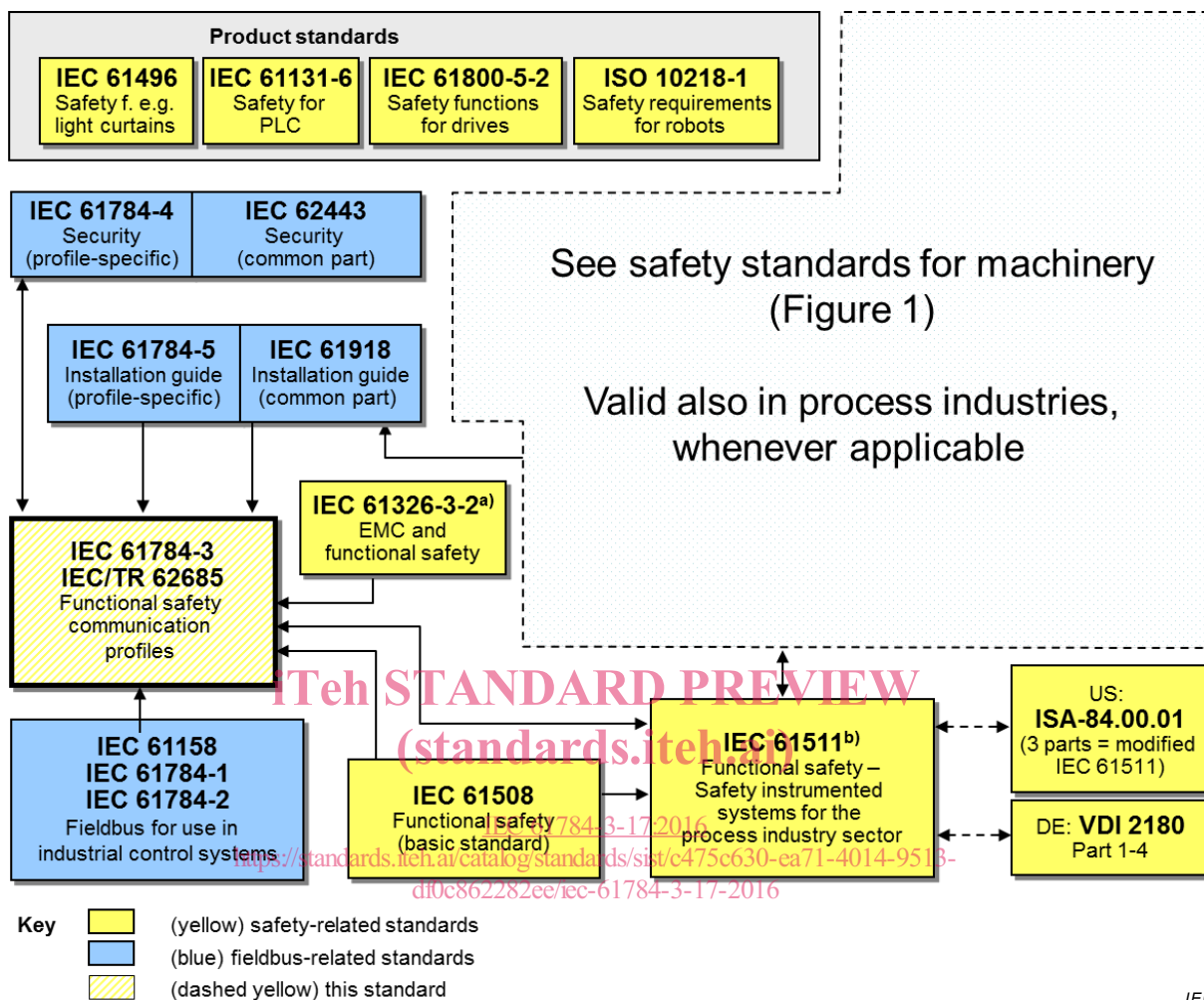
Figure 1 shows the relationships between this standard and relevant safety and fieldbus standards in a machinery environment.



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.



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

^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 (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.

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;
- 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 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 17 as follows, where the [xx] notation indicates the holder of the patent right:

PCT/KR2012/008651	[LSIS]	Communication apparatus and Communication method
PCT/KR2012/008653	[LSIS]	Communication apparatus and Communication method
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KR 10-1389604	[LSIS]	Communication Device and communication method
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INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 3-17: Functional safety fieldbuses – Additional specifications for CPF 17

1 Scope

This part of the IEC 61784-3 series specifies a safety communication layer (services and protocol) based on CPF 17 of IEC 61784-2 (CP 17/1) and IEC 61158 Type 21. 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 is related to hazards such as electrical shock. Intrinsic safety is related 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.

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NOTE 2 The resulting SIL claim of a system depends on 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 for it to qualify as a safety device.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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 61158-3-21:2010, *Industrial communication networks – Fieldbus specifications – Part 3-21: Data-link layer service definition – Type 21 elements*

IEC 61158-4-21:2010, *Industrial communication networks – Fieldbus specifications – Part 4-21: Data-link layer protocol specification – Type 21 elements*

IEC 61158-5-21:2010, *Industrial communication networks – Fieldbus specifications – Part 5-21: Application layer service definition – Type 21 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 61158-6-21:2010, *Industrial communication networks – Fieldbus specifications – Part 6-21: Application layer protocol specification – Type 21 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 61508-1:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements*

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

IEC 61784-5-17:2013, *Industrial communication networks – Profiles – Part 5: Installation of fieldbuses – Installation profiles for CPF 17*

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.

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:—.

3.1.1.1

availability

probability in 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

defined communication system containing one or more elements without evidence of design or validation according to IEC 61508

Note 1 to entry: This definition expands the usual meaning of channel to include the system that contains the channel.

³ To be published.

3.1.1.3

closed communication system

fixed number or fixed maximum number of participants linked by a communication system with well-known and fixed properties, and where the risk of unauthorized access is considered negligible

[SOURCE: IEC 62280:2014, 3.16, modified – transmission replaced by communication]

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 7498-1 application layer) from one application to another

3.1.1.6

connection

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

3.1.1.7

Cyclic Redundancy Check

CRC

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

<method> procedure used to calculate the redundant data

Note 1 to entry: Terms “CRC code” and “CRC signature” and labels such as CRC1 CRC2 may also be used in this standard to refer to redundant data.

Note 2 to entry: See also [34], [35]⁴.

3.1.1.8

defined communication system

defined channel

fixed number or fixed maximum number of participants linked by a fieldbus based communication system with well-known and fixed properties, such as installation conditions, electromagnetic immunity, industrial (active) network elements, and where the risk of unauthorized access is reduced to a tolerated level according to the lifecycle model of IEC 62443, using for example zones and conduits

3.1.1.9

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 may 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 added]

⁴ Figures in square brackets refer to the bibliography.

**3.1.1.10
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 to entry: Failure may 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 replaced]

**3.1.1.11
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 such 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 deleted]

**3.1.1.12
fieldbus**

communication system based on serial data transfer and used in industrial automation or process-control applications

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**3.1.1.13
fieldbus system**

system using a *fieldbus* with connected devices

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**3.1.1.14
frame**

denigrated synonym for DLPDU

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**3.1.1.15
Frame Check Sequence**

FCS

redundant data derived from a block of data within a DLPDU (frame) using a hash function and stored or transmitted together with the block of data to detect data corruption

Note 1 to entry: An FCS can be derived using for example a CRC or other hash function.

Note 2 to entry: See also [34], [35].

**3.1.1.16
hash function**

(mathematical) function that maps values from a (possibly very) large set of values into a (usually) smaller range of values

Note 1 to entry: Hash functions can be used to detect data corruption.

Note 2 to entry: Common hash functions include parity, checksum, or CRC.

[SOURCE: IEC TR 62210:2003, 4.1.12, modified – addition of “usually” and notes]

**3.1.1.17
hazard**

state or set of conditions of a system that, together with other related conditions, will inevitably lead to harm to persons, property, or the environment