



SLOVENSKI STANDARD

SIST EN 61784-3-6:2008

01-september-2008

Industrijska komunikacijska omrežja - Profili - 3-6. del: Funkcijska varnost procesnih vodil - Dodatne specifikacije za CPF 6 (IEC 61784-3-6:2007)

Industrial communication networks - Profiles - Part 3-6: Functional safety fieldbuses - Additional specifications for CPF 6

Industrielle Kommunikationsnetze - Profile - Teil 3-6: Funktional sichere Übertragung bei Feldbussen - Zusätzliche Festlegungen für die Kommunikationsprofilfamilie 6

Réseaux de communication industriels - Profils - Partie 3-6: Bus de terrain de sécurité fonctionnelle - Spécification supplémentaire pour CPF 6

Ta slovenski standard je istoveten z: EN 61784-3-6:2008

ICS:

25.040.40	Merjenje in krmiljenje industrijskih postopkov	Industrial process measurement and control
35.100.05	Več slojne uporabniške rešitve	Multilayer applications

SIST EN 61784-3-6:2008

en,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61784-3-6:2008

<https://standards.iteh.ai/catalog/standards/sist/885a59f1-c33d-40eb-8ae3-7ab6610c62bb/sist-en-61784-3-6-2008>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 61784-3-6

June 2008

ICS 35.100.05; 25.040.40

English version

**Industrial communication networks -
Profiles -
Part 3-6: Functional safety fieldbuses -
Additional specifications for CPF 6
(IEC 61784-3-6:2007)**

Réseaux de communication industriels -
Profils -
Partie 3-6: Bus de terrain
de sécurité fonctionnelle -
Spécification supplémentaire pour CPF 6
(CEI 61784-3-6:2007)

Industrielle Kommunikationsnetze -
Profile -
Teil 3-6: Funktional sichere Übertragung
bei Feldbussen -
Zusätzliche Festlegungen für die
Kommunikationsprofilfamilie 6
(IEC 61784-3-6:2007)

ITEH STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61784-3-6:2008

<https://standards.iteh.ai/catalog/standards/sist/885a59f1-c33d-40eb-8ae3->

This European Standard was approved by CENELEC on 2008-05-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 65C/470/FDIS, future edition 1 of IEC 61784-3-6, 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 was approved by CENELEC as EN 61784-3-6 on 2008-05-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2009-02-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2011-05-01

The International Electrotechnical Commission (IEC) and CENELEC draw 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 6 as follows, where the [xx] notation indicates the holder of the patent right:

DE 103 25 263 A1 [PxC]	Sicherstellung von maximalen Reaktionszeiten in komplexen oder verteilten sicheren und/oder nicht sicheren Systemen
DE 103 18 068 A1 [PxC]	Verfahren und Vorrichtung zum Paket-orientierten Übertragen sicherheitsrelevanter Daten

The IEC and CENELEC take no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured the IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with IEC.

Information may be obtained from:

[PxC] Phoenix Contact GmbH & Co. KG
Intellectual Property Licenses & Standards
Flachsmarktstr. 8
D-32825 Blomberg,
Germany

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. IEC and CENELEC shall not be held responsible for identifying any or all such patent rights.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61784-3-6:2007 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60204-1	NOTE	Harmonized as EN 60204-1:2006 (not modified).
IEC 61131-2	NOTE	Harmonized as EN 61131-2:2007 (not modified).
IEC 61158	NOTE	Harmonized in EN 61158 series (not modified).
IEC 61326-3-1	NOTE	Harmonized in EN 61326-3-1:2008 (not modified).
IEC 61326-3-2	NOTE	Harmonized in EN 61326-3-2:2008 (not modified).
IEC 61496	NOTE	Harmonized as EN 61496-1:2004 (modified) and as CLC/TS 61496-2:2006 (not modified) and CLC/TC 61496-3:2008 (not modified)
IEC 61508-4	NOTE	Harmonized as EN 61508-4:2001 (not modified).
IEC 61508-6	NOTE	Harmonized as EN 61508-6:2001 (not modified).
IEC 61511	NOTE	Harmonized in EN 61511 series (not modified).
IEC 61784-5	NOTE	Harmonized in EN 61784-5 series (not modified).
IEC 61800-5-2	NOTE	Harmonized as EN 61800-5-2:2007 (not modified).
ISO 12100-1	NOTE	Harmonized as EN ISO 12100-1:2003 (not modified).
ISO 13849-1	NOTE	Harmonized as EN ISO 13849-1:2006 (not modified).
ISO 13849-2	NOTE	Harmonized as EN ISO 13849-2:2003 (not modified).

<https://standards.iteh.ai/catalog/standards/sist/885a59f1-c33d-40eb-8ae3-7ab6610c62bb/sist-en-61784-3-6-2008>

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61131-3	- ¹⁾	Programmable controllers - Part 3: Programming languages	EN 61131-3	2003 ²⁾
IEC 61158-2	- ¹⁾	Industrial communication networks - Fieldbus specifications - Part 2: Physical layer specification and service definition	EN 61158-2	2008 ²⁾
IEC 61158-3-8	- ¹⁾	Industrial communication networks - Fieldbus specifications - Part 3-8: Data-link layer service definition - Type 8 elements	EN 61158-3-8	2008 ²⁾
IEC 61158-4-8	- ¹⁾	Industrial communication networks - Fieldbus specifications - Part 4-8: Data-link layer protocol specification - Type 8 elements	EN 61158-4-8	2008 ²⁾
IEC 61158-5-8	- ¹⁾	Industrial communication networks - Fieldbus specifications - Part 5-8: Application layer service definition - Type 8 elements	EN 61158-5-8	2008 ²⁾
IEC 61158-6-8	- ¹⁾	Industrial communication networks - Fieldbus specifications - Part 6-8: Application layer protocol specification - Type 8 elements	EN 61158-6-8	2008 ²⁾
IEC 61508	Series	Functional safety of electrical/electronic/programmable electronic safety-related systems	EN 61508	Series
IEC 61784-1	- ¹⁾	Industrial communication networks - Profiles - Part 1: Fieldbus profiles	EN 61784-1	2008 ²⁾
IEC 61784-2	- ¹⁾	Industrial communication networks - Profiles - Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3	EN 61784-2	2008 ²⁾
IEC 61784-3	- ¹⁾	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions	EN 61784-3	2008 ²⁾

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61784-5-6	- ¹⁾	Industrial communication networks - Profiles - Part 5-6: Installation of fieldbuses - Installation profiles for CPF 6	EN 61784-5-6	2008 ²⁾
IEC 61918 (mod)	- ¹⁾	Industrial communication networks - Installation of communication networks in industrial premises	EN 61918	2008 ²⁾
IEC 62061	- ¹⁾	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems	EN 62061	2005 ²⁾

iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN 61784-3-6:2008

<https://standards.iteh.ai/catalog/standards/sist/885a59f1-c33d-40eb-8ae3-7ab6610c62bb/sist-en-61784-3-6-2008>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61784-3-6:2008

<https://standards.iteh.ai/catalog/standards/sist/885a59f1-c33d-40eb-8ae3-7ab6610c62bb/sist-en-61784-3-6-2008>



IEC 61784-3-6

Edition 1.0 2007-12

INTERNATIONAL STANDARD

**Industrial communication networks – Profiles –
Part 3-6: Functional safety fieldbuses – Additional specifications for CPF 6**

[SIST EN 61784-3-6:2008
https://standards.iteh.ai/catalog/standards/sist/885a59f1-c33d-40eb-8ae3-
7ab6610c62bb/sist-en-61784-3-6-2008](https://standards.iteh.ai/catalog/standards/sist/885a59f1-c33d-40eb-8ae3-7ab6610c62bb/sist-en-61784-3-6-2008)

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

XC

CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	12
2 Normative references	12
3 Terms, definitions, symbols, abbreviated terms and conventions	13
3.1 Terms and definitions	13
3.1.1 Common terms and definitions	13
3.1.2 CPF 6: Additional terms and definitions	17
3.2 Symbols and abbreviated terms.....	18
3.2.1 Common symbols and abbreviated terms	18
3.2.2 CPF 6: Additional symbols and abbreviated terms	18
3.3 Conventions	19
4 Overview of FSCP 6/7 (INTERBUS™ Safety)	19
4.1 General.....	19
4.2 Technical overview.....	19
4.3 Functional Safety Communication Profile 6/7.....	20
5 General	21
5.1 External documents providing specifications for the profile	21
5.2 Safety functional requirements	21
5.3 Safety measures	21
5.3.1 General	21
5.3.2 Sequence number	22
5.3.3 Time stamp	22
5.3.4 Time expectation	22
5.3.5 Acknowledgement	22
5.3.6 Connection authentication	22
5.3.7 Distinction between safety relevant messages and non-safety relevant messages – different data integrity assurance system.....	23
5.3.8 Parameterized shutdown time.....	23
5.4 Safety communication layer structure	23
5.4.1 Decomposition process.....	23
5.4.2 Definition of the safety function of the safety communication system	24
5.4.3 Decomposition of the safety function of a safety communication system into function blocks.....	25
5.4.4 Assignment of the function blocks to subsystems	26
5.4.5 Safety requirements and safety integrity requirements.....	29
5.4.6 Specification of the safe state.....	29
5.4.7 Response to a fault	30
5.4.8 Stop category	32
5.4.9 Safe Transmission.....	32
5.5 Relationships with FAL (and DLL, PhL)	33
5.5.1 Overview	33
5.5.2 Use of the AR-US service to initiate and parameterize.....	33
5.5.3 Use of the AR-US service to transmit safety data	34
5.5.4 Use of the AR-US service to abort.....	35
5.5.5 Data types	35
6 Safety communication layer services	35

6.1	General	35
6.2	Transmission principle for safety messages between SCLM and SCLS	35
6.3	Function block requirements	36
6.3.1	Input Safe Data function block	36
6.3.2	Output Safe Data function block	36
6.3.3	Safe Calculation function block	36
6.4	Context management	37
6.4.1	Initiate service	37
6.4.2	Abort service	38
6.5	Function block parameterization	39
6.5.1	Send application parameter service	39
6.5.2	Send application parameter ID service	40
6.5.3	Parameterize device service	41
6.6	Safe Process Data Mode	41
6.6.1	Transmit-Safety-Data	41
6.6.2	Set-Diagnostic-Data service	43
6.6.3	Set-Acknowledgement-Data service	43
7	Safety communication layer protocol	44
7.1	Safety PDU format	44
7.1.1	Structure of safety messages	44
7.1.2	Description of the polynomial used	45
7.1.3	Structure of safety messages for safe parameterization and idle	45
7.1.4	Structure of safety messages for the transmission of safety data	51
7.1.5	Messages for synchronization	52
7.1.6	Structure of safety messages for aborting connections	53
7.2	State description	54
7.2.1	SCLM and SCLS state machines	54
7.2.2	Initiate	55
7.2.3	Parameterization	56
7.2.4	Process data mode	59
7.2.5	Process data mode with diagnostic data transmission	64
7.2.6	Process data mode with Acknowledgement-Data transmission	65
7.2.7	Connection aborted	66
7.3	Abort	66
7.3.1	Connection abort in the event of an error detected by the SCLM	66
7.3.2	Abort of all connections in the event of an error detected by the SCLS	67
7.3.3	Abort of all connections in the event of an error detected by the SCLM	69
8	Safety communication layer management	70
8.1	General	70
8.2	Requirements of safety communication layer management	70
8.3	Set-Safety-Configuration service	70
8.4	Start IEC 61158 Type 8 service	72
9	System requirements	72
9.1	Indicators and switches	72
9.2	Installation guidelines	72
9.3	Safety function response time	72
9.3.1	General	72

9.3.2 Calculation of the parameterized shutdown time	73
9.4 Duration of demands	77
9.5 Constraints for calculation of system characteristics	77
9.5.1 System characteristics	77
9.5.2 Calculation of the number of telegrams per second	77
9.6 Maintenance	78
9.7 Safety manual	79
10 Certification	79
Bibliography	80
Table 1 – Overview of profile identifier usable for FSCP 6/7	21
Table 2 – Selection of the various measures for possible errors	22
Table 3 – List of function blocks and subsystems	26
Table 4 – Signal flow between the function blocks	28
Table 5 – Initiate service parameters	37
Table 6 – Parameterization mode and related services	38
Table 7 – Abort service parameters	38
Table 8 – Abort of a point-to-point connection by the SRP or SRC	39
Table 9 – Send application parameter service	39
Table 10 – Send application parameter ID service	40
Table 11 – Parameterize device parameters	41
Table 12 – Transmit-Safety-Data service parameters	42
Table 13 – Set-Diagnostic-Data service parameters	43
Table 14 – Set-Acknowledgement-Data service parameters	44
Table 15 – Parameter ID	47
Table 16 – Block 0: Device ID	48
Table 17 – Block 1: Parameter record ID	49
Table 18 – Block 2: Application parameter	49
Table 19 – TIME encoding	52
Table 20 – Abort_Info: Connection abort in the event of an error detected by the SCLM	67
Table 21 – Abort_Info: Abort of all connections in the event of an error detected by the SCLS	68
Table 22 – Abort_Info: Abort of all connections in the event of an error detected by the SCLM	70
Table 23 – Set-Safety-Configuration service	71
Table 24 – Error_Info	71
Table 25 – Calculation of t_{IB}	76
Table 26 – Calculation of t_{SRC}	77
Table 27 – Calculation of t_{PST}	77
Figure 1 – Relationships of IEC 61784-3 with other standards (machinery)	9
Figure 2 – Relationships of IEC 61784-3 with other standards (process)	10
Figure 3 – FSCP 6/7 communication preconditions	20

Figure 4 – Example of a safety function	24
Figure 5 – Decomposition of safety function into function blocks	25
Figure 6 – Overview of the results of the decomposition process	27
Figure 7 – Signal flow between the function blocks	27
Figure 8 – Interfaces between the safety devices within the safety communication system	28
Figure 9 – Signal flow and safe states	30
Figure 10 – Mapping of the Safe Transmission function block	32
Figure 11 – Relationship between SCL and the other layers of IEC 61158 Type 8	33
Figure 12 – Use of the AR-US service to initiate and parameterize	34
Figure 13 – Use of the AR-US service to transmit safety data	34
Figure 14 – Use of the AR-US service to abort	35
Figure 15 – Use of the AR-US service to abort	35
Figure 16 – Structure of the safety PDU	44
Figure 17 – Integration of safety data and deterministic remedial measures in the summation frame	45
Figure 18 – Write_Parameter_Byte_Req message	46
Figure 19 – Read_Parameter_Byte_Req message	46
Figure 20 – Parameter_Byte_Con message	46
Figure 21 – Set_Safety_Connection_ID_Req message	50
Figure 22 – Set_Safety_Connection_ID_Con message of safety slaves	50
Figure 23 – Parameter_Idle_Req	50
Figure 24 – Parameter_Idle_Con	50
Figure 25 – Parameter_Check_Con	51
Figure 26 – Parameter_Loc_ID_Changed_Con	51
Figure 27 – Transmit Safety Data Message	51
Figure 28 – Sync_a message of the SCLM	52
Figure 29 – Req_b message of the SCLM	53
Figure 30 – Req_c message of the SCLM	53
Figure 31 – Req_d message of the SCLM	53
Figure 32 – Abort_Connection message	54
Figure 33 – Safety-Slave_Error message	54
Figure 34 – SCLM state machine	54
Figure 35 – SCLS state machine	55
Figure 36 – Initiate sequence	56
Figure 37 – Send Application Parameter sequence	57
Figure 38 – Send Application Parameter ID sequence	58
Figure 39 – Parameterize device sequence	59
Figure 40 – Simultaneous transmission of safety data to the safety slaves	60
Figure 41 – Use of the sequence number in the SCLM and SCLS	61
Figure 42 – Startup and error-free operation	62
Figure 43 – Resynchronization during operation	63
Figure 44 – Invalid CRC 24 checksum detected by the SCLS	64
Figure 45 – Process data mode with diagnostic data transmission	65

Figure 46 – Process data mode with Acknowledgement-Data transmission	66
Figure 47 – Error when initiating a connection	67
Figure 48 – Error at an SCLS when aborting all connections.....	68
Figure 49 – Abort of all connections in the event of an error detected by the SCLM	69
Figure 50 – Overview of the shutdown time.....	74

iTeh STANDARD PREVIEW **(standards.iteh.ai)**

[SIST EN 61784-3-6:2008](https://standards.iteh.ai/catalog/standards/sist/885a59f1-c33d-40eb-8ae3-7ab6610c62bb/sist-en-61784-3-6-2008)

<https://standards.iteh.ai/catalog/standards/sist/885a59f1-c33d-40eb-8ae3-7ab6610c62bb/sist-en-61784-3-6-2008>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL COMMUNICATION NETWORKS – PROFILES

**Part 3-6: Functional safety fieldbuses – Additional specifications
for CPF 6**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
<https://standards.iteh.ai/catalog/standards/sist/885a59f1-c33d-40eb-8ae3-7ab6610cf62bb/sist-en-61784-3-6-2008>
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

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 6 as follows, where the [xx] notation indicates the holder of the patent right:

DE 103 25 263 A1	[PxC]	Sicherstellung von maximalen Reaktionszeiten in komplexen oder verteilten sicheren und/oder nicht sicheren Systemen
DE 103 18 068 A1	[PxC]	Verfahren und Vorrichtung zum Paket-orientierten Übertragen sicherheitsrelevanter Daten

IEC takes no position concerning the evidence, validity and scope of these patent rights.

The holders of these patents rights have assured the IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holders of these patent rights are registered with IEC.