

DIN EN IEC 61784-1

ICS 35.160; 35.240.50

Ersatz für
DIN EN 61784-1:2015-02
Siehe Anwendungsbeginn

**Industrielle Kommunikationsnetze –
Profile –****Teil 1: Feldbusprofile****(IEC 61784-1:2019);****Englische Fassung EN IEC 61784-1:2019, nur auf CD-ROM**

Industrial communication networks –

Profiles –

Part 1: Fieldbus profiles

(IEC 61784-1:2019);

English version EN IEC 61784-1:2019, only on CD-ROM

Réseaux de communication industriels –

Profils –

Partie 1: Profils de bus de terrain

(IEC 61784-1:2019);

Version anglaise EN IEC 61784-1:2019, seulement en CD-ROM

Gesamtumfang 392 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE

Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2019-05-15 angenommene Europäische Norm als DIN-Norm ist 2020-08-01.

Für DIN EN 61784-1:2015-02 besteht eine Übergangsfrist bis 2022-05-15.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN EN 61784-1:2018-02.

Für dieses Dokument ist das nationale Arbeitsgremium K 956 „Industrielle Kommunikation“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE (www.dke.de) zuständig.

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- bestätigt,
- zurückgezogen,
- durch eine Folgeausgabe ersetzt oder
- geändert.

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf ein Dokument ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils aktuellste Ausgabe des in Bezug genommenen Dokuments.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe des Dokuments.

Der Zusammenhang der zitierten Dokumente mit den entsprechenden deutschen Dokumenten ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für die vorliegende Norm erfüllt.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der IEC 61784-1 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich festlegt, und Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für die meiste der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Änderungen

Gegenüber DIN EN 61784-1:2015-02 wurden folgende Änderungen vorgenommen:

- a) Im gesamten Dokument Aktualisierung der datierten Verweisungen bezüglich der Normenreihe IEC 61158, Normenreihe IEC 61784-2, Normenreihe IEC 61784-3, Normenreihe IEC 61784-5 und der IEC 61918;
- b) Aktualisierung der Auswahltabellen CPF 2 und CPF 4.

Frühere Ausgaben

DIN V 19245-1: 1988-01
DIN 19245-1: 1991-04
DIN 19245-2: 1991-04
DIN EN 50170/1: 1997-07
DIN EN 50170/2: 1997-07
DIN EN 50170/3: 1997-07
DIN EN 50254: 1999-07
DIN EN 61491: 1999-11
DIN EN 50170/A2: 2000-08
DIN EN 50170/A1: 2002-11
DIN EN 50170/A3: 2002-11
DIN EN 61784-1: 2005-05, 2008-10, 2011-04, 2015-02

Nationaler Anhang NA (informativ)

Auszugsweise Übersetzung

Reihenfolge und Inhalt der folgenden Abschnitte sind identisch mit denen in den jeweiligen Abschnitten der Englischen Fassung.

1 Anwendungsbereich

Dieser Teil der IEC 61784 legt, vorwiegend auf Grundlage der Normenreihe IEC 61158, einen Satz von protokollspezifischen Kommunikationsprofilen fest, die für die Gestaltung von kommunikationsrelevanten Geräten in der Herstellung und Prozesskontrolle bestimmt sind.

Jedes Profil wählt Vorgaben für den Kommunikationsprotokollstack an einem Gerät aus. Es enthält einen minimalen Satz von erforderlichen Diensten in der Anwendungsschicht und Vorgaben für Optionen in Zwischenschichten, die durch Referenzen definiert werden. Wenn keine Application Layer enthalten ist, wird ein minimaler Satz von erforderlichen Diensten am Data-Link Layer festgelegt. Die entsprechenden Verweisungen auf die protokollspezifischen Typen werden in jeder Kommunikationsprofilfamilie oder den zugehörigen Profilen angegeben.

ANMERKUNG Alle Profile beruhen auf von der IEC veröffentlichten Normen oder Norm-Entwürfen oder Internationalen Normen oder auf Normen oder Internationalen Normen, die von anderen Normungsorganisationen oder in offenen Normierungsprozessen erstellt wurden.

Die Struktur von Kommunikationsprofilfamilien wird in Bild 1 dargestellt.

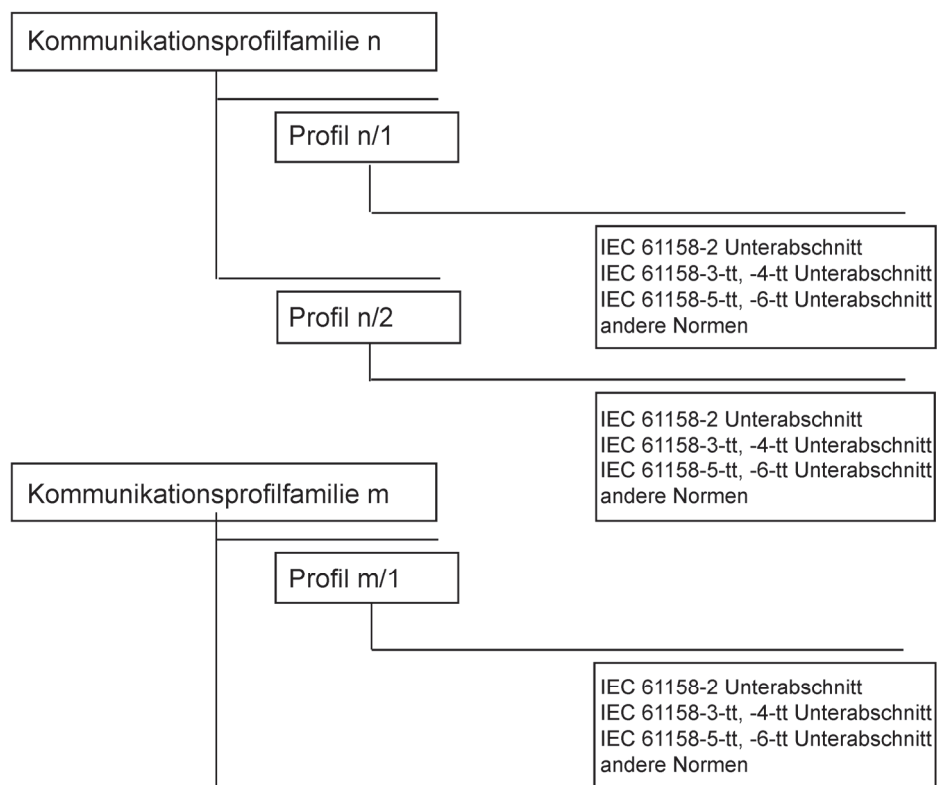


Bild 1 – Kommunikationsprofilfamilien und Profile

Jedes Profil wählt aus den in IEC 61158 definierten und modellierten Diensten und Protokollen eine geeignete konsistente und kompatible Untermenge aus. Für die ausgewählte Untermenge von Diensten und Pro-

tokollen beschreibt das Profil außerdem alle möglichen oder notwendigen Einschränkungen bei den Werten für die Parameter.

Tabelle 1 zeigt die Kommunikationsprofilfamilien, die in dieser Norm definiert sind.

Tabelle 1 – Bezug zwischen Kommunikationsprofilfamilien und Typennummern

IEC 61784-1 Inhalte			Entsprechende IEC 61158-Typen
CPF	Abschnitt	Kommunikationsprofilfamilien (Anmerkung 1)	Typ
1	5	Foundation® Fieldbus	1, 5, 9 (siehe Anmerkung 2)
2	6	CIP™	2
3	7	PROFIBUS & PROFINET	3 (siehe Anmerkung 3)
4	8	P-NET®	4
5	9	WorldFIP®	7
6	10	INTERBUS®	8
7	11	Wurde mangels Marktrelevanz zurückgezogen	6
8	12	CC-Link	18
9	13	HART	20
16	14	SERCOS	16
19	15	MECHATROLINK	24

ANMERKUNG 1 Siehe spezifische CPF-Abschnitte für Informationen zu den jeweiligen Markenzeicheninhabern.

ANMERKUNG 2 CP 1/1 hat eine abgewertete PhL-Geräteprofil-Unterklasse, die eine Variante einer PhL vom Typ 3 verwendet.

ANMERKUNG 3 CP 3/2 hat eine abgewertete PhL-Geräteprofil-Unterklasse, die eine Variante einer PhL vom Typ 1 verwendet.

ANMERKUNG 4 Weitere CPFs sind in IEC 61784-2 zu finden.

3 Begriffe, Abkürzungen, Symbole und Vereinbarungen

3.1 Begriffe

Für die Anwendung dieses Dokuments gelten die Begriffe nach IEC 61158 (alle Teile).

ISO und IEC stellen terminologische Datenbanken für die Verwendung in der Normung unter den folgenden Adressen bereit:

- IEC Electropedia: verfügbar unter <http://www.electropedia.org/>
- ISO Online Browsing Platform: verfügbar unter <http://www.iso.org/obp>

3.2 Abkürzungen und Symbole

3.2.1 IEC 61158 Abkürzungen und Symbole

Für die Anwendung dieses Dokuments gelten alle Abkürzungen und Symbole nach IEC 61158 (alle Teile). Die folgenden Abkürzungen, die sich innerhalb der Normenreihe IEC 61158 befinden, werden hier für diejenigen wiederholt, die die allgemeine Struktur dieser Internationalen Norm verstehen möchten, ohne auf die Normenreihe IEC 61158 zu verweisen.

AL	Application layer
APDU	Application protocol data unit
AR	Application relationship
ASE	Application service element
DL-	Data Link layer (als Präfix)
DLL	Data Link layer
DLSDU	Data Link service data unit
PhL	Physical layer
TPDU	Transport protocol data unit

3.2.2 Weitere Abkürzungen und Symbole

CE	„Europäische Konformität“ (Conformité Européenne)
CP	Kommunikationsprofil
CPF	Kommunikationsprofilfamilie
DP-V0	PROFIBUS DP version 0
DP-V1	PROFIBUS DP version 1
EMC	elektromagnetische Verträglichkeit (EMV)
IDN	Identifikationsnummer
IP	Internetprotokoll
IS	eigensicher (Adjektiv) Eigensicherheit (Substantiv)
ISP	internationale standardisierte Profile
IV	Initialisierungsvektor
MAU	medium attachment unit
PPDU	presentation protocol data unit
RS 485	MAU according to ANSI TIA/EIA-485-A
RS 485-IS	MAU according to ANSI TIA/EIA-485-A and applicable to IS
TCP	terminal control protocol
UDP	user datagram protocol

3.3 Vereinbarungen

3.3.1 Allgemeine Vereinbarungen für alle Schichten

3.3.1.1 (Unter-)Abschnitt Auswahl-Tabellen

Die (Unter-)Abschnitt Auswahl für alle Schichten ist in Tabellen definiert, wie in Tabelle 2 und Tabelle 3 dargestellt. Die ausgewählten Basisspezifikationen werden kurz vor der/den Auswahltable(n) angezeigt. Die Auswahl erfolgt auf der höchstmöglichen (Unter-)Abschnittsebene, um die Profilauswahl eindeutig zu definieren.

Tabelle 2 – Layout für Profile (Unter-)Abschnitt Auswahl-Tabellen

Abschnitt	Kopfzeile	Vorhanden- sein	Einschränkungen

Tabelle 3 – Inhalt der (Unter-)Abschnitt Auswahl-Tabellen

Spalte	Text	Bedeutung
Abschnitt	<#>	(Unter-)Abschnittnummer der Basisspezifikationen
	Nächster Unterabschnitt	alle folgenden Unterabschnitte der gleichen Ebene bis zum letzten Unterabschnitt
	Nächster Abschnitt	alle folgenden Abschnitte bis zum letzten Abschnitt der Basisspezifikation
	Nächste Anhänge	alle folgenden Anhänge bis zum letzten Anhang der Basisspezifikation
Kopfzeile	<text>	(Unter-)Abschnittstitel der Basisspezifikationen
Vorhanden-sein	Nein	Diese (Unter-)Abschnitt ist nicht im Profil enthalten
	Ja	Diese (Unter-)Abschnitt ist vollständig (100 %) im Profil enthalten. In diesem Fall werden keine weiteren Details angegeben.
	–	Das Vorhandensein wird in den folgenden Unterabschnitten definiert.
	Partiell	Teile dieses (Unter-)Abschnitt sind im Profil enthalten
Einschränkungen	Siehe <#>	Einschränkungen/Bemerkungen sind in dem angegebenen Abschnitt, in der Tabelle oder im Bild dieses Profildokuments angegeben
	–	Keine anderen Einschränkungen als die im Referenzdokument (Unter-)Abschnitt angegeben, oder nicht anwendbar
	<text>	Der Text definiert die Einschränkung direkt, bei längerem Text können Fußnoten oder Tabellennotizen verwendet werden

Wenn Sequenzen von (Unter-)Abschnitten nicht mit dem Profil übereinstimmen, werden die Zahlen verkettet.

BEISPIEL 1 Verkettete Unterabschnitte.

3.4 bis 3.7	–	Nein	–
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BEISPIEL 2 Verkettete Abschnitte bis zum letzten Abschnitt

Nächste Abschnitte	–	Nein	–
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BEISPIEL 3 Verkettete Anhänge bis zum letzten Anhang

Nächste Anhänge	–	Nein	–
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3.3.1.2 Dienst-Auswahl-Tabellen

Wenn die Auswahl der Dienste in einer Tabelle definiert ist, wird das Format der Tabelle 4 verwendet. Die Tabelle identifiziert die ausgewählten Dienste und enthält Dienst-Einschränkungen, wie in Tabelle 5 erläutert.

Tabelle 4 – Layout der Dienst-Auswahl-Tabellen

Dienst ref.	Dienst-Name	Verwendung	Einschränkung

Tabelle 5 – Inhalte der Dienst-Auswahl-Tabellen

Spalte	Text	Bedeutung
Dienst ref.	<#>	(Unter-)Abschnittnummer der Basisspezifikationen, in denen der Dienst definiert ist
	–	Nicht anwendbar
Dienst-Name	<text>	Der Name des Dienstes
Verwendung	M	Obligatorisch
	O	Optional
	–	Dienst wird nie genutzt
Einschränkung	Siehe <#>	Einschränkungen/Bemerkungen sind in dem angegebenen Abschnitt, in der Tabelle oder im Bild dieses Profildokuments angegeben
	–	Keine anderen Einschränkungen als die im Referenzdokument (Unter-)Abschnitt angegeben, oder nicht anwendbar
	<text>	Der Text definiert die Einschränkung direkt, bei längerem Text können Fußnoten oder Tabellennotizen verwendet werden.

Wenn die Auswahl der Serviceparameter in einer Tabelle definiert ist, wird das Format der Tabelle 6 verwendet. Jede Tabelle identifiziert die ausgewählten Parameter und enthält Parametereinschränkungen, wie in Tabelle 7 erläutert.

Tabelle 6 – Layout der Parameter-Auswahl-Tabelle

Parameter ref.	Parameter Name	Verwendung	Einschränkung

Tabelle 7 – Inhalte der Parameter-Auswahl-Tabelle

Spalte	Text	Bedeutung
Parameter ref.	<#>	(Unter-)Abschnittnummer der Basisspezifikationen, in denen der Dienst definiert ist
	–	Nicht anwendbar
Parameter Name	<text>	Der Name des Dienstparameters
Verwendung	M	Obligatorisch
	O	Optional
	–	Attribut ist nie vorhanden
Einschränkung	Siehe <#>	Einschränkungen/Bemerkungen sind in dem angegebenen Abschnitt, in der Tabelle oder im Bild dieses Profildokuments angegeben
	–	Keine anderen Einschränkungen als die im Referenzdokument (Unter-)Abschnitt angegeben, oder nicht anwendbar
	<text>	Der Text definiert die Einschränkung direkt, bei längerem Text können Fußnoten oder Tabellennotizen verwendet werden.

3.3.2 Physical layer

Keine zusätzlichen Vereinbarungen sind definiert.

3.3.3 Data-Link Layer

3.3.3.1 Dienst-Profile-Vereinbarungen

Keine zusätzlichen Vereinbarungen sind definiert.

3.3.3.2 Dienste- und Parameter-Auswahl

Diese werden mit den üblichen Vereinbarungen beschrieben, siehe 3.3.1.2.

3.3.4 Application Layer

3.3.4.1 Dienst-Profile-Vereinbarungen

Das ASE und die Klassenauswahl wird durch (Unter-)Abschnitt Auswahl-Tabellen beschrieben, siehe 3.3.1.1. Wenn die Verwendung ausgewählter ASE und Klassen weiter eingeschränkt ist, wird dies im Profil angegeben (z. B. ist ein optionales Element der Basisnorm im Profil obligatorisch).

Wenn die Auswahl der Klassenattribute in einer Tabelle definiert ist, wird das Format der Tabelle 8 verwendet. Die Tabelle identifiziert die ausgewählten Klassenattribute und beinhaltet deren Einschränkungen, wie in Tabelle 9 erläutert.

Tabelle 8 – Layout der Klassenattribut-Auswahltabellen

Attribut	Attribut Name	Verwendung	Einschränkung

Tabelle 9 – Inhalt der Klassenattribut-Auswahl-Tabellen

Spalte	Text	Bedeutung
Attribute	<#>	Attributsnummer der Basisspezifikationsklasse
	–	Nicht anwendbar
Attributs-Name	<text>	Der Name des Attributs
Verwendung	M	Obligatorisch
	O	Optional
	–	Attribut ist nie vorhanden
Einschränkung	Siehe <#>	Einschränkungen/Bemerkungen sind in dem angegebenen Abschnitt, in der Tabelle oder im Bild dieses Profildokuments angegeben
	–	Keine anderen Einschränkungen als die im Referenzdokument (Unter-)Abschnitt angegeben, oder nicht anwendbar
	<text>	Der Text definiert die Einschränkung direkt, bei längerem Text können Fußnoten oder Tabellennotizen verwendet werden

3.3.4.2 Dienste- und Parameter-Auswahl

Diese werden mit den üblichen Vereinbarungen beschrieben, siehe 3.3.1.2.

English Version

Industrial communication networks - Profiles -
Part 1: Fieldbus profiles
(IEC 61784-1:2019)

Réseaux de communication industriels - Profils -
Partie 1: Profils de bus de terrain
(IEC 61784-1:2019)

Industrielle Kommunikationsnetze - Profile -
Teil 1: Feldbusprofile
(IEC 61784-1:2019)

This European Standard was approved by CENELEC on 2019-05-15. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 65C/942/FDIS, future edition 5 of IEC 61784-1, 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 approved by CENELEC as EN IEC 61784-1:2019.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2020-02-15
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-05-15

This document supersedes EN 61784-1:2014.

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

Endorsement notice

The text of the International Standard IEC 61784-1:2019 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 60079-14	NOTE	Harmonized as EN 60079-14.
IEC 60793 (series)	NOTE	Harmonized as EN 60793 (series).
IEC 61158-1	NOTE	Harmonized as EN 61158-1.
IEC 61800-7-204	NOTE	Harmonized as EN 61800-7-204.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60079-11	-	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"	EN 60079-11	-
IEC 60079-25	-	Explosive atmospheres - Part 25: Intrinsically safe electrical systems	EN 60079-25	-
IEC 61010	series	Safety requirements for electrical equipment for measurement, control, and laboratory	-	series
IEC 61131-2	-	Programmable controllers	-	-
IEC 61158	series	Industrial communication networks - Fieldbus specifications	-	-
IEC 61158-2	2014	Industrial communication networks - Fieldbus specifications - Part 2: Physical layer specification and service definition	EN 61158-2	2014
IEC 61158-3-1	2014	Industrial communication networks - Fieldbus specifications - Part 3-1: Data-link layer service definition - Type 1 elements	EN 61158-3-1	2014
IEC 61158-3-2	2014	Industrial communication networks - Fieldbus specifications - Part 3-2: Data-link layer service definition - Type 2 elements	EN 61158-3-2	2014
+A1	2019		+A1	2019
IEC 61158-3-3	2014	Industrial communication networks - Fieldbus specifications - Part 3-3: Data-link layer service definition - Type 3 elements	EN 61158-3-3	2014
IEC 61158-3-4	2019	Industrial communication networks - Fieldbus specifications - Part 3-4: Data-link layer service definition - Type 4 elements	EN 61158-3-4	2019
IEC 61158-3-7	2007	Industrial communication networks - Fieldbus specifications - Part 3-7: Data-link layer service definition - Type 7 elements	EN 61158-3-7	2008
IEC 61158-3-8	2007	Industrial communication networks - Fieldbus specifications - Part 3-8: Data-link layer service definition - Type 8 elements	EN 61158-3-8	2008
IEC 61158-3-16	2007	Industrial communication networks - Fieldbus specifications - Part 3-16: Data-link layer service definition - Type 16 elements	EN 61158-3-16	2008
IEC 61158-3-18	2007	Industrial communication networks - Fieldbus specifications - Part 3-18: Data-link layer service definition - Type 18 elements	EN 61158-3-18	2008

IEC 61158-3-19	2019	Industrial communication networks - Fieldbus specifications - Part 3-19: Data-link layer service definition - Type 19 elements	EN IEC 61158-3-19	2019
IEC 61158-3-20	2014	Industrial communication networks - Fieldbus specifications - Part 3-20: Data-link layer service definition - Type 20 elements	EN 61158-3-20	2014
IEC 61158-3-24	2014	Industrial communication networks - Fieldbus specifications - Part 3-24: Data-link layer service definition - Type 24 elements	EN 61158-3-24	2014
IEC 61158-4-1	2014	Industrial communication networks - Fieldbus specifications - Part 4-1: Data-link layer protocol specification - Type 1 elements	EN 61158-4-1	2014
IEC 61158-4-2	2019	Industrial communication networks - Fieldbus specifications - Part 4-2: Data-link layer protocol specification - Type 2 elements	EN IEC 61158-4-2	2019
IEC 61158-4-3	2019	Industrial communication networks - Fieldbus specifications - Part 4-3: Data-link layer protocol specification - Type 3 elements	EN IEC 61158-4-3	2019
IEC 61158-4-4	2019	Industrial communication networks - Fieldbus specifications - Part 4-4: Data-link layer protocol specification - Type 4 elements	EN IEC 61158-4-4	2019
IEC 61158-4-7	2007	Industrial communication networks - Fieldbus specifications - Part 4-7: Data-link layer protocol specification - Type 7 elements	EN 61158-4-7	2008
IEC 61158-4-8	2007	Industrial communication networks - Fieldbus specifications - Part 4-8: Data-link layer protocol specification - Type 8 elements	EN 61158-4-8	2008
IEC 61158-4-16	2007	Industrial communication networks - Fieldbus specifications - Part 4-16: Data-link layer protocol specification - Type 16 elements	EN 61158-4-16	2008
IEC 61158-4-18	2010	Industrial communication networks - Fieldbus specifications - Part 4-18: Data-link layer protocol specification - Type 18 elements	EN 61158-4-18	2012
IEC 61158-4-19	2019	Industrial communication networks - Fieldbus specifications - Part 4 -19: Data-link layer protocol specification - Type 19 elements	EN IEC 61158-4-19	2019
IEC 61158-4-20	2014	Industrial communication networks - Fieldbus specifications - Part 4-20: Data-link layer protocol specification - Type 20 elements	EN 61158-4-20	2014
IEC 61158-4-24	2019	Industrial communication networks - Fieldbus specifications - Part 4-24: Data-link layer protocol specification - Type 24 elements	EN IEC 61158-4-20	2019
IEC 61158-5-2	2019	Industrial communication networks - Fieldbus specifications - Part 5-2: Application layer service definition - Type 2 elements	EN IEC 61158-5-2	2019
IEC 61158-5-3	2014	Industrial communication networks - Fieldbus specifications - Part 5-3: Application layer service definition - Type 3 elements	EN 61158-5-3	2014
IEC 61158-5-4	2019	Industrial communication networks - Fieldbus specifications - Part 5-4: Application layer service definition - Type 4 elements	-	-
IEC 61158-5-5	2014	Industrial communication networks - Fieldbus specifications - Part 5-5: Application layer service definition - Type 5 elements	EN 61158-5-5	2014
IEC 61158-5-7	2007	Industrial communication networks - Fieldbus specifications - Part 5-7: Application layer service definition - Type 7 elements	EN 61158-5-7	2008

IEC 61158-5-8	2007	Industrial communication networks - Fieldbus specifications - Part 5-8: Application layer service definition - Type 8 elements	EN 61158-5-8	2008
IEC 61158-5-9	2014	Industrial communication networks - Fieldbus specifications - Part 5-9: Application layer service definition - Type 9 elements	EN 61158-5-9	2014
IEC 61158-5-16	2007	Industrial communication networks - Fieldbus specifications - Part 5-16: Application layer service definition - Type 16 elements	EN 61158-5-16	2008
IEC 61158-5-18	2010	Industrial communication networks - Fieldbus specifications - Part 5-18: Application layer service definition - Type 18 elements	EN 61158-5-18	2012
IEC 61158-5-19	2019	Industrial communication networks - Fieldbus specifications - Part 5-19: Application layer service definition - Type 19 elements	-	-
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INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 1: Fieldbus profiles

INTRODUCTION

This document provides a set of Communication Profiles (CP) in the sense of ISO/IEC TR 10000-1. These answer the need of identifying the protocol families co-existing within the IEC 61158 series, as a result of the international harmonization of fieldbus technologies available on the market. More specifically, these profiles help to correctly state the compliance to the IEC 61158 series, and to avoid the spreading of divergent implementations, which would limit its use, clearness and understanding. Additional profiles to address specific market concerns, such as functional safety or information security, may be addressed by future parts of this standard.

This standard contains several Communication Profile Families (CPF), which specify one or more communication profiles. Such profiles identify, in a strict sense, protocol subsets of the IEC 61158 series via protocol specific communication profiles. They do not define device-type-specific communication profiles for the purpose of guiding manufacturers in feature set selection – for example, in selecting the minimum set of communication services and protocol to implement a specific class of devices, such as generic slaves or transmitters ("implementation profiles"). Neither do they define device profiles that specify communication profiles together with application functions needed to answer the need of a specific application ("application profiles").

It is agreed that these latter classes of profiles would help the use of the IEC 61158 series of standards; the profiles defined in this document are a necessary step to achieve that task.

It is also important to clarify that interoperability – defined as the ability of two or more network systems to exchange information and to make mutual use of the information that has been exchanged (see ISO/IEC TR 10000-1) – can be directly achieved on the same link only for those devices complying to the same communication profile.

Profiles contained in this International Standard are constructed of references to IEC 61158-2 and the IEC 61158-3, IEC 61158-4, IEC 61158-5 and IEC 61158-6 series, and other IS, TS or worldwide-accepted standards, as appropriate¹. Each profile is required to reference at least one (sub)part of IEC 61158-2 through IEC 61158-6.

Two or more Profiles, which are related to a common family, are specified within a "Communication Profile Family" (CPF).

¹ International Standardised Profiles may contain normative references to specifications other than International Standards; see ISO/IEC JTC 1 N 4047: *The Normative Referencing of Specifications other than International Standards in JTC 1 International Standardized Profiles – Guidelines for ISP Submitters*.

INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

Part 1: Fieldbus profiles

1 Scope

This part of IEC 61784 defines a set of protocol specific communication profiles based primarily on the IEC 61158 series, to be used in the design of devices involved in communications in factory manufacturing and process control.

Each profile selects specifications for the communications protocol stack at a device. It contains a minimal set of required services at the application layer and specification of options in intermediate layers defined through references. If no application layer is included, then a minimal set of required services at the Data-link layer is specified. The appropriate references to the protocol specific types are given in each communication profile family or associated profiles.

NOTE All profiles are based on standards or draft standards or International Standards published by the IEC or from standards or International Standards established by other standards bodies or open standards processes.

The structure of communication profile families is specified in Figure 1.

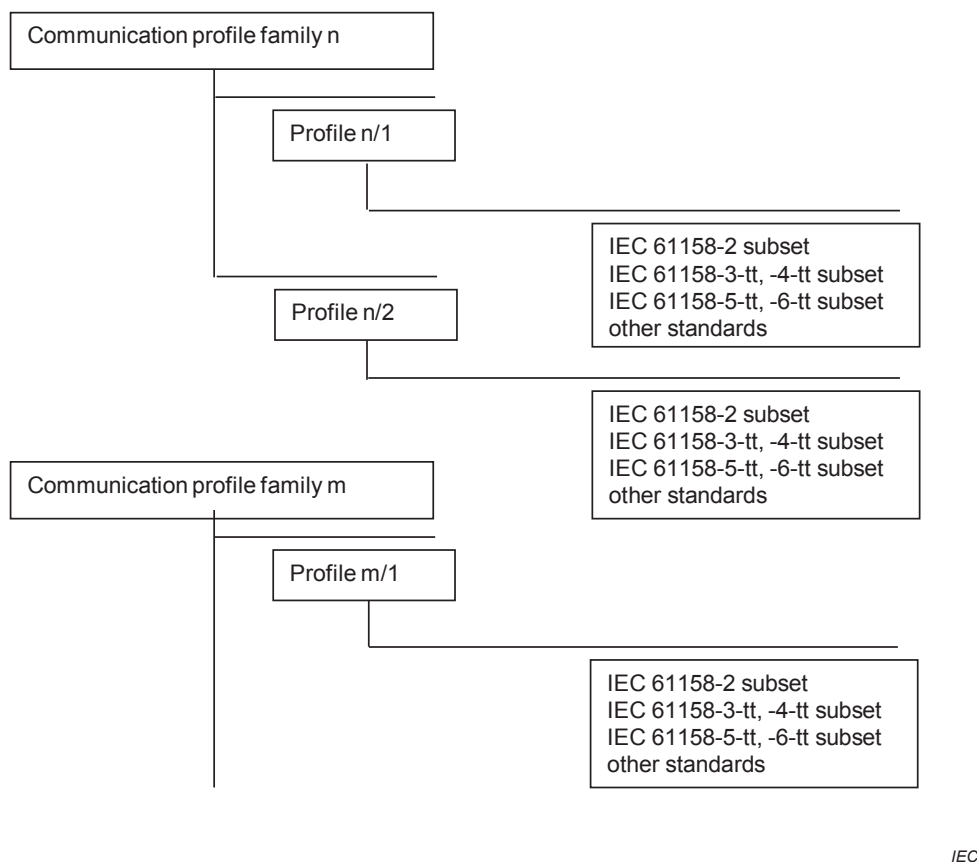


Figure 1 – Communication profile families and profiles

Each profile selects an appropriate consistent and compatible subset of services and protocols from the total available set that is defined and modelled in IEC 61158. For the selected subset of services and protocols, the profile also describes any possible or necessary constraints in parameter values.

Table 1 shows the communication profile families that are defined in this standard.

Table 1 – Relations of Communication Profile Families to type numbers

IEC 61784-1 contents			Corresponding IEC 61158 Types
CPF	Clause	Communication Profile Families (Note 1)	Type
1	5	Foundation® Fieldbus	1, 5, 9 (see Note 2)
2	6	CIP™	2
3	7	PROFIBUS & PROFINET	3 (see Note 3)
4	8	P-NET®	4
5	9	WorldFIP®	7
6	10	INTERBUS®	8
7	11	Has been removed based for lack of market relevance	6
8	12	CC-Link	18
9	13	HART	20
16	14	SERCOS	16
19	15	MECHATROLINK	24
<p>NOTE 1 See the specific CPF clauses for information on the respective trademark holders.</p> <p>NOTE 2 CP 1/1 has a denigrated PhL device profile subclass, which uses a variant of a Type 3 PhL.</p> <p>NOTE 3 CP 3/2 has a denigrated PhL device profile subclass, which uses a variant of a Type 1 PhL.</p> <p>NOTE 4 Other CPFs can be found in IEC 61784-2.</p>			

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.

NOTE All parts of the IEC 61158 series, as well as IEC 61784-1 and IEC 61784-2 are maintained simultaneously. Cross-references to these documents within the text therefore refer to the editions as dated in this list of normative references.

IEC 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"*

IEC 60079-25, *Explosive atmospheres – Part 25: Intrinsically safe electrical systems*

IEC 61010 (all parts), *Safety requirements for electrical equipment for measurement, control and laboratory use*

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

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

IEC 61158-2:2014, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-3-1:2014, *Industrial communication networks – Fieldbus specifications – Part 3-1: Data-link layer service definition – Type 1 elements*

IEC 61158-3-2:2014, *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*

IEC 61158-3-2:2014/AMD1:2019

IEC 61158-3-3:2014, *Industrial communication networks – Fieldbus specifications – Part 3-3: Data-link layer service definition – Type 3 elements*

IEC 61158-3-4:2019, *Industrial communication networks – Fieldbus specifications – Part 3-4: Data-link layer service definition – Type 4 elements*

IEC 61158-3-7:2007, *Industrial communication networks – Fieldbus specifications – Part 3-7: Data-link layer service definition – Type 7 elements*

IEC 61158-3-8:2007, *Industrial communication networks – Fieldbus specifications – Part 3-8: Data-link layer service definition – Type 8 elements*

IEC 61158-3-16:2007, *Industrial communication networks – Fieldbus specifications – Part 3-16: Data-link layer service definition – Type 16 elements*

IEC 61158-3-18:2007, *Industrial communication networks – Fieldbus specifications – Part 3-18: Data-link layer service definition – Type 18 elements*

IEC 61158-3-19:2019, *Industrial communication networks – Fieldbus specifications – Part 3-19: Data-link layer service definition – Type 19 elements*

IEC 61158-3-20:2014, *Industrial communication networks – Fieldbus specifications – Part 3-20: Data-link layer service definition – Type 20 elements*

IEC 61158-3-24:2014, *Industrial communication networks – Fieldbus specifications – Part 3-24: Data-link layer service definition – Type 24 elements*

IEC 61158-4-1:2014, *Industrial communication networks – Fieldbus specifications – Part 4-1: Data-link layer protocol specification – Type 1 elements*

IEC 61158-4-2:2019, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*

IEC 61158-4-3:2019, *Industrial communication networks – Fieldbus specifications – Part 4-3: Data-link layer protocol specification – Type 3 elements*

IEC 61158-4-4:2019, *Industrial communication networks – Fieldbus specifications – Part 4-4: Data-link layer protocol specification – Type 4 elements*

IEC 61158-4-7:2007, *Industrial communication networks – Fieldbus specifications – Part 4-7: Data-link layer protocol specification – Type 7 elements*

IEC 61158-4-8:2007, *Industrial communication networks – Fieldbus specifications – Part 4-8: Data-link layer protocol specification – Type 8 elements*

IEC 61158-4-16:2007, *Industrial communication networks – Fieldbus specifications – Part 4-16: Data-link layer protocol specification – Type 16 elements*

IEC 61158-4-18:2010, *Industrial communication networks – Fieldbus specifications – Part 4-18: Data-link layer protocol specification – Type 18 elements*

IEC 61158-4-19:2019, *Industrial communication networks – Fieldbus specifications – Part 4-19: Data-link layer protocol specification – Type 19 elements*

IEC 61158-4-20:2014, *Industrial communication networks – Fieldbus specifications – Part 4-20: Data-link layer protocol specification – Type 20 elements*

IEC 61158-4-24:2019, *Industrial communication networks – Fieldbus specifications – Part 4-24: Data-link layer protocol specification – Type 24 elements*

IEC 61158-5-2:2019, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61158-5-3:2014, *Industrial communication networks – Fieldbus specifications – Part 5-3: Application layer service definition – Type 3 elements*

IEC 61158-5-4:2019, *Industrial communication networks – Fieldbus specifications – Part 5-4: Application layer service definition – Type 4 elements*

IEC 61158-5-5:2014, *Industrial communication networks – Fieldbus specifications – Part 5-5: Application layer service definition – Type 5 elements*

IEC 61158-5-7:2007, *Industrial communication networks – Fieldbus specifications – Part 5-7: Application layer service definition – Type 7 elements*

IEC 61158-5-8:2007, *Industrial communication networks – Fieldbus specifications – Part 5-8: Application layer service definition – Type 8 elements*

IEC 61158-5-9:2014, *Industrial communication networks – Fieldbus specifications – Part 5-9: Application layer service definition – Type 9 elements*

IEC 61158-5-16:2007, *Industrial communication networks – Fieldbus specifications – Part 5-16: Application layer service definition – Type 16 elements*

IEC 61158-5-18:2010, *Industrial communication networks – Fieldbus specifications – Part 5-18: Application layer service definition – Type 18 elements*

IEC 61158-5-19:2019, *Industrial communication networks – Fieldbus specifications – Part 5-19: Application layer service definition – Type 19 elements*

IEC 61158-5-20:2014, *Industrial communication networks – Fieldbus specifications – Part 5-20: Application layer service definition – Type 20 elements*

IEC 61158-5-24:2014, *Industrial communication networks – Fieldbus specifications – Part 5-24: Application layer service definition – Type 24 elements*

IEC 61158-6-2:2019, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*

IEC 61158-6-3:2019, *Industrial communication networks – Fieldbus specifications – Part 6-3: Application layer protocol specification – Type 3 elements*

IEC 61158-6-4:2019, *Industrial communication networks – Fieldbus specifications – Part 6-4: Application layer protocol specification – Type 4 elements*

IEC 61158-6-5:2014, *Industrial communication networks – Fieldbus specifications – Part 6-5: Application layer protocol specification – Type 5 elements*

IEC 61158-6-7:2007, *Industrial communication networks – Fieldbus specifications – Part 6-7: Application layer protocol specification – Type 7 elements*

IEC 61158-6-8:2007, *Industrial communication networks – Fieldbus specifications – Part 6-8: Application layer protocol specification – Type 8 elements*

IEC 61158-6-9:2014, *Industrial communication networks – Fieldbus specifications – Part 6-9: Application layer protocol specification – Type 9 elements*

IEC 61158-6-16:2007, *Industrial communication networks – Fieldbus specifications – Part 6-16: Application layer protocol specification – Type 16 elements*

IEC 61158-6-18:2010, *Industrial communication networks – Fieldbus specifications – Part 6-18: Application layer protocol specification – Type 18 elements*

IEC 61158-6-19:2019, *Industrial communication networks – Fieldbus specifications – Part 6-19: Application layer protocol specification – Type 19 elements*

IEC 61158-6-20:2014, *Industrial communication networks – Fieldbus specifications – Part 6-20: Application layer protocol specification – Type 20 elements*

IEC 61158-6-24:2014, *Industrial communication networks – Fieldbus specifications – Part 6-24: Application layer protocol specification – Type 24 elements*

IEC 61784-2:2019, *Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC/IEEE 8802-3*

IEC 61784-5-2:2018, *Industrial communication networks – Profiles – Part 5-2: Installation of fieldbuses – Installation profiles for CPF 2*

IEC 61918:2018, *Industrial communication networks – Installation of communication networks in industrial premises*

IEC 62026-3, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) – Part 3: DeviceNet*

IEC 62591:2016, *Industrial communication networks – Wireless communication network and communication profiles – WirelessHART™*

ISO/IEC 8482, *Information technology – Telecommunications and information exchange between systems – Twisted pair multipoint interconnections*

ISO/IEC 8802-2:1998, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control*

ISO/IEC/IEEE 8802-3:2017, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Standard for Ethernet*

ISO/IEC 15802-3, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Common specifications – Part 3: Media Access Control (MAC) Bridges*

ISO 15745-3:2003, *Industrial automation systems and integration – Open systems application integration framework – Part 3: Reference description for IEC 61158-based control systems*

ANSI TIA/EIA-485-A:1998, *Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems*

IETF RFC 768, *User Datagram Protocol*. Available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 791, *Internet Protocol*. Available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 792, *Internet Control Message Protocol*. Available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 793, *Transmission Control Protocol*. Available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 826, *Ethernet Address Resolution Protocol*. Available at <<http://www.ietf.org>>

IETF RFC 894, *A standard for the Transmission of IP Datagrams over Ethernet Networks*. Available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 1112, *Host Extensions for IP Multicasting*. Available at <<http://www.ietf.org>>

IETF RFC 1122, *Requirements for Internet Hosts – Communication Layers*. Available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 1123, *Requirements for Internet Hosts – Application and Support*. Available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 1127, *A Perspective on the Host Requirements RFCs*. Available at <<http://www.ietf.org>> [viewed 2018-09-03]

IETF RFC 2236, *Internet Group Management Protocol, Version 2*. Available at <<http://www.ietf.org>> [viewed 2018-09-03]

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

3.1 Terms and definitions

For the purposes of this document, all terms and definitions provided in the IEC 61158 series apply.

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

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

3.2 Abbreviations and symbols

3.2.1 IEC 61158 abbreviations and symbols

For the purposes of this profile, all abbreviations and symbols defined in the IEC 61158 series apply. The following abbreviations, found within the IEC 61158 series, are repeated here for use by those who wish to understand the general structure of this International Standard without referring to the IEC 61158 series.

AL	Application layer
APDU	Application protocol data unit
AR	Application relationship
ASE	Application service element
DL-	Data-link layer (as a prefix)
DLL	Data-link layer
DLSDU	Data-link service data unit
PhL	Physical layer
TPDU	Transport protocol data unit

3.2.2 Other abbreviations and symbols

CE	"Conformité Européenne" (i.e., "European Conformity")
CP	communication profile
CPF	communication profile family
DP-V0	PROFIBUS DP version 0
DP-V1	PROFIBUS DP version 1
EMC	electro-magnetic compatibility
IDN	identification number
IP	internet protocol
IS	intrinsically safe (as an adjective) intrinsic safety (as a noun)
ISP	international standardized profiles
IV	initialization vector
MAU	medium attachment unit
PPDU	presentation protocol data unit
RS 485	MAU according to ANSI TIA/EIA-485-A
RS 485-IS	MAU according to ANSI TIA/EIA-485-A and applicable to IS
TCP	terminal control protocol
UDP	user datagram protocol

3.3 Conventions

3.3.1 Conventions common to all layers

3.3.1.1 (Sub)clause selection tables

(Sub)clause selection for all layers is defined in tables, as shown in Table 2 and Table 3. The selected base specifications are indicated just before the selection table(s). Selection is done at the highest (sub)clause level possible to define the profile selection unambiguously.

Table 2 – Layout of profile (sub)clause selection tables

Clause	Header	Presence	Constraints

Table 3 – Contents of (sub)clause selection tables

Column	Text	Meaning
Clause	<#>	(sub)clause number of the base specifications
	Next subclauses	any following subclauses of the same level up to the last subclause
	Next clauses	any following clauses up to the last clause of the base specification
	Next annexes	any following annexes up to the last annex of the base specification
Header	<text>	(sub)clause title of the base specifications
Presence	NO	This (sub)clause is not included in the profile
	YES	This (sub)clause is fully (100 %) included in the profile in this case no further detail is given
	—	Presence is defined in the following subclauses
	Partial	Parts of this (sub)clause is included in the profile
Constraints	See <#>	Constraints/remarks are defined in the given subclause, table or figure of this profile document
	—	No constraints other than given in the reference document (sub)clause, or not applicable
	<text>	The text defines the constraint directly, for longer text, table footnotes or table notes may be used

If sequences of (sub)clauses do not match the profile, then the numbers are concatenated.

EXAMPLE 1 Concatenated subclauses

3.4 – 3.7	—	NO	—
-----------	---	----	---

EXAMPLE 2 Concatenated clauses up to the last clause

Next clauses	—	NO	—
--------------	---	----	---

EXAMPLE 3 Concatenated annexes up to the last annex

Next annexes	—	NO	—
--------------	---	----	---

3.3.1.2 Service selection tables

If selection of services is defined in a table, the format of Table 4 is used. The table identifies the selected services and includes service constraints, as explained in Table 5.

Table 4 – Layout of service selection tables

Service ref.	Service name	Usage	Constraint

Table 5 – Contents of service selection tables

Column	Text	Meaning
Service ref.	<#>	(sub)clause number of the base specifications where the service is defined
	—	Not applicable
Service name	<text>	The name of the service
Usage	M	Mandatory
	O	Optional
	—	Service is never used
Constraints	See <#>	Constraints/remarks are defined in the given subclause, table or figure of this profile document
	—	No constraints other than given in the reference document (sub)clause, or not applicable
	<text>	The text defines the constraint directly, for longer text table footnotes or table notes may be used

If selection of service parameters is defined in a table, the format of Table 6 is used. Each table identifies the selected parameters and includes parameter constraints, as explained in Table 7.

Table 6 – Layout of parameter selection tables

Parameter ref.	Parameter name	Usage	Constraint

Table 7 – Contents of parameter selection tables

Column	Text	Meaning
Parameter ref.	<#>	(sub)clause number of the base specifications where the service is defined
	—	Not applicable
Parameter name	<text>	The name of the service parameter
Usage	M	Mandatory
	O	Optional
	—	Attribute is never present
Constraints	See <#>	Constraints/remarks are defined in the given subclause, table or figure of this profile document
	—	No constraints other than given in the reference document (sub)clause, or not applicable
	<text>	The text defines the constraint directly, for longer text table footnotes or table notes may be used

3.3.2 Physical layer

No additional conventions are defined.

3.3.3 Data-link layer

3.3.3.1 Service profile conventions

No additional conventions are defined.

3.3.3.2 Service and parameter selections

These are described using the common conventions, see 3.3.1.2.

3.3.4 Application layer

3.3.4.1 Service profile conventions

ASE and class selection is described using (sub)clause selection tables, see 3.3.1.1. If the usage of selected ASE and classes is further constrained, this is specified in the profile (e.g. an optional item of the base standard is mandatory in the profile).

If selection of class attributes is defined in a table, the format of Table 8 is used. The table identifies the selected class attributes and includes their constraints, as explained in Table 9.

Table 8 – Layout of class attribute selection tables

Attribute	Attribute Name	Usage	Constraint

Table 9 – Contents of class attribute selection tables

Column	Text	Meaning
Attribute	<#>	Attribute number of the base specification class
	—	Not applicable
Attribute Name	<text>	The name of the attribute
Usage	M	Mandatory
	O	Optional
	—	Attribute is never present
Constraints	See <#>	Constraints/remarks are defined in the given subclause, table or figure of this profile document
	—	No constraints other than given in the reference document (sub)clause, or not applicable
	<text>	The text defines the constraint directly, for longer text table footnotes or table notes may be used

3.3.4.2 Service and parameter selections

These are described using the common conventions, see 3.3.1.2.

4 Conformance to communication profiles

Each communication profile within this International Standard includes part of the IEC 61158 series. It may also include parts of other standards or international specifications.

A statement of compliance to a Communication Profile Family (CPF) of this International Standard shall be stated² as either

Compliance to IEC 61784-1:2019³ CPF n <Type>

or

Compliance to IEC 61784-1 (Ed.5.0) CPF n <Type>

and a statement of compliance to a Communication Profile (CP) of this International Standard shall be stated as either

Compliance to IEC 61784-1:2019³ CP n/n <Type>

or

Compliance to IEC 61784-1 (Ed.5.0) CP n/n <Type>

where the Type within the angle brackets < > is optional and the angle brackets are not to be included.

Product Standards shall not include any Conformity Assessment aspects (including QM provisions), neither normative nor informative, other than provisions for product testing (evaluation and examination).

² In accordance with ISO/IEC Directives.

³ The date should not be used when the edition number is used.

5 Communication Profile Family 1 (FOUNDATION™ fieldbus⁴)

5.1 General overview

Communication Profile Family 1 defines profiles based on IEC 61158-2, IEC 61158-3-1, IEC 61158-4-1 physical and data-link protocol Type 1, IEC 61158-5-9 and IEC 61158-6-9 application protocol Type 9, and IEC 61158-5-5 and IEC 61158-6-5 application protocol Type 5, and on other standards. (See Table 10.)

The FOUNDATION Fieldbus family of protocols consists primarily of two distinct protocol sets, known generically (for historical reasons) as H1 and HSE. The H1 profiles are a subset of IEC 61158 Type 1 physical and data-link and Type 9 application services and protocols, and include both wire-media and fiber-media physical layers operating at 31,25 kbit/s. The HSE profiles are based on use of the ISO/IEC/IEEE 8802-3 (Ethernet-like) MAC and physical layers, and on use of standard internet network and transport layer protocols; they use the Type 5 application services and protocols.

A third profile set has been developed within the Fieldbus Foundation, but is not in current or planned use. It is included in this profile because it provides a migration path to CPF 1 from some of the CPF 5 protocols, and exclusion from this International Standard could inhibit that migration.

Table 10 – CPF 1: overview of profile sets

Layer	Profile 1/1 (H1)	Profile 1/2 (HSE)	Profile 1/3 (H2)
Application	IEC 61158-5-9, IEC 61158-6-9	IEC 61158-5-5, IEC 61158-6-5	IEC 61158-5-9, IEC 61158-6-9
Transport	—	RFC 768, RFC 793	—
Network	—	RFC 791	—
Data-link	IEC 61158-3-1, IEC 61158-4-1	ISO/IEC/IEEE 8802-3, ISO/IEC 8802-2,	IEC 61158-3-1, IEC 61158-4-1
Physical	IEC 61158-2, 31,25 kbit/s, primarily Type 1	any of ISO/IEC/IEEE 8802-3	Type 1 of IEC 61158-2

NOTE See Clause A.1 for an overview of FOUNDATION Fieldbus communications concepts.

5.2 Profile 1/1 (FOUNDATION™ H1)

5.2.1 Physical layer

5.2.1.1 Communicating devices

5.2.1.1.1 Introduction

Table 11 specifies the IEC 61158-2 PhL selection for a communicating device and its MAU(s).

⁴ Foundation™ fieldbus is the trade name of the non-profit consortium “Fieldbus Foundation”. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name Foundation Fieldbus. Use of the trade name Foundation Fieldbus requires permission of the trade name holder.

Table 11 – CP 1/1: PhL selection for communicating devices and their MAUs

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2	Type 1: Terms and definitions	YES	—
Next subclauses	—	NO	—
4	Symbols and abbreviations	—	—
4.1	Symbols	—	—
4.1.1	Type 1: Symbols	YES	—
4.1.2 – 4.1.11	—	NO	—
4.2	Abbreviations	—	—
4.2.1	Type 1: Abbreviations	YES	—
Next subclauses	—	NO	—
5	Data-link layer – Physical Layer interface	—	—
5.1	General	Partial	Used when applicable
5.2	Type 1: Required services	YES	—
Next subclauses	—	NO	—
6	Systems Management – Physical Layer interface	—	—
6.1	General	Partial	Used when applicable
6.2	Type 1: Systems Management – Physical Layer interface	YES	—
Next subclauses	—	NO	—
7	DCE Independent Sublayer (DIS)	—	—
7.1	General	Partial	Used when applicable
7.2	Type 1: DIS	YES	—
Next subclauses	—	NO	—
8	DTE – DCE interface	—	—
8.1	General	Partial	Used when applicable
8.2	Type 1: DTE – DCE interface	YES	—
Next subclauses	—	NO	—
9	Medium Dependent Sublayer (MDS)	—	—
9.1	General	Partial	Used when applicable
9.2	Type 1: MDS: Wire and optical media	YES	—

Clause	Header	Presence	Constraints
Next subclauses	—	NO	—
10	MDS – MAU interface	—	—
10.1	General	Partial	Used when applicable
10.2	Type 1: MDS – MAU interface: wire and optical media	YES	—
Next subclauses	—	NO	—
11	Type 1 and 7: Medium Attachment Unit: voltage mode, linear-bus-topology 150 Ω twisted-pair wire medium	NO	—
12	Type 1 and 3: Medium Attachment Unit: 31,25 kbit/s, voltage-mode with low-power option, bus- and tree-topology, 100 Ω wire medium	YES	See 5.2.1.1.2
13 – 15	—	NO	—
16	Type 1: Medium Attachment Unit: 31,25 kbit/s, single-fiber optical medium	YES	See 5.2.1.1.2
17 – 20	—	NO	—
21	Type 3: Medium Attachment Unit: Synchronous transmission, 31,25 kbit/s, voltage mode, wire medium	YES	See 5.2.1.1.2 (denigrated)
Next clauses	—	NO	—
Annex A	Type 1: Connector specification	—	—
A.1	Internal Connector for wire medium	YES	a
A.2	External Connectors for wire medium	YES	a
A.3	External Connectors for optical medium	Partial	b
Annex B	Type 1: Cable specifications and trunk and spur lengths for the 31,25 kbit/s voltage-mode MAU	YES	—
Annex C	Types 1 and 7: Optical passive stars	Partial	b
Annex D	Types 1 and 7: Star topology	Partial	b
Annex E	Type 1: Alternate fibers	Partial	b
Next annexes	—	NO	—
^a Connector is optional for use with shielded or twisted-pair 100 Ω wire media. ^b Single fiber specifications are optional for use with single fiber media.			

5.2.1.1.2 MAU and device classes

Each MAU is classified according to its characteristics when interfacing to its associated medium, as specified in Table 12. For devices with a single attached MAU, whether separate or integral, the MAU class is also considered to be the device class. The selection of the proper clause of IEC 61158-2, Clause 12 or Clause 16, is based on the MAU class for which the MAU, and sometimes the associated device, are designed. The selection of Clause 21 is denigrated – not recommended for new designs – because the alternative clause, Clause 12, permits devices to lower their power consumption during periods of non-transmission.

This profile also lists recommendations, which are not mandatory for implementation and/or not specified in IEC 61158-2, but are included to achieve interoperability amongst devices conforming to this profile. Specifically, 5.2.1.1.3.3 applies to each MAU, as does 5.2.1.1.3.4 for MAUs meeting IS rules.

Table 12 – CP 1/1: PhL classification of MAUs and attached devices

Attribute	Attribute value	CP 1/1 MAU class										
		111	112	113	114	115	116			511	512	411
Connected medium	100 Ω shielded or twisted wire pair	X	X	X	X	X	X			X	X	
	Single bidirectional multimode fiber											X
Device powered from medium	Completely (see NOTE 2, 3)	X		X		X				X		
	Partially; not completely (see NOTE 2, 4)		X		X		X				X	
	Not at all											X
Intrinsic Safety construction rules	Not specified by this profile											X
	None			X	X							
	Entity model (see IEC 60079-11)	X	X									
	Energy Limited (Ex nL) or Nonincendive Field Wiring (NIFW)					X	X			X	X	
	FISCO model (see IEC 60079-11 and IEC 60079-25)											
Relevant MAU and device clause of IEC 61158-2	Clause 16 (see Table 13)											X
	Clause 12 (see Table 14)	X	X	X	X	X	X			X	X	
	Clause 21 (denigrated)											

NOTE 1 Low power signaling, optionally specified in Clause 12, is not included in any of these MAU types.

NOTE 2 Bus powered devices require a compatible power supply.

NOTE 3 The device does not contain a power supply, intrinsic safety barrier, galvanic isolator or terminator.

NOTE 4 The MAU needs to draw at least the equivalent of its transmit power from the medium to ensure a positive current on the medium throughout the transmit waveform (thereby keeping any polarity protection diodes in connected MAUs forward biased).

Table 13 – CP 1/1: PhL selection of Clause 16 for devices and their MAUs

Clause	Header	Presence	Constraints
16.1	General	YES	—
16.2	Transmitted bit rate	YES	—
16.3	Network specifications	NO	—
16.4	MAU transmit circuit specifications	YES	—
16.5	MAU receive circuit specifications	Partial	High-sensitivity only
16.6	Jabber inhibit	YES	—
16.7	Medium specifications	—	—
16.7.1	Connector	YES	ST or FC type connector
16.7.2	Standard test fiber	YES	The 1 m test fiber shall be used with a mode filter
16.7.3	Optical passive star	NO	—
16.7.4	Optical active star	NO	—

Table 14 – CP 1/1: PhL selection of Clause 12 for devices and their MAUs

Clause	Header	Presence	Constraints
12.1	General	YES	—
12.2	Transmitted bit rate	YES	—
12.3	Network specifications	NO	—
12.4	MAU transmit circuit specifications	YES	—
12.5	MAU receive circuit specifications	YES	See 5.2.1.1.3.2 for recommended receive filters
12.6	Jabber inhibit	YES	—
12.7	Power distribution	—	—
12.7.1	General	Partial	IEC 61158-2, Table 70, applies only to CP 1/1 device classes 121, 123 and 511. All else applies except IEC 61158-2, Table 71
12.7.2	Supply voltage	YES	—
12.7.3	Powered via signal conductors	YES	Applies only to CP 1/1 device classes 121, 123 and 511
12.7.4	Power supply impedance	NO	—
12.7.5	Powered separately from signal conductors	Partial	Applies only to CP 1/1 device class 122, 124 and 512, which do not require power on the bus. However, these devices shall be suitable for use on a powered bus. For example, a transformer-coupled device requires a DC-blocking capacitor in series with the transformer
12.7.6	Electrical isolation	YES	—
12.8	Medium specifications	—	—
12.8.1	Connector	YES	See 5.2.1.1.3.3 for labeling of the connector
12.8.2	Cable (standard test cable)	NO	—
12.8.3	Coupler	YES	—
12.8.4	Splices	NO	—
12.8.5	Terminator	NO	—
12.8.6	Shielding rules	NO	—
12.8.7	Grounding (earthing) rules	YES	—
12.9	Intrinsic safety	NO	See 5.2.1.1.3.4 for the IS device parameters for CP 1/1 device classes 121, 122, 511 and 512
12.10	Galvanic isolators	NO	—

Table 15 – Void

5.2.1.1.3 Recommended values for MAUs and their devices

5.2.1.1.3.1 Signal polarity

The signal polarity for CP 1/1 MAU classes 111 to 114 shall be the signal polarity specified in IEC 61158-2, 12.4.5.

5.2.1.1.3.2 Receive filters

The receive filters for MAU classes 111 to 114, 121 to 124, 511 and 512 should be:

- a) 1 kHz 2-pole high pass, $0,6 \leq Q \leq 1,0$;
- b) 40 kHz 2-pole low pass, $0,6 \leq Q \leq 1,0$.

5.2.1.1.3.3 Labelling

The positive (“+”) and negative (“-”) terminals shall be clearly identified on all MAUs that:

- a) do not provide automatic polarity detection, and
- b) do not use the external connectors specified in IEC 61158-2, Clause A.2.

Each device incorporating an MAU shall be labelled with the MAUs CP 1/1 class. Where a device contains multiple MAUs, the labelling shall indicate the MAUs to which it (the labelling) applies.

The apparatus marking requirements of IEC 60079-11 apply to MAU classes 111 to 114, 121 to 124, 511 and 512. The apparatus marking requirements of IEC 60079-11 and IEC 60079-25 apply to MAU classes 511 and 512.

5.2.1.1.3.4 IS device parameters

From a communications standpoint, devices of any of the CP 1/1 classes can coexist on the same fieldbus segment. However, in IS applications, device power requirements and device and component approvals shall be taken into consideration.

NOTE Bus powered devices require a compatible power supply. See 5.2.1.2.2.

The recommended IS parameters for devices meeting Entity-model IS rules are listed in Table 16.

Table 16 – CP 1/1: PhL selection of recommended IS parameters for MAU classes 111, 112, 121, 122, 511 and 512

Parameter	Recommended values	
	Entity model	FISCO model
Applicable CP 1/1 devices classes	111, 112, 121, 122	511, 512
Device approval voltage	24 V minimum	17,5 V minimum
Device approval current	250 mA minimum	380 mA minimum
Device input power	1,2 W minimum	5,32 W minimum
Device residual capacitance	≤ 5 nF	≤ 5 nF
Device residual inductance	≤ 20 μ H	≤ 10 μ H
Leakage current	(not specified)	≤ 50 μ A
IS classification	Ex ia, IIC (gas groups A & B), T4	Ex ia, IIC (gas groups A, B, C, D), T4 Ex ib, IIC (gas groups A, B, C, D), T4
Governing requirements	See IEC 60079-11	See IEC 60079-11 and IEC 60079-25

The CP 1/1 class 111, 112, 511 and 512 devices shall be designed to only sink power from the bus; i.e., these devices shall not source power to the bus. Since the CP 1/1 class 112 and 512 devices includes a separate source of power, extra precautions, such as galvanic isolation, may be required to prevent power transfer to the bus.

5.2.1.2 Wire media and related network components and considerations

5.2.1.2.1 Wire media

All components shall conform to IEC 61158-2 as shown in Table 17.

NOTE All wire media require termination. See 5.2.1.2.3.