

DIN EN 61784-1

ICS 35.160; 35.240.50

Ersatz für
DIN EN 61784-1:2011-04
Siehe Anwendungsbeginn

**Industrielle Kommunikationsnetze –
Profile –
Teil 1: Feldbusprofile
(IEC 61784-1:2014);
Englische Fassung EN 61784-1:2014, nur auf CD-ROM**

Industrial communication networks –
Profiles –
Part 1: Fieldbus profiles
(IEC 61784-1:2014);
English version EN 61784-1:2014, only on CD-ROM

Réseaux de communication industriels –
Profils –
Partie 1: Profils de bus de terrain
(CEI 61784-1:2014);
Version anglaise EN 61784-1:2014, seulement en CD-ROM

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Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2014-09-23 angenommene Europäische Norm als DIN-Norm ist 2015-02-01.

Für DIN EN 61784-1:2011-04 besteht eine Übergangsfrist bis 2017-09-23.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN EN 61784-1:2013-01.

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

Die enthaltene IEC-Publikation wurde vom SC 65C „Industrial networks“ erarbeitet.

Das IEC-Komitee hat entschieden, dass der Inhalt dieser Publikation bis zu dem Datum (stability date) unverändert bleiben soll, das auf der IEC-Website unter „<http://webstore.iec.ch>“ zu dieser Publikation angegeben ist. Zu diesem Zeitpunkt wird entsprechend der Entscheidung des Komitees die Publikation

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

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

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

Der Zusammenhang der zitierten Normen mit den entsprechenden Deutschen Normen 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 EN 61784-1 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich festlegt, und Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für viele 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.

Das Original-Dokument enthält Bilder in Farbe, die in der Papierversion in einer Graustufen-Darstellung wiedergegeben werden. Elektronische Versionen dieses Dokuments enthalten die Bilder in der originalen Farbdarstellung.

Änderungen

Gegenüber DIN EN 61784-1:2011-04 wurden folgende Änderungen vorgenommen:

- a) Aktualisierung der datierten Verweisungen auf die IEC 61158-Reihe, IEC 61784-2, IEC 61784-3-Reihe, IEC 61785-5-Reihe und durch das ganze Dokument auf die IEC 61918;
- b) neue Kommunikationsprotokollfamilie 19 hinzugefügt;

c) Auswahltablelle für die Kommunikationsprofilfamilien 1 und 9 auf den neuesten Stand gebracht.

Frühere Ausgaben

DIN 19245-1: 1991-04, 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

Nationaler Anhang NA (informativ)

1 Anwendungsbereich

Dieser Teil der IEC 61784 beschreibt eine Menge an protokollspezifischen Kommunikationsprofilen, welche primär auf der IEC 61158-Reihe basieren. Diese werden in der Entwicklung von Geräten verwendet, die in der Kommunikation der Fabrik-Produktion und -Prozesssteuerung beteiligt sind.

Jedes Profil wählt Festlegungen für den Kommunikationsprotokoll-Stack am Gerät aus. Es beinhaltet eine minimale Menge von erforderlichen Diensten am Application-Layer und Festlegungen von Auswahlmöglichkeiten in den Zwischenschichten, die durch Referenzen festgelegt sind. Wenn kein Application-Layer enthalten ist, dann ist eine minimale Menge von erforderlichen Diensten am Data-Link-Layer beschrieben. Die entsprechenden Referenzen zu den protokollspezifischen Typen sind in jeder Kommunikationsprofilfamilie oder in zugehörigen Profilen gegeben.

ANMERKUNG Alle Profile basieren auf Normen oder Normentwürfen oder internationalen Normen, die von der IEC publiziert sind, oder internationalen Standards, die von anderen Standardisierungsinstituten eingeführt wurden.

Die Struktur der Kommunikationsprofilfamilien ist in Bild 1 festgelegt.

Subset other standards = Untermenge anderer Normen

Communication profile family n= Kommunikationsprofilfamilie n

Bild 1 – Kommunikationsprofilfamilien und Profile

Jedes Profil wählt eine bestimmte konsistente und kompatible Untermenge von Diensten und Protokollen aus der Gesamtmenge aus, diese ist in IEC 61158 beschrieben und geformt. Für die ausgewählte Untermenge von Diensten und Protokollen beschreibt das Profil auch jede mögliche oder notwendige Beschränkung in den Parameterwerten.

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

Tabelle 1 – Beziehung der Kommunikationsprofilfamilien zu den Typnummern

IEC 61784-1 Inhalte			Gemäß Typ IEC 61158
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 aus Mangel an Marktrelevanz entfernt	6
8	12	CC-Link	18
9	13	HART	20
16	14	SERCOS	16
19	15	MECHATROLINK	24
ANMERKUNG 1 Siehe den speziellen CPF-Abschnitt für Informationen des entsprechenden Markeninhabers. ANMERKUNG 2 CP 1/1 hat eine herabgesetzte PhL-Geräteprofil-Unterklasse, welche eine Variante von Typ 3 PhL verwendet. ANMERKUNG 3 CP 3/2 hat eine herabgesetzte PhL-Geräteprofil-Unterklasse, welche eine Variante von Typ 1 PhL verwendet. ANMERKUNG 4 Andere CPFs können in IEC 61784-2 gefunden werden.			

3.1 Begriffe

Für die Anwendung dieses Dokuments gelten die Begriffe nach Reihe IEC 61158.

English Version

Industrial communication networks - Profiles - Part 1: Fieldbus
profiles
(IEC 61784-1:2014)

Réseaux de communication industriels - Profils - Partie 1:
Profils de bus de terrain
(CEI 61784-1:2014)

Industrielle Kommunikationsnetze - Profile - Teil 1:
Feldbusprofile
(IEC 61784-1:2014)

This European Standard was approved by CENELEC on 2014-09-23. 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.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of document 65C/760/FDIS, future edition 4 of IEC 61784-1, prepared by IEC/TC 65C "Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61784-1:2014.

The following dates are fixed:

- latest date by which the document has (dop) 2015-06-23
to be implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2017-09-23
standards conflicting with the
document have to be withdrawn

This document supersedes EN 61784-1:2010.

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

Endorsement notice

The text of the International Standard IEC 61784-1:2014 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	Harmonised as EN 60079-14.
IEC 60793 (Series)	NOTE	Harmonised as EN 60793 (Series).
IEC 61131-3	NOTE	Harmonised as EN 61131-3.
IEC 61158-1	NOTE	Harmonised as EN 61158-1.
IEC 61800-7-204	NOTE	Harmonised as EN 61800-7-204.
ISO/IEC 7498-3	NOTE	Harmonised as EN ISO/IEC 7498-1.

CONTENTS

INTRODUCTION.....	16
1 Scope.....	17
2 Normative references	18
3 Definitions	22
3.1 Terms and definitions	22
3.2 Abbreviations and symbols	22
3.2.1 IEC 61158 abbreviations and symbols	22
3.2.2 Other abbreviations and symbols	23
3.3 Conventions.....	23
3.3.1 Conventions common to all layers.....	23
3.3.2 Physical layer.....	25
3.3.3 Data-link layer.....	25
3.3.4 Application layer.....	26
4 Conformance to communication profiles	26
5 Communication Profile Family 1 (FOUNDATION™ fieldbus)	27
5.1 General overview	27
5.2 Profile 1/1 (FOUNDATION™ H1).....	28
5.2.1 Physical layer.....	28
5.2.2 Data-link layer.....	46
5.2.3 Application layer.....	116
5.3 Profile 1/2 (FOUNDATION™ HSE)	118
5.3.1 Physical layer.....	118
5.3.2 Data-link layer.....	118
5.3.3 Network layer	118
5.3.4 Transport layer.....	118
5.3.5 Application layer.....	118
5.4 Profile 1/3 (FOUNDATION™ H2).....	119
5.4.1 Physical layer.....	119
5.4.2 Data-link layer.....	122
5.4.3 Application layer.....	122
6 Communication Profile Family 2 (CIP™).....	122
6.1 General overview	122
6.2 Profile 2/1 (ControlNet).....	123
6.2.1 Physical layer.....	123
6.2.2 Data-link layer.....	124
6.2.3 Application layer.....	126
6.3 Profile 2/2 (EtherNet/IP)	127
6.3.1 Physical layer.....	127
6.3.2 Data-link layer.....	128
6.3.3 Application layer.....	129
6.4 Profile 2/3 (DeviceNet)	131
6.4.1 Physical layer.....	131
6.4.2 Data-link layer.....	131
6.4.3 Application layer.....	133
7 Communication Profile Family 3 (PROFIBUS & PROFINET)	135

7.1	General overview	135
7.2	Profile 3/1 (PROFIBUS DP)	137
7.2.1	Physical layer	137
7.2.2	Data-link layer.....	139
7.2.3	Application layer	163
7.3	Profile 3/2 (PROFIBUS PA)	222
7.3.1	Physical layer	222
7.3.2	Data-link layer.....	227
7.3.3	Application layer	240
7.4	Profile 3/3 (PROFINET CBA)--- <i>Void</i>	240
8	Communication Profile Family 4 (P-NET®)	240
8.1	General overview	240
8.2	Profile 4/1 (P-NET RS-485)	241
8.2.1	Physical layer	241
8.2.2	Data-link layer.....	242
8.2.3	Application layer	242
9	Communication Profile Family 5 (WorldFIP®)	243
9.1	General overview	243
9.2	Profile 5/1 (WorldFIP).....	244
9.2.1	Physical layer	244
9.2.2	Data-link layer.....	246
9.2.3	Application layer	248
9.3	Profile 5/2 (WorldFIP).....	254
9.3.1	Physical layer	254
9.3.2	Data-link layer.....	254
9.3.3	Application layer	254
9.4	Profile 5/3 (WorldFIP).....	260
9.4.1	Physical layer	260
9.4.2	Data-link layer.....	260
9.4.3	Application layer	260
10	Communication Profile Family 6 (INTERBUS®)	261
10.1	General overview	261
10.2	Profile 6/1	262
10.2.1	Physical layer	262
10.2.2	Data-link layer.....	264
10.2.3	Application layer	266
10.3	Profile 6/2	267
10.3.1	Physical layer	267
10.3.2	Data-link layer.....	268
10.3.3	Application layer	269
10.4	Profile 6/3	270
10.4.1	Physical layer	270
10.4.2	Data-link layer.....	270
10.4.3	Application layer	271
11	Communication Profile Family 7 – <i>Void</i>	272
12	Communication Profile Family 8 (CC-Link)	273
12.1	General overview	273
12.1.1	General.....	273

12.1.2	Profile 8/1	273
12.1.3	Profile 8/2	274
12.1.4	Profile 8/3	274
12.2	Profile 8/1	274
12.2.1	Physical layer.....	274
12.2.2	Data-link layer.....	275
12.2.3	Application layer.....	278
12.3	Profile 8/2	281
12.3.1	Physical layer.....	281
12.3.2	Data-link layer.....	281
12.3.3	Application layer.....	281
12.4	Profile 8/3	281
12.4.1	Physical layer.....	281
12.4.2	Data-link layer.....	282
12.4.3	Application layer.....	285
13	Communication Profile Family 9 (HART®).....	288
13.1	General Overview.....	288
13.2	Profile 9/1, HART®	288
13.2.1	Physical layer.....	288
13.2.2	Data-link layer.....	289
13.2.3	Application layer.....	290
13.3	Profile 9/2, WirelessHART®.....	291
14	Communication Profile Family 16 (SERCOS).....	291
14.1	General overview	291
14.2	Profile 16/1 (SERCOS I).....	291
14.2.1	Physical layer selection	291
14.2.2	Data-link layer.....	292
14.2.3	Application layer.....	293
14.3	Profile 16/2 (SERCOS II).....	293
14.3.1	Physical layer.....	293
14.3.2	Data-link layer.....	294
14.3.3	Application layer.....	295
15	Communication Profile Family 19 (MECHATROLINK).....	295
15.1	General overview	295
15.2	Profile 19/1 (MECHATROLINK-II)	295
15.2.1	Physical layer selection	295
15.2.2	Data-link layer.....	297
15.2.3	Application layer.....	306
15.3	Profile 19/2 (M-III)	312
15.3.1	Physical layer.....	312
15.3.2	Data-link layer.....	312
15.3.3	Application layer.....	323
	Annex A (informative) Communication concepts	328
A.1	CPF 1 (FOUNDATION Fieldbus) communication concepts.....	328
A.1.1	Overview.....	328
A.1.2	Physical layer characteristics.....	328
A.1.3	Data-link layer characteristics.....	328
A.1.4	Application layer characteristics.....	329

A.1.5	Management characteristics	329
A.2	CPF 2 (CIP) communication concepts	329
A.2.1	Overview	329
A.2.2	CIP common characteristics	329
A.2.3	ControlNet	330
A.2.4	EtherNet/IP	331
A.2.5	DeviceNet	332
A.3	CPF 3 (PROFIBUS & PROFINET) communication concepts	332
A.3.1	Basic characteristics	332
A.3.2	Physical layer profiles	333
A.3.3	Communication feature list (GSD)	333
A.3.4	PROFINET---Void	334
A.4	CPF 4 (P-NET) communication concepts.....	334
A.5	CPF 5 (WorldFIP) communication concepts.....	335
A.5.1	Physical layer characteristics	335
A.5.2	Data-link layer characteristics.....	336
A.5.3	Application layer characteristics	336
A.6	CPF 6 (INTERBUS) communication concepts.....	336
A.7	CPF 8 (CC-LINK) communication concepts	338
A.7.1	Basic characteristics	338
A.7.2	Variants	338
A.8	CPF 9 (HART) communication concepts.....	338
A.9	CPF 16 (SERCOS) communication concepts.....	339
Annex B (informative)	Added value of IEC 61784-1	341
Bibliography		342
Annex ZA (normative)		344
Figure 1 – Communication profile families and profiles		17
Figure 2 – Example optical power budget for a 100/140 µm fiber system with a 16/16 optical passive star coupler.....		45
Figure 3 – CP 3/2 Slave devices usable in applications		137
Figure A.1 – Ring structure		339
Figure A.2 – Topology example.....		340
Table 1 – Relations of Communication Profile Families to type numbers		18
Table 2 – Layout of profile (sub)clause selection tables		23
Table 3 – Contents of (sub)clause selection tables		24
Table 4 – Layout of service selection tables		24
Table 5 – Contents of service selection tables.....		25
Table 6 – Layout of parameter selection tables.....		25
Table 7 – Contents of parameter selection tables		25
Table 8 – Layout of class attribute selection tables.....		26
Table 9 – Contents of class attribute selection tables		26
Table 10 – CPF 1: overview of profile sets		28
Table 11 – CP 1/1: PhL selection for communicating devices and their MAUs		28

Table 12 – CP 1/1: PhL classification of MAUs and attached devices	30
Table 13 – CP 1/1: PhL selection of Clause 16 for devices and their MAUs	31
Table 14 – CP 1/1: PhL selection of Clause 12 for devices and their MAUs	31
Table 15 – Void	32
Table 16 – CP 1/1: PhL selection of recommended IS parameters for MAU classes 111, 112, 121, 122, 511 and 512	33
Table 17 – CP 1/1: PhL selection for media components.....	34
Table 18 – CP 1/1: PhL selection of imperative IS parameters for media in FISCO systems..	35
Table 19 – CP 1/1: PhL selection for power supplies	36
Table 20 – CP 1/1: PhL selection of power supply types	37
Table 21 – CP 1/1: PhL selection of permissible output voltage and IS parameters for FISCO power supplies	37
Table 22 – CP 1/1: PhL selection for terminators	38
Table 23 – CP 1/1: PhL selection of IS parameters for terminators.....	39
Table 24 – CP 1/1: PhL selection of Clause 12 for intrinsic safety barriers	40
Table 25 – CP 1/1: PhL selection of recommended IS parameters for intrinsic safety barriers and galvanic isolators (Entity model only).....	41
Table 26 – CP 1/1: PhL selection of Clause 12 for intrinsically safe galvanic isolators	42
Table 27 – CP 1/1: PhL selection of Clause 15, recommended optical fiber types.....	43
Table 28 – CP 1/1: PhL selection of passive star couplers, recommended maximum insertion loss 43	
Table 29 – CP 1/1: PhL selection of active star couplers.....	44
Table 30 – CP 1/1: Optical power budget considerations	44
Table 31 – CP 1/1: DLL service selection	46
Table 32 – CP 1/1: DLL service selection of Clause 5.....	46
Table 33 – CP 1/1: DLL service selection of 5.4.....	46
Table 34 – CP 1/1: DLL service selection of 5.4.1.....	47
Table 35 – CP 1/1: DLL service selection of 5.4.3.....	47
Table 36 – CP 1/1: DLL service selection of 5.4.6.....	48
Table 37 – CP 1/1: DLL service selection of Clause 6.....	49
Table 38 – CP 1/1: DLL service selection of the summary of 6.3, DL-connection QoS.....	50
Table 39 – CP 1/1: DLL service selection of figures 9 to 14 of 6.4.....	50
Table 40 – CP 1/1: DLL service selection of 6.5.....	51
Table 41 – CP 1/1: DLL service selection: replacement for Table 13 of 6.5.....	52
Table 42 – CP 1/1: DLL service selection of 6.5, replacement for Table 14.....	53
Table 43 – CP 1/1: DLL service selection of 6.5 for use of addresses for peer DLC	53
Table 44 – CP 1/1: DLL service selection of 6.5 for use of addresses for multipeer DLC connect request at publisher	53
Table 45 – CP 1/1: DLL service selection of 6.5 for use of addresses for multipeer DLC connect request at subscriber	53
Table 46 – CP 1/1: DLL service selection of 6.6.....	54
Table 47 – CP 1/1: DLL service selection: replacement for Table 15 of 6.6.....	54
Table 48 – CP 1/1: DLL service selection of 6.7.....	55
Table 49 – CP 1/1: DLL service selection of 6.7, replacement for Table 16.....	55
Table 50 – CP 1/1: DLL service selection of 6.7, replacement for Table 17.....	55

Table 51 – CP 1/1: DLL service selection of 6.7, replacement for Table 18	56
Table 52 – CP 1/1: DLL service selection of Clause 7.....	56
Table 53 – CP 1/1: DLL service selection of 7.5, replacement for Table 23	57
Table 54 – CP 1/1: DLL service selection of Clause 8.....	58
Table 55 – CP 1/1: DLL service selection of 8.5, replacement for Table 28	58
Table 56 – CP 1/1: DLL protocol selection.....	59
Table 57 – CP 1/1: DLL protocol selection of Clause 4	59
Table 58 – CP 1/1: DLL protocol selection of 4.3	60
Table 59 – CP 1/1: DLL protocol selection of 4.3.2.1 for use of link designators	60
Table 60 – CP 1/1: DLL protocol selection of 4.3.2.2 for use of node designators.....	60
Table 61 – CP 1/1: DLL protocol selection of 4.3.3.1 for predefined flat non-local DL-addresses	61
Table 62 – CP 1/1: DLL protocol selection of 4.3.3.2 for predefined flat link-local DL-addresses	61
Table 63 – CP 1/1: DLL protocol selection of 4.3.3.3 for predefined node-local DL-addresses.....	61
Table 64 – CP 1/1: DLL protocol selection of 4.7	62
Table 65 – CP 1/1: DLL protocol selection of 4.7.4	63
Table 66 – CP 1/1: DLL protocol selection of 4.7.5	64
Table 67 – CP 1/1: DLL protocol selection of Clause 6	65
Table 68 – CP 1/1: DLL protocol selection, replacement for Table 10 of 6.0	66
Table 69 – CP 1/1: DLL protocol selection of 6.5	67
Table 70 – CP 1/1: DLL protocol selection of 6.7	70
Table 71 – CP 1/1: DLL protocol selection of 6.8	74
Table 72 – CP 1/1: DLL protocol selection of 6.11	75
Table 73 – CP 1/1: DLL protocol selection of 6.12	75
Table 74 – CP 1/1: DLL protocol selection of 6.15	76
Table 75 – CP 1/1: DLL protocol selection of 6.20	77
Table 76 – CP 1/1: DLL protocol selection of Clause 7	78
Table 77 – CP 1/1: DLL protocol selection of 7.4	79
Table 78 – CP 1/1: DLL protocol selection of Clause 8	80
Table 79 – CP 1/1: DLL protocol selection of 8.2	81
Table 80 – CP 1/1: DLL protocol selection of 8.2.2	91
Table 81 – CP 1/1: DLL protocol selection of 8.3	103
Table 82 – CP 1/1: DLL protocol selection of 8.4	104
Table 83 – CP 1/1: DLL protocol selection of Clause 9	105
Table 84 – CP 1/1: DLL protocol selection of 9.3	106
Table 85 – CP 1/1: DLL protocol selection of 9.3.5	108
Table 86 – CP 1/1: DLL protocol selection of 9.3.5.2.2, replacement for element encoding.	109
Table 87 – CP 1/1: DLL protocol selection of Clause 10.....	109
Table 88 – CP 1/1: DLL protocol selection of 10.2	110
Table 89 – CP 1/1: DLL protocol selection of 10.3	111
Table 90 – CP 1/1: DLL protocol selection of 10.3.7, specification of errors.....	113
Table 91 – CP 1/1: DLL protocol selection of 10.4	114

Table 92 – CP 1/1: DLL protocol selection of 10.5	115
Table 93 – CP 1/1: DLL protocol selection of 10.6	116
Table 94 – CP 1/1: AL service selection	116
Table 95 – CP 1/1: AL data type selection of Clause 4.....	117
Table 96 – CP 1/1: AL protocol selection	117
Table 97 – CP 1/2: AL service selection	118
Table 98 – CP 1/2: AL protocol selection	119
Table 99 – CP 1/3: PhL selection for H2 devices	120
Table 100 – CP 1/3: PhL selection for H2 media and related components	121
Table 101 – CPF 2: overview of profile sets.....	123
Table 102 – CP 2/1: PhL selection	123
Table 103 – CP 2/1: DLL service selection	125
Table 104 – CP 2/1: DLL protocol selection	125
Table 105 – CP 2/1: DLL protocol selection of management objects.....	126
Table 106 – CP 2/1: AL service selection	126
Table 107 – CP 2/1: AL protocol selection	127
Table 108 – CP 2/2: DLL protocol selection	128
Table 109 – CP 2/2: DLL protocol selection of management objects.....	129
Table 110 – CP 2/2: AL service selection	129
Table 111 – CP 2/2: AL protocol selection	130
Table 112 – CP 2/3: DLL protocol selection	132
Table 113 – CP 2/3: DLL protocol selection of management objects.....	133
Table 114 – CP 2/3: AL service selection	134
Table 115 – CP 2/3: AL protocol selection	135
Table 116 – CPF 3: overview of profile sets.....	136
Table 117 – CP 3/1: PhL selection	137
Table 118 – CP 3/1: PhL selection of Clause 3	139
Table 119 – CP 3/1: PhL selection of Clause 4	139
Table 120 – CP 3/1: General DLL service selection	139
Table 121 – CP 3/1: DLL service selection for DP-V0 master (class 1)	140
Table 122 – CP 3/1: DLM service selection for DP-V0 master (class 1)	141
Table 123 – CP 3/1: DLL service selection for DP-V1 master (class 1)	142
Table 124 – CP 3/1: DLM service selection for DP-V1 master (class 1)	143
Table 125 – CP 3/1: DLL service selection for DP-V0 master (class 2)	143
Table 126 – CP 3/1: DLL service selection for DP-V1 master (class 2)	144
Table 127 – CP 3/1: DLL service selection for DP-V0 slave	146
Table 128 – CP 3/1: DLM service selection for DP-V0 slave.....	147
Table 129 – CP 3/1: DLL service selection for DP-V1 slave	148
Table 130 – CP 3/1: DLM service selection for DP-V1 slave.....	149
Table 131 – CP 3/1: General DLL protocol selection	150
Table 132 – CP 3/1: DLL protocol selection of Clause 5.....	150
Table 133 – CP 3/1: DLL protocol selection of Clause 6.....	151
Table 134 – CP 3/1: DLL protocol selection of Clause 7.....	151

Table 135 – CP 3/1: Time variable selection for DP-V0 master (class 1)	152
Table 136 – CP 3/1: Timer and counter selection for DP-V0 master (class 1)	153
Table 137 – CP 3/1: DLPDU selection for DP-V0 master (class 1).....	153
Table 138 – CP 3/1: MAC state selection for DP-V0 master (class 1)	154
Table 139 – CP 3/1: Time selection for DP-V1 master (class 1)	155
Table 140 – CP 3/1: Timer and counter selection for DP-V1 master (class 1)	156
Table 141 – CP 3/1: DLPDU selection for DP-V1 master (class 1).....	156
Table 142 – CP 3/1: MAC state selection for DP-V1 master (class 1)	157
Table 143 – CP 3/1: CS protocol selection for DP-V1 master (class 1)	157
Table 144 – CP 3/1: Time selection for DP-V1 master (class 2)	158
Table 145 – CP 3/1: Timer and counter selection for DP-V1 master (class 2)	158
Table 146 – CP 3/1: DLPDU selection for DP-V1 master (class 2).....	159
Table 147 – CP 3/1: Time selection for DP-V0 slave.....	159
Table 148 – CP 3/1: Timer and counter selection for DP-V0 slave.....	160
Table 149 – CP 3/1: DLPDU selection for DP-V0 slave	160
Table 150 – CP 3/1: MAC state selection for DP-V0 slave	161
Table 151 – CP 3/1: Time selection for DP-V1 slave.....	161
Table 152 – CP 3/1: Timer and counter selection for DP-V1 slave.....	162
Table 153 – CP 3/1: DLPDU selection for DP-V1 slave	162
Table 154 – CP 3/1: CS protocol selection for DP-V1 slave	163
Table 155 – CP 3/1, 3/2: AL service selection	163
Table 156 – CP 3/1, 3/2: AL service selection of Clause 6	164
Table 157 – CP 3/1, 3/2: AL service selection of I/O data ASE.....	164
Table 158 – CP 3/1, 3/2: AL service selection of Diagnosis ASE	165
Table 159 – CP 3/1, 3/2: AL service selection of Context ASE	165
Table 160 – CP 3/1, 3/2: AL service selection of Management ASE	166
Table 161 – CP 3/1, 3/2: AL service selection of AR ASE	167
Table 162 – CP 3/1, 3/2: AL service selection of Clause 6	168
Table 163 – CP 3/1, 3/2: AL service selection of Process data ASE	168
Table 164 – CP 3/1, 3/2: AL service selection of I/O data ASE.....	169
Table 165 – CP 3/1, 3/2: AL service selection of Alarm ASE	169
Table 166 – CP 3/1, 3/2: AL service selection of Context ASE	169
Table 167 – CP 3/1, 3/2: AL service selection of Load region ASE	170
Table 168 – CP 3/1, 3/2: AL service selection of Function invocation ASE	170
Table 169 – CP 3/1, 3/2: AL service selection of Time ASE	170
Table 170 – CP 3/1, 3/2: AL service selection of AR ASE	171
Table 171 – CP 3/1, 3/2: AL service selection of Clause 6	172
Table 172 – CP 3/1, 3/2: AL service selection of I/O data ASE.....	172
Table 173 – CP 3/1, 3/2: AL service selection of Diagnosis ASE	173
Table 174 – CP 3/1, 3/2: AL service selection of Context ASE	173
Table 175 – CP 3/1, 3/2: AL service selection of Management ASE	174
Table 176 – CP 3/1, 3/2: AL service selection of AR ASE	174
Table 177 – CP 3/1, 3/2: AL service selection of Clause 6	175

Table 178 – CP 3/1, 3/2: AL service selection of Process data ASE	176
Table 179 – CP 3/1, 3/2: AL service selection of Context ASE	176
Table 180 – CP 3/1, 3/2: AL service selection of Load region ASE	177
Table 181 – CP 3/1, 3/2: AL service selection of Function invocation ASE.....	177
Table 182 – CP 3/1, 3/2: AL service selection of Time ASE.....	177
Table 183 – CP 3/1, 3/2: AL service selection of AR ASE	178
Table 184 – CP 3/1, 3/2: AL service selection of Clause 6	179
Table 185 – CP 3/1, 3/2: AL service selection of I/O data ASE	180
Table 186 – CP 3/1, 3/2: AL service selection of Diagnosis ASE	181
Table 187 – CP 3/1, 3/2: AL service selection of Context ASE	182
Table 188 – CP 3/1, 3/2: AL service selection of AR ASE	183
Table 189 – CP 3/1, 3/2: AL service selection of Clause 6	184
Table 190 – CP 3/1, 3/2: AL service selection of Process data ASE	184
Table 191 – CP 3/1, 3/2: AL service selection of I/O data ASE	185
Table 192 – CP 3/1, 3/2: AL service selection of diagnosis ASE.....	185
Table 193 – CP 3/1, 3/2: AL service selection of Alarm ASE	186
Table 194 – CP 3/1, 3/2: AL service selection of Context ASE	186
Table 195 – CP 3/1, 3/2: AL service selection of Load region ASE	187
Table 196 – CP 3/1, 3/2: AL service selection of Function invocation ASE.....	187
Table 197 – CP 3/1, 3/2: AL service selection of Time ASE.....	187
Table 198 – CP 3/1, 3/2: AL service selection of AR ASE	188
Table 199 – CP 3/1, 3/2: AL protocol selection	189
Table 200 – CP 3/1, 3/2: AL protocol selection of Clause 4 to 11	190
Table 201 – CP 3/1, 3/2: AL protocol selection of APDUs	192
Table 202 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives	193
Table 203 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives	194
Table 204 – CP 3/1, 3/2: AL protocol selection of Clause 4 to 11	195
Table 205 – CP 3/1, 3/2: AL protocol selection of APDUs	197
Table 206 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives	198
Table 207 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives	200
Table 208 – CP 3/1, 3/2: AL protocol selection of Clause 4 to 6	201
Table 209 – CP 3/1, 3/2: AL protocol selection of APDUs	203
Table 210 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives	204
Table 211 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives	204
Table 212 – CP 3/1, 3/2: AL protocol selection of Clause 4 to 11	205
Table 213 – CP 3/1, 3/2: AL protocol selection of APDUs	207
Table 214 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives	209
Table 215 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives	210
Table 216 – CP 3/1, 3/2: AL protocol selection of Clause 4 to 11	210
Table 217 – CP 3/1, 3/2: AL protocol selection of APDU selection.....	212
Table 218 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives	213
Table 219 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives	214
Table 220 – CP 3/1, 3/2: AL protocol selection of Clause 4 to 11	215

Table 221 – CP 3/1, 3/2: AL protocol selection of APDUs	217
Table 222 – CP 3/1, 3/2: AL protocol selection of FSPM services primitives	218
Table 223 – CP 3/1, 3/2: AL protocol selection of DMPM services primitives	220
Table 224 – CP 3/2: PhL selection	223
Table 225 – CP 3/2: PhL selection of Clause 12 for devices and their MAUs	225
Table 226 – CP 3/2: PhL selection of recommended IS parameters	226
Table 227 – CP 3/2: PhL selection of Clause 21 for devices and their MAUs	227
Table 228 – CP 3/2: General DLL protocol selection.....	228
Table 229 – CP 3/2: DLL protocol selection of Clause 4	228
Table 230 – CP 3/2: DLL protocol selection of Clause 5	229
Table 231 – CP 3/2: DLL protocol selection of Clause 6	229
Table 232 – CP 3/2: DLL protocol selection of Clause 7	230
Table 233 – CP 3/2: Time variable selection for DP-V0 master (class 1)	231
Table 234 – CP 3/2: Timer and counter selection for DP-V0 master (class 1)	231
Table 235 – CP 3/2: DLPDU selection for DP-V0 master (class 1).....	232
Table 236 – CP 3/2: Time variable selection for DP-V1 master (class 1)	233
Table 237 – CP 3/2: Timer and counter selection for DP-V1 master (class 1)	234
Table 238 – CP 3/2: DLPDU selection for DP-V1 master (class 1).....	234
Table 239 – CP 3/2: Time variable selection for DP-V1 master (class 2)	235
Table 240 – CP 3/2: Timer and counter selection for DP-V1 master (class 2)	236
Table 241 – CP 3/2: DLPDU selection for DP-V1 master (class 2).....	236
Table 242 – CP 3/2: Time variable selection for DP-V0 slave.....	237
Table 243 – CP 3/2: Timer and counter selection for DP-V0 slave.....	238
Table 244 – CP 3/2: DLPDU selection for DP-V0 slave	238
Table 245 – CP 3/2: Time variable selection for DP-V1 slave.....	239
Table 246 – CP 3/2: Timer and counter selection for DP-V1 slave.....	239
Table 247 – CP 3/2: DLPDU selection for DP-V1 slave	240
Table 248 – CP 4/1: PhL selection	241
Table 249 – CP 4/1: DLL service selection	242
Table 250 – CP 4/1: DLL protocol selection.....	242
Table 251 – CP 4/1: AL service selection	243
Table 252 – CP 4/1: AL protocol selection.....	243
Table 253 – CPF 5: overview of profile sets	244
Table 254 – CPF 5: PhL selection	245
Table 255 – CPF 5: DLL service selection	246
Table 256 – CPF 5: DLL service selection of Clause 4.....	246
Table 257 – CPF 5: DLL protocol selection.....	247
Table 258 – CPF 5: DLL protocol selection of variables and resources	247
Table 259 – CPF 5: DLL protocol selection of DLPDUs.....	248
Table 260 – CP 5/1: AL service selection	248
Table 261 – CP 5/1: AL service selection of ASEs	249
Table 262 – CPF 5: AL service selection of MPS ASEs.....	249
Table 263 – CPF 5: AL service selection of variable elements	249

Table 264 – CPF 5: AL service selection of produced variable elements	250
Table 265 – CPF 5: AL service selection of consumed variable elements	250
Table 266 – CP 5/1: AL service selection of MPS services	250
Table 267 – CP 5/1, 5/2: AL service selection of A_Readloc service parameters	250
Table 268 – CP 5/1, 5/2: AL service selection of A_Readfar service parameters	251
Table 269 – CP 5/1, 5/2: AL service selection of A_Read service parameters	251
Table 270 – CP 5/1: AL service selection of MCS service classes	251
Table 271 – CP 5/1: AL service selection of QoS	251
Table 272 – CP 5/1: AL service selection of MCS services	252
Table 273 – CP 5/1, 5/2: AL service selection of A_Data parameters	252
Table 274 – CP 5/1: AL protocol selection	252
Table 275 – CPF 5/1: AL protocol selection of MPS data types	252
Table 276 – CPF 5/1: AL protocol selection of MPS PDUs	253
Table 277 – CPF 5/1: AL protocol selection of MPS encoding rules	253
Table 278 – CP 5/1, 5/2: AL protocol selection of MCS PDUs	253
Table 279 – CP 5/1: AL protocol selection of MCS state machines	254
Table 280 – CP 5/2: AL service selection	254
Table 281 – CP 5/2: AL service selection of ASEs	255
Table 282 – CP 5/2: AL service selection of MPS services	255
Table 283 – CP 5/2: AL service selection of MCS service classes	255
Table 284 – CP 5/2: AL service selection of QoS	256
Table 285 – CP 5/2: AL service selection of MCS services	256
Table 286 – CP 5/2: AL service selection of domain services	256
Table 287 – CP 5/2: AL service selection of domain object attributes	257
Table 288 – CP 5/2: AL service selection of program services	257
Table 289 – CP 5/2: AL service selection of program object attributes	257
Table 290 – CP 5/2: AL service selection of variable services	258
Table 291 – CP 5/2: AL service selection of variable classes	258
Table 292 – CP 5/2: AL service selection of variable class attributes	258
Table 293 – CP 5/2: AL protocol selection	258
Table 294 – CP 5/2: AL protocol selection of MCS state machines	259
Table 295 – CP 5/2: AL protocol selection of sub-MMS coding rules	259
Table 296 – CP 5/2: AL protocol selection of sub-MMS PDUs	260
Table 297 – CP 5/3: AL service selection	260
Table 298 – CP 5/3: AL service selection of ASEs	261
Table 299 – CP 5/3: AL protocol selection	261
Table 300 – CPF 6: device CP identifier assignment	262
Table 301 – CPF 6: PhL selection	263
Table 302 – CP 6/1: DLL service selection, assignment of DLL services to device types	265
Table 303 – CPF 6: DLL protocol selection of data widths supported by master	266
Table 304 – CP 6/1: AL service selection, assignment of AL services to device types	267
Table 305 – CP 6/2: DLL service selection, assignment of DLL services to device types	268
Table 306 – CP 6/2: AL service selection, assignment of AL services to device types	269

Table 307 – CP 6/2: AL service selection of AR-Data-Send-Acknowledge service parameters	270
Table 308 – CP 6/3: DLL service selection, assignment of DLL services to device types	271
Table 309 – CP 6/3: AL service selection, assignment of AL services to device types	272
Table 310 – CP 8/1 transmission support level	274
Table 311 – CP 8/1 PhL selection	275
Table 312 – CP 8/1 DLL services selection	276
Table 313 – CP 8/1 DLL protocol selection	277
Table 314 – CP 8/1 AL services selection	279
Table 315 – CP 8/1 AL protocol selection	280
Table 316 – CP 8/2 DLL protocol selection	281
Table 317 – CP 8/3 PhL selection	282
Table 318 – CP 8/3 DLL services selection	283
Table 319 – CP 8/3 DLL protocol selection	284
Table 320 – CP 8/3 AL services selection	286
Table 321 – CP 8/3 AL protocol selection	287
Table 322 – CP 9/1 PhL selection	289
Table 323 – CP 9/1: DLL service selection	290
Table 324 – CP 9/1: DLL protocol selection	290
Table 325 – CP 9/1: AL service selection	290
Table 326 – CP 9/1: AL protocol selection	291
Table 327 – CP 16/1: PhL selection	292
Table 328 – CP 16/1: DLL protocol selection	293
Table 329 – CP 16/1: AL service selection	293
Table 330 – CP 16/2: PhL selection	294
Table 331 – CPF 19: overview of profile sets	295
Table 332 – CP 19/1 profile: PhL selection	296
Table 333 – CP 19/1: DLL service selection	297
Table 334 – DLL service selection for C1 master of CP 19/1	298
Table 335 – DLL service selection for C2 master of CP 19/1	299
Table 336 – DLL service selection for slave of CP 19/1	300
Table 337 – CP 19/1: DLL protocol selection	301
Table 338 – DLL protocol selection for C1 master of CP 19/1	303
Table 339 – DLL protocol selection for C2 master of CP 19/1	304
Table 340 – DLL protocol selection for slave of CP 19/1	305
Table 341 – CP 19/1: AL service selection	307
Table 342 – Class selection for C1 master of CP 19/1	308
Table 343 – Master class attribute selection for C1 master of CP 19/1	308
Table 344 – Master class service selection	308
Table 345 – FDCMaster-AR class attribute selection for C1 master of CP 19/1	308
Table 346 – FDCMaster-AR class service selection	309
Table 347 – Class selection for C2 master of CP 19/1	309
Table 348 – Monitor class attribute selection for C2 master of CP 19/1	309
Table 349 – Monitor class service selection	309

Table 350 – FDCMonitor-AR class attribute selection for C2 master of CP 19/1.....	310
Table 351 – FDCMonitor-AR class service selection	310
Table 352 – Class selection for slave AP of CP 19/1.....	310
Table 353 – Slave class attribute selection for slave AP of CP 19/1	311
Table 354 – Slave class service selection.....	311
Table 355 – FDCSlave-AR class attribute selection for slave AP of CP 19/1.....	311
Table 356 – FDCSlave-AR class service selection	311
Table 357 – CP 19/1: AL protocol selection	311
Table 358 – CP 19/2: DLL service selection	312
Table 359 – DLL service selection for C1 master of CP 19/2	314
Table 360 – DLL service selection for C2 master of CP 19/2.....	315
Table 361 – DLL service selection for slave of CP 19/2.....	315
Table 362 – CP 19/2: DLL protocol selection	316
Table 363 – DLL protocol selection for C1 master of CP 19/2.....	319
Table 364 – DLL protocol selection for C2 master of CP 19/2.....	320
Table 365 – DLL protocol selection for slave of CP 19/2	322
Table 366 – CP 19/2: AL service selection	323
Table 367 – Class selection for C1 master of CP 19/2	324
Table 368 – EventManager class attribute selection for C1 master of CP 19/2.....	324
Table 369 – EventManager class service selection	324
Table 370 – Class selection for C2 master of CP 19/2	325
Table 371 – EventManager class attribute selection for C2 master of CP 19/2.....	325
Table 372 – EventManager class service selection	325
Table 373 – Class selection for slave AP of CP 19/2.....	326
Table 374 – EventManager class attribute selection for slave AP of CP 19/2.....	326
Table 375 – EventManager class service selection	326
Table 376 – CP 19/2: AL protocol selection	327
Table A.1 – Number of devices per CP16/1 and CP16/2 systems (examples)	340

INTRODUCTION

This part of IEC 61784 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 3.2.1 of 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.

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.

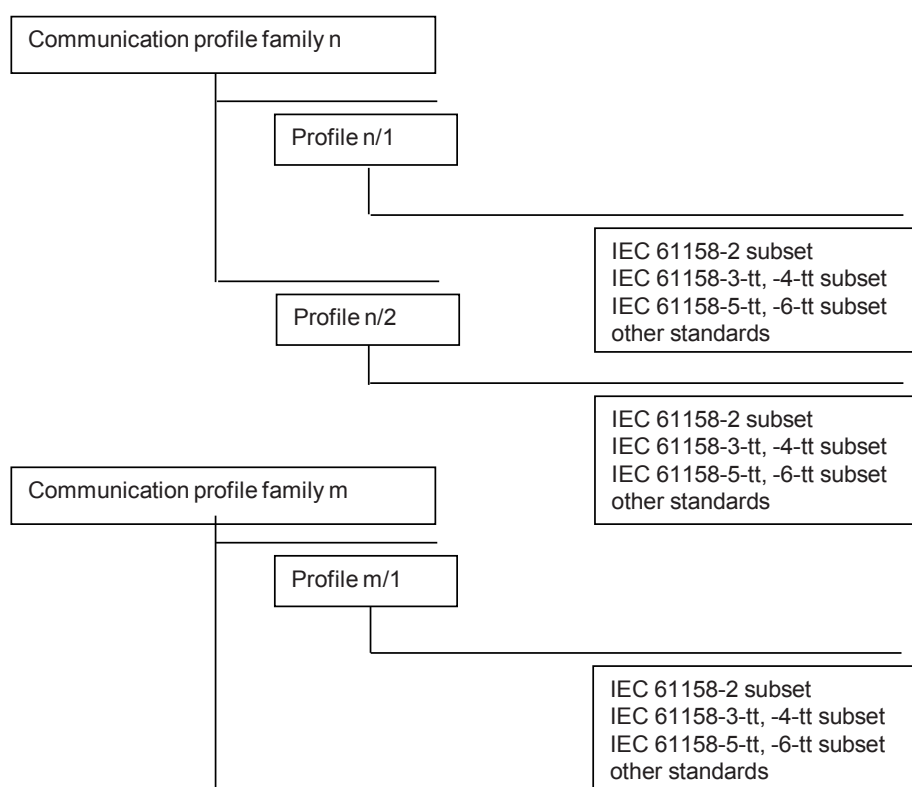


Figure 1 – Communication profile families and profiles

Each profile selects an appropriate consistent and compatible subset of services and protocols from the total available set that is defined and modeled 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
NOTE 1 See the specific CPF clauses for information on the respective trademark holders. NOTE 2 CP 1/1 has a denigrated PhL device profile subclass, which uses a variant of a Type 3 PhL. NOTE 3 CP 3/2 has a denigrated PhL device profile subclass, which uses a variant of a Type 1 PhL. NOTE 4 Other CPFs can be found in IEC 61784-2.			

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.

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 61158-3-3:2014, *Industrial communication networks – Fieldbus specifications – Part 3-3: Data-link layer service definition – Type 3 elements*
- IEC 61158-3-4:2014, *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 61158-3-19:2014, *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 61158-4-2:2014, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*
- IEC 61158-4-3:2014, *Industrial communication networks – Fieldbus specifications – Part 4-3: Data-link layer protocol specification – Type 3 elements*
- IEC 61158-4-4:2014, *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 61158-4-19:2014, *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 61158-4-24:2014, *Industrial communication networks – Fieldbus specifications – Part 4-24: Data-link layer protocol specification – Type 24 elements*
- IEC 61158-5-2:2014, *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 61158-5-4:2014, *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 61158-5-19:2014, *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 61158-6-2:2014, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*
- IEC 61158-6-3:2014, *Industrial communication networks – Fieldbus specifications – Part 6-3: Application layer protocol specification – Type 3 elements*
- IEC 61158-6-4:2014, *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 61158-6-19:2014, *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 61784-2:2014, *Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3*

IEC 61784-5-2:2013, *Industrial communication networks – Profiles – Part 5-2: Installation of fieldbuses – Installation profiles for CPF 2*

IEC 61918:2013, *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 62591:2010, *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 8802-3:2000, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

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*

ISO 15745-4:2003, *Industrial automation systems and integration – Open systems application integration framework – Part 4: Reference description for Ethernet-based control systems*, Amendment 1:2006, *PROFINET profiles*

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

IEEE 802.3-2002, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications*

IETF RFC 768, *User Datagram Protocol*; available at <<http://www.ietf.org>>

IETF RFC 791, *Internet Protocol*; available at <<http://www.ietf.org>>

IETF RFC 792, *Internet Control Message Protocol*; available at <<http://www.ietf.org>>

IETF RFC 793, *Transmission Control Protocol*; available at <<http://www.ietf.org>>

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>>

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>>

IETF RFC 1123, *Requirements for Internet Hosts – Application and Support*; available at <<http://www.ietf.org>>

IETF RFC 1127, *A Perspective on the Host Requirements RFCs*; available at <<http://www.ietf.org>>

IETF RFC 2236, *Internet Group Management Protocol, Version 2*; available at <<http://www.ietf.org>>

3 Definitions

3.1 Terms and definitions

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

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 Européene" (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 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

² In accordance with ISO/IEC Directives

Compliance to IEC 61784-1:2014³ CPF n <Type>
or

Compliance to IEC 61784-1 (Ed.4.0) 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 61784-1:2014³ CP n/n <Type>
or

Compliance to IEC 61784-1 (Ed.4.0) 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).

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 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.

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

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 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 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 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).

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	—
3.3 – 3.7	—	NO	—
4	Symbols and abbreviations	—	—
4.1	Symbols	—	—
4.1.1	Type 1: Symbols	YES	—
4.1.2 – 4.1.6	—	NO	—
4.2	Abbreviations	—	—
4.2.1	Type 1: Abbreviations	YES	—
4.2.2 – 4.2.6	—	NO	—
5	Data-link layer – Physical Layer interface	—	—
5.1	General	Partial	Used when applicable
5.2	Type 1: Required services	YES	—
5.3 – 5.7	—	NO	—
6	Systems Management – Physical Layer interface	—	—
6.1	General	Partial	Used when applicable
6.2	Type 1: Systems Management – Physical Layer interface	YES	—
6.3 – 6.7	—	NO	—
7	DCE Independent Sublayer (DIS)	—	—

Clause	Header	Presence	Constraints
7.1	General	Partial	Used when applicable
7.2	Type 1: DIS	YES	—
7.3 – 7.5	—	NO	—
8	DTE – DCE interface	—	—
8.1	General	Partial	Used when applicable
8.2	Type 1: DTE – DCE interface	YES	—
8.3 – 8.4	—	NO	—
9	Medium Dependent Sublayer (MDS)	—	—
9.1	General	Partial	Used when applicable
9.2	Type 1: MDS: Wire and optical media	YES	—
9.3 – 9.8	—	NO	—
10	MDS – MAU interface	—	—
10.1	General	Partial	Used when applicable
10.2	Type 1: MDS — MAU interface: wire and optical media	YES	—
10.3 – 10.6	—	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 μH	≤ 10 μH
Leakage current	(not specified)	≤ 50 μA
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.

Table 17 – CP 1/1: PhL selection for media components

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 – 3.7	—	NO	—
4 – 11	—	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	—	—
12.1	General	YES	—
12.2	Network specifications	YES	This text contains important network configuration specifications
12.3 – 12.6	—	NO	—
12.8	—	NO	—
12.8.1	Connector	YES	—
12.8.2	Cable	YES	^b
12.8.3	Coupler	YES	—
12.8.4	Splices	YES	^b
12.8.5	—	NO	—
12.8.6	Shielding rules	YES	—
12.8.7	Grounding rules	YES	—
12.9 – 12.10	—	NO	—
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	—	NO	—
Next annexes	—	NO	—
^a The connector is optional.			
^b Networks and their components designed to meet FISCO IS rules shall also conform to Table 18.			

Table 18 – CP 1/1: PhL selection of imperative IS parameters for media in FISCO systems

Parameter	Minimum	Maximum in IIC application	Maximum in IIB application
Maximum trunk cable for IIC applications	0 km	1 km	5 km
Maximum spur cable for IIC applications	0 m	30 m	
Loop resistance	15 Ω/km	150 Ω/km	
Inductance	0,4 μH / km	1 μH / km	
Capacitance	80 nF / km	200 nF / km	
See IEC 60079-11 and IEC 60079-25.			

5.2.1.2.2 Power supplies

Unless specifically stated otherwise, it is assumed that a power supply does not contain a fieldbus device, terminator, Intrinsic safety barrier or galvanic isolator.

All power supplies shall conform to IEC 61158-2 as shown in Table 19.

Table 19 – CP 1/1: PhL selection for power supplies

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 – 3.7	—	NO	—
4 – 11	—	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	—	—
12.1	General	YES	—
12.2	Network specifications	YES	This text contains important network configuration specifications
12.3 – 12.7	—	NO	—
12.7	Power distribution	—	—
12.7.1	General	YES	a, b
12.7.2	Supply voltage	YES	a
12.7.3	Powered via signal conductors	Partial	a, b
12.7.4	Power supply impedance	YES	a
12.7.5	—	NO	—
12.7.6	Electrical isolation	YES	a
12.8	Medium specifications	—	—
12.8.1	Connector	YES	c
12.8.2 – 12.8.4	—	NO	—
12.8.5	Terminator	Partial	a
12.8.6	—	NO	—
12.8.7	Grounding rules	Partial	Used when applicable
12.9 – 12.10	—	NO	—
Next clauses	—	NO	—
Annex A	Type 1: Connector specification	—	—
A.1	Internal Connector for wire medium	YES	c
A.2	External Connectors for wire medium	YES	c
A.3	—	NO	—
Next annexes	—	NO	—
^a For power supplies designed to meet FISCO rules, in case of conflict, FISCO rules take precedence. ^b Power supplies with multiple outputs shall comply with the transmit and receive waveform requirements of IEC 61158-2, 12.7, with regard to the signal transfer characteristics between their output ports, and with the requirements of IEC 61158-2, 12.7.4.3. ^c The connector is optional.			

A fieldbus power supply is categorized as defined in Table 20.

Table 20 – CP 1/1: PhL selection of power supply types

Power supply type	Output voltage	Description
Type 131	compatible with barrier	Non-IS power supply intended for feeding an entity model IS barrier
Type 132	$\leq 32 \text{ V}$	Non-IS power supply not intended for feeding an IS barrier
Type 133	$\leq 24 \text{ V}$	Entity model, IS power supply
Type 551	$\leq 14,0 - 17,5 \text{ V}^a$	FISCO Power Supply for Zone 0, Group IIC Gas applications, [Ex ia] IIC
Type 552	$\leq 14,0 - 17,5 \text{ V}^a$	FISCO Power Supply for Zone 0, Group IIB Gas applications, [Ex ia] IIB
Type 553	$\leq 14,0 - 17,5 \text{ V}^a$	FISCO Power Supply for Zone 2, Group IIC Gas applications, [Ex ic] IIC
Type 554	$\leq 14,0 - 17,5 \text{ V}^a$	FISCO Power Supply for Zone 2, Group IIB Gas applications, [Ex ic] IIB
^a The actual maximum output voltage is a function of the maximum rated current.		

Type 55, 552, 553 and 554 power supplies may

- a) be linear (resistance limited),
- b) have a trapezoidal (voltage limited) output characteristic, or
- c) have a rectangular (voltage and current limited) output characteristic.

The recommended output voltage and maximum IS parameters for a Type 551 or Type 552 power supply, which is intended to operate with devices of Types 511 or 512 or both, are listed in Table 21. A Type 551 or Type 552 power supply shall be separated from the nearest terminator, at an end of the trunk cable, by no more than 30 m of cable.

Table 21 – CP 1/1: PhL selection of permissible output voltage and IS parameters for FISCO power supplies

Parameter	Permissible values	
	Type 551 – IIC	Type 552 – IIB
Voltage	14,0 V to 17,5 V	
Maximum current		
at 14,0 V	183 mA	380 mA
at 15,0 V	133 mA	354 mA
at 16,0 V	103 mA	288 mA
at 17,0 V	81 mA	240 mA
at 17,5 V	75 mA	213 mA
Maximum output power	2,52 W	5,32 W
Maximum residual capacitance	5 nF	
Maximum residual inductance	10 μH	
See IEC 60079-11 and IEC 60079-25.		

5.2.1.2.3 Terminators

It is assumed that the terminator does not contain a fieldbus MAU, power supply, intrinsic safety barrier or galvanic isolator.

All terminators shall conform to IEC 61158-2 as shown in Table 22.

Table 22 – CP 1/1: PhL selection for terminators

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 – 3.7	—	NO	—
4 – 11	—	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	—	—
12.1	General	YES	—
12.2 – 12.6	—	NO	—
12.7	Power distribution	—	—
12.7.1	General	Partial	Does not include IEC 61158-2, Table 70 or Table 71
12.7.2 – 12.7.5	—	NO	—
12.7.6	Electrical isolation	YES	—
12.8	Medium	—	—
12.8.1	Connector	YES	—
12.8.2 – 12.8.4	—	NO	—
12.8.5	Terminator	YES	^a
12.8.6	—	NO	—
12.8.7	Grounding (earthing) rules	YES	—
12.9	Intrinsic safety	—	For intrinsically safe networks the network terminator will require appropriate approvals if installed in a hazardous area. See Table 23 for the IS parameters for a terminator intended for installation in a hazardous area
12.9.1	—	NO	—
12.9.2	Intrinsic safety barrier	YES	—
12.9.3	Barrier and terminator placement	YES	—
12.10	—	NO	—
Next clauses	—	NO	—
Annex A	Type 1: Connector specification	—	—
A.1	Internal Connector for wire medium	YES	^b
A.2	External Connectors for wire medium	YES	^b
Next annexes	—	NO	—
^a For terminators designed to meet FISCO IS rules, in case of conflict, FISCO rules take precedence.			
^b The connector is optional.			

Table 23 – CP 1/1: PhL selection of IS parameters for terminators

Parameter	Required values	
	Entity model	FISCO model
Mounting	Zone 0 (US Div. 1)	Zone 0 (US Div. 1)
Gas group	IIC (US Groups A & B)	IIC (US Groups A & B)
Device approval voltage	$\geq 24 \text{ V}$	$\geq 17,5 \text{ V}$
Device approval current	$\geq 250 \text{ mA}$	$\geq 380 \text{ mA}$
Device input power	$\geq 1,2 \text{ W}$	$\geq 5,32 \text{ W}$
Terminator residual inductance	$\leq 20 \mu\text{H}$	$\leq 10 \mu\text{H}$
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

5.2.1.2.4 Intrinsic safety barriers

NOTE FISCO rules do not permit use of intrinsic safety barriers as separate components. See IEC 60079-11 and IEC 60079-25.

It is assumed that the intrinsic safety barrier does not contain a fieldbus MAU, terminator or power supply.

An Intrinsic safety barrier is used to communicate with devices and other network elements installed in a hazardous area. It should be suitably approved by relevant safety authorities for use in the intended application.

All Intrinsic safety barriers shall conform to IEC 61158-2, Clause 12, as shown in Table 24.

Table 24 – CP 1/1: PhL selection of Clause 12 for intrinsic safety barriers

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 – 3.7	—	NO	—
4 – 11	—	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	—	—
12.1	General	YES	—
12.2	Transmitted bit rate	NO	—
12.3	Network specifications	NO	—
12.4	MAU transmit circuit specifications	YES	IS barriers shall comply with the transmit waveform requirements of the referenced subclause
12.5	MAU receive circuit specifications	YES	IS barriers shall comply with the receive waveform requirements of the referenced subclause
12.6	Jabber inhibit	NO	—
12.7	Power distribution	—	—
Table 70	Network powered device characteristics	NO	—
Table 71	Network power supply requirements	NO	—
12.7.1	General	NO	—
12.7.2	Supply voltage	NO	—
12.7.3	Powered via signal conductors	NO	—
12.7.4	Power supply impedance	—	—
12.7.4.1	Power supply impedance for single output power supplies	NO	—
12.7.4.2	Power distribution through an IS barrier	YES	—
12.7.4.3	Power supply impedance for multiple output supplies with signal coupling between outputs	NO	—
12.7.5	Powered separately from signal conductors	NO	—
12.7.6	Electrical isolation	YES	For system safety the network shall be grounded only at the IS barrier
12.8	Medium specifications	—	—
12.8.1	Connector	YES	^a
12.8.2-12.8.6	—	NO	—
12.8.7	Grounding rules	YES	For system safety the network shall be grounded only at the IS barrier
12.9	Intrinsic safety	YES	See Table 25 for the IS parameters for intrinsic safety barriers
12.10	Galvanic isolators	NO	—
Next clauses	—	NO	—
Annex A	Type 1: Connector specification	—	—

Clause	Header	Presence	Constraints
A.1	Internal Connector for wire medium	YES	^a
A.2	External Connectors for wire medium	YES	^a
Next annexes		NO	—
^a The connector is optional.			

Table 25 – CP 1/1: PhL selection of recommended IS parameters for intrinsic safety barriers and galvanic isolators (Entity model only)

Parameter	Value
Mounting	Zone 0 (US Div. 1)
Gas group	IIC (US Groups A & B)
Open circuit output voltage (see Note)	$\leq 24 \text{ V}$
Short circuit output current	$\leq 250 \text{ mA}$
Matched output power	$\leq 1,2 \text{ W}$
NOTE The maximum working voltage of the barrier will be less than this value. The power supply voltage of the system is selected to be compatible with the working voltage.	

5.2.1.2.5 Galvanic isolators

NOTE FISCO rules do not permit use of galvanic isolators as separate components. See IEC 60079-11 and IEC 60079-25.

It is assumed that the Intrinsically safe galvanic isolator does not contain a fieldbus MAU, terminator or power supply.

An Intrinsically safe galvanic isolator is used to communicate with devices and other network elements installed in a hazardous area. It should be suitably approved by relevant safety authorities for use in the intended application.

All Intrinsically safe galvanic isolators shall conform to IEC 61158-2 as shown in Table 26.

Table 26 – CP 1/1: PhL selection of Clause 12 for intrinsically safe galvanic isolators

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 – 3.7	—	NO	—
4 – 11	—	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	—	—
12.1	General	YES	—
12.2	Transmitted bit rate	NO	—
12.3	Network specifications	NO	—
12.4	Transmit circuit specifications	YES	Intrinsically safe galvanic isolator shall comply with the transmit waveform requirements of the referenced subclause
12.5	Receive circuit specifications	YES	Intrinsically safe galvanic isolator shall comply with the receive waveform requirements of the referenced subclause
12.6	Jabber inhibit	NO	—
12.7	Power distribution	—	—
12.7.1	General	YES	—
Table 70	Network powered device characteristics for the 31,25 kbit/s, voltage mode MAU	NO	—
Table 71	Network power supply requirements for the 31,25 kbit/s, voltage mode MAU	NO	—
12.7.2-12.7-5	—	NO	—
12.7.6	Electrical isolation	YES	Where a galvanic isolator includes one or more fieldbus power supplies these shall comply with the relevant conditions in 5.2.1.2.2
12.8	Medium specifications	—	—
12.8.1	Connector	YES	—
12.8.2-12.8.7	—	NO	—
12.9	Intrinsic safety	YES	See Table 25 for the IS parameters
12.10	Galvanic isolators	YES	—
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
Next annexes	—	NO	—
^a The connector is optional.			

5.2.1.3 Fiber media and related network components and considerations**5.2.1.3.1 Optical fiber types**

The alternatives for optical fiber type for a Type 411 device are listed in Table 27.

Table 27 – CP 1/1: PhL selection of Clause 15, recommended optical fiber types

Fiber use	31,25 kbit/s single fiber	NA (numerical aperture)	Attenuation ($f = 850 \text{ nm}$)	Comments
Standard test fiber	100/140 μm (A1d)	$0,26 \pm 0,03$	$\leq 4,0 \text{ dB/km}$	Mode filter required
Recommended operating fiber	100/140 μm (A1d)	$0,26 \pm 0,03$	$\leq 4,0 \text{ dB/km}$	
	200/230 μm (A3c)	$0,4 \pm 0,04$	$\leq 10,0 \text{ dB/km}$	
	50/125 μm (A1a)	$0,2 \pm 0,02$	$\leq 3,0 \text{ dB/km}$	
	62,5/125 μm (A1b)	$0,275 \pm 0,015$	$\leq 3,0 \text{ dB/km}$	
NOTE For fiber types A1d, A3c, A1a and A1b, structure (SI or GI) and bandwidth, refer to IEC 60793, optical fiber specifications. For attenuation, bandwidth and numerical aperture (NA), refer to the test methods of IEC 60793.				

5.2.1.3.2 Passive star couplers

The recommended maximum insertion losses for optical passive star couplers for the 31,25 kbit/s single-fiber optical medium are listed in Table 28. Reflective star couplers (see IEC 61158-2, Annex D) are required for the single-fiber medium.

Table 28 – CP 1/1: PhL selection of passive star couplers, recommended maximum insertion loss

	CP 1/1 class for passive star coupler	Number of branches					
		2	3	4	8	16	32
Recommended maximum insertion loss	CP 1/1 class 421 (100/140 μm (A1d))	7,0	9,0	10,5	14,5	17,5	21,5
	CP 1/1 class 422 (200/230 μm (A3c))	7,5	10,0	11,0	15,0	18,5	22,5
	CP 1/1 class 423 (50/125 μm (A1a))	7,0	9,0	10,5	14,5	18,0	22,0
	CP 1/1 class 424 (62,5/125 μm (A1b))	7,0	9,0	10,5	14,5	18,0	22,0
NOTE The insertion loss includes the loss due to two connectors.							

5.2.1.3.3 Active star couplers

The characteristics for active star couplers for the 31,25 kbit/s, single-fiber optical medium are listed in Table 29.

Table 29 – CP 1/1: PhL selection of active star couplers

Parameter	CP 1/1 class 431 (with timing regeneration)	CP 1/1 class 432 (without timing regeneration)
	Recommended value	
Peak emission wavelength	850 ± 30 nm	
Typical half Intensity wavelength	≤ 50 nm	
Effective launch power Hi level (see Note)	−13,5 ± 1,0 dBm	
Receiver operating range	−40,0 dBm to −20,0 dBm	
Maximum received bit cell jitter	± 14 % nominal bit time	
Rise and fall times of transmitted signal	≤ 2,0 % nominal bit time	
Maximum temporal deformation	± 3,0 % nominal bit time	
Maximum transmitted bit cell jitter	± 2,0 % normal bit time	<not specified>
Propagation time	≤ 2,0 nominal bit times	<not specified>
Number of branches	≤32	
NOTE This is the power measured with a standard test fiber connected to a CPIC as defined in IEC 61158-2, 16.4 and 16.7.2.		

5.2.1.3.4 Optical power budget

Optical power budget considerations are shown in Table 30, and an example optical power budget for a system is shown in Figure 2.

Table 30 – CP 1/1: Optical power budget considerations

Parameter	100/140 μm fiber system	200/230 μm fiber system	62,5/125 μm fiber system	50/125 μm fiber system
Launch power	−14,5 dBm	−8,0 dBm	−18,5 dBm	−21,5 dBm
Receiver sensitivity	−40 dBm	−40 dBm	−40 dBm	−40 dBm
Dynamic range	25,5 dB	31,0 dB	21,5 dB	18,5 dB
OPSC (Optical Passive Star Coupler) attenuation:				
(16/16 OPSC)	17,5 dB	18,5 dB	—	—
(8/8 OPSC)	—	—	14,5 dB	—
(4/4 OPSC)	—	—	—	10,5 dB
Attenuation margin	3 dB	6,5 dB	3 dB	3 dB
Attenuation of optical fiber cable	5 dB	6 dB	4 dB	5 dB
Maximum transmission distance:				
(16/16 OPSC)	1,25 km	0,6 km	—	—
(8/8 OPSC)	—	—	1,33 km	—
(4/4 OPSC)	—	—	—	1,66 km
NOTE OPSC attenuation measurements include loss from two connectors.				

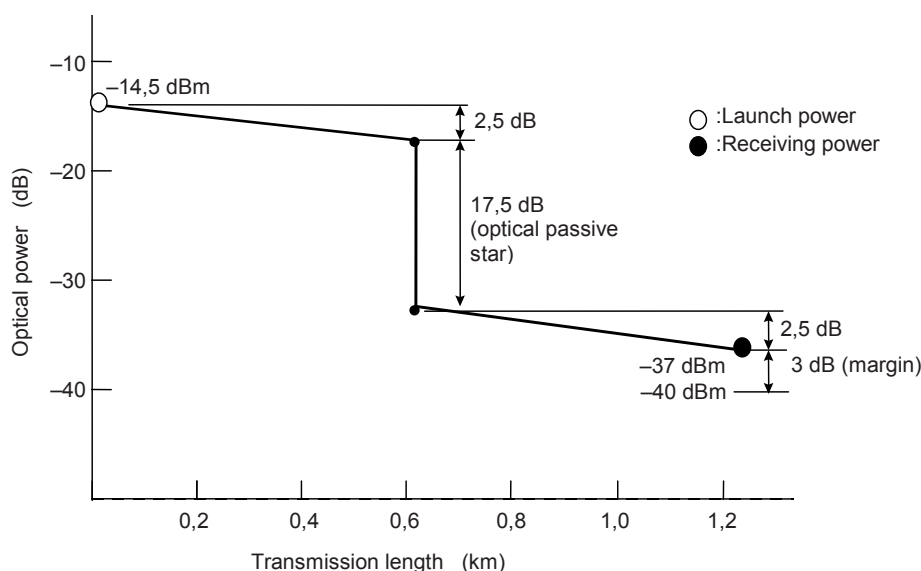


Figure 2 – Example optical power budget for a 100/140 μm fiber system with a 16/16 optical passive star coupler

5.2.1.4 Optical / electrical signaling converters

Active star couplers can have both optical-media and wire-media ports. CP 1/1 class 433 devices are active star couplers with timing regeneration with one or more wire-media ports. Their optical ports shall meet the specifications of CP 1/1 class 431 devices, while each of their electrical ports shall meet the relevant specifications of one of the following CP 1/1 device classes: 121, 122, 123, 124, 511 or 512.

CP 1/1 class 434 devices are active star couplers without timing regeneration with one or more wire-media ports. Their optical ports shall meet the specifications of CP 1/1 class 432 devices, while each of their electrical ports shall meet the relevant specifications of one of the following CP 1/1 device classes: 121, 122, 123, 124, 511 or 512.

5.2.2 Data-link layer

5.2.2.1 DLL service selection

5.2.2.1.1 General

Table 31 specifies the DLL service selection within IEC 61158-3-1 for this profile.

Table 31 – CP 1/1: DLL service selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used as needed
3	Terms, definitions, symbols, abbreviations and conventions	YES	—
4	Overview of Data-link Services	YES	—
5	DL(SAP)-address, queue and buffer management Data-link Service	—	See Table 32
6	Connection-mode Data-link Service	—	See Table 37
7	Connectionless-mode Data-link Service	—	See Table 52
8	Time and scheduling guidance Data-link Service	—	See Table 54
9	DL-Management service definition	NO	—

Table 32 – CP 1/1: DLL service selection of Clause 5

Clause	Header	Presence	Constraints
5.1	Facilities of the DL(SAP)-address, queue and buffer management Data-link Service	YES	—
5.2	Model of the DL(SAP)-address, queue and buffer management Data-link Service	YES	—
5.3	Sequence of primitives at one DL(SAP)	YES	—
5.4	DL(SAP)-address, queue and buffer management Services	—	See Table 33

Table 33 – CP 1/1: DLL service selection of 5.4

Clause	Header	Presence	Constraints
5.4.0	—	YES	—
5.4.1	Create	Partial	Only the attributes of the objects created by this service are included. See Table 34
5.4.2	Delete	NO	—
5.4.3	Bind	Partial	Only the attributes of the objects bound by this service are included. See Table 35
5.4.4	Unbind	NO	—
5.4.5	Put	YES	—
5.4.6	Get	—	See Table 36