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DIN EN 61784-1:2015-02**Entwurf**

**Industrielle Kommunikationsnetze –
Profile –
Teil 1: Feldbusprofile
(IEC 65C/862A/CDV:2017);
Englische Fassung prEN 61784-1:2017, nur auf CD-ROM**

Industrial communication networks –
Profiles –
Part 1: Fieldbus profiles
(IEC 65C/862A/CDV:2017);
English version prEN 61784-1:2017, only on CD-ROM

Réseaux de communication industriels –
Profils –
Partie 1: Profils de bus de terrain
(IEC 65C/862A/CDV:2017);
Version anglaise prEN 61784-1:2017, seulement en CD-ROM

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2018-01-26 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfs besonders zu vereinbaren.

Stellungnahmen werden erbeten

- vorzugsweise online im Norm-Entwurfs-Portal von DIN unter www.din.de/go/entwuerfe bzw. für Norm-Entwürfe der DKE auch im Norm-Entwurfs-Portal der DKE unter www.entwuerfe.normenbibliothek.de, sofern dort wiedergegeben;
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- oder in Papierform an die DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE, Stresemannallee 15, 60596 Frankfurt am Main.

Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 349 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE

Nationales Vorwort

Die englische Fassung des europäischen Dokuments prEN 61784-1:2017, nur auf CD-ROM „Industrielle Kommunikationsnetze – Profile – Teil 1: Feldbusprofile“ (Entwurf in der Umfrage) ist unverändert in diesen Norm-Entwurf übernommen worden.

Die Internationale Elektrotechnische Kommission (IEC) und das Europäische Komitee für Elektrotechnische Normung (CENELEC) haben vereinbart, dass ein auf IEC-Ebene erarbeiteter Entwurf für eine Internationale Norm zeitgleich (parallel) bei IEC und CENELEC zur Umfrage (CDV-Stadium) und Abstimmung als FDIS (en: Final Draft International Standard) bzw. Schluss-Entwurf für eine Europäische Norm gestellt wird, um eine Beschleunigung und Straffung der Normungsarbeit zu erreichen. Dem entsprechend ist das internationale Dokument IEC 65C/862A/CDV:2017 „Industrial communication networks – Profiles – Part 1: Fieldbus profiles“ unverändert in den Entwurf prEN 61784-1:2017, nur auf CD-ROM übernommen worden.

Das internationale Dokument wurde vom SC 65C „Industrial networks“ der Internationalen Elektrotechnischen Kommission (IEC) erarbeitet.

Bei der Abstimmung zu dem Europäischen Schluss-Entwurf bei CENELEC und dem Internationalen Schluss-Entwurf bei IEC [Final Draft International Standard (FDIS)] sind jeweils nur „JA/NEIN“-Entscheidungen möglich, wobei „NEIN“-Entscheidungen fundiert begründet werden müssen. Dokumente, die bei CENELEC als Europäische Norm angenommen und ratifiziert werden, sind unverändert als Deutsche Normen zu übernehmen.

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.

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

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

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

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

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

Es ist vorgesehen, auch bei der entsprechenden zukünftigen Deutschen Norm auf die deutsche Sprachfassung zu verzichten und diese in der englischsprachigen Fassung zu veröffentlichen.

Es wird auf die Möglichkeit hingewiesen, dass einige Elemente dieses Dokuments Patentrechte berühren können. ISO [und/oder] IEC sind nicht dafür verantwortlich, einige oder alle diesbezüglichen Patentrechte zu identifizieren.

Änderungen

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

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

Nationaler Anhang NA (informativ)

Auszugsweise Übersetzung^{N1)}

1 Anwendungsbereich

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

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

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

Die Struktur von Kommunikationsprofilfamilien wird in Bild 1 dargestellt.

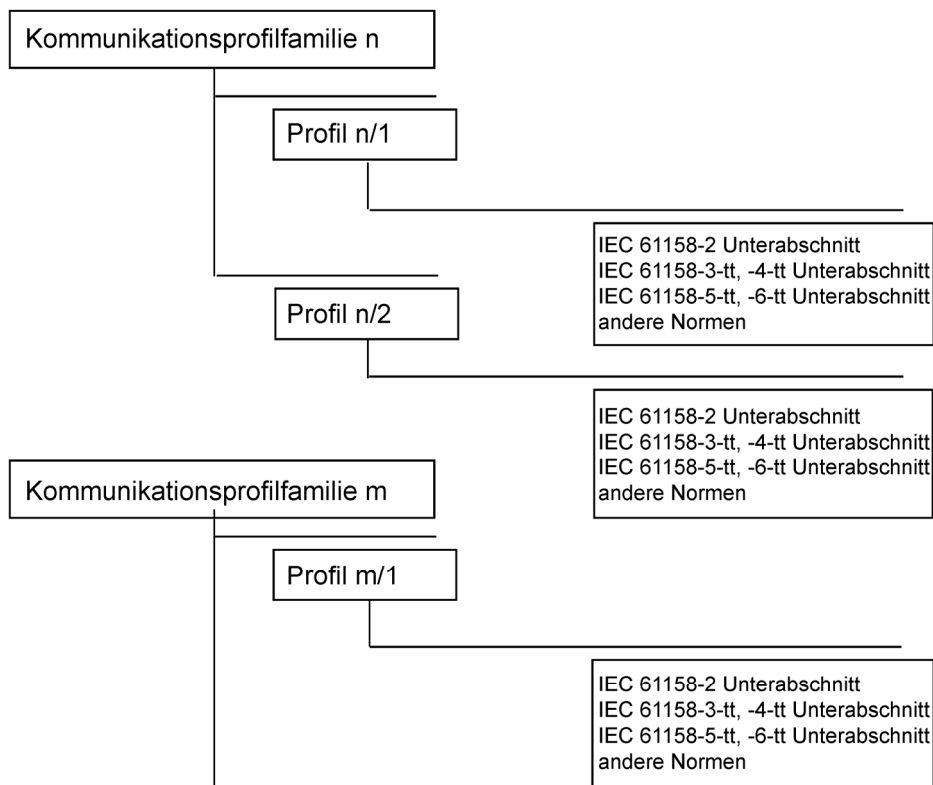


Bild 1 – Kommunikationsprofilfamilien und Profile

^{N1)} Nationale Fußnote: Die Nummerierung des IEC-Schriftstücks 65C/862A/CDV:2017-06 wurde beibehalten.

Jedes Profil wählt aus den in IEC 61158 definierten und modellierten Diensten und Protokollen eine geeignete konsistente und kompatible Untermenge aus. Für die ausgewählte Untermenge von Diensten und Protokollen beschreibt das Profil außerdem alle möglichen oder notwendigen Einschränkungen bei den Werten für die Parameter.

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

Tabelle 1 – Bezug zwischen Kommunikationsprofilfamilien und Typennummern

IEC 61784-1 Inhalt			Entsprechende IEC 61158-Typen
CPF	Abschnitt	Kommunikationsprofilfamilien (Anmerkung 1)	Typ
1	5	Foundation® Fieldbus	1, 5, 9 (siehe Anmerkung 2)
2	6	CIP™	2
3	7	PROFIBUS & PROFINET	3 (siehe Anmerkung 3)
4	8	P-NET®	4
5	9	WorldFIP®	7
6	10	INTERBUS®	8
7	11	Wurde mangels Marktrelevanz zurückgezogen	6
8	12	CC-Link	18
9	13	HART	20
16	14	SERCOS	16
19	15	MECHATROLINK	24
<p>ANMERKUNG 1 Siehe spezifische CPF-Abschnitte für Informationen zu den jeweiligen Markenzeicheninhabern.</p> <p>ANMERKUNG 2 CP 1/1 hat eine abgewertete PhL-Geräteprofil-Unterklasse, die eine Variante einer PhL vom Typ 3 verwendet.</p> <p>ANMERKUNG 3 CP 3/2 hat eine abgewertete PhL-Geräteprofil-Unterklasse, die eine Variante einer PhL vom Typ 1 verwendet.</p> <p>ANMERKUNG 4 Weitere CPFs sind in IEC 61784-2 zu finden.</p>			

3 Begriffe

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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
PROFILES –**

Part 1: Fieldbus profiles

FOREWORD

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NOTE Combinations of protocol types are specified in IEC 61784-1 and IEC 61784-2.

International Standard IEC 61784-1 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This fifth edition cancels and replaces the fourth edition published in 2014. This edition constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

- update of the dated references to the IEC 61158 series, to IEC 61784-2, to the IEC 61784-3 series, to the IEC 61784-5 series and to IEC 61918 throughout the document;
- update of selection tables CPF 2 and CPF 4.

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

FDIS	Report on voting
65C/xxx/FDIS	65C/xxx/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61784 series, published under the general title *Industrial communication networks – Profiles*, can be found on the IEC web site

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.
-

The National Committees are requested to note that for this publication the stability date is 2023.

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

647

INTRODUCTION

648 This part of IEC 61784 provides a set of Communication Profiles (CP) in the sense of
649 ISO/IEC TR 10000-1. These answer the need of identifying the protocol families co-existing
650 within the IEC 61158 series, as a result of the international harmonization of fieldbus
651 technologies available on the market. More specifically, these profiles help to correctly state
652 the compliance to the IEC 61158 series, and to avoid the spreading of divergent
653 implementations, which would limit its use, clearness and understanding. Additional profiles to
654 address specific market concerns, such as functional safety or information security, may be
655 addressed by future parts of this standard.

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

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

667 It is also important to clarify that interoperability – defined as the ability of two or more
668 network systems to exchange information and to make mutual use of the information that has
669 been exchanged (see 3.2.1 of ISO/IEC TR 10000-1) – can be directly achieved on the same
670 link only for those devices complying to the same communication profile.

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

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

677

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.

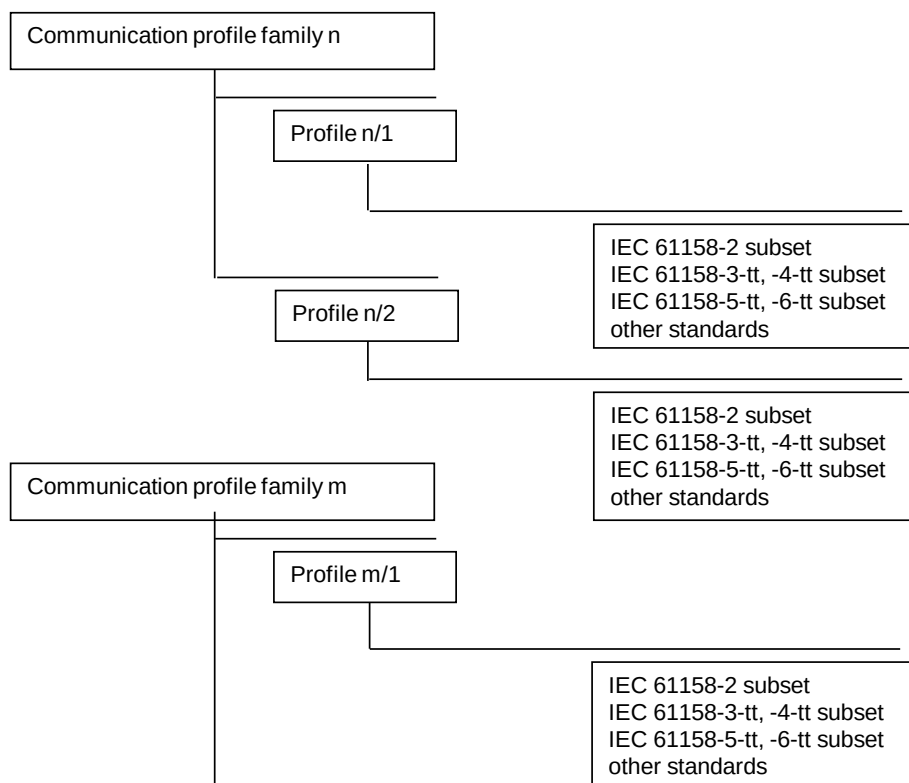


Figure 1 – Communication profile families and profiles

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

702 selected subset of services and protocols, the profile also describes any possible or
703 necessary constrains in parameter values.

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

705 **Table 1 – Relations of Communication Profile Families to type numbers**

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

706

707 2 Normative references

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

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

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

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

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

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

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

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

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

725 **Year “:201X” indicates that for this part of IEC 61158 a new edition is planned for 2018.**
726 **It is planned, that the CDV of these parts will be distributed concurrently with**
727 **IEC 61784-1 (this document) and IEC 61784-2.**

728 **The year will be updated and this note deleted at the publication stage.**

729 IEC 61158-3-2:201X, *Industrial communication networks – Fieldbus specifications – Part 3-2:*
730 *Data-link layer service definition – Type 2 elements*

731 IEC 61158-3-3:201X, *Industrial communication networks – Fieldbus specifications – Part 3-3:*
732 *Data-link layer service definition – Type 3 elements*

733 IEC 61158-3-4:201X, *Industrial communication networks – Fieldbus specifications – Part 3-4:*
734 *Data-link layer service definition – Type 4 elements*

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

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

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

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

743 IEC 61158-3-19:201X, *Industrial communication networks – Fieldbus specifications –*
744 *Part 3-19: Data-link layer service definition – Type 19 elements*

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

747 IEC 61158-3-24:201X, *Industrial communication networks – Fieldbus specifications –*
748 *Part 3-24: Data-link layer service definition – Type 24 elements*

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

751 IEC 61158-4-2:201X, *Industrial communication networks – Fieldbus specifications – Part 4-2:*
752 *Data-link layer protocol specification – Type 2 elements*

753 IEC 61158-4-3:201X, *Industrial communication networks – Fieldbus specifications – Part 4-3:*
754 *Data-link layer protocol specification – Type 3 elements*

755 IEC 61158-4-4:201X, *Industrial communication networks – Fieldbus specifications – Part 4-4:*
756 *Data-link layer protocol specification – Type 4 elements*

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

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

- 761 IEC 61158-4-16:2007, *Industrial communication networks – Fieldbus specifications –*
762 *Part 4-16: Data-link layer protocol specification – Type 16 elements*
- 763 IEC 61158-4-18:2010, *Industrial communication networks – Fieldbus specifications –*
764 *Part 4-18: Data-link layer protocol specification – Type 18 elements*
- 765 IEC 61158-4-19:201X, *Industrial communication networks – Fieldbus specifications –*
766 *Part 4-19: Data-link layer protocol specification – Type 19 elements*
- 767 IEC 61158-4-20:2014, *Industrial communication networks – Fieldbus specifications –*
768 *Part 4-20: Data-link layer protocol specification – Type 20 elements*
- 769 IEC 61158-4-24:201X, *Industrial communication networks – Fieldbus specifications –*
770 *Part 4-24: Data-link layer protocol specification – Type 24 elements*
- 771 IEC 61158-5-2:201X, *Industrial communication networks – Fieldbus specifications – Part 5-2:*
772 *Application layer service definition – Type 2 elements*
- 773 IEC 61158-5-3:201X, *Industrial communication networks – Fieldbus specifications – Part 5-3:*
774 *Application layer service definition – Type 3 elements*
- 775 IEC 61158-5-4:201X, *Industrial communication networks – Fieldbus specifications – Part 5-4:*
776 *Application layer service definition – Type 4 elements*
- 777 IEC 61158-5-5:2014, *Industrial communication networks – Fieldbus specifications – Part 5-5:*
778 *Application layer service definition – Type 5 elements*
- 779 IEC 61158-5-7:2007, *Industrial communication networks – Fieldbus specifications – Part 5-7:*
780 *Application layer service definition – Type 7 elements*
- 781 IEC 61158-5-8:2007, *Industrial communication networks – Fieldbus specifications – Part 5-8:*
782 *Application layer service definition – Type 8 elements*
- 783 IEC 61158-5-9:2014, *Industrial communication networks – Fieldbus specifications – Part 5-9:*
784 *Application layer service definition – Type 9 elements*
- 785 IEC 61158-5-16:2007, *Industrial communication networks – Fieldbus specifications –*
786 *Part 5-16: Application layer service definition – Type 16 elements*
- 787 IEC 61158-5-18:2010, *Industrial communication networks – Fieldbus specifications –*
788 *Part 5-18: Application layer service definition – Type 18 elements*
- 789 IEC 61158-5-19:201X, *Industrial communication networks – Fieldbus specifications –*
790 *Part 5-19: Application layer service definition – Type 19 elements*
- 791 IEC 61158-5-20:2014, *Industrial communication networks – Fieldbus specifications –*
792 *Part 5-20: Application layer service definition – Type 20 elements*
- 793 IEC 61158-5-24:2014, *Industrial communication networks – Fieldbus specifications –*
794 *Part 5-24: Application layer service definition – Type 24 elements*
- 795 IEC 61158-6-2:201X, *Industrial communication networks – Fieldbus specifications – Part 6-2:*
796 *Application layer protocol specification – Type 2 elements*
- 797 IEC 61158-6-3:201X, *Industrial communication networks – Fieldbus specifications – Part 6-3:*
798 *Application layer protocol specification – Type 3 elements*

- 799 IEC 61158-6-4:201X, *Industrial communication networks – Fieldbus specifications – Part 6-4:*
800 *Application layer protocol specification – Type 4 elements*
- 801 IEC 61158-6-5:2014, *Industrial communication networks – Fieldbus specifications – Part 6-5:*
802 *Application layer protocol specification – Type 5 elements*
- 803 IEC 61158-6-7:2007, *Industrial communication networks – Fieldbus specifications – Part 6-7:*
804 *Application layer protocol specification – Type 7 elements*
- 805 IEC 61158-6-8:2007, *Industrial communication networks – Fieldbus specifications – Part 6-8:*
806 *Application layer protocol specification – Type 8 elements*
- 807 IEC 61158-6-9:2014, *Industrial communication networks – Fieldbus specifications – Part 6-9:*
808 *Application layer protocol specification – Type 9 elements*
- 809 IEC 61158-6-16:2007, *Industrial communication networks – Fieldbus specifications –*
810 *Part 6-16: Application layer protocol specification – Type 16 elements*
- 811 IEC 61158-6-18:2010, *Industrial communication networks – Fieldbus specifications –*
812 *Part 6-18: Application layer protocol specification – Type 18 elements*
- 813 IEC 61158-6-19:201X, *Industrial communication networks – Fieldbus specifications –*
814 *Part 6-19: Application layer protocol specification – Type 19 elements*
- 815 IEC 61158-6-20:2014, *Industrial communication networks – Fieldbus specifications –*
816 *Part 6-20: Application layer protocol specification – Type 20 elements*
- 817 IEC 61158-6-24:2014, *Industrial communication networks – Fieldbus specifications –*
818 *Part 6-24: Application layer protocol specification – Type 24 elements*
- 819 IEC 61784-2:201X, *Industrial communication networks – Profiles – Part 2: Additional fieldbus*
820 *profiles for real-time networks based on ISO/IEC 8802-3*
- 821 **For IEC 61784-5-2 an amendment or a new edition is planned.**
822 **The reference will be updated accordingly and this note deleted at the publication**
823 **stage.**
- 824 IEC 61784-5-2:2013, *Industrial communication networks – Profiles – Part 5-2: Installation of*
825 *fieldbuses – Installation profiles for CPF 2*
- 826 IEC 61918:201X, *Industrial communication networks – Installation of communication networks*
827 *in industrial premises*
- 828 IEC 62026-3, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) –*
829 *Part 3: DeviceNet*
- 830 IEC 62591:2016, *Industrial communication networks – Wireless communication network and*
831 *communication profiles – WirelessHART™*
- 832 ISO/IEC 8482, *Information technology – Telecommunications and information exchange*
833 *between systems – Twisted pair multipoint interconnections*
- 834 ISO/IEC 8802-2:1998, *Information technology – Telecommunications and information*
835 *exchange between systems – Local and metropolitan area networks – Specific requirements –*
836 *Part 2: Logical link control*

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

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

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

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

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

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

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

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

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

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

857 IETF RFC 894, *A standard for the Transmission of IP Datagrams over Ethernet Networks*;
858 available at <<http://www.ietf.org>>

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

860 IETF RFC 1122, *Requirements for Internet Hosts – Communication Layers*; available at
861 <<http://www.ietf.org>>

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

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

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

868 **3 Definitions**

869 **3.1 Terms and definitions**

870 For the purposes of this document, all terms and definitions provided in the IEC 61158 series
871 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 subclauses	any following subclauses of the same level up to the last subclause
	Next clauses	any following clauses up to the last clause of the base specification
	Next Annexes	any following annexes up to the last annex of the base specification
Header	<text>	(sub)clause title of the base specifications
Presence	NO	This (sub)clause is not included in the profile
	YES	This (sub)clause is fully (100 %) included in the profile in this case no further detail is given
	—	Presence is defined in the following subclauses
	Partial	Parts of this (sub)clause is included in the profile
Constraints	See <#>	Constraints/remarks are defined in the given subclause, table or figure of this profile document
	—	No constraints other than given in the reference document (sub)clause, or not applicable
	<text>	The text defines the constraint directly, for longer text table footnotes or table notes may be used

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

EXAMPLE 1 Concatenated subclauses

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

EXAMPLE 2 Concatenated clauses up to the last clause

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

EXAMPLE 3 concatenated annexes up to the last annex

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

3.3.1.2 Service selection tables

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

Table 4 – Layout of service selection tables

Service ref.	Service name	Usage	Constraint

Table 5 – Contents of service selection tables

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

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

Table 6 – Layout of parameter selection tables

Parameter ref.	Parameter name	Usage	Constraint

Table 7 – Contents of parameter selection tables

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

3.3.2 Physical layer

No additional conventions are defined.

3.3.3 Data-link layer

3.3.3.1 Service profile conventions

No additional conventions are defined.

915 3.3.3.2 Service and parameter selections

916 These are described using the common conventions, see 3.3.1.2.

917 3.3.4 Application layer

918 3.3.4.1 Service profile conventions

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

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

924 **Table 8 – Layout of class attribute selection tables**

Attribute	Attribute Name	Usage	Constraint

926 **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

928 3.3.4.2 Service and parameter selections

929 These are described using the common conventions, see 3.3.1.2.

930 4 Conformance to communication profiles

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

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

² In accordance with ISO/IEC Directives

Compliance to IEC 61784-1:201X³ CPF n <Type>

or

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

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

Compliance to IEC 61784-1:201X³ CP n/n <Type>

or

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

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

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

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.

965

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

966

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

968 **5.2 Profile 1/1 (FOUNDATION™ H1)**

969 **5.2.1 Physical layer**

970 **5.2.1.1 Communicating devices**

971 **5.2.1.1.1 Introduction**

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

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

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2	Type 1: Terms and definitions	YES	—
Next subclauses	—	NO	—
4	Symbols and abbreviations	—	—
4.1	Symbols	—	—
4.1.1	Type 1: Symbols	YES	—
4.1.2 – 4.1.11	—	NO	—
4.2	Abbreviations	—	—
4.2.1	Type 1: Abbreviations	YES	—
Next subclauses	—	NO	—
5	Data-link layer – Physical Layer interface	—	—
5.1	General	Partial	Used when applicable
5.2	Type 1: Required services	YES	—
Next subclauses	—	NO	—
6	Systems Management – Physical Layer interface	—	—
6.1	General	Partial	Used when applicable
6.2	Type 1: Systems Management – Physical Layer interface	YES	—

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

975 **5.2.1.1.2 MAU and device classes**

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

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

987 **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).												

988

989

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	—

990

991

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	—

992

993

Table 15 – Void

994

5.2.1.1.3 Recommended values for MAUs and their devices

995

5.2.1.1.3.1 Signal polarity

996

997

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.

998

5.2.1.1.3.2 Receive filters

999

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

1000

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

1001

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

1002

5.2.1.1.3.3 Labelling

1003

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

1004

a) do not provide automatic polarity detection, and

1005

b) do not use the external connectors specified in IEC 61158-2, Clause A.2.

1006

1007

1008

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.

1009

1010

1011

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.

1012

5.2.1.1.3.4 IS device parameters

1013

1014

1015

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.

1016

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

1017

1018

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.

1030

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
Next subclauses	—	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.			

1031

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.

1039

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
Next subclauses	—	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	—
<p>^a For power supplies designed to meet FISCO rules, in case of conflict, FISCO rules take precedence.</p> <p>^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.</p> <p>^c The connector is optional.</p>			

1040

1041 A fieldbus power supply is categorized as defined in Table 20.

1042

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 <u>not</u> 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.		

1043

1044 Type 55, 552, 553 and 554 power supplies may

1045 a) be linear (resistance limited),

1046 b) have a trapezoidal (voltage limited) output characteristic, or

1047 c) have a rectangular (voltage and current limited) output characteristic.

1048 The recommended output voltage and maximum IS parameters for a Type 551 or Type 552
 1049 power supply, which is intended to operate with devices of Types 511 or 512 or both, are
 1050 listed in Table 21. A Type 551 or Type 552 power supply shall be separated from the nearest
 1051 terminator, at an end of the trunk cable, by no more than 30 m of cable.

1052

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

1053

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.		

1054

1055 **5.2.1.2.3 Terminators**

1056 It is assumed that the terminator does not contain a fieldbus MAU, power supply, intrinsic
 1057 safety barrier or galvanic isolator.

1058 All terminators shall conform to IEC 61158-2 as shown in Table 22.

1059

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
Next subclauses	—	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.			

1060

1061

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	≥ 24 V	≥ 17,5 V
Device approval current	≥ 250 mA	≥ 380 mA
Device input power	≥ 1,2 W	≥ 5,32 W
Terminator residual inductance	≤ 20 µH	≤ 10 µH
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

1062

1063 **5.2.1.2.4 Intrinsic safety barriers**

1064 NOTE FISCO rules do not permit use of intrinsic safety barriers as separate components. See IEC 60079-11 and
1065 IEC 60079-25.

1066 It is assumed that the intrinsic safety barrier does not contain a fieldbus MAU, terminator or
1067 power supply.

1068 An Intrinsic safety barrier is used to communicate with devices and other network elements
1069 installed in a hazardous area. It should be suitably approved by relevant safety authorities for
1070 use in the intended application.

1071 All Intrinsic safety barriers shall conform to IEC 61158-2, Clause 12, as shown in Table 24.

1072 **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
Next subclauses	—	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	—

Clause	Header	Presence	Constraints
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	—	—
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.			

1073

1074

1075

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)	≤ 24 V
Short circuit output current	≤ 250 mA
Matched output power	≤ 1,2 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.	

1076

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
Next subclauses	—	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	—

Clause	Header	Presence	Constraints
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.			

1087

1088 5.2.1.3 Fiber media and related network components and considerations

1089 5.2.1.3.1 Optical fiber types

1090 The alternatives for optical fiber type for a Type 411 device are listed in Table 27.

1091 **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 nm)	Comments
Standard test fiber	100/140 μm (A1d)	0,26 ± 0,03	≤ 4,0 dB/km	Mode filter required
Recommended operating fiber	100/140 μm (A1d)	0,26 ± 0,03	≤ 4,0 dB/km	
	200/230 μm (A3c)	0,4 ± 0,04	≤ 10,0 dB/km	
	50/125 μm (A1a)	0,2 ± 0,02	≤ 3,0 dB/km	
	62,5/125 μm (A1b)	0,275 ± 0,015	≤ 3,0 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.				

1092

1093 5.2.1.3.2 Passive star couplers

1094 The recommended maximum insertion losses for optical passive star couplers for the
 1095 31,25 kbit/s single-fiber optical medium are listed in Table 28. Reflective star couplers (see
 1096 IEC 61158-2, Annex D) are required for the single-fiber medium.

1097 **Table 28 – CP 1/1: PhL selection of passive star couplers,**
 1098 **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.							

1099

1100 5.2.1.3.3 Active star couplers

1101 The characteristics for active star couplers for the 31,25 kbit/s, single-fiber optical medium are
 1102 listed in Table 29.

1103

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.		

1104

1105 5.2.1.3.4 Optical power budget

1106 Optical power budget considerations are shown in Table 30, and an example optical power
1107 budget for a system is shown in Figure 2.

1108

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.				

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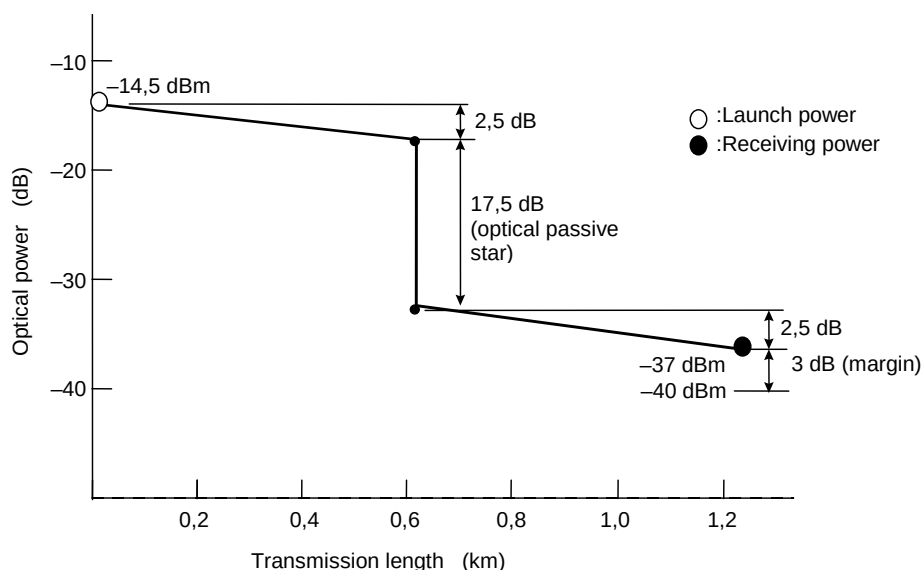


Figure 2 – Example optical power budget for a 100/140 μm fiber system with a 16/16 optical passive star coupler

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.