IEC 61784-1-3

Edition 1.0 2023-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial networks – Profiles –
Part 1-3: Fieldbus profiles – Communication Profile Family 3

Réseaux industriels – Profils –
Partie 1-3: Profils de bus de terrain – Famille de profils de communication 3

IEC 61784-1-3:2023-03(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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

IEC 61784-1-3 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This first edition, together with the other parts of the same series, cancels and replaces the fifth edition of IEC 61784-1 published in 2019. This first edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 61784-1:2019:

a) split of the original IEC 61784-1 into several subparts, one subpart for the material of a generic nature, and one subpart for each Communication Profile Family specified in the original document.

The text of this International Standard is based on the following documents:

Draft	Report on voting
65C/1207/FDIS	65C/1236/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts of the IEC 61784-1 series, published under the general title *Industrial networks – Profiles – Part 1: Fieldbus profiles*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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- withdrawn,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

INTRODUCTION

The IEC 61784-1 series 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 with 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, can be addressed by future parts of the IEC 61784-1 series.

The IEC 61784-1 series 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 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 facilitate the use of the IEC 61158 series of standards; the profiles defined in the IEC 61784-1 series are a necessary step to achieve that task.

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

Profiles contained in the IEC 61784-1 series 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 appropriate[1]. Each profile is required to reference at least one part of the IEC 61158 series in addition to IEC 61158-1.

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

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

INDUSTRIAL NETWORKS – PROFILES –

Part 1-3: Fieldbus profiles – Communication Profile Family 3

1 Scope

This part of IEC 61784-1 defines Communication Profile Family 3 (CPF 3). CPF 3 specifies a set of protocol specific communication profiles (CPs) based on the IEC 61158 series (Type 3 and Type 10) and other standards, to be used in the design of devices involved in communications in factory manufacturing and process control.

NOTE 1 All CPs are based on standards or draft standards or International Standards published by the IEC or on standards or International Standards established by other standards bodies or open standards processes.

NOTE 2 Some CPs of CPF 3 are specified in IEC 61784-2-3.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE All parts of the IEC 61158 series, as well as the IEC 61784-1 series and the IEC 61784-2 series 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, *Industrial-process measurement and control − Programmable controllers – Part 2: Equipment requirements and tests*

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

IEC 61158-2:2023, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

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

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

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

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

IEC 61784-1-0:2023, *Industrial networks – Profiles – Part 1-0: Fieldbus profiles – General concepts and terminology*

IEC 61784-2-3:2023, *Industrial networks – Profiles – Part 2-3: Additional real-time fieldbus profiles based on ISO/IEC/IEEE 8802-3 – CPF 3*

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

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

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

3.1 Terms and definitions

For the purposes of this document, all terms and definitions provided in the IEC 61158 series and IEC 61784-1-0 apply.

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

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

3.2 Abbreviations and symbols

3.2.1 Common abbreviations and symbols

For the purposes of this document, all abbreviations and symbols defined in the IEC 61158 series and IEC 61784-1-0 apply.

CP	communication profile
CPF	communication profile family
MAU	medium attachment unit

3.2.2 Other abbreviations and symbols

CE	"Conformité Européenne" (i.e., "European Conformity")
DP-V0	PROFIBUS DP version 0
DP-V1	PROFIBUS DP version 1
EMC	electro-magnetic compatibility
IS	intrinsically safe (as an adjective) intrinsic safety (as a noun)
RS 485	MAU according to TIA-485-A
RS 485-IS	MAU according to TIA-485-A and applicable to IS

3.3 Conventions

For the purposes of this document, the conventions defined in IEC 61784-1-0 apply.

4 CPF 3 (PROFIBUS & PROFINET[2])

4.1 General overview

Communication Profile Family 3 (CPF 3) defines communication profiles using Type 3 and Type 10 of IEC 61158 series, which corresponds to parts of the communication systems commonly known as PROFIBUS and PROFINET. CP 3/1 and CP 3/2 are specified in this document. CP 3/4, CP3/5, and CP 3/6 are RTE specific PROFINET profiles and specified in IEC 61784-2-3.

Table 1 gives an overview of the specified profile sets.

Table 1 – CPF 3: overview of profile sets

Layer	Profile 3/1				Profile 3/2
Application	IEC 61158-5-3, IEC 61158-6-3				
Data-link	IEC 61158-3-3, IEC 61158-4-3 Asynchronous transmission				IEC 61158-3-3, IEC 61158-4-3 Synchronous transmission
Physical	0 [a]	2 [a]	3 [a]	4 [a]	1 [a]

NOTE PROFIBUS uses Profile 3/1 and 3/2. PROFIBUS DP is the name of AL protocol and service part, which is identical for CP 3/1 and CP 3/2 and uses the Type 3 DL parts.

[a] These numbers are the CP identifier used within Communication Feature List (GSD) in keyword "Physical Interface".

Coding: 0: RS 485 (TIA-485-A);optional RS 485-IS
1: Manchester coded and bus powered (MBP); optional IS (MBP-IS) and lower power (MBP-LP)
2: Plastic fiber;
3: Glass multi mode fiber or Glass single mode fiber;
4: PCF fiber.

NOTE 1 See Annex A for an overview of PROFIBUS communications concepts and definition of DP-V0, DP-V1 and Options.

An implementation profile like temperature transmitter or master device shall select from CPF 3 these behaviors that are needed for a certain device type. The manufacturer of a device shall describe the selection for CP 3/1 and CP 3/2 by writing a Communication Feature List (GSD) according ISO 15745-3:2003, 6.2. The GSD is necessary to specify an implementation profile.

It is recommended to perform a conformance test, which is not normative but specified within the consortium PROFIBUS International. Each CP 3/1 and CP 3/2 conformant device shall have a type specific GSD, which is part of the conformance test.

The CPF3 specifies in this document two distinct profiles:

a) Profile 3/1
Profile 3/1 is a subset of IEC 61158 Type 3 services and protocols and uses the as physical layer (PhL) four different media, see Table 1. A Communication Profile (CP) identifier identifies these.

b) Profile 3/2
Profile 3/2 is a subset of IEC 61158 Type 3 services and protocols and uses the Manchester coded bus powered (MBP) synchronous transmission of PhL specified in Type 3. Based on

[2] PROFIBUS and PROFINET are trademarks of PROFIBUS Nutzerorganisation e.V. (PNO). PNO is a non-profit trade organization to support the fieldbus PROFIBUS. 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 with this profile does not require use of the registered trademark. Use of the trademark PROFIBUS and PROFINET requires permission of the trade name holder.

different transmission technologies for PROFIBUS DP, the DLL contains different interfaces to the PhL. That causes different communication profiles for PROFIBUS DP.
The MBP non-IS PhL is the basis for the extended specification for IS (MBP-IS) and low power (MBP-LP) capability. MBP-LP supports IS. Slave devices with a MAU supporting MBP-LP are also usable in systems that require MBP-IS or MBP. Slave devices with a MAU supporting MBP-IS are also usable in a system that requires MBP. Figure 1 shows this hierarchy.

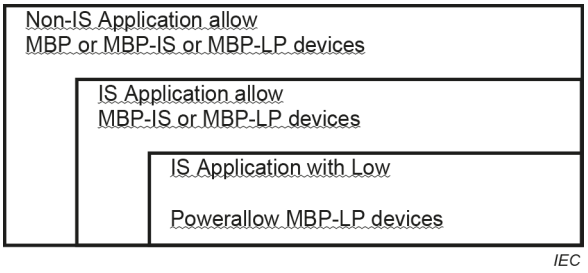

Figure 1 – CP 3/2 Slave devices usable in applications

NOTE 2 Additional CPs are defined in IEC 61784-2-3.

NOTE 3 CP 3/3 has been withdrawn.

4.2 CP 3/1 (PROFIBUS DP)

4.2.1 Physical layer

4.2.1.1 PhL selection

Table 2 specifies the selection of IEC 61158-2 for devices of all types of this profile. 4.2.1.2 specifies additional considerations.

Table 2 – CP 3/1: PhL selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	Partial	See Table 3
4	Symbols and abbreviated terms	Partial	See Table 4
5	DLL – PhL interface	—	—
5.1	General	YES	—
5.2 – 5.3	—	NO	—
5.4	Type 3: Required services	—	—
5.4.1	Synchronous transmission	NO	—
5.4.2	Asynchronous transmission	YES	—
Next subclauses	—	NO	—
6	Systems management – PhL interface	—	—
6.1	General	YES	—
6.2	Type 1: Systems management – PhL interface	NO	—
6.3	Type 3: Systems management – PhL interface	—	—
6.3.1	Synchronous transmission	NO	—
6.3.2	Asynchronous transmission	YES	—
Next subclauses	—	NO	—

Clause	Header	Presence	Constraints
7	DCE Independent sublayer (DIS)	—	—
7.1	General	YES	—
7.2	Type 1: DIS	NO	—
7.3	Type 3: DIS	—	—
7.3.1	Synchronous transmission	NO	—
7.3.2	Asynchronous transmission	YES	—
Next subclauses	—	NO	—
8	DTE – DCE interface and MIS-specific functions	—	—
8.1	General	YES	—
8.2	Type 1: DTE – DCE interface	NO	—
8.3	Type 3: DTE – DCE interface	—	—
8.3.1	Synchronous transmission	NO	—
8.3.2	Asynchronous transmission	YES	—
Next subclauses	—	NO	—
9	Medium dependent sublayer (MDS)	—	—
9.1	General	YES	—
9.2 – 9.4	—	NO	—
9.5	Type 3: MDS: Wire and optical media	—	—
9.5.1	Synchronous Transmission	NO	—
9.5.2	Asynchronous Transmission	YES	—
Next subclauses	—	NO	—
10	MDS – MAU interface	—	—
10.1	General	YES	—
10.2 – 10.4	—	NO	—
10.5	Type 3: MDS – MAU interface: Wire and optical media	—	—
10.5.1	Synchronous Transmission	NO	—
10.5.2	Asynchronous Transmission	YES	—
Next subclauses	—	NO	—
11 – 21	—	NO	—
22	Type 3: Medium Attachment Unit: Asynchronous Transmission, wire medium	—	—
22.1	Medium Attachment Unit for non intrinsic Safety	YES	For RS 485
22.2	Medium Attachment Unit for intrinsic Safety	YES	For RS 485-IS
23	Type 3: Medium Attachment Unit: Asynchronous Transmission, optical medium	YES	For Plastic, Glass and PCF fiber
Next clauses	—	NO	—
Annex A – H	—	NO	—
Annex I	(normative) Type 3: Connector specification	—	—
I.1	Connector for synchronous transmission	NO	—
I.2	Connector for asynchronous transmission	YES	For RS 485
I.3	Connector for fiber optic cable	YES	For Plastic, Glass and PCF fiber