IEC 61784-1-4

Edition 1.0   2023-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial networks – Profiles –
Part 1-4: Fieldbus profiles – Communication Profile Family 4

Réseaux industriels – Profils –
Partie 1-4: Profils de bus de terrain – Famille de profils de communication 4

IEC 61784-1-4:2023-03(en-fr)

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CONTENTS

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INDUSTRIAL NETWORKS –
PROFILES –

Part 1-4: Fieldbus profiles –
Communication Profile Family 4

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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

IEC 61784-1-4 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).

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[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 1-4: Fieldbus profiles –
Communication Profile Family 4

1 Scope

This part of IEC 61784-1 defines Communication Profile Family 4 (CPF 4). CPF 4 specifies a set of protocol specific communication profiles (CPs) based on the IEC 61158 series (Type 4) 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 4 are specified in IEC 61784-2-4.

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 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 61158-3-4:2023, *Industrial communication networks – Fieldbus specifications – Part 3-4: Data-link layer service definition – Type 4 elements*

IEC 61158-4-4:2023, *Industrial communication networks – Fieldbus specifications – Part 4-4: Data-link layer protocol specification – Type 4 elements*

IEC 61158-5-4:2023, *Industrial communication networks – Fieldbus specifications – Part 5-4: Application layer service definition – Type 4 elements*

IEC 61158-6-4:2023, *Industrial communication networks – Fieldbus specifications – Part 6-4: Application layer protocol specification – Type 4 elements*

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

IEC 61784-2-4:2023, *Industrial networks – Profiles – Part 2-4: Additional real-time fieldbus profiles based on ISO/IEC/IEEE 8802-3 – CPF 4*

ISO/IEC/IEEE 8802-3, *Telecommunications and exchange between information technology systems – Requirements for local and metropolitan area networks – Part 3: Standard for Ethernet*

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

IP   internet protocol (see IETF RFC 791)

RS 485   MAU according to TIA-485-A

UDP   user datagram protocol (see IETF RFC 768)

3.3 Conventions

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

4 CPF 4 (P-NET®[2])

4.1 General overview

Communication Profile Family 4 defines profiles based on IEC 61158-2 type 4, IEC 61158-3-4, IEC 61158-4-4, IEC 61158-5-4 and IEC 61158-6-4, which corresponds to parts of a communication system commonly known as P-NET.

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[2] P-NET is the trade name of International P-NET User Organisation ApS (IPUO). 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 trade name P-NET. Use of the trade name P-NET requires permission of the trade name holder.

CPF 4 (P-NET) communication concepts are explained in Annex A.

Profile 4/1 P-NET RS-485

This profile contains AL, DLL and PhL services and protocol references with an IEC 61158 compliant application access. Profile 4/1 is based on TIA-485-A, and allows up to 125 devices of normal or simple class to communicate on the same physical link, in half duplex mode.

Profile 4/2 *Void*
Profile 4/3 P-NET on IP

This profile contains AL and DLL services and protocol references with an IEC 61158 compliant application access. Profile 4/3 is based to ISO/IEC/IEEE 8802-3, and allows up to 125 devices of normal class to communicate on the same logical link, in full duplex mode.

Profile 4/1 is described in this document, whereas profile 4/3 is described in IEC 61784-2-4.

4.2   CP 4/1 (P-NET RS-485)

4.2.1   Physical layer

Table 1 holds the physical layer service and protocol selections from IEC 61158-2 for this profile.

Table 1 – CP 4/1: PhL selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms and definitions	Partial	Used when applicable
4	Symbols and abbreviated terms	Partial	Used when applicable
5	Data-link layer – Physical Layer Interface	—	—
5.1	General	YES	—
5.2 – 5.4	—	NO	—
5.5	Type 4: Required services	YES	See text following this table
Next subclauses	—	NO	—
6	Station Management – Physical Layer Interface	—	—
6.1	General	YES	—
6.2	Type 1: Station Management – Physical Layer interface	Partial	Only Ph-SETVALUE and Ph-GETVALUE
6.3	—	NO	—
6.4	Type 4: Station Management – Physical Layer interface	YES	At least, Baud rate 76800 shall be supported. Only half duplex mode shall be supported
Next subclauses	—	NO	—
7 – 8	—	NO	—
9	Medium Dependent Sublayer (MDS)	—	—
9.1	General	YES	—
9.2 – 9.5	—	NO	—
9.6	Type 4: MDS: Wire medium	—	—
9.6.1	Half Duplex	YES	—
9.6.2	Full Duplex	NO	—
Next subclauses	—	NO	—
10 – 23	—	NO	—
24	Type 4: Medium Attachment Unit: RS-485	YES	—
Next clauses	—	NO	—
Next annexes	—	NO	—

Simple class devices shall only support:

a) Ph-Data request, classes start-of-activity-11, data and end-of-activity.

b) Ph-DATA indication, classes START-OF-ACTIVITY and DATA.

4.2.2 Data-link layer

4.2.2.1 DLL service selection

Table 2 holds the Data-link layer service selections from IEC 61158-3-4 for this profile.

Table 2 – CP 4/1: DLL service selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Terms, definitions, symbols, abbreviated terms and conventions	Partial	Used when applicable
4	Data-link Service and concepts	YES	—
5	DL-management Service	—	—
5.1	Scope and inheritance	NO	—
5.2	Facilities of the DL-management service	Partial	Items a) and b)
5.3	Model of the DL_management service	YES	—
5.4	Constraints on sequence of primitives	Partial	Only the parts referring to DLM-Set and DLM-Get
5.5	Set	YES	—
5.6	Get	YES	—
5.7 – 5.8	—	NO	—

For this profile, DLS-user data size is limited to 56 octets and hence the Data-field-format parameter always holds one octet of information, as described in IEC 61158-3-4, 4.7.2.11.

4.2.2.2   DLL protocol selection

Table 3 holds the Data-link layer protocol selections from IEC 61158-4-4 for this profile.

Table 3 – CP 4/1: DLL protocol selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Used if needed
3	Definitions, symbols and abbreviated terms	Partial	Used when applicable
4	Data-link Protocol definition	YES	a

^a A device shall provide at least the necessary protocol options to fulfill the supported services.

For this profile, only half duplex transmission, as defined in IEC 61158-4-4, 4.1.3.3 should be supported.

Simple class devices should support responder functionality only, as defined in IEC 61158-4-4, 4.1.2.

For this profile, the Data-field-format field always holds one octet of information, and shall be interpreted as described in IEC 61158-4-4, 4.2.3.4.

4.2.3   Application layer

4.2.3.1   AL service selection

Table 4 holds the application layer service selections from IEC 61158-5-4 for this profile.