IEC 61784-1-16

Edition 1.0 2023-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial networks – Profiles –
Part 1-16: Fieldbus profiles – Communication Profile Family 16

Réseaux industriels – Profils –
Partie 1-16: Profils de bus de terrain – Famille de profils de communication 16

IEC 61784-1-16:2023-03(en-fr)

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INDUSTRIAL NETWORKS – PROFILES –

Part 1-16: Fieldbus profiles – Communication Profile Family 16

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 61784-1-16 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 1-16: Fieldbus profiles – Communication Profile Family 16

1 Scope

This part of IEC 61784-1 defines Communication Profile Family 16 (CPF 16). CPF 16 specifies a set of protocol specific communication profiles (CPs) based on the IEC 61158 series (Type 16 and Type 19) 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 16 are specified in IEC 61784-2-16.

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

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

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

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

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

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

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

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

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

IEC 61784-2-16:2023, *Industrial networks – Profiles – Part 2-16: Additional real-time fieldbus profiles based on ISO/IEC/IEEE 8802-3 – CPF 16*

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

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

None.

3.3 Conventions

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

4 CPF 16 (SERCOS[2])

4.1 General overview

Communication Profile Family 16 defines communication profiles based on IEC 61158-2 type 16, IEC 61158-3-16, IEC 61158-4-16, IEC 61158-5-16 and IEC 61158-6-16, and on IEC 61158-3-19, IEC 61158-4-19, IEC 61158-5-19 and IEC 61158-6-19, which collectively correspond to parts of a communication system commonly known as SERCOS interface.

– Profile 16/1 (SERCOS I)
This profile is based on fiber-media physical layers and operates at 2 Mbit/s and 4 Mbit/s (see 4.2).

– Profile 16/2 (SERCOS II)
This profile is similar to 16/1, but operates also at 8 Mbit/s and 16 Mbit/s, and provides for additional features (see 4.3).

– Profile 16/3 (SERCOS III)
This profile is based on ISO/IEC/IEEE 8802-3 (Ethernet) MAC and physical layers; it provides again for additional features (see IEC 61784-2-16, 4.2).

NOTE See Annex A for an overview of SERCOS communications concepts.

4.2 CP 16/1 (SERCOS I)

4.2.1 Physical layer selection

Table 1 specifies the PhL selection within IEC 61158-2 for this profile.

2 SERCOS is a trade name of Sercos International e.V. 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 trade name requires permission of the trade name holder.

Table 1 – CP 16/1: PhL selection

Clause	Header	Presence	Constraints
0	Introduction	YES	—
1	Scope	YES	—
2	Normative references	Partial	Used as needed
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Used when applicable
3.2 – 3.8	—	NO	—
3.9	Type 16: Terms and definitions	YES	—
Next subclauses	—	NO	—
4	Symbols and abbreviated terms	—	—
4.1	Symbols	—	—
4.1.1 – 4.1.7	—	NO	—
4.1.8	Type 16: Symbols	YES	—
Next subclauses	—	NO	—
4.2	Abbreviated terms	—	—
4.2.1 – 4.2.7	—	NO	—
4.2.8	Type 16: Abbreviations	YES	—
Next subclauses	—	NO	—
5	Data-link layer – physical layer interface	—	—
5.1	General	Partial	Used as needed
5.2 – 5.8	—	NO	—
5. 9	Type 16: Required services	YES	—
Next subclauses	—	NO	—
6 – 8	—	NO	—
9	Medium dependent sublayer (MDS)	—	—
9.1	General	Partial	Used as needed
9.1 – 9.9	—	NO	—
9.10	Type 16: MDS: Optical media	YES	—
Next subclauses	—	NO	—
10 – 29	—	NO	—
30	Medium attachment unit: optical fiber medium at 2 Mbit/s, 4 Mbit/s, 8 Mbit/s and 16 Mbit/s	YES	Used up to the exception below
30.2.3	Data rate	Partial	CP16/2 not used
Next clauses	—	NO	—
Annex A – M	—	NO	—
Annex N	Type 16: Connector specification	YES	—
Annex O	Type 16: Optical network topology	YES	—
Annex P	Type 16: Reference design example	YES	—
Next annexes	—	NO	—

4.2.2 Data-link layer

4.2.2.1 DLL service selection

DLL services are defined in IEC 61158-3-16. IEC 61158-3-16 applies except 4.3.

4.2.2.2 DLL protocol selection

Table 2 specifies the DLL protocol selection within IEC 61158-4-16 for this profile.

Table 2 – CP 16/1: DLL protocol selection

Clause	Header	Presence	Constraints
Whole document	Data-link protocol specification (Type 16)	YES	Used up to the exceptions below
5.3	MDT DLPDU	—	—
5.3.1 – 5.3.4	—	YES	—
5.3.5	CP5	NO	Not used for CP16/1
5.3.6	CP6	NO	Not used for CP16/1
5.4	AT DLPDU	—	—
5.4.1 – 5.4.4	—	YES	—
5.4.5	CP5	NO	Not used for CP16/1
5.4.6	CP6	NO	Not used for CP16/1

4.2.3 Application layer

4.2.3.1 AL service selection

Table 3 specifies the AL service selection within IEC 61158-5-16 for this profile.

Table 3 – CP 16/1: AL service selection

Clause	Header	Presence	Constraints
Whole document	Application service specification (Type 16)	YES	Used up to the exceptions below
6.2.3.3.10	File download service	NO	Not used for CP16/1
6.2.3.3.11	File upload service	NO	Not used for CP16/1

4.2.3.2 AL protocol selection

AL protocols are specified in IEC 61158-5-16. IEC 61158-5-16 applies except 4.5.3.3.10.

4.3 CP 16/2 (SERCOS II)

4.3.1 Physical layer

Table 4 specifies the PhL selection within IEC 61158-2 for this profile.