

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Industrial networks – Profiles –
Part 1-8: Fieldbus profiles – Communication Profile Family 8**

**Réseaux industriels – Profils –
Partie 1-8: Profils de bus de terrain – Famille de profils de communication 8**

<https://standards.iteh.ai/catalog/standards/sist/37505031-ed54-4aef-9ebc-a49bca5fe44b/iec-61784-1-8-2023>



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INDUSTRIAL NETWORKS – PROFILES –

Part 1-8: Fieldbus profiles – Communication Profile Family 8

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 61784-1-8 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- withdrawn,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 appropriate¹. 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 1-8: Fieldbus profiles – Communication Profile Family 8

1 Scope

This part of IEC 61784-1 defines Communication Profile Family 8 (CPF 8). CPF 8 specifies a set of protocol specific communication profiles (CPs) based on the IEC 61158 series (Type 18 and Type 23) 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 8 are specified in IEC 61784-2-8.

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

IEC 61158-4-18:2010, *Industrial communication networks – Fieldbus specifications – Part 4-18: Data-link layer protocol specification – Type 18 elements*

IEC 61158-5-18:2010, *Industrial communication networks – Fieldbus specifications – Part 5-18: Application layer service definition – Type 18 elements*

IEC 61158-6-18:2010, *Industrial communication networks – Fieldbus specifications – Part 6-18: Application layer protocol specification – Type 18 elements*

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

ISO/IEC 8482, *Information technology – Telecommunications and information exchange between systems – Twisted pair multipoint interconnections*

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

RS 485	MAU according to TIA-485-A
--------	----------------------------

3.3 Conventions

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

4 CPF 8 (CC-Link²)

4.1 General overview

4.1.1 General

Communication Profile Family 8 (CPF8) defines communication profiles based on IEC 61158-2 type 18, IEC 61158-3-18, IEC 61158-4-18, IEC 61158-5-18 and IEC 61158-6-18, which corresponds to parts of the communication systems commonly known as CC-Link.

CPF 8 consists of three profile sets:

- Profile 8/1 – CC-Link/V1

² CC-Link Logo is the registered trademark of CC-Link Partners Association (CLPA). CLPA is a non-profit trade organization to support the fieldbus CC-Link. 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 registered trademark CC-Link Logo requires permission of the trade name holder.

b) Profile 8/2 – CC-Link/V2

c) Profile 8/3 – CC-Link/LT

Common to all CPF 8 profiles, there are two fundamental device types defined: Master devices and Slave devices.

Master devices determine the data communication on the bus; only a Master device is able to initiate transmissions on the bus.

Slave devices are field devices such as I/O devices, valves, drives and measuring transducers. Slave devices are assigned to a Master device as a provider for cyclic I/O data exchange, and optionally, acyclic messaging. A Slave device is not able to initiate transmissions on the bus, it only responds to requests from a Master device.

Each device is considered a station and is identified on the network by its station identifier. The addressing space for devices on the network is mapped as sequential numbers called slot identifiers. A device is configured to occupy one or more slots as specified by its station identifier (the first slot occupied) and its number of occupied slots (sequentially numbered slots in the network's address space).

NOTE See Annex A for an overview of CC-LINK communications concepts.

4.1.2 Profile 8/1

CP 8/1 defines a transmission method named Polled which uses the:

polled response access protocol – the transmission of data managed by the process of a Master individually interrogating each Slave in sequence called scanning. A Slave device transmits a response immediately upon receipt of an explicitly coded poll request addressed to the Slave station from the Master station.

There are three fundamental types of Slave station specified, each identified by their transmission support level as shown in Table 1.

Table 1 – CP 8/1 transmission support level

Transmission support level	Commonly named Slave device type	Bit-oriented cyclic	Word-oriented cyclic	Acyclic
A	Remote I/O station	YES	NO	NO
B	Remote device station	YES	YES	NO
C	Intelligent device station	YES	YES	YES

The PhL specifies a balanced transmission signal over a shielded 3-core twisted cable. Communication data rates as high as 10 mbps and transmission distances as long as 1 200 m are specified. CP 8/1 implements an MAU compliant with ISO/IEC 8482 Twisted Pair Multipoint Interconnections, and a derivative of TIA-485-A.

4.1.3 Profile 8/2

CP 8/2 is the same as CP 8/1 but adds segmenting capabilities to the cyclic data transfer, using a technique called extended frames. Devices that support this profile are labelled as compliant with CC-Link V2.

4.1.4 Profile 8/3

CP 8/3 defines a transmission method named Packed which uses the:

packed response access protocol – the transmission of data managed by the process of a Master broadcasting a trigger message whereupon each Slave waits a time period unique to its station identifier, then transmits its response. This results in a time-sliced packed response frame from all Slaves triggered by a single Master request.

The PhL is a powered-bus that specifies a balanced transmission signal over a 4-core unshielded cable in both flat and round configurations with conductors specified for communications signal as well as network-embedded power distribution.

Communication data rates as high as 2,5 mbps and transmission distances as long as 500 m are specified. CP 8/3 implements a MAU compliant with ISO/IEC 8482 Twisted Pair Multipoint Interconnections, and is a derivative of TIA-485-A.

4.2 CP 8/1

4.2.1 Physical layer

Table 2 specifies the PhL selection within IEC 61158-2 for devices of all types of this profile.

Table 2 – CP 8/1 PhL selection

Clause	Header	Presence	Constraints
1	Scope	YES	—
2	Normative references	Partial	Relevant references only
3	Terms and definitions	—	—
3.1	Common terms and definitions	Partial	Relevant definitions only
3.2 – 3.9	—	NO	—
3.10	Type 18: Terms and definitions	YES	—
Next subclauses	—	NO	—
4	Symbols and abbreviated terms	—	—
4.1	Symbols	—	—
4.1.1 – 4.1.8	—	NO	—
4.1.9	Type 18: Symbols	YES	—
Next subclauses	—	NO	—
4.2	Abbreviated terms	—	—
4.2.1 – 4.2.8	—	NO	—
4.2.9	Type 18: Abbreviations	YES	—
Next subclauses	—	NO	—
5	DLL – PhL interface	—	—
5.1	General	YES	—
5.2 – 5.9	—	NO	—
5.10	Type 18: Required services	YES	—
Next subclauses	—	NO	—
6	Systems management – PhL interface	—	—
6.1	General	YES	—
6.2 – 6.7	—	NO	—
6.8	Type 18: Systems management – PhL interface	YES	—

Clause	Header	Presence	Constraints
Next subclauses	—	NO	—
7 – 8	—	NO	—
9	Medium dependent sublayer (MDS)	—	—
9.1	General	YES	—
9.2 – 9.10	—	NO	—
9.11	Type 18: MDS: Wire media	YES	—
Next subclauses	—	NO	—
10	MDS – MAU interface	—	—
10.1	General	YES	—
10.2 – 10.6	—	NO	—
10.7	Type 18: MDS – MAU interface: Wire media	YES	—
Next subclauses	—	NO	—
11 – 30	—	NO	—
31	Type 18: Medium attachment unit: basic medium	YES	—
32	Type 18: Medium attachment unit: powered medium	NO	—
Next clauses	—	NO	—
Annex A – P	—	NO	—
Annex Q	Type 18: Connector specifications	NO	—
Annex R	Type 18: Media cable specifications	—	—
R.1	Type 18-PhL-B cable	YES	—
R.2	Type 18-PhL-P cable	NO	—
Next annexes	—	NO	—

4.2.2 Data-link layer

4.2.2.1 DLL services

Table 3 specifies the DLL services selection within IEC 61158-3-18 for devices of all types of this profile.

Table 3 – CP 8/1 DLL services selection

Clause	Header	Presence	Constraints
3	Terms, definitions, symbols, abbreviations and conventions	YES	—
4	Data-link services	—	—
4.1	Overview	YES	—
4.2	Primitives of the DLS	YES	—
4.3	CYCLIC-DATA-UPDATE	—	—
4.3.1	Parameters	YES	—
4.3.2	Master-polled	Partial	Used in Master type devices
4.3.3	Slave-polled	Partial	Used in Slave type devices
4.3.4	Master-packed	NO	—
4.3.5	Slave-packed	NO	—
4.4	ACYCLIC-DATA-TRANSMIT	—	—
4.4.1	Parameters	YES	—
4.4.2	Master-polled	Partial	Used in Master type devices
4.4.3	Slave-polled	Partial	Used in transmission support level C Slave type devices
4.5	MASTER-TRANSMISSION-TRIGGER	Partial	Used in Master type devices
5	DL-management Services	—	—
5.1	Overview	YES	—
5.2	Required services	YES	—
5.3	ESTABLISH-MASTER-POLLED	Partial	Used in Master type devices
5.4	ESTABLISH-SLAVE-POLLED	Partial	Used in Slave type devices
5.5	ESTABLISH-MASTER-PACKED	NO	—
5.6	ESTABLISH-SLAVE-PACKED	NO	—
5.7	RELEASE-CONNECTION	YES	—
5.8	SUSPEND-CONNECTION	YES	—
5.9	RESUME-CONNECTION	YES	—
5.10	ACTIVATE-STANDBY-MASTER	Partial	Used in Master type devices with standby Master status
5.11	ERROR	YES	—

4.2.2.2 DLL protocol

Table 4 specifies the DLL protocol selection within IEC 61158-4-18 for devices of all types of this profile.

Table 4 – CP 8/1 DLL protocol selection

Clause	Header	Presence	Constraints
3	Terms, definitions, symbols, abbreviations and conventions	YES	—
4	DL-protocol overview	YES	—
4.1	Introduction	YES	—
4.2	Polled DLE classes	YES	—
4.3	Packed DLE classes	NO	—
5	Type 18: DLPDU encoding and transmission	—	—
5.1	DL – PhL interface	YES	—
5.2	DLPDU transmission encoding	—	—
5.2.1	General	YES	—
5.2.2	Polled DLE	YES	—
5.2.3	Packed DLE	NO	—
5.2.4	HDLC conventions	YES	—
5.2.5	HDLC exceptions	YES	—
5.2.6	Error handling	YES	—
6	DLPDU – basic structure	—	—
6.1	Overview	YES	—
6.2	Address field	—	—
6.2.1	Master-polled DLE generated address field	Partial	Used in Master type devices
6.2.2	Slave-polled DLE generated address field	Partial	Used in Slave type devices
6.2.3	Master-packed DLE generated address field	NO	—
6.2.4	Slave-packed DLE generated address field	NO	—
6.3	Status field	—	—
6.3.1	Master-polled DLE generated status field	Partial	Used in Master type devices
6.3.2	Slave-polled DLE generated status field	Partial	Used in Slave type devices
6.3.3	Master-packed DLE generated status field	NO	—
6.3.4	Slave-packed DLE generated status field	NO	—
6.4	Data field	—	—
6.4.1	Master-polled DLE generated data field	YES	—
6.4.1.1	Overview	YES	—
6.4.1.2	Bit-oriented cyclic data field	YES	—
6.4.1.3	Word-oriented cyclic data field	YES	Used in transmission support level B and C Slave type devices
6.4.1.4	Acyclic data field	Partial	Used in transmission support level C Slave type devices
6.4.2	Slave-polled DLE generated data field	—	—
6.4.2.1	Overview	YES	—
6.4.2.2	Bit-oriented cyclic data field	YES	—