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Industriell processtyrning – Fältbuss – Del 5-10: Definition av tjänster i applikationsskiktet – Delar i fältbuss, Typ 10

*Industrial communication networks –
Fieldbus specifications –
Part 5-10: Application layer service definition –
Type 10 elements*

Som svensk standard gäller europastandarden EN IEC 61158-5-10:2023. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 61158-5-10:2023.

Nationellt förord

Europastandarden EN IEC 61158-5-10:2023

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 61158-5-10, Fifth edition, 2023 - Industrial communication networks –
Fieldbus specifications – Part 5-10: Application layer
service definition – Type 10 elements**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN IEC 61158-5-10, utg 4:2019 med eventuella tillägg, ändringar och rättelser gäller ej fr o m 2026-04-28.

ICS 25.040.40; 35.100.70; 35.110.00

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English Version

Industrial communication networks - Fieldbus specifications -
Part 5-10: Application layer service definition - Type 10 elements
(IEC 61158-5-10:2023)

Réseaux de communication industriels - Spécifications des
bus de terrain - Partie 5-10: Définition des services de la
couche application - Eléments de type 10
(IEC 61158-5-10:2023)

Industrielle Kommunikationsnetze - Feldbusse - Teil 5-10:
Dienstfestlegungen des Application Layer
(Anwendungsschicht) - Typ 10-Elemente
(IEC 61158-5-10:2023)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 65C/1203/FDIS, future edition 5 of IEC 61158-5-10, prepared by SC 65C "Industrial networks" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61158-5-10:2023.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2024-01-28 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2026-04-28 document have to be withdrawn

This document supersedes EN IEC 61158-5-10:2019 and all of its amendments and corrigenda (if any).

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Endorsement notice

The text of the International Standard IEC 61158-5-10:2023 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC/IEEE 60802:— ¹	NOTE Approved as EN IEC 60802:— ² (not modified)
IEC 60870-5-4	NOTE Approved as EN 60870-5-4
IEC 61131-1	NOTE Approved as EN 61131-1
IEC 61375-2-1	NOTE Approved as EN 61375-2-1
IEC 61784-1 (series)	NOTE Approved as EN IEC 61784-1 (series)
IEC 61784-2 (series)	NOTE Approved as EN IEC 61784-2 (series)

¹ Under preparation: Stage at the time of publication: IEC/IEEE CD 60802:2022.

² Under preparation: Stage at the time of publication: prEN IEC 60802:2020.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61131-3	2013	Programmable controllers - Part 3: Programming languages	EN 61131-3	2013
IEC 61158-1	2023	Industrial communication networks - Fieldbus specifications - Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series	EN IEC 61158-1	2023
IEC 61158-2	2023	Industrial communication networks - Fieldbus specifications - Part 2: Physical layer specification and service definition	EN IEC 61158-2	2023
IEC 61158-5-3	2023	Industrial communication networks - Fieldbus specifications - Part 5-23: Application layer service definition - Type 23 elements	-	-
IEC 61158-6-3	2023	Industrial communication networks - Fieldbus specifications - Part 6-23: Application layer protocol specification - Type 23 elements	-	-
IEC 61158-6-10	2023	Industrial communication networks - Fieldbus specifications - Part 6-10: Application layer protocol specification - Type 10 elements	-	-
IEC 61784-3-3	-	Industrial communication networks - Profiles - Part 3-3: Functional safety fieldbuses - Additional specifications for CPF 3	EN IEC 61784-3-3	-
IEC 61800-7-203	2015	Adjustable speed electrical power drive systems - Part 7-203: Generic interface and use of profiles for power drive systems - Profile type 3 specification	EN 61800-7-203	2016
IEC 62439-2	2021	Industrial communication networks - High availability automation networks - Part 2: Media Redundancy Protocol (MRP)	EN IEC 62439-2	2022
ISO/IEC 646	1991	Information technology - ISO 7-bit coded character set for information interchange	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO/IEC 7498-1	-	Information technology - Open Systems Interconnection - Basic reference model: The basic model	-	-
ISO/IEC 8822	-	Information technology - Open Systems Interconnection - Presentation service definition	-	-
ISO/IEC 8824-1	-	Information technology - Abstract Syntax Notation One (ASN.1) - Part 1: Specification of basic notation	-	-
ISO/IEC 9545	-	Information technology - Open Systems Interconnection - Application layer structure	-	-
ISO/IEC 9834-8	-	Information technology - Procedures for the operation of object identifier registration authorities - Part 8: Generation of universally unique identifiers (UUIDs) and their use in object identifiers	-	-
ISO/IEC 10646	-	Information technology - Universal coded character set (UCS)	-	-
ISO/IEC 10731	-	Information technology - Open Systems Interconnection - Basic Reference Model - Conventions for the definition of OSI services	-	-
ISO/IEC/IEEE 60559	2020	Information technology - Microprocessor Systems - Floating-Point arithmetic	-	-
ISO 8601-1	2019	Date and time - Representations for information interchange - Part 1: Basic rules	-	-
IEEE 802.1AB	2016	IEEE Standard for Local and metropolitan area networks - Station and Media Access Control Connectivity Discovery	-	-
IEEE 802.1AS	2020	IEEE Standard for Local and Metropolitan Area Networks - Timing and Synchronization for Time-Sensitive Applications	-	-
IEEE 802.1CB	2017	IEEE Standard for Local and metropolitan area networks - Frame Replication and Elimination for Reliability	-	-
IEEE Std 802.1Q	2018	IEEE Standard for Local and metropolitan area networks - Media Access Control (MAC) Bridges and Virtual Bridged Local Area Networks	-	-
IEEE 802.3	2018	IEEE Standard for Ethernet	-	-
IETF RFC 768	1980	User Datagram Protocol	-	-
IETF RFC 791	1981	Internet Protocol Darpa Internet Program Protocol Specification	-	-
IETF RFC 792	1981	Internet Control Message Protocol	-	-
IETF RFC 826	1982	Ethernet Address Resolution Protocol: Or Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware	-	-
IETF RFC 894	1984	Standard for the Transmission of IP Datagrams over Ethernet Networks	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IETF RFC 1034	1987	Domain names - concepts and facilities	-	-
IETF RFC 1112	1989	Host Extensions for IP multicasting	-	-
IETF RFC 1157	1990	Simple Network Management Protocol (SNMP)	-	-
IETF RFC 1213	1991	Management Information Base for Network Management of TCP/IP-based Internets: MIB-II	-	-
IETF RFC 2131	1997	Dynamic Host Configuration Protocol	-	-
IETF RFC 2132	1997	DHCP Options and BOOTP Vendor Extensions	-	-
IETF RFC 2365	1998	Administratively Scoped IP Multicast	-	-
IETF RFC 2674	1999	Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering and Virtual LAN Extensions	-	-
IETF RFC 2737	1999	Entity MIB (Version 2)	-	-
IETF RFC 2863	2000	The Interfaces Group MIB	-	-
IETF RFC 3418	2002	Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)	-	-
IETF RFC 3490	2003	Internationalizing Domain Names in Applications (IDNA)	-	-
IETF RFC 3621	2003	Power Ethernet MIB	-	-
IETF RFC 4836	2007	Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs)	-	-
IETF RFC 5905	2010	Network Time Protocol Version 4: Protocol and Algorithms Specification	-	-
IETF RFC 6020	2010	A Data Modeling Language for the Network Configuration Protocol (NETCONF)	-	-
IETF RFC 6241	2011	Network Configuration Protocol (NETCONF)	-	-
IETF RFC 6890	2013	Special-Purpose IP Address Registries	-	-
The Open Group - Publication C706	-	Technical Standard DCE1.1: Remote Procedure Call	-	-
Metro Ethernet Forum - MEF 10.4	2018	Subscriber Ethernet Service Attributes	-	-



IEC 61158-5-10

Edition 5.0 2023-03

INTERNATIONAL STANDARD



**Industrial communication networks – Fieldbus specifications –
Part 5-10: Application layer service definition – Type 10 elements**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-6578-9

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 5-10: Application layer service definition –
Type 10 elements****FOREWORD**

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IEC 61158-5-10 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 fifth edition cancels and replaces the fourth edition published in 2019. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) integration of system redundancy basic functionality;
- b) integration of dynamic reconfiguration basic functionality;
- c) integration of reporting system basic functionality;
- d) integration of asset management basic functionality;

e) integration of media redundancy ring interconnection basic functionality.

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

Draft	Report on voting
65C/1203/FDIS	65C/1244/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 61158 series, published under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC web site.

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.

IMPORTANT – The "colour inside" logo on the cover page of this document 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.

INTRODUCTION

This part of IEC 61158 is one of a series produced to facilitate the interconnection of automation system components. It is related to other standards in the set as defined by the “three-layer” fieldbus reference model described in IEC 61158-1.

The application service is provided by the application protocol making use of the services available from the data-link or other immediately lower layer. This document defines the application service characteristics that fieldbus applications and/or system management can exploit.

Throughout the set of fieldbus standards, the term “service” refers to the abstract capability provided by one layer of the OSI Basic Reference Model to the layer immediately above. Thus, the application layer service defined in this document is a conceptual architectural service, independent of administrative and implementation divisions.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 5-10: Application layer service definition – Type 10 elements

1 Scope

1.1 General

The fieldbus application layer (FAL) provides user programs with a means to access the fieldbus communication environment. In this respect, the FAL can be viewed as a “window between corresponding application programs”.

This part of IEC 61158 provides common elements for basic time-critical and non-time-critical messaging communications between application programs in an automation environment and material specific to Type 10 fieldbus. The term “time-critical” is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the time window risks failure of the applications requesting the actions, with attendant risk to equipment, plant and possibly human life.

This document defines in an abstract way the externally visible service provided by the Type 10 fieldbus application layer in terms of:

- an abstract model for defining application resources (objects) capable of being manipulated by users via the use of the FAL service,
- the primitive actions and events of the service;
- the parameters associated with each primitive action and event, and the form which they take; and
- the interrelationship between these actions and events, and their valid sequences.

The purpose of this document is to define the services provided to:

- the FAL user at the boundary between the user and the application layer of the fieldbus reference model, and
- Systems Management at the boundary between the application layer and Systems Management of the fieldbus reference model.

This document specifies the structure and services of the Type 10 fieldbus application layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498-1) and the OSI application layer structure (ISO/IEC 9545).

FAL services and protocols are provided by FAL application-entities (AE) contained within the application processes. The FAL AE is composed of a set of object-oriented application service elements (ASEs) and a layer management entity (LME) that manages the AE. The ASEs provide communication services that operate on a set of related application process object (APO) classes. One of the FAL ASEs is a management ASE that provides a common set of services for the management of the instances of FAL classes.

Although these services specify, from the perspective of applications, how request and responses are issued and delivered, they do not include a specification of what the requesting and responding applications are to do with them. That is, the behavioral aspects of the applications are not specified; only a definition of what requests and responses they can send/receive is specified. This permits greater flexibility to the FAL users in standardizing such object behavior. In addition to these services, some supporting services are also defined in this document to provide access to the FAL to control certain aspects of its operation.

1.2 Specifications

The principal objective of this document is to specify the characteristics of conceptual application layer services suitable for time-critical communications, and thus supplement the OSI Basic Reference Model in guiding the development of application layer protocols for time-critical communications.

A secondary objective is to provide migration paths from previously existing industrial communications protocols. It is this latter objective which gives rise to the diversity of services standardized as the various Types of IEC 61158, and the corresponding protocols standardized in subparts of IEC 61158-6.

This document can be used as the basis for formal application programming interfaces. Nevertheless, it is not a formal programming interface, and any such interface will need to address implementation issues not covered by this specification, including

- a) the sizes and octet ordering of various multi-octet service parameters, and
- b) the correlation of paired request and confirm, or indication and response, primitives.

1.3 Conformance

This document does not specify individual implementations or products, nor does it constrain the implementations of application layer entities within industrial automation systems.

There is no conformance of equipment to this application layer service definition standard. Instead, conformance is achieved through implementation of conforming application layer protocols that fulfill the Type 10 application layer services as defined in this document.

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 61131-3:2013, *Programmable controllers – Part 3: Programming languages*

IEC 61158-1:2023, *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

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

IEC 61158-5-3:2023, *Industrial communication networks – Fieldbus specifications – Part 5-3: Application layer service definition – Type 3 elements*

IEC 61158-6-3:2023, *Industrial communication networks – Fieldbus specifications – Part 6-3: Application layer protocol specification – Type 3 elements*

IEC 61158-6-10:2023, *Industrial communication networks – Fieldbus specifications – Part 6-10: Application layer protocol specification – Type 10 elements*

IEC 61784-3-3, *Industrial communication networks – Profiles – Part 3-3: Functional safety fieldbuses – Additional specifications for CPF 3*

IEC 61800-7-203:2015, *Adjustable speed electrical power drive systems – Part 7-203: Generic interface and use of profiles for power drive systems – Profile type 3 specification*

IEC 62439-2:2021, *Industrial communication networks – High availability automation networks – Part 2: Media Redundancy Protocol (MRP)*

ISO/IEC 646:1991, *Information technology – ISO 7-bit coded character set for information interchange*

ISO/IEC 7498-1, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

ISO/IEC 8822, *Information technology – Open Systems Interconnection – Presentation service definition*

ISO/IEC 8824-1, *Information technology – Abstract Syntax Notation One (ASN.1) – Part 1: Specification of basic notation*

ISO/IEC 9545, *Information technology – Open Systems Interconnection – Application Layer structure*

ISO/IEC 9834-8, *Information technology – Procedures for the operation of object identifier registration authorities – Part 8: Generation of universally unique identifiers (UUIDs) and their use in object identifiers*

ISO/IEC 10646, *Information technology – Universal coded character set (UCS)*

ISO/IEC 10731, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

ISO/IEC/IEEE 60559:2020, *Information technology – Microprocessor Systems – Floating-Point arithmetic*

ISO 8601-1:2019, *Data and time – Representations for information interchange – Part 1: Basic rules*

IEEE Std 802.1AB-2016, *IEEE Standard for Local and metropolitan area networks: Station and Media Access Control Connectivity Discovery*

IEEE Std 802.1AS-2020, *IEEE Standard for Local and Metropolitan Area Networks – Timing and Synchronization for Time-Sensitive Applications*

IEEE Std 802.1CB-2017, *IEEE Standard for Local and metropolitan area networks – Frame Replication and Elimination for Reliability*

IEEE Std 802.1Q-2018, *IEEE Standard for Local and Metropolitan Area Networks – Bridges and Bridged Networks*

IEEE Std 802.3-2018, *IEEE Standard for Ethernet*

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IETF RFC 791, J. Postel, "Internet Protocol", September 1981, available at <https://www.rfc-editor.org/info/rfc791> [viewed 2022-09-29]

IETF RFC 792, J. Postel, "Internet Control Message Protocol", September 1981, available at <https://www.rfc-editor.org/info/rfc792> [viewed 2022-09-29]

IETF RFC 826, D. Plummer, "An Ethernet Address Resolution Protocol: Or Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware", November 1982, available at <https://www.rfc-editor.org/info/rfc826> [viewed 2022-09-29]

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