

Industrial communication networks - Fieldbus
specifications - Part 6-2: Application layer protocol
specification - Type 2 elements

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

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English Version

Industrial communication networks - Fieldbus specifications -
Part 6-2: Application layer protocol specification - Type 2
elements
(IEC 61158-6-2:2023)

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couche liaison de données - Éléments de type 2
(IEC 61158-6-2:2023)

Industrielle Kommunikationsnetze - Feldbusse - Teil 6-2:
Protokollspezifikation des Application Layer
(Anwendungsschicht) - Typ 2-Elemente
(IEC 61158-6-2:2023)

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European foreword

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INTERNATIONAL STANDARD

**Industrial communication networks – Fieldbus specifications –
Part 6-2: Application layer protocol specification – Type 2 elements**



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INTERNATIONAL STANDARD

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 6-2: Application layer protocol specification –
Type 2 elements****FOREWORD**

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Attention is drawn to the fact that the use of the associated protocol type is restricted by its intellectual-property-right holders. In all cases, the commitment to limited release of intellectual-property-rights made by the holders of those rights permits a layer protocol type to be used with other layer protocols of the same type, or in other type combinations explicitly authorized by its intellectual-property-right holders.

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

IEC 61158-6-2 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) update of normative and bibliographic references;
- b) review of Get/Set_Attributes_All parameter format in 3.5.3;
- c) new services in 4.1.2.1, 4.1.8.1 and 8.2, 8.3;
- d) clarifications of services in 4.1.5;
- e) definition of specific connection path in 4.1.6.12;
- f) clarifications and updates of Get/Set_attribute_list services in 4.1.8.1;
- g) clarifications, new attributes for the Identity object in 4.1.8.2;
- h) new attributes, service parameters and service for the Message Router object in 4.1.8.3;
- i) clarifications, new attribute and other extensions for the Assembly object in 4.1.8.4;
- j) clarifications, new attributes, service parameters, services and diagnostics connection points for the Time Sync object in 4.1.8.6;
- k) clarifications, new services and addition of diagnostics connection points for the Connection Manager object in 4.1.8.9;
- l) clarifications and extensions of Path Segments in 4.1.9;
- m) updates and extensions of class, attribute and service codes in 4.1.10;
- n) clarifications and additions of error codes in 4.1.11;
- o) update of STIME, UTIME and NTIME data types in 4.2.3 and 5.1.3.5;
- p) updates of encapsulation protocol in 4.3.1;
- q) addition of internal services in 7.1;
- r) removal of obsoleted transport options and related services in Clause 9 and Clause 11;
- s) updates of DMPM2 in Clause 11;
- t) removal of all references to CPF and CPs (material moved to profile documents);
- u) miscellaneous editorial corrections.

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

Draft	Report on voting
65C/1204/FDIS	65C/1245/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.

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 protocol provides the application service by making use of the services available from the data-link or other immediately lower layer. The primary aim of this document is to provide a set of rules for communication expressed in terms of the procedures to be carried out by peer application entities (AEs) at the time of communication. These rules for communication are intended to provide a sound basis for development in order to serve a variety of purposes:

- as a guide for implementers and designers;
- for use in the testing and procurement of equipment;
- as part of an agreement for the admittance of systems into the open systems environment;
- as a refinement to the understanding of time-critical communications within OSI.

This document is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this document together with other standards positioned within the OSI or fieldbus reference models, otherwise incompatible systems can work together in any combination.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 6-2: Application layer protocol specification – Type 2 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 2 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 specifies interactions between remote applications and defines the externally visible behavior provided by the Type 2 fieldbus application layer in terms of

- the formal abstract syntax defining the application layer protocol data units conveyed between communicating application entities;
- the transfer syntax defining encoding rules that are applied to the application layer protocol data units;
- the application context state machine defining the application service behavior visible between communicating application entities;
- the application relationship state machines defining the communication behavior visible between communicating application entities.

The purpose of this document is to define the protocol provided to

- define the wire-representation of the service primitives defined in IEC 61158-5-2, and
- define the externally visible behavior associated with their transfer.

This document specifies the protocol of the Type 2 fieldbus application layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498-1) and the OSI application layer structure (ISO/IEC 9545).

1.2 Specifications

The principal objective of this document is to specify the syntax and behavior of the application layer protocol that conveys the application layer services defined in IEC 61158-5-2.

A secondary objective is to provide migration paths from previously-existing industrial communications protocols.

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. Conformance is achieved through implementation of this application layer protocol specification.

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

IEC 61158-3-2:2023, *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*

IEC 61158-4-2:2023, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*

IEC 61158-5-2:2023, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61588:2021, *Precision clock synchronization protocol for networked measurement and control systems*

IEC 61784-3-2, *Industrial communication networks – Profiles – Part 3-2: Functional safety fieldbuses – Additional specifications for CPF 2*

IEC 61800-7-202, *Adjustable speed electrical power drive systems – Part 7-202: Generic interface and use of profiles for power drive systems – Profile type 2 specification*

IEC 62026-3:2014, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) – Part 3: DeviceNet*

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

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

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

ISO/IEC 8825-1, *Information technology – ASN.1 encoding rules – Part 1: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

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

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 639-2, *Codes for the representation of names of languages – Part 2: Alpha-3 code*

ISO 11898-1:2015, *Road vehicles – Controller area network (CAN) – Part 1: Data link layer and physical signalling*

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*

IETF RFC 791, J. Postel, *Internet Protocol*, September 1981, available at <https://www.rfc-editor.org/info/rfc791> [viewed 2022-02-18]

IETF RFC 1035, P.V. Mockapetris, *Domain Names – Implementation and Specification*, November 1987, available at <https://www.rfc-editor.org/info/rfc1035> [viewed 2022-02-18]

IETF RFC 1112, S.E. Deering, *Host Extensions for IP Multicasting*, August 1989, available at <https://www.rfc-editor.org/info/rfc1112> [viewed 2022-02-18]

IETF RFC 1117, S. Romano, M.K. Stahl, M. Recker, *Internet Numbers*, August 1989, available at <https://www.rfc-editor.org/info/rfc1117> [viewed 2022-02-18]

IETF RFC 1122, R. Braden, *Requirements for Internet Hosts – Communication Layers*, October 1989, available at <https://www.rfc-editor.org/info/rfc1122> [viewed 2022-02-18]

IETF RFC 1759, R. Smith, F. Wright, T. Hastings, S. Zilles, J. Gyllenskog, *Printer MIB*, March 1995, available at <https://www.rfc-editor.org/info/rfc1759> [viewed 2022-02-18]

IETF RFC 2236, W. Fenner, *Internet Group Management Protocol, Version 2*, November 1997, available at <https://www.rfc-editor.org/info/rfc2236> [viewed 2022-02-18]

IETF RFC 2474, K. Nichols, S. Blake, F. Baker, D. Black, *Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers*, December 1998, available at <https://www.rfc-editor.org/info/rfc2474> [viewed 2022-02-18]

IETF RFC 2475, S. Blake, D. Black, M. Carlson, E. Davies, Z. Wang, W. Weiss, *An Architecture for Differentiated Services*, December 1998, available at <https://www.rfc-editor.org/info/rfc2475> [viewed 2022-02-18]

IETF RFC 2597, J. Heinanen, F. Baker, W. Weiss, J. Wroclawski, *Assured Forwarding PHB Group*, June 1999, available at <https://www.rfc-editor.org/info/rfc2597> [viewed 2022-02-18]

IETF RFC 2873, X. Xiao, A. Hannan, V. Paxson, E. Crabbe, *TCP Processing of the IPv4 Precedence Field*, June 2000, available at <https://www.rfc-editor.org/info/rfc2873> [viewed 2022-02-18]

IETF RFC 3140, D. Black, S. Brim, B. Carpenter, F. Le Faucheur, *Per Hop Behavior Identification Codes*, June 2001, available at <https://www.rfc-editor.org/info/rfc3140> [viewed 2022-02-18]

IETF RFC 3246, B. Davie, A. Charny, J.C.R. Bennet, K. Benson, J.Y. Le Boudec, W. Courtney, S. Davari, V. Firoiu, D. Stiliadis, *An Expedited Forwarding PHB (Per-Hop Behavior)*, March 2002, available at <https://www.rfc-editor.org/info/rfc3246> [viewed 2022-02-18]

IETF RFC 3376, B. Cain, S. Deering, I. Kouvelas, B. Fenner, A. Thyagarajan, *Internet Group Management Protocol, Version 3*, October 2002, available at <https://www.rfc-editor.org/info/rfc3376> [viewed 2022-02-18]

IETF RFC 4594, J. Babiarez, K. Chan, F. Baker, *Configuration Guidelines for DiffServ Service Classes*, August 2006, available at <https://www.rfc-editor.org/info/rfc4594> [viewed 2022-02-18]

3 Terms, definitions, symbols, abbreviated terms and conventions

For the purposes of this document, the following terms, definitions, symbols, abbreviated terms and conventions 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>

3.1 Terms and definitions from other ISO/IEC standards

3.1.1 Terms and definitions from ISO/IEC 7498-1

- abstract syntax
- application entity
- application process
- application protocol data unit
- application service element
- application entity invocation
- application process invocation
- application transaction
- presentation context
- real open system
- transfer syntax

3.1.2 Terms and definitions from ISO/IEC 9545

- application-association
- application-context
- application context name
- application-entity-invocation
- application-entity-type
- application-process-invocation
- application-process-type
- application-service-element
- application control service element