

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



Industrial communication networks – Fieldbus specifications –  
Part 5-2: Application layer service definition – Type 2 elements  
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Réseaux de communication industriels – Spécifications des bus de terrain –  
Partie 5-2: Définition des services de la couche application – Éléments de type 2

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

**Réseaux de communication industriels – Spécifications des bus de terrain –  
Partie 5-2: Définition des services de la couche application – Éléments de type 2**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –  
FIELD BUS SPECIFICATIONS –****Part 5-2: Application layer service definition –  
Type 2 elements**

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

International Standard IEC 61158-5-2 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This fourth edition cancels and replaces the third edition published in 2014. This edition constitutes a technical revision.



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

- addition of a data type in 5.3.2;
- clarifications of Object management ASE in 6.2.1;
- extensions of General ASE in 6.2.1.2.1;
- extensions/clarifications of Identity ASE in 6.2.1.2.2;
- update of Message Router ASE in 6.2.1.2.4;
- extensions/clarifications of Time Sync ASE in 6.2.1.2.6;
- updates of Parameter ASE in 6.2.1.2.7;
- updates of FAL ASE service specification in 6.2.1.3;
- extensions/clarifications of Connection manager ASE in 6.2.2;
- extensions/clarifications of Connection ASE in 6.2.3;
- extensions/clarifications of Application type in 6.3.1.4.5.
- miscellaneous editorial corrections.

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

FDIS	Report on voting
65C/947/FDIS	65C/950/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with [IEC 61158-5-2:2019](#) [ISO/IEC Directives, Part 2](#).  
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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.

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## INTRODUCTION

This document 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 may 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.

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# INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

## Part 5-2: Application layer service definition – 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 International Standard defines in an abstract way the externally visible service provided by the Type 2 fieldbus application layer in terms of:

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

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

- a) the FAL user at the boundary between the user and the application layer of the fieldbus reference model, and
- b) 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 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).

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 specification may 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 2 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 IEC 61784-1 and IEC 61784-2 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 61131-3:2003<sup>1</sup>, *Programmable controllers – Part 3: Programming languages*

IEC 61158-1:2019, *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

IEC 61158-3-2:2014, *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*

IEC 61158-3-2:2014/AMD1:2019

IEC 61158-4-2:2019, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*

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<sup>1</sup> A newer edition of this standard has been published, but only the cited edition applies.

IEC 61158-6-2:2019, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*

IEC 61588:2009, *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*

ISO/IEC 646, *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 8859-1, *Information technology – 8-bit single-byte coded graphic character sets – Part 1: Latin alphabet No. 1*

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

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

ISO 8859-1<sup>2</sup>:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 1: Latin alphabet No. 1*

ISO 8859-2<sup>3</sup>:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 2: Latin alphabet No. 2*

ISO 8859-3<sup>4</sup>:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 3: Latin alphabet No. 3*

ISO 8859-4<sup>5</sup>:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 4: Latin alphabet No. 4*

ISO 8859-5<sup>6</sup>:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 5: Latin/Cyrillic alphabet*

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<sup>5</sup> A newer edition of this standard has been published by ISO/IEC, but the cited edition is the one used in the referenced IETF standards.

ISO 8859-6<sup>7</sup>:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 6: Latin/Arabic alphabet*

ISO 8859-7<sup>8</sup>:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 7: Latin/Greek alphabet*

ISO 8859-8<sup>9</sup>:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 8: Latin/Hebrew alphabet*

ISO 8859-9<sup>10</sup>:1989, *Information processing – 8-bit single-byte coded graphic character sets – Part 9: Latin alphabet No. 5*

ISO 11898:1993<sup>11</sup>, *Road vehicles – Interchange of digital information – Controller area network (CAN) for high-speed communication*

IETF RFC 1759, *Printer MIB*, available at <<http://www.ietf.org>> [viewed 2018-09-04]

### 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 <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>  
<https://standards.iteh.ai/catalog/standards/sist/359f02fd-eedd-4c55-bc8b-187bcd54a570/iec-61158-5-2-2019>

#### 3.1 ISO/IEC 7498-1 terms

- a) application entity
- b) application process
- c) application protocol data unit
- d) application service element
- e) application entity invocation
- f) application process invocation
- g) application transaction
- h) real open system
- i) transfer syntax

<sup>6</sup> A newer edition of this standard has been published by ISO/IEC, but the cited edition is the one used in the referenced IETF standards.

<sup>7</sup> A newer edition of this standard has been published by ISO/IEC, but the cited edition is the one used in the referenced IETF standards.

<sup>8</sup> A newer edition of this standard has been published by ISO/IEC, but the cited edition is the one used in the referenced IETF standards.

<sup>9</sup> A newer edition of this standard has been published by ISO/IEC, but the cited edition is the one used in the referenced IETF standards.

<sup>10</sup> A newer edition of this standard has been published by ISO/IEC, but the cited edition is the one used in the referenced IETF standards.

<sup>11</sup> A newer edition of this standard has been published, but only the cited edition applies.

**3.2 ISO/IEC 8822 terms**

- a) abstract syntax
- b) presentation context

**3.3 ISO/IEC 9545 terms**

- a) application-association
- b) application-context
- c) application context name
- d) application-entity-invocation
- e) application-entity-type
- f) application-process-invocation
- g) application-process-type
- h) application-service-element
- i) application control service element

**3.4 ISO/IEC 8824-1 terms**

- a) object identifier
- b) type

**3.5 Type 2 fieldbus data-link layer terms**

The following terms, defined in IEC 61158-3-2 and IEC 61158-4-2, apply.

- a) DL-time
- b) DL-scheduling-policy
- c) DLCEP
- d) DLC
- e) DL-connection-oriented mode
- f) DLPDU
- g) DLSDU
- h) DLSAP
- i) fixed tag
- j) generic tag
- k) link
- l) MAC ID
- m) network address
- n) node address
- o) node
- p) tag
- q) scheduled
- r) unscheduled

**3.6 Type 2 fieldbus application-layer specific definitions**

For the purposes of this document, the following terms and definitions apply.

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