

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

Industrial communication networks – Fieldbus specifications –  
Part 5-7: Application Layer Service definition – Type 7 elements

Réseaux de communication industriels – Spécifications des bus de terrain –  
Partie 5-7: Définition des services des couches d'application –  
Éléments de Type 7



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International Standard IEC 61158-5-7 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This first edition and its companion parts of the IEC 61158-5 subseries cancel and replace IEC 61158-5:2003. This edition of this part constitutes an editorial revision.

This edition of IEC 61158-5 includes the following significant changes from the previous edition:

- a) deletion of the former Type 6 fieldbus for lack of market relevance;
- b) addition of new types of fieldbuses;
- c) partition of part 5 of the third edition into multiple parts numbered -5-2, -5-3, ...

This bilingual version (2014-12) corresponds to the monolingual English version, published in 2007-12.

The text of this standard is based on the following documents:

FDIS	Report on voting
65C/475/FDIS	65C/486/RVD

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

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The list of all the parts of the IEC 61158 series, under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC web site.

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## 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/TR 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 standard 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 standard is a conceptual architectural service, independent of administrative and implementation divisions.

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## INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

### Part 5-7: Application Layer Service definition – Type 7 elements

#### 1 Scope

##### 1.1 Overview

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 standard provides common elements for basic time-critical and non-time-critical messaging communications between application programs in an automation environment. 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 standard defines in an abstract way the externally visible service provided by the Type 7 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 standard is to define the services provided to

- 1) the FAL user at the boundary between the user and the Application Layer of the Fieldbus Reference Model, and
- 2) Systems Management at the boundary between the Application Layer and Systems Management of the Fieldbus Reference Model.

This standard specifies the structure and services of the IEC fieldbus Application Layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498) 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 standard to provide access to the FAL to control certain aspects of its operation.

## 1.2 Specifications

The principal objective of this standard 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.

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 standard 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 7 application layer services as defined in this standard.

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## 2 Normative references

[IEC 61158-5-7:2007](https://standards.iteh.ai/catalog/standards/sist/259322a4-114e-477d-b2d2-779db5737d75/iec-61158-5-7-2007)

The following referenced documents are indispensable for the application 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.

IEC 60559, *Binary Floating-point Arithmetic for Microprocessor Systems*

IEC/TR 61158-1 (Ed.2.0), *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

IEC 61158-3-7, *Industrial communication networks – Fieldbus specifications – Part 3-7: Data-link layer service definition – Type 7 elements*

IEC 61158-4-7, *Industrial communication networks – Fieldbus specifications – Part 4-7: Data-link layer protocol specification – Type 7 elements*

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

ISO/IEC 7498-3, *Information technology – Open Systems Interconnection – Basic Reference Model – Part 3: Naming and addressing*

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

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

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

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

### 3 Terms, definitions, symbols, abbreviations and conventions

For the purposes of this document, the following terms as defined in these publications apply.

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

For the purposes of this document, the following terms as defined in ISO/IEC 7498-1 apply:

- 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

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#### 3.2 ISO/IEC 8822 terms

- a) abstract syntax <https://standards.iteh.ai/catalog/standards/sist/259322a4-114e-4724-b242-770da5737d75/iec-61158-5-7-2007>
- b) presentation context [IEC 61158-5-7:2007](https://standards.iteh.ai/catalog/standards/sist/259322a4-114e-4724-b242-770da5737d75/iec-61158-5-7-2007)

#### 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 terms

- a) object identifier
- b) type

#### 3.5 Fieldbus data-link layer terms

The following terms as defined in IEC 61158-3-7 and IEC 61158-4-7 apply.

- a) acknowledgement response DLPDU
- b) basic cycle
- c) basic transaction

- d) bus-arbitrator (BA)
  - e) control field
  - f) destination address
  - e) DL-segment, local link
  - g) DLCEP-identifier
  - h) DLCEP-identifier DLPDU
  - i) end of message transaction indication DLPDU
  - j) identified variable (or simply « variable »)
  - k) invalid DLCEP-identifier
  - l) macrocycle
  - m) message DLPDU identifier
  - n) message response DLPDU
  - o) periodic scanning of variables
  - p) published identified variable
  - q) request response DLPDU
  - r) source address
  - s) subscribed identified variable
  - t) triggered message scanning
  - u) triggered periodic scanning of messages
  - w) triggered periodic scanning of variables
  - x) triggered scanning of variables
  - y) turnaround time
  - z) variable response DLPDU
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- <https://standards.iteh.ai/catalog/standards/sist/259322a4-114e-4724-b242-770da5737d75/iec-61158-5-7-2007>

The following symbols and abbreviations as defined in IEC 61158-3-7 and IEC 61158-4-7 apply.

- a) BA
- b) B\_Dat\_cons
- c) B\_Dat\_Prod
- d) B\_Req1/2
- e) ID\_DAT
- f) ID\_MSG
- g) ID\_RQ1/2
- h) PRT
- i) Q\_IDMSG
- j) Q\_IDRQ1/2
- k) Q\_Msg\_Aper
- l) Q\_Req1/2
- m) Q\_RPRQ
- n) RQ\_Inhibit
- o) RP\_ACK
- p) RP\_DAT
- q) RP\_DAT\_MSG