

INTERNATIONAL STANDARD

Industrial communication networks – Fieldbus specifications –
Part 5-19: Application layer service definition – Type 19 elements
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IEC 61158-5-19:2019

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
1.1 General.....	7
1.2 Specifications	8
1.3 Conformance	8
2 Normative references	8
3 Terms, definitions, symbols, abbreviations and conventions	9
3.1 ISO/IEC 7498-1 terms.....	9
3.2 ISO/IEC 8822 terms.....	9
3.3 ISO/IEC 9545 terms.....	9
3.4 ISO/IEC 8824-1 terms.....	10
3.5 Fieldbus application-layer specific definitions.....	10
3.6 Abbreviations and symbols	12
3.7 Conventions.....	12
3.7.1 Overview	12
3.7.2 General conventions.....	12
3.7.3 Conventions for class definitions.....	12
3.7.4 Conventions for service definitions.....	14
4 Concepts.....	15
5 Data type ASE.....	15
5.1 Bitstring types.....	15
5.1.1 BitString8.....	15
5.1.2 BitString16.....	16
5.1.3 BitString32.....	16
5.1.4 BitString64.....	16
5.2 Unsigned types.....	16
5.2.1 Unsigned16	16
5.2.2 Unsigned32	16
5.2.3 Unsigned64	17
5.3 Integer types.....	17
5.3.1 Integer16.....	17
5.3.2 Integer32.....	17
5.3.3 Integer64.....	17
5.4 Floating Point types	17
5.4.1 Float32	17
5.4.2 Float64	18
5.5 Structure types	18
5.5.1 STRING2.....	18
6 Communication model specification.....	18
6.1 Concepts	18
6.1.1 Communication mechanisms	18
6.1.2 IDN concept.....	18
6.2 ASEs	18
6.2.1 Identification number (IDN) ASE.....	18
6.2.2 CYCIDN ASE.....	21

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IEC 61158-5-19:2019
<https://standards.iteh.ai/catalog/standards/sist/dfe54690-4025-4579-a66f-0274fa1ec8c4/iec-61158-5-19-2019>

6.2.3	Management (MGT) ASE	24
6.3	ARs	31
6.3.1	General	31
6.3.2	Point-to-point user-triggered confirmed client/server AREP (SVC)	31
6.3.3	Point-to-point network-scheduled unconfirmed publisher/subscriber AREP (RTC-MS).....	31
6.3.4	Point-to-multipoint network-scheduled unconfirmed publisher/subscriber AREP (RTC-CC).....	32
6.4	Summary of AR classes	32
6.5	Permitted FAL services by AREP role	33
	Bibliography.....	34
	Table 1 – Read service parameters.....	20
	Table 2 – Write service parameters.....	21
	Table 3 – Read service parameters.....	22
	Table 4 – Write service parameters.....	23
	Table 5 – Notify service parameters.....	24
	Table 6 – Get network status service parameters.....	25
	Table 7 – Get device status service parameters.....	26
	Table 8 – Network status change report service parameters	26
	Table 9 – Station status change report service parameters	27
	Table 10 – Set device status service parameters	27
	Table 11 – Enable RTC service parameters.....	28
	Table 12 – Enable hotplug service parameters.....	29
	Table 13 – Notify RTC service parameters.....	30
	Table 14 – Disable RTC service parameters	30
	Table 15 – AREP (SVC) class summary.....	32
	Table 16 – AREP (RTC-MS) class summary	32
	Table 17 – AREP (RTC-CC) class summary.....	33
	Table 18 – FAL services by AR type	33

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**INDUSTRIAL COMMUNICATION NETWORKS –
FIELD BUS SPECIFICATIONS –****Part 5-19: Application layer service definition –
Type 19 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 IEC 61784-1 and IEC 61784-2.

International Standard IEC 61158-5-19 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:

- improving the hotplug and redundancy features;
- improving the phase switching and the error handling;
- editorial improvements.

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 ISO/IEC Directives, Part 2.

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 publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or [IEC 61158-5-19:2019](https://standards.iteh.ai/catalog/standards/sist/dfe54690-4025-4579-a66f-0274fafec8c4/iec-61158-5-19-2019)
- amended. <https://standards.iteh.ai/catalog/standards/sist/dfe54690-4025-4579-a66f-0274fafec8c4/iec-61158-5-19-2019>

A bilingual version of this publication may be issued at a later date.

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 5-19: Application layer service definition – Type 19 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 19 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 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 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 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, *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 61158-4-19:2019, *Industrial communication networks – Fieldbus specifications – Part 4-19: Data-link layer protocol specification – Type 19 elements*

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): Specification of basic notation*

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*

3 Terms, definitions, symbols, abbreviations and conventions

For the purposes of this document, the following terms, definitions, symbols, abbreviations 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>

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

3.2 ISO/IEC 8822 terms

For the purposes of this document, the following terms as defined in ISO/IEC 8822 apply:

- a) abstract syntax
- b) presentation context

3.3 ISO/IEC 9545 terms

For the purposes of this document, the following terms as defined in ISO/IEC 9545 apply:

- 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

For the purposes of this document, the following terms as defined in ISO/IEC 8824-1 apply:

- a) object identifier
- b) type

3.5 Fieldbus application-layer specific definitions

3.5.1

coded character set

code

set of unambiguous rules that establish a character set and one-to-one relationship between the characters of the set and their representation by one or more bit combinations

3.5.2

cross communication

direct data transfer between slave devices (without active involvement of master)

3.5.3

cycle time

duration of a communication cycle

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3.5.4

cyclic data

part of a telegram, which does not change its meaning during cyclic operation of the network

3.5.5

device

slave in the communication network

Note 1 to entry: Examples are a power drive system as defined in the IEC 61800-7 (all parts), I/O stations as defined in IEC 61131 (all parts), etc.

3.5.6

device status

four adjacent octets inside the acknowledge telegram containing status information for each device

3.5.7

element

part of IDNs

Note 1 to entry: Each IDN has 7 elements, whereas each one has a specific meaning (e.g., number, name, data).

3.5.8

hot plug

possibility to open the communication network and insert or remove slaves while the network is still in real-time operation