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NORME INTERNATIONALE

Industrial communication networks – Fieldbus specifications –
Part 5-9: Application layer service definition – Type 9 elements
(standards.iteh.ai)

Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 5-9: Définition des services de la couche application – Éléments de type 9

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CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
1.1 General.....	8
1.2 Specifications.....	9
1.3 Conformance.....	9
2 Normative references.....	9
3 Terms, definitions, symbols, abbreviations and conventions.....	10
3.1 ISO/IEC 7498-1 terms.....	10
3.2 ISO/IEC 8822 terms.....	10
3.3 ISO/IEC 9545 terms.....	10
3.4 ISO/IEC 8824-1 terms.....	10
3.5 IEC 61158-1 terms.....	10
3.6 Type 9 fieldbus application-layer specific definitions.....	14
3.7 Abbreviations and symbols.....	14
3.8 Conventions.....	15
4 Concepts.....	18
5 Data type ASE.....	18
5.1 Overview.....	18
5.2 Formal definition of data type objects.....	21
5.3 FAL defined data types.....	22
5.4 Data type ASE service specification.....	25
5.5 Summary of data types.....	25
6 Communication model specification.....	26
6.1 Concepts.....	26
6.2 Common parameters.....	26
6.3 ASEs.....	26
6.4 ARs.....	115
6.5 Summary of classes.....	118
6.6 Permitted services by AREP role.....	119
Bibliography.....	121
Figure 1 – Data type class hierarchy.....	19
Figure 2 – VFD model.....	27
Figure 3 – Abstract model of an automation system (VFD).....	27
Figure 4 – Source OD/remote OD.....	33
Figure 5 – Put OD state machine.....	46
Figure 6 – Transaction object state machine.....	52
Figure 7 – Context test of two features-supported with different bitstring length.....	60
Figure 8 – Overview of event.....	80
Figure 9 – Event state machine.....	85
Figure 10 – Domain genericdownload/download state machine (server).....	100
Figure 11 – Domain upload state machine (server).....	102
Figure 12 – State diagram.....	113

Table 1 – Data type summary	26
Table 2 – Logical status	28
Table 3 – Status	29
Table 4 – Unsolicited status	30
Table 5 – Identify	31
Table 6 – Structure of the object dictionary	34
Table 7 – Structure of the static list of types	34
Table 8 – Structure of the static object dictionary	34
Table 9 – Structure of the dynamic list of variable lists	35
Table 10 – Structure of the dynamic list of program invocations	35
Table 11 – Empty object dictionary	39
Table 12 – Get OD service parameters	42
Table 13 – Initiate put OD service parameters	44
Table 14 – Put OD service parameters	45
Table 15 – Terminate put OD service parameters	46
Table 16 – Put OD state transitions	48
Table 17 – Attribute FMS features supported	50
Table 18 – Transaction object state transitions	53
Table 19 – Initiate service parameters	54
Table 20 – Failure reasons	55
Table 21 – Abort service parameters	56
Table 22 – User abort reasons	57
Table 23 – APO ASE abort reasons	57
Table 24 – Reject service parameters	58
Table 25 – Reject APDU reasons	58
Table 26 – Compatibility of the local context to the remote context	59
Table 27 – Unconfirmed send service parameters	62
Table 28 – Confirmed send service parameters	63
Table 29 – AR-Abort service parameters	64
Table 30 – Compel service parameters	64
Table 31 – Get buffered message service parameters	65
Table 32 – AR-Status service parameters	66
Table 33 – Simple variable access group membership	68
Table 34 – Simple variable access rights membership	68
Table 35 – Array variable access group membership	70
Table 36 – Array variable access rights membership	70
Table 37 – Variable list access group membership	72
Table 38 – Variable list access rights membership	72
Table 39 – Read service parameters	75
Table 40 – Write service parameters	76
Table 41 – Information report service parameters	77
Table 42 – Define variable list service parameters	78

Table 43 – Delete variable list service parameters	79
Table 44 – Event access group membership	81
Table 45 – Event access rights membership	81
Table 46 – Event notification service parameters	82
Table 47 – Acknowledge event notification service parameters	83
Table 48 – Alter event condition monitoring service parameters	84
Table 49 – Event state transitions	85
Table 50 – Domain access group membership	87
Table 51 – Domain access rights membership	87
Table 52 – GenericInitiateDownloadSequence	89
Table 53 – GenericDownloadSegment	90
Table 54 – GenericTerminateDownloadSequence	91
Table 55 – InitiateDownloadSequence	92
Table 56 – DownloadSegment	93
Table 57 – TerminateDownloadSequence	94
Table 58 – RequestDomainDownload	95
Table 59 – InitiateUploadSequence	96
Table 60 – UploadSegment	97
Table 61 – TerminateUploadSequence	98
Table 62 – RequestDomainUpload	99
Table 63 – Domain genericDownload/download state machine (server)	100
Table 64 – Domain upload state machine (server)	102
Table 65 – Program invocation access group membership	104
Table 66 – Program invocation access group membership	104
Table 67 – Create program invocation service parameters	106
Table 68 – Delete program invocation service parameters	107
Table 69 – Start service parameters	108
Table 70 – Stop service parameters	109
Table 71 – Resume service parameters	110
Table 72 – Reset service parameters	111
Table 73 – Kill service parameters	112
Table 74 – Program invocation state machine	114
Table 75 – Class summary	119
Table 76 – Services by AREP role	119

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 (standards.iteh.ai)
 IEC 61158-5-9:2014
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FIELDBUS SPECIFICATIONS –****Part 5-9: Application layer service definition –
Type 9 elements**

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

International Standard IEC 61158-5-9 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision. The main change with respect to the previous edition is listed below:

- Correct download state machine event service

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

FDIS	Report on voting
65C/763/FDIS	65C/773/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.

This publication has been drafted in accordance with ISO/IEC Directives, Part 2.

A 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.

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:

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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 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 5-9: Application layer service definition – Type 9 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 standard 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 9 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 standard defines in an abstract way the externally visible service provided by the different Types of 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 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 7498-1) 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 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 9 application layer services as defined in this standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 61158-1:2014, *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

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 – Part 1: 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 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 as defined in these publications apply.

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

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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 IEC 61158-1 terms

For the purposes of the present document, the following IEC 61158-1 terms apply.

3.5.1

application

function or data structure for which data is consumed or produced

3.5.2

application layer interoperability

capability of application entities to perform coordinated and cooperative operations using the services of the FAL

3.5.3

application object

object class that manages and provides the run time exchange of messages across the network and within the network device

Note 1 to entry: Multiple types of application object classes may be defined.

3.5.4

application process

part of a distributed application on a network, which is located on one device and unambiguously addressed

3.5.5

application process identifier

component that distinguishes multiple application processes used in a device

3.5.6

application process object ([standards.iteh.ai](https://standards.iteh.ai/catalog/standards/sist/f59def7f-34c5-4891-8047-0261048c1185/iec-61158-5-9-2014))

component of an application process that is identifiable and accessible through an FAL application relationship

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Note 1 to entry: Application process object definitions are composed of a set of values for the attributes of their class (see the definition for Application Process Object Class Definition). Application process object definitions may be accessed remotely using the services of the FAL Object Management ASE. FAL Object Management services can be used to load or update object definitions, to read object definitions, and to dynamically create and delete application objects and their corresponding definitions.

3.5.7

application process object class

class of application process objects defined in terms of the set of their network-accessible attributes and services

3.5.8

application relationship

cooperative association between two or more application-entity-invocations for the purpose of exchange of information and coordination of their joint operation

Note 1 to entry: This relationship is activated either by the exchange of application-protocol-data-units or as a result of preconfiguration activities.

3.5.9

application relationship application service element

application-service-element that provides the exclusive means for establishing and terminating all application relationships

3.5.10

application relationship endpoint

context and behavior of an application relationship as seen and maintained by one of the application processes involved in the application relationship

Note 1 to entry: Each application process involved in the application relationship maintains its own application relationship endpoint.

**3.5.11
attribute**

description of an externally visible characteristic or feature of an object

Note 1 to entry: The attributes of an object contain information about variable portions of an object. Typically, they provide status information or govern the operation of an object. Attributes may also affect the behaviour of an object. Attributes are divided into class attributes and instance attributes.

**3.5.12
behaviour**

indication of how the object responds to particular events

Note 1 to entry: Its description includes the relationship between attribute values and services.

**3.5.13
class**

set of objects, all of which represent the same kind of system component

Note 1 to entry: A class is a generalisation of the object; a template for defining variables and methods. All objects in a class are identical in form and behaviour, but usually contain different data in their attributes.

**3.5.14
class attributes**

attribute that is shared by all objects within the same class

**3.5.15
class code**

unique identifier assigned to each object class

**3.5.16
class specific service**

service defined by a particular object class to perform a required function which is not performed by a common service

Note 1 to entry: A class specific object is unique to the object class which defines it.

**3.5.17
client**

(a) object which uses the services of another (server) object to perform a task

(b) initiator of a message to which a server reacts, such as the role of an AR endpoint in which it issues confirmed service request APDUs to a single AR endpoint acting as a server

**3.5.18
conveyance path**

unidirectional flow of APDUs across an application relationship

**3.5.19
cyclic**

events which repeat in a regular and repetitive manner

**3.5.20
dedicated AR**

AR used directly by the FAL User

Note 1 to entry: On Dedicated ARs, only the FAL Header and the user data are transferred.

**3.5.21
device**

physical hardware connection to the link

Note 1 to entry: A device may contain more than one node.

3.5.22

device profile

collection of device dependent information and functionality providing consistency between similar devices of the same device type

3.5.23

dynamic AR

AR that requires the use of the AR establishment procedures to place it into an established state

3.5.24

endpoint

one of the communicating entities involved in a connection

3.5.25

error

discrepancy between a computed, observed or measured value or condition and the specified or theoretically correct value or condition

3.5.26

error class

general grouping for error definitions

Note 1 to entry: Error codes for specific errors are defined within an error class.

3.5.27

error code

identification of a specific type of error within an error class

3.5.28

FAL subnet

networks composed of one or more data link segments

Note 1 to entry: They are permitted to contain bridges, but not routers. FAL subnets are identified by a subset of the network address.

3.5.29

logical device

FAL class that abstracts a software component or a firmware component as an autonomous self-contained facility of an automation device

3.5.30

management information

network-accessible information that supports managing the operation of the fieldbus system, including the application layer

Note 1 to entry: Managing includes functions such as controlling, monitoring, and diagnosing.

3.5.31

network

series of nodes connected by some type of communication medium

Note 1 to entry: The connection paths between any pair of nodes can include repeaters, routers and gateways.

3.5.32

peer

role of an AR endpoint in which it is capable of acting as both client and server

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