

# SLOVENSKI STANDARD

## SIST EN 61158-5-9:2015

01-marec-2015

Nadomešča:

SIST EN 61158-5-9:2008

---

**Industrijska komunikacijska omrežja - Specifikacije za procesna vodila - 5-9. del:  
Definicija opravil na aplikacijski ravni - Elementi tipa 9 (IEC 61158-5-9:2014)**

Industrial communication networks - Fieldbus specifications - Part 5-9: Application layer service definition - Type 9 elements (IEC 61158-5-9:2014)

Industrielle Kommunikationsnetze - Feldbusse - Teil 5-9: Dienstfestlegungen des Application Layer (Anwendungsschicht) - Typ 9-Elemente (IEC 61158-5-9:2014)

Réseaux de communication industriels - Spécifications des bus de terrain - Partie 5-9: Définition des services de la couche application - Éléments de type 9 (CEI 61158-5-9:2014)

**Ta slovenski standard je istoveten z: EN 61158-5-9:2014**

**ICS:**

25.040.40	Merjenje in krmiljenje industrijskih postopkov	Industrial process measurement and control
35.100.70	Uporabniški sloj	Application layer
35.110	Omreževanje	Networking

**SIST EN 61158-5-9:2015**

**en,fr,de**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 61158-5-9:2015

<https://standards.iteh.ai/catalog/standards/sist/4d249e0d-b843-4d4f-9e19-38c64da20a3c/sist-en-61158-5-9-2015>

EUROPEAN STANDARD

**EN 61158-5-9**

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2014

ICS 25.040.40; 35.100.70; 35.110

Supersedes EN 61158-5-9:2008

English Version

**Industrial communication networks - Fieldbus specifications -  
Part 5-9: Application layer service definition - Type 9 elements  
(IEC 61158-5-9:2014)**

Réseaux de communication industriels - Spécifications des  
bus de terrain - Partie 5-9: Définition des services de la  
couche application - Eléments de type 9  
(CEI 61158-5-9:2014)

Industrielle Kommunikationsnetze - Feldbusse -  
Teil 5-9: Dienstfestlegungen des Application Layer  
(Anwendungsschicht) - Typ 9-Elemente  
(IEC 61158-5-9:2014)

This European Standard was approved by CENELEC on 2014-09-22. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

SIST EN 61158-5-9:2015

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

## Foreword

The text of document 65C/763/FDIS, future edition 2 of IEC 61158-5-9, prepared by SC 65C "Industrial networks" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61158-5-9:2014.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-06-22
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-09-22

This document supersedes EN 61158-5-9:2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

## iTeh STANDARD PREVIEW Endorsement notice (standards.iteh.ai)

The text of the International Standard IEC 61158-5-9:2014 was approved by CENELEC as a European Standard without any modification.

[SIST EN 61158-5-9:2015](#)

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61158-3-1	NOTE	Harmonized as EN 61158-3-1.
IEC 61158-4-1	NOTE	Harmonized as EN 61158-4-1.
IEC 61158-5-5	NOTE	Harmonized as EN 61158-5-5.
IEC 61158-6-9	NOTE	Harmonized as EN 61158-6-9.
IEC 61784-1	NOTE	Harmonized as EN 61784-1.
IEC 61784-2	NOTE	Harmonized as EN 61784-2.

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-1	2014	Industrial communication networks - Fieldbus specifications - Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series	EN 61158-1	2014
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 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	-	-

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 61158-5-9:2015](#)

<https://standards.iteh.ai/catalog/standards/sist/4d249e0d-b843-4d4f-9e19-38c64da20a3c/sist-en-61158-5-9-2015>



IEC 61158-5-9

Edition 2.0 2014-08

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Industrial communication networks – Fieldbus specifications –  
Part 5-9: Application layer service definition – Type 9 elements**

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

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX

**XF**

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-1735-1

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## 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

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –  
FIELD BUS SPECIFICATIONS –****Part 5-9: Application layer service definition –  
Type 9 elements**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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 61158-5-9 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:

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN 61158-5-9:2015

<https://standards.iteh.ai/catalog/standards/sist/4d249e0d-b843-4d4f-9e19-38c64da20a3c/sist-en-61158-5-9-2015>

## 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.

## **iTeh STANDARD PREVIEW** **(standards.iteh.ai)**

[SIST EN 61158-5-9:2015](https://standards.iteh.ai/catalog/standards/sist/4d249e0d-b843-4d4f-9e19-38c64da20a3c/sist-en-61158-5-9-2015)

<https://standards.iteh.ai/catalog/standards/sist/4d249e0d-b843-4d4f-9e19-38c64da20a3c/sist-en-61158-5-9-2015>

## 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*