

**SLOVENSKI STANDARD**  
**SIST EN 61158-6-15:2012****01-september-2012****Nadomešča:****SIST EN 61158-6-15:2008**

---

**Industrijska komunikacijska omrežja - Specifikacije za procesno vodilo - 6-15. del:  
Specifikacija protokola na aplikacijskem nivoju - Elementi tipa 15 (IEC 61158-6-  
15:2010)**Industrial communication networks - Fieldbus specifications - Part 6-15: Application layer  
protocol specification - Type 15 elements (IEC 61158-6-15:2010)**iTeh STANDARD PREVIEW**Industrielle Kommunikationsnetze - Feldbusse - Teil 6-15: Protokollspezifikation des  
Application Layer (Anwendungsschicht) - Typ 15-Elemente (IEC 61158-6-15:2010)[SIST EN 61158-6-15:2012](#)Réseaux de communication industriels - Spécifications des bus de terrain - Partie 6-15:  
Spécification des protocoles des couches d'application - Eléments de type 15 (CEI  
61158-6-15:2010)**Ta slovenski standard je istoveten z: EN 61158-6-15:2012****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 61158-6-15:2012****en**

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

[SIST EN 61158-6-15:2012](https://standards.iteh.ai/catalog/standards/sist/c02b17f2-988c-4e32-be2c-3ca6d4bcc4b0/sist-en-61158-6-15-2012)

<https://standards.iteh.ai/catalog/standards/sist/c02b17f2-988c-4e32-be2c-3ca6d4bcc4b0/sist-en-61158-6-15-2012>

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 61158-6-15**

June 2012

ICS 25.040.40; 35.100.70; 35.110

Supersedes EN 61158-6-15:2008

English version

**Industrial communication networks -  
Fieldbus specifications -  
Part 6-15: Application layer protocol specification -  
Type 15 elements  
(IEC 61158-6-15:2010)**

Réseaux de communication industriels -  
Spécifications des bus de terrain -  
Partie 6-15: Spécification des protocoles  
des couches d'application -  
Éléments de type 15  
(CEI 61158-6-15:2010)

Industrielle Kommunikationsnetze -  
Feldbusse -  
Teil 6-15: Protokollspezifikation des  
Application Layer (Anwendungsschicht) -  
Typ 15-Elemente  
(IEC 61158-6-15:2010)

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

[SIST EN 61158-6-15:2012](https://standards.iteh.ai/catalog/standards/sist/c02b17d2-988c-4e32-be2c-2012-03-282)

<https://standards.iteh.ai/catalog/standards/sist/c02b17d2-988c-4e32-be2c-2012-03-282>

This European Standard was approved by CENELEC on 2012-03-28. 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, 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.

**CENELEC**

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

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

## Foreword

The text of document 65C/607/FDIS, future edition 2 of IEC 61158-6-15, 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 61158-6-15:2012.

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) 2012-12-28
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-03-28

This document supersedes EN 61158-6-15:2008.

EN 61158-6-15:2012 includes the following significant technical changes with respect to EN 61158-6-15:2008:

- editorial corrections.

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.

**STANDARD PREVIEW**  
(standards.iteh.ai)  
<https://standards.iteh.ai/catalog/standards/sist/c02b17d2-988c-4e32-be2c-3ca6d70cc400/sist-en-61158-6-15-2012>  
**Endorsement notice**

The text of the International Standard IEC 61158-6-15:2010 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC/TR 61158-1:2010      NOTE Harmonized as CLC/TR 61158-1:2010 (not modified).

## 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 When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-5-15	2010	Industrial communication networks - Fieldbus specifications - Part 5-15: Application layer service definition - Type 15 elements	EN 61158-5-15	2012
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	-	-

iTeH STANDARD PREVIEW  
(standards.iteh.ai)  
SIST EN 61158-6-15:2012  
<https://standards.iteh.ai/catalog/standards/sist/c02b17d2-988c-4e32-be2c-3ca6d4bcc4b0/sist-en-61158-6-15-2012>

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

SIST EN 61158-6-15:2012

<https://standards.iteh.ai/catalog/standards/sist/c02b17f2-988c-4e32-be2c-3ca6d4bcc4b0/sist-en-61158-6-15-2012>



IEC 61158-6-15

Edition 2.0 2010-08

# INTERNATIONAL STANDARD

---

**Industrial communication networks – Fieldbus specifications –  
Part 6-15: Application layer protocol specification – Type 15 elements**

***iTech STANDARD PREVIEW  
(standards.iteh.ai)***  
SIST EN 61158-6-15:2012  
<https://standards.iteh.ai/catalog/standards/sist/c02b17f2-988c-4e32-be2c-3ca6d4bcc4b0/sist-en-61158-6-15-2012>

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

PRICE CODE **XD**

---

ICS 25.04.40; 35.100.70; 35.110

ISBN 978-2-88912-131-1

## CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
1.1 General.....	9
1.2 Specifications.....	9
1.3 Conformance.....	10
2 Normative references.....	10
3 Terms and definitions, abbreviations, symbols and conventions.....	10
3.1 Terms and definitions.....	10
3.2 Abbreviations and symbols.....	17
3.3 Conventions.....	19
3.4 Conventions used in state machines.....	21
4 Abstract syntax for client/server.....	22
5 Transfer syntax for client/server.....	22
5.1 General.....	22
5.2 Common APDU structure.....	22
5.3 Service-specific APDU structures.....	26
5.4 Data representation on the wire.....	51
6 Abstract syntax for publish/subscribe.....	51
7 Transfer syntax for publish/subscribe.....	52
7.1 General.....	52
7.2 APDU structure.....	52
7.3 Sub-message structure.....	53
7.4 APDU interpretation.....	55
7.5 Service specific APDU structures.....	57
7.6 Common data representation for publish/subscribe.....	79
8 Structure of FAL protocol state machines.....	83
9 AP-context state machines for client/server.....	85
10 FAL service protocol machine (FSPM) for client/server.....	85
10.1 General.....	85
10.2 FSPM state tables.....	85
10.3 Functions used by FSPM.....	92
10.4 Parameters of FSPM/ARPM primitives.....	92
10.5 Client/server server transactions.....	92
11 Application relationship protocol machines (ARPMs) for client/server.....	94
11.1 Application relationship protocol machines (ARPMs).....	94
11.2 AREP state machine primitive definitions.....	95
11.3 AREP state machine functions.....	96
12 DLL mapping protocol machine (DMPM) for client/server.....	96
12.1 AREP mapping to data link layer.....	96
12.2 DMPM states.....	97
12.3 DMPM state machine.....	97
12.4 Primitives exchanged between data link layer and DMPM.....	98
12.5 Client/server on TCP/IP.....	98
13 AP-Context state machines for publish/subscribe.....	102



14 Protocol machines for publish/subscribe .....	102
14.1 General .....	102
14.2 Publish/subscribe on UDP .....	104
Bibliography .....	105
Figure 1 – APDU Format .....	22
Figure 2 – Client to server confirmed service request .....	24
Figure 3 – Normal response from server to client .....	24
Figure 4 – Exception response from server to client .....	24
Figure 5 – Client to server unconfirmed service request .....	25
Figure 6 – Publish/subscribe APDU .....	52
Figure 7 – Flags of issue request .....	58
Figure 8 – Flags of heartbeat request .....	60
Figure 9 – Flags of VAR request .....	64
Figure 10 – Flags of GAP request .....	66
Figure 11 – Flags of ACK request .....	68
Figure 12 – Flags of INFO_DST request .....	72
Figure 13 – Flags of INFO_REPLY request .....	73
Figure 14 – Flags of INFO_SRC request .....	75
Figure 15 – Flags of INFO_TS request .....	77
Figure 16 – Flags of PAD request .....	78
Figure 17 – Encoding of octet .....	80
Figure 18 – Encoding of boolean .....	80
Figure 19 – Encoding of unsigned short .....	80
Figure 20 – Encoding of unsigned long .....	80
Figure 21 – Encoding of unsigned long long .....	81
Figure 22 – Encoding of float .....	81
Figure 23 – Encoding of double .....	81
Figure 24 – Relationships among protocol machines and adjacent layers .....	84
Figure 25 – State transition diagram of FSPM .....	85
Figure 26 – Transaction state machine, per connection .....	86
Figure 27 – Client/server server transactions .....	93
Figure 28 – State transition diagram of the Client ARPM .....	94
Figure 29 – State transition diagram of the server ARPM .....	95
Figure 30 – State transition diagram of DMPM .....	97
Figure 31 – APDU Format .....	98
Figure 32 – TCP/IP PDU Format .....	99
Figure 33 – Publish/subscribe receiver .....	103
Table 1 – Conventions used for state machines .....	21
Table 2 – Exception code .....	25
Table 3 – Read discretely request .....	26
Table 4 – Read discretely response .....	26

Table 5 – Read coils request .....	27
Table 6 – Read coils response.....	27
Table 7 – Write single coil request .....	28
Table 8 – Write single coil response .....	28
Table 9 – Write multiple coils request .....	29
Table 10 – Write multiple coils response.....	29
Table 11 – Broadcast write single coil request .....	30
Table 12 – Broadcast write multiple coils request.....	31
Table 13 – Read input registers request .....	31
Table 14 – Read input registers response.....	32
Table 15 – Read holding registers request.....	32
Table 16 – Read holding registers response .....	33
Table 17 – Write single holding register request .....	33
Table 18 – Write single holding register response.....	34
Table 19 – Write multiple holding registers request.....	34
Table 20 – Write multiple holding registers response .....	35
Table 21 – Mask write holding register request .....	36
Table 22 – Mask write holding register request .....	36
Table 23 – Read/Write multiple holding registers request.....	37
Table 24 – Read/Write multiple holding registers response.....	38
Table 25 – Read FIFO request.....	38
Table 26 – Read FIFO response.....	39
Table 27 – Broadcast write single holding register request.....	40
Table 28 – Broadcast write multiple holding registers request.....	41
Table 29 – Read file record request .....	42
Table 30 – Read file record response .....	43
Table 31 – Write file record request .....	44
Table 32 – Write file record response .....	46
Table 33 – Read device identification request.....	47
Table 34 – Device identification categories .....	48
Table 35 – Read device ID code .....	48
Table 36 – Read device identification response .....	49
Table 37 – Conformity level .....	50
Table 38 – Requested vs. returned known objects .....	51
Table 39 – APDU structure .....	53
Table 40 – Sub-message structure .....	54
Table 41 – Publish/subscribe service identifier encoding .....	54
Table 42 – Attributes changed modally and affecting APDUs interpretations .....	56
Table 43 – Issue request .....	57
Table 44 – Meaning of issue request flags.....	58
Table 45 – Interpretation of issue.....	59
Table 46 – Heartbeat request .....	60
Table 47 – Meaning of heartbeat request flags .....	61

Table 48 – Interpretation of heartbeat .....	62
Table 49 – VAR request .....	63
Table 50 – Meaning of VAR request flags .....	64
Table 51 – Interpretation of VAR .....	65
Table 52 – GAP request .....	66
Table 53 – Meaning of GAP request flags .....	67
Table 54 – Interpretation of GAP .....	67
Table 55 – ACK request .....	68
Table 56 – Meaning of ACK request flags .....	69
Table 57 – Interpretation of ACK .....	69
Table 58 – Header request .....	70
Table 59 – Change in state of the receiver .....	71
Table 60 – INFO_DST request .....	71
Table 61 – Meaning of INFO_DST request flags .....	72
Table 62 – INFO_REPLY request .....	73
Table 63 – Meaning of INFO_REPLY request flags .....	74
Table 64 – INFO_SRC request .....	75
Table 65 – Meaning of INFO_SRC request flags .....	75
Table 66 – INFO_TS request .....	76
Table 67 – Meaning of INFO_TS request flags .....	77
Table 68 – PAD request .....	78
Table 69 – Meaning of PAD request flags .....	78
Table 70 – Semantics .....	79
Table 71 – FSPM state table – client transactions .....	87
Table 72 – FSPM state table – server transactions .....	92
Table 73 – Function MatchInvokeID() .....	92
Table 74 – Function HighBit() .....	92
Table 75 – Parameters used with primitives exchanged between FSPM and ARPM .....	92
Table 76 – Client ARPM states .....	94
Table 77 – Client ARPM state table .....	94
Table 78 – Server ARPM states .....	94
Table 79 – Server ARPM state table .....	95
Table 80 – Primitives issued from ARPM to DMPM .....	95
Table 81 – Primitives issued by DMPM to ARPM .....	95
Table 82 – Parameters used with primitives exchanged between ARPM and DMPM .....	96
Table 83 – DMPM state descriptions .....	97
Table 84 – DMPM state table – client transactions .....	97
Table 85 – DMPM state table – server transactions .....	98
Table 86 – Primitives exchanged between data-link layer and DMPM .....	98
Table 87 – Encapsulation parameters for client/server on TCP/IP .....	99

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

**INDUSTRIAL COMMUNICATION NETWORKS –  
 FIELDBUS SPECIFICATIONS –**
**Part 6-15: Application layer protocol specification –  
 Type 15 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.

NOTE 1 Use of some of the associated protocol types is restricted by their 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 particular data-link layer protocol type to be used with physical layer and application layer protocols in Type combinations as specified explicitly in the profile parts. Use of the various protocol types in other combinations may require permission from their respective intellectual-property-right holders.

International Standard IEC 61158-6-15 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 changes with respect to the previous edition are listed below:

- editorial corrections.

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

FDIS	Report on voting
65C/607/FDIS	65C/621/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 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
- amended.

NOTE 2 The revision of this standard will be synchronized with the other parts of the IEC 61158 series.

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

[SIST EN 61158-6-15:2012](https://standards.iteh.ai/catalog/standards/sist/c02b17f2-988c-4e32-be2c-3ca6d4bcc4b0/sist-en-61158-6-15-2012)

<https://standards.iteh.ai/catalog/standards/sist/c02b17f2-988c-4e32-be2c-3ca6d4bcc4b0/sist-en-61158-6-15-2012>

## 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 protocol provides the application service by making use of the services available from the data-link or other immediately lower layer. The primary aim of this standard is to provide a set of rules for communication expressed in terms of the procedures to be carried out by peer application entities (AEs) at the time of communication. These rules for communication are intended to provide a sound basis for development in order to serve a variety of purposes:

- as a guide for implementers and designers;
- for use in the testing and procurement of equipment;
- as part of an agreement for the admittance of systems into the open systems environment;
- as a refinement to the understanding of time-critical communications within OSI.

This standard is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this standard together with other standards positioned within the OSI or fieldbus reference models, otherwise incompatible systems may work together in any combination.

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

[SIST EN 61158-6-15:2012](https://standards.iteh.ai/catalog/standards/sist/c02b17f2-988c-4e32-be2c-3ca6d4bcc4b0/sist-en-61158-6-15-2012)

<https://standards.iteh.ai/catalog/standards/sist/c02b17f2-988c-4e32-be2c-3ca6d4bcc4b0/sist-en-61158-6-15-2012>

## INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

### Part 6-15: Application layer protocol specification – Type 15 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 15 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 behavior provided by the Type 15 fieldbus Application Layer in terms of

- a) the abstract syntax defining the application layer protocol data units conveyed between communicating application entities,
- b) the transfer syntax defining the application layer protocol data units conveyed between communicating application entities,
- c) the application context state machine defining the application service behavior visible between communicating application entities; and
- d) the application relationship state machines defining the communication behavior visible between communicating application entities; and.

The purpose of this standard is to define the protocol provided to

- a) define the wire-representation of the service primitives defined in IEC 61158-5-15, and
- b) define the externally visible behavior associated with their transfer.

This standard specifies the protocol of the Type 15 IEC fieldbus Application Layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498) and the OSI Application Layer Structure (ISO/IEC 9545).

##### 1.2 Specifications

The principal objective of this standard is to specify the syntax and behavior of the application layer protocol that conveys the application layer services defined in IEC 61158-5-15.

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 protocols standardized in IEC 61158-6.