

---

**Industrijska komunikacijska omrežja - Specifikacije za procesna vodila - 6-23. del: Specifikacija protokola na aplikacijski ravni - Elementi tipa 23 (IEC 61158-6-23:2014)**

Industrial communication networks - Fieldbus specifications - Part 6-23: Application layer protocol specification - Type 23 elements (IEC 61158-6-23:2014)

Industrielle Kommunikationsnetze - Feldbusse - Teil 6-23: Protokollspezifikation des Application Layer (Anwendungsschicht) - Typ 23-Elemente (IEC 61158-6-23:2014)

Réseaux de communication industriels - Spécifications des bus de terrain - Partie 6-23: Spécification du protocole de la couche application - Éléments de type 23 (CEI 61158-6-23:2014)

**Ta slovenski standard je istoveten z: EN 61158-6-23:2014**

---

**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 61158-6-23:2015**

**en,fr,de**

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

[SIST EN 61158-6-23:2015](#)

<https://standards.iteh.ai/catalog/standards/sist/5039719b-2ac4-4fe3-bfbb-8a4f254c22cf/sist-en-61158-6-23-2015>

EUROPEAN STANDARD

**EN 61158-6-23**

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2014

ICS 25.040.40; 35.100.70; 35.110

English Version

Industrial communication networks - Fieldbus specifications -  
Part 6-23: Application layer protocol specification - Type 23  
elements  
(IEC 61158-6-23:2014)

Réseaux de communication industriels - Spécifications des  
bus de terrain - Partie 6-23: Spécification du protocole de la  
couche application - Eléments de type 23  
(CEI 61158-6-23:2014)

Industrielle Kommunikationsnetze - Feldbusse - Teil 6-23:  
Protokollspezifikation des Application Layer  
(Anwendungsschicht) - Typ 23-Elemente  
(IEC 61158-6-23:2014)

This European Standard was approved by CENELEC on 2014-09-23. 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, 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/764/FDIS, future edition 1 of IEC 61158-6-23, 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 61158-6-23:2014.

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) 2015-06-23
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-09-23

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.

(standards.iteh.ai)

### Endorsement notice

<https://standards.iteh.ai/catalog/standards/sist/5039719b-2ac4-4fe3-bfbb-8a4f254c22cf/sist-en-61158-6-23-2015>

The text of the International Standard IEC 61158-6-23:2014 was approved by CENELEC as a European Standard without any modification.

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

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
IEC 61158-5-23	-	Industrial communication networks - Fieldbus specifications - Part 5-23: Application layer service definition - Type 23 elements	EN 61158-5-23	-
IEC 61158-6	series	Industrial communication networks - Fieldbus specifications - Part 6: Application layer protocol specification	EN 61158-6	series
ISO/IEC 7498-1	-	Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model	-	-
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	-	-

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

[SIST EN 61158-6-23:2015](#)

<https://standards.iteh.ai/catalog/standards/sist/5039719b-2ac4-4fe3-bfbb-8a4f254c22cf/sist-en-61158-6-23-2015>



IEC 61158-6-23

Edition 1.0 2014-08

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Industrial communication networks – Fieldbus specifications –  
Part 6-23: Application layer protocol specification – Type 23 elements**

**Réseaux de communication industriels – Spécifications des bus de terrain –  
Partie 6-23: Spécification du protocole de la couche application – Éléments  
de type 23**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX

**XH**

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-1768-9

**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.....	7
0 INTRODUCTION .....	9
0.1 General.....	9
0.2 Patent disclosure.....	9
1 Scope.....	11
1.1 General.....	11
1.2 Specifications.....	12
1.3 Conformance.....	12
2 Normative references .....	12
3 Terms, definitions, symbols, abbreviated terms and conventions .....	12
3.1 Referenced terms and definitions .....	13
3.2 Type 23 specific terms and definitions.....	14
3.3 Symbols and abbreviated terms.....	16
3.4 Conventions .....	17
4 FAL syntax description .....	19
4.1 FALPDU type C abstract syntax .....	19
4.2 FALPDU type F abstract syntax.....	25
4.3 Data type assignments for type C.....	36
4.4 Data type assignments for type F.....	37
5 FAL transfer syntax .....	38
5.1 Encoding rules .....	38
5.2 FALPDU type C elements encoding.....	38
5.3 FALPDU type F elements encoding.....	68
6 Structure of the FAL protocol state machine .....	102
7 FAL service protocol machine (FSPM).....	102
7.1 Overview .....	102
7.2 FSPM type C.....	103
7.3 FSPM type F .....	106
8 Application relationship protocol machine (ARPM).....	113
8.1 ARPM type C.....	113
8.2 ARPM type F.....	159
9 DLL mapping protocol machine (DMPM).....	211
9.1 DMPM type C.....	211
9.2 DMPM type F .....	212
Bibliography.....	213
Figure 1 – Bit description in octets .....	18
Figure 2 – Structure for memory access information retrieve response .....	55
Figure 3 – Attribute definitions .....	56
Figure 4 – Access code definitions.....	56
Figure 5 – Structure for RUN request.....	57
Figure 6 – Structure for RUN response .....	58
Figure 7 – Structure for STOP request.....	58
Figure 8 – Structure for STOP response .....	58



Figure 9 – Structure for batch memory read request .....	59
Figure 10 – Structure for batch memory read response .....	59
Figure 11 – Structure for random memory read request .....	60
Figure 12 – Structure for random memory read response .....	60
Figure 13 – Structure for batch memory write request .....	61
Figure 14 – Structure for batch memory write response .....	61
Figure 15 – Structure for random memory write request .....	62
Figure 16 – Structure for random memory write response .....	62
Figure 17 – Relationships between protocol machines .....	102
Figure 18 – Structure of FSPM C .....	103
Figure 19 – Structure of FSPM F .....	106
Figure 20 – Structure of ARPM C .....	113
Figure 21 – Structure of ARPM F .....	160
Figure 22 – Structure of type C DMPM .....	211
Figure 23 – Structure of type F DMPM .....	212
Table 1 – State machine description elements .....	18
Table 2 – Description of state machine elements .....	18
Table 3 – Conventions used in state machines .....	18
Table 4 – afFType .....	38
Table 5 – priority .....	39
Table 6 – portChoice .....	41
Table 7 – portCheckResult .....	41
Table 8 – dstPortInfo .....	41
Table 9 – scanState .....	42
Table 10 – nodeType .....	42
Table 11 – loopState .....	43
Table 12 – Cyclic status .....	43
Table 13 – Parameter setting mode .....	44
Table 14 – opState .....	46
Table 15 – errorState .....	47
Table 16 – Data type .....	48
Table 17 – CPW .....	49
Table 18 – CPWC .....	49
Table 19 – CPWCR .....	49
Table 20 – cmParam .....	49
Table 21 – Details of param area .....	50
Table 22 – Details of application parameters .....	50
Table 23 – Details of LB/LW CM area and LB/LW CM additional area .....	51
Table 24 – Details of LX/LY CM 1 area and LX/LY CM 2 area .....	51
Table 25 – Destination module flag .....	53
Table 26 – Command types .....	54
Table 27 – Access codes of network module memory .....	56

Table 28 – Access codes of controller memory .....	56
Table 29 – byteValidity .....	63
Table 30 – afFType .....	68
Table 31 – dataType .....	69
Table 32 – varField .....	69
Table 33 – nodeType .....	70
Table 34 – ProtocolVerType .....	71
Table 35 – Link status .....	74
Table 36 – Port enable/disable specification .....	75
Table 37 – Cyclic transmission parameter hold status .....	82
Table 38 – Detailed application operation status .....	82
Table 39 – Error detection status .....	82
Table 40 – Slave-specific event reception status .....	84
Table 41 – dataSupType of dataType (0x07) .....	86
Table 42 – FieldSpecificTransient opHeader .....	87
Table 43 – command (dataType: 0x07, dataSubType: 0x0002) .....	87
Table 44 – subCommand type for each command type .....	88
Table 45 – Structure of Deliver node information .....	88
Table 46 – Structure of Deliver node information – message .....	88
Table 47 – Structure of Get statistical information response .....	89
Table 48 – Structure of Acquisition of node details response .....	89
Table 49 – Execution module specification .....	92
Table 50 – Command type .....	93
Table 51 – Cyclic data state table .....	104
Table 52 – Acyclic data state table .....	104
Table 53 – Management state table .....	106
Table 54 – Cyclic data state table .....	109
Table 55 – Acyclic data state table .....	109
Table 56 – Management state table .....	112
Table 57 – Synchronization state table .....	112
Table 58 – Measurement state table .....	112
Table 59 – Acyclic transmission state table .....	113
Table 60 – Acyclic transmission functions .....	114
Table 61 – Cyclic transmission state table .....	115
Table 62 – Cyclic transmission functions .....	119
Table 63 – Connection control state machine – Initial .....	120
Table 64 – Connection control state machine – Connect .....	120
Table 65 – Connection control state machine – Scan .....	122
Table 66 – Connection control state machine – ScanWait .....	125
Table 67 – Connection control state machine – Collect .....	127
Table 68 – Connection control state machine – CollectWait .....	130
Table 69 – Connection control state machine – Select .....	133
Table 70 – Connection control state machine – TokenStartWait .....	136

Table 71 – Connection control state machine – LaunchWait.....	138
Table 72 – Connection control state machine – TokenReleaseWait.....	141
Table 73 – Connection control state machine – TokenReleased.....	144
Table 74 – Connection control state machine – TokenWait.....	149
Table 75 – Connection control state machine – NTNTestMaster.....	153
Table 76 – Connection control state machine – NTNTestSlave.....	154
Table 77 – Function list of connection control.....	154
Table 78 – Common parameter dist state table.....	154
Table 79 – Function list of connection control.....	158
Table 80 – Mapping of internal service and acyclic transmission service.....	159
Table 81 – Acyclic transmission states.....	160
Table 82 – Acyclic transmission state table.....	160
Table 83 – Acyclic transmission functions.....	162
Table 84 – Acyclic transmission variables.....	162
Table 85 – Cyclic transmission states.....	163
Table 86 – Cyclic transmission state table.....	163
Table 87 – Cyclic transmission functions.....	165
Table 88 – Cyclic transmission variables.....	165
Table 89 – Master station channel control states.....	165
Table 90 – Slave station channel control states.....	166
Table 91 – Master station state table – MasterDown.....	166
Table 92 – Master station state table – Listen.....	166
Table 93 – Master station state table – MasterArbitration.....	168
Table 94 – Master station state table – PrimaryMasterScatterTD.....	169
Table 95 – Master station state table – PrimaryMasterSettingUp.....	171
Table 96 – Master station state table – PrimaryMasterHoldToken.....	173
Table 97 – Master station state table – PrimaryMasterSolicitToken.....	176
Table 98 – Master station state table – PrimaryMasterInviting.....	179
Table 99 – Master station state table – MasterWaitTD.....	180
Table 100 – Master station state table – MasterWaitSetup.....	182
Table 101 – Master station state table – MasterSolicitToken (without Transmission path delay measurement).....	183
Table 102 – Master station state table – MasterSolicitToken (with Transmission path delay measurement).....	185
Table 103 – Master station state table – MasterHoldToken.....	187
Table 104 – Master station state table – MasterMeasurement (without Transmission path delay measurement function).....	189
Table 105 – Master station state table – MasterMeasurement (with Transmission path delay measurement function).....	190
Table 106 – Slave station state table – SlaveDown.....	190
Table 107 – Slave station state table – SlaveWaitTD.....	190
Table 108 – Slave station state table – SlaveWaitSetup.....	191
Table 109 – Slave station state table – SlaveSolicitToken (without Transmission path delay measurement).....	192

Table 110 – Slave station state table – SlaveSolicitToken (with Transmission path delay measurement) .....	194
Table 111 – Slave station state table – SlaveHoldToken .....	195
Table 112 – Master station channel control functions .....	198
Table 113 – Slave station channel control functions .....	199
Table 114 – Master station channel control variables .....	200
Table 115 – Slave station channel control variables .....	200
Table 116 – Master station channel control timers .....	201
Table 117 – Slave station channel control timers .....	201
Table 118 – Master station parameter dist states .....	201
Table 119 – Slave station parameter dist states .....	201
Table 120 – Master station parameter dist state table .....	202
Table 121 – Slave station parameter dist state table .....	202
Table 122 – Master station parameter dist functions .....	204
Table 123 – Slave station parameter dist functions .....	204
Table 124 – Master station synchronous trigger states .....	204
Table 125 – Slave station synchronous trigger states .....	205
Table 126 – Master station synchronous trigger state table .....	205
Table 127 – Slave station synchronous trigger state table .....	205
Table 128 – Synchronous trigger functions .....	205
Table 129 – Timer states – Best effort type .....	205
Table 130 – Timer states – Fixed cycle type .....	206
Table 131 – Timer state table – Best effort type .....	206
Table 132 – Timer state table – Fixed cycle type .....	206
Table 133 – Timer variables .....	206
Table 134 – Fixed cycle timer .....	206
Table 135 – Master station measure transmission states .....	207
Table 136 – Slave station measure transmission states .....	207
Table 137 – Master station measure transmission state table .....	207
Table 138 – Slave station measure transmission state table .....	208
Table 139 – Master station measure transmission functions .....	209
Table 140 – Slave station measure transmission functions .....	210
Table 141 – Master station measure transmission variables .....	210
Table 142 – Mapping of type C DMPM service and DL service .....	211
Table 143 – Destination address for each type C PDU .....	211
Table 144 – Mapping of type F DMPM service and DL service .....	212

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

**INDUSTRIAL COMMUNICATION NETWORKS –  
FIELDBUS SPECIFICATIONS –**
**Part 6-23: Application layer protocol specification –  
Type 23 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.

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 61158-6-23 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

FDIS	Report on voting
65C/764/FDIS	65C/774/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 the ISO/IEC Directives, Part 2.

A list of all the parts of the IEC 61158 series, published under the general title *Industrial communication networks — Fieldbus specifications*, can be found on the IEC website.

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 61158-6-23:2015](https://standards.iteh.ai/catalog/standards/sist/5039719b-2ac4-4fe3-bfbb-8a4f254c22cf/sist-en-61158-6-23-2015)

<https://standards.iteh.ai/catalog/standards/sist/5039719b-2ac4-4fe3-bfbb-8a4f254c22cf/sist-en-61158-6-23-2015>

## 0 INTRODUCTION

### 0.1 General

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 61158-1:2014.

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 implementors 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.

### 0.2 Patent disclosure

(standards.iteh.ai)

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning Type 23 elements and possibly other types given in 8.1 and 8.2 as follows:

JP 05106658 US 7983177 DE 112006003943.1 KR 10-1029201 TW I338476	[MEC]	Communication management device, communication node, communication system, and data communication method
JP 4503678 DE 112006003895.8 KR 10-1024472 CN 201110218295.6 TW I333356	[MEC]	Communication management device, communication device, and communication method
JP 2010-045463 US 12/774377 DE 112006004225.4 KR 10-1024482 CN 201010148761.3 TW 099112461	[MEC]	Communication node, and token issuing method and token-ring communication method in ring communication system
JP 05127977	[MEC]	Synchronization system, time master nodes, time slave nodes and synchronization method
JP 05106658 US 13/334863 DE 112008004265.9 KR 10-2011-7030535 CN 201210026699.X TW 101108048	[MEC]	Communication management device, communication node, communication system, and data communication method