
**Industrijska komunikacijska omrežja - Specifikacije za procesna vodila - 6-24. del:
Specifikacija protokola na aplikacijski ravni - Elementi tipa 24 (IEC 61158-6-
24:2014)**

Industrial communication networks - Fieldbus specifications - Part 6-24: Application layer
protocol specification - Type-24 Elements (IEC 61158-6-24:2014)

Industrielle Kommunikationsnetze - Feldbusse - Teil 6-24: Protokollspezifikation des
Application Layer (Anwendungsschicht) - Typ 24-Elemente (IEC 61158-6-24:2014)

Réseaux de communication industriels - Spécifications des bus de terrain - Partie 6-24:
Spécification du protocole de la couche application - Éléments de type 24 (CEI 61158-6-
24:2014)

Ta slovenski standard je istoveten z: EN 61158-6-24:2014

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 61158-6-24:2015**en,fr,de**

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 61158-6-24:2015](https://standards.iteh.ai/catalog/standards/sist/5c49b48d-0c79-4fa1-89a2-c7c47b68d84c/sist-en-61158-6-24-2015)

<https://standards.iteh.ai/catalog/standards/sist/5c49b48d-0c79-4fa1-89a2-c7c47b68d84c/sist-en-61158-6-24-2015>

EUROPEAN STANDARD

EN 61158-6-24

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2014

ICS 25.040.40; 35.100.70; 35.110

English Version

Industrial communication networks - Fieldbus specifications -
Part 6-24: Application layer protocol specification - Type-24
Elements
(IEC 61158-6-24:2014)

Réseaux de communication industriels - Spécifications des
bus de terrain - Partie 6-24: Spécification du protocole de la
couche application - Éléments de type 24
(CEI 61158-6-24:2014)

Industrielle Kommunikationsnetze - Feldbusse - Teil 6-24:
Protokollspezifikation des Application Layer
(Anwendungsschicht) - Typ 24-Elemente
(IEC 61158-6-24:2014)

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 61158-6-24, 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 61158-6-24:2014.

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/5c49b48d-0c79-4fa1-89a2-c7c47b68d84c/sist-en-61158-6-24-2015>

The text of the International Standard IEC 61158-6-24:2014 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 61158-1:2014	NOTE	Harmonized as EN 61158-1:2014 (not modified).
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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-5-24	2014	Industrial communication networks - Fieldbus specifications - Part 5-24: Application layer service definition - Type 24 elements	EN 61158-5-24	2014
IEC 61158-6	series	Industrial communication networks - Fieldbus specifications - Part 6: Application layer protocol specification	EN 61158-6	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: The basic model	-	-
ISO/IEC 9545	-	Information technology - Open Systems Interconnection - Application layer structure	-	-
ISO/IEC 9899	-	Information technology - Programming languages - C	-	-
ISO/IEC 10731	-	Information technology - Open Systems Interconnection - Basic Reference Model - Conventions for the definition of OSI services	-	-
ISO/IEC 19501	2005	Information technology - Open Distributed Processing - Unified Modeling Language (UML) Version 1.4.2	-	-
ISO/IEC/IEEE 60559	-	Information technology - Microprocessor Systems - Floating-Point arithmetic	-	-

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 61158-6-24:2015](https://standards.iteh.ai/catalog/standards/sist/5c49b48d-0c79-4fa1-89a2-c7c47b68d84c/sist-en-61158-6-24-2015)

<https://standards.iteh.ai/catalog/standards/sist/5c49b48d-0c79-4fa1-89a2-c7c47b68d84c/sist-en-61158-6-24-2015>



IEC 61158-6-24

Edition 1.0 2014-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial communication networks – Fieldbus specifications –
Part 6-24: Application layer protocol specification – Type-24 Elements
(standards.iteh.ai)

Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 6-24: Spécification du protocole de la couche application – Éléments
de type 24
c7c47b68d84c/sist-en-61158-6-24-2015

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

XF

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-1769-6

**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.....	8
1.3 Conformance.....	9
2 Normative references.....	9
3 Terms, definitions, abbreviations, symbols and conventions.....	9
3.1 Referenced terms and definitions.....	9
3.2 Additional terms and definitions.....	11
3.3 Abbreviations and symbols.....	16
3.4 Conventions.....	17
4 Abstract syntax.....	19
4.1 Basic Data types.....	19
4.2 FAL PDU types.....	21
4.3 Detailed definitions of _FDCService-PDUs.....	33
4.4 Device profile.....	52
5 Transfer syntax.....	52
5.1 Concepts.....	52
5.2 Encode rules.....	53
6 Structure of FAL protocol state machine.....	58
7 AP-context state machine (APC:SM).....	61
7.1 Overview.....	61
7.2 State descriptions.....	62
7.3 Triggering events.....	63
7.4 Action descriptions at state transitions.....	63
8 FAL service protocol machines (FSPM).....	64
8.1 Overview.....	64
8.2 Field Deice Control Protocol Machine (FDC PM).....	64
8.3 Message Protocol Machine (MSGPM).....	89
9 Application relationship protocol machine (ARPM).....	95
9.1 General.....	95
9.2 ARPM for FDC ASE.....	95
9.3 ARPM for MSG ASE (ARPM-MSG).....	109
10 DLL mapping protocol machine (DMPM).....	111
Annex A (informative) Device profile and FDC command sets.....	112
Annex B (normative) Virtual memory space and Device Information.....	113
B.1 Overview.....	113
B.2 Device Information.....	114
B.2.1 Device identifier area structure.....	114
B.2.2 Detail specifications of device IDs.....	114
Annex C (informative) Basic message function.....	120
Bibliography.....	121

Figure 1 – Tree structure of APDU types.....	22
Figure 2 – Encode of Integer subtypes.....	53
Figure 3 – Example of transfer of INTEGER value	54
Figure 4 – Encode of Unsigned subtypes	54
Figure 5 – Float32 type encode.....	55
Figure 6 – Float64 type encode.....	55
Figure 7 – Bit field definition example with named bits	56
Figure 8 – Bit field definition example with field size	57
Figure 9 – SEQUENCE type encode	58
Figure 10 – Structure of FAL protocol state machines	60
Figure 11 – Statechart diagram of APCSM.....	62
Figure 12 – Example communication cycle of FDC master AP.....	66
Figure 13 – Example communication cycle of FDC slave AP	67
Figure 14 – Synchronous command communication in sync state	68
Figure 15 – Asynchronous command communication in sync state.....	69
Figure 16 – Asynchronous command communication in async state.....	70
Figure 17 – Event-driven communication	71
Figure 18 – Statechart diagram of FDCPM-M.....	72
Figure 19 – Statechart diagram of FDCPM-S	78
Figure 20 – Statechart diagram of FDCPM-MN.....	85
Figure 21 – PDU transmission flow for user message	89
Figure 22 – PDU transmission flow for one-way message.....	90
Figure 23 – Statechart diagram of MSGPM-RQ.....	91
Figure 24 – Statechart diagram of MSGPM-RS	93
Figure 25 – Example of single transfer process.....	95
Figure 26 – Example of dual transfer process	96
Figure 27 – Statechart diagram of ARPM-FDCM	97
Figure 28 – Statechart diagram of ARPM-FDCS.....	102
Figure 29 – Statechart diagram of ARPM-FDCMN.....	107
Figure 30 – Statechart diagram of ARPM-MSG	110
Figure B.1 – Memory map of virtual memory space.....	113
Figure B.2 – Memory map of device ID area	114
Table 1 – State transition descriptions	18
Table 2 – Description of state machine elements	18
Table 3 – Conventions used in state machines	19
Table 4 – Mapping for Protocol State Machines	60
Table 5 – State descriptions of APC SM	62
Table 6 – Trigger event descriptions of APC SM	63
Table 7 – Transitions of APC SM	63
Table 8 – FDC protocol mode	65
Table 9 – State descriptions of FDCPM-M	72
Table 10 – Trigger event descriptions of FDCPM-M	73

Table 11 – Transitions of main SM of FDCPM-M.....	74
Table 12 – Transitions of submachine of FDCPM-M.....	75
Table 13 – State descriptions of FDCPM-S	78
Table 14 – Trigger event descriptions of FDCPM-S.....	79
Table 15 – Transitions of main SM of FDCPM-S	80
Table 16 – Transitions of submachine of FDCPM-S	82
Table 17 – State descriptions of FDCPM-MN	85
Table 18 – Trigger event descriptions of FDCPM-MN.....	86
Table 19 – Transitions of main SM of FDCPM-MN	86
Table 20 – Transitions of submachine of FDCPM-MN	86
Table 21 – State descriptions of MSGPM-RQ.....	91
Table 22 – Trigger event descriptions of MSGPM-RQ	92
Table 23 – Transitions of MSGPM-RQ	92
Table 24 – State descriptions of MSGPM-RS	93
Table 25 – Trigger event descriptions of MSGPM-RS.....	94
Table 26 – Transitions of MSGPM-RS.....	94
Table 27 – State descriptions of ARPM-FDCM.....	97
Table 28 – Trigger event descriptions of ARPM-FDCM.....	99
Table 29 – Transitions of main SM of ARPM-FDCM.....	100
Table 30 – Transitions of submachine of ARPM-FDCM.....	100
Table 31 – State descriptions of ARPM-FDCS	102
Table 32 – Trigger event descriptions of ARPM-FDCS.....	104
Table 33 – Transitions of main SM of ARPM-FDCS.....	105
Table 34 – Transitions of submachine of ARPM-FDCS.....	106
Table 35 – State descriptions of ARPM-FDCMN	108
Table 36 – Trigger event descriptions of ARPM-FDCMN	108
Table 37 – Transitions of main SM of ARPM-FDCMN.....	108
Table 38 – Transitions of submachine of ARPM-FDCMN.....	109
Table 39 – State descriptions of ARPM-MSG	110
Table 40 – Trigger event descriptions of ARPM-MSG.....	110
Table 41 – Transitions of ARPM-MSG.....	111
Table A.1 – Example of registered device profiles.....	112
Table A.2 – Example command list of the profile '00'H.....	112
Table B.1 – Specifications of device IDs	115
Table C.1 – Example of message command set.....	120

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
 FIELDBUS SPECIFICATIONS –**
**Part 6-24: Application layer protocol specification –
 Type-24 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 61158-6-24 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 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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 61158-6-24:2015](https://standards.iteh.ai/catalog/standards/sist/5c49b48d-0c79-4fa1-89a2-c7c47b68d84c/sist-en-61158-6-24-2015)

<https://standards.iteh.ai/catalog/standards/sist/5c49b48d-0c79-4fa1-89a2-c7c47b68d84c/sist-en-61158-6-24-2015>

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 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 61158-6-24:2015](https://standards.iteh.ai/catalog/standards/sist/5c49b48d-0c79-4fa1-89a2-c7c47b68d84c/sist-en-61158-6-24-2015)

<https://standards.iteh.ai/catalog/standards/sist/5c49b48d-0c79-4fa1-89a2-c7c47b68d84c/sist-en-61158-6-24-2015>

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 6-24: Application layer protocol specification – Type-24 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 24 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 24 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 machines defining the application service behavior visibly between communicating application entities, and
- d) the application relationship state machines defining the communication behavior visibly between communicating application entities.

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

- a) define the representation-on-wire of the service primitives defined in IEC 61158-5-24, and
- b) define the externally visible behavior associated with their transfer.

This standard specifies the protocol of the Type 24 fieldbus application layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498-1) 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 61158-5-24.

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.

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.

Conformance is achieved through implementation of this application layer protocol specification.

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 61158-5-24:2014, *Industrial communication networks – Fieldbus specifications – Part 5-24: Application layer service definition – Type 24 elements*

IEC 61158-6 (all parts), *Industrial communication networks – Fieldbus specifications – Part 6: Application layer protocol specification*

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 9545, *Information technology – Open Systems Interconnection – Application Layer structure*

ISO/IEC 9899, *Information technology – Programming languages – C*

ISO/IEC 10731, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

ISO/IEC 19501:2005, *Information technology – Open Distributed Processing – Unified Modeling Language (UML) Version 1.4.2*

ISO/IEC/IEEE 60559:2011, *Information technology – Microprocessor Systems – Floating-Point arithmetic*

3 Terms, definitions, abbreviations, symbols and conventions

For the purposes of this document, the following terms, definitions, symbols, abbreviations and conventions apply.

3.1 Referenced terms and definitions

For the purposes of this document, the following terms, definitions, symbols, abbreviations and conventions apply.