

INTERNATIONAL STANDARD

**Industrial communication networks – Fieldbus specifications –
Part 6-4: Application layer protocol specification – Type 4 elements**

IEC 61158-6-4:2023

<https://standards.iteh.ai/catalog/standards/sist/a35acaab-68ba-438f-a356-28c7d5d2c8d0/iec-61158-6-4-2023>



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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, symbols, abbreviated terms and conventions	10
3.1 Referenced terms and definitions.....	10
3.1.1 ISO/IEC 7498-1 terms.....	10
3.1.2 ISO/IEC 8822 terms.....	10
3.1.3 ISO/IEC 9545 terms.....	10
3.1.4 ISO/IEC 8824-1 terms.....	10
3.1.5 Fieldbus data-link layer terms.....	11
3.2 Abbreviations and symbols	11
3.3 Conventions.....	12
3.3.1 General concept	12
3.3.2 Conventions for state machines for Type 4	12
4 FAL syntax description	13
4.1 FAL-AR PDU abstract syntax	13
4.1.1 General	13
4.1.2 Abstract syntax of APDU header.....	13
4.1.3 Abstract syntax of APDU body.....	15
4.2 Data types	16
5 Transfer syntaxes	16
5.1 APDU encoding	16
5.1.1 APDU Header encoding.....	16
5.1.2 APDU body encoding.....	18
5.2 Variable object encoding and packing	20
5.2.1 Encoding of simple variables	20
5.2.2 Encoding of constructed variables	21
5.2.3 Alignment	22
5.2.4 Variable object attributes	24
5.3 Error codes	25
6 FAL protocol state machines	26
7 AP-context state machine	27
8 FAL service protocol machine (FSPM).....	27
8.1 Primitives exchanged between FAL User and FSPM	27
8.2 FSPM states	27
8.2.1 General	27
8.2.2 FSPM proxy object states	27
8.2.3 FSPM real object state machine description	32
9 Application relationship protocol machine (ARPM).....	34
9.1 Primitives exchanged between ARPM and FSPM.....	34
9.2 ARPM States	35
9.2.1 General	35

9.2.2	Sender state transitions	35
9.2.3	Receiver state transitions	36
10	DLL mapping protocol machine (DMPM)	37
10.1	Data-link Layer service selection	37
10.1.1	General	37
10.1.2	DL-UNITDATA request	37
10.1.3	DL-UNITDATA indication	37
10.1.4	DL-UNITDATA response	37
10.1.5	DLM-Set primitive and parameters	37
10.1.6	DLM-Get primitive and parameters	37
10.2	Primitives exchanged between ARPM and DLPM	37
10.3	Primitives exchanged between DLPM and data-link layer	38
10.4	DLPM states	38
10.4.1	States	38
10.4.2	Sender state transitions	38
10.4.3	Receiver state transitions	39
11	Protocol options	40
	Bibliography	41
	Figure 1 – State transition diagram	12
	Figure 2 – APDU header structure	16
	Figure 3 – Subfields of ControlStatus for Request	17
	Figure 4 – Subfields of ControlStatus for Response with error	17
	Figure 5 – Subfields of ControlStatus for Response with no error	18
	Figure 6 – DataFieldFormat encoding	18
	Figure 7 – Structure of request APDU body	19
	Figure 8 – Structure of response APDU body	19
	Figure 9 – Variable identifier	19
	Figure 10 – Code subfield of variable identifier	19
	Figure 11 – Sequence of data in the APDU body subfield	21
	Figure 12 – MSG consists of APDU header and APDU body	22
	Figure 13 – Summary of FAL architecture	26
	Figure 14 – FSPM proxy object state machine	28
	Figure 15 – FSPM real object state machine	33
	Figure 16 – ARPM state machine	35
	Figure 17 – DLPM state machine	38
	Table 1 – State machine description elements	12
	Table 2 – APDU header	13
	Table 3 – APDU body	15
	Table 4 – Transfer syntax for Array	23
	Table 5 – Transfer syntax for Structure	23
	Table 6 – Common variable object attributes	24
	Table 7 – Variable type identifiers	24
	Table 8 – FIFO variable object attributes	25

Table 9 – Error codes	25
Table 10 – Primitives exchanged between FAL-User and FSPM	27
Table 11 – REQUEST.req FSPM constraints.....	28
Table 12 – REQUEST.req FSPM actions	29
Table 13 – RESPONSE.cnf FSPM constraints	31
Table 14 – RESPONSE.cnf FSPM actions	31
Table 15 – AR Send.ind proxy FSPM constraints	32
Table 16 – AR Send.ind proxy FSPM actions	32
Table 17 – AR Send.ind real FSPM constraints.....	33
Table 18 – AR Send.ind real FSPM Actions	34
Table 19 – Primitives issued by FSPM to ARPM	34
Table 20 – Primitives issued by ARPM to FSPM	34
Table 21 – Primitives issued by ARPM to ARPM	35
Table 22 – AR Send.req ARPM constraints	35
Table 23 – AR Send.req ARPM actions.....	35
Table 24 – AR Acknowledge.req ARPM constraints	36
Table 25 – AR Acknowledge.req ARPM actions	36
Table 26 – AR Send.ind ARPM constraints	36
Table 27 – AR Send.req ARPM actions.....	36
Table 28 – Primitives issued by ARPM to DLPM	37
Table 29 – Primitives issued by DLPM to ARPM	37
Table 30 – Primitives issued by DLPM to data-link layer	38
Table 31 – Primitives issued by data-link layer to DLPM	38
Table 32 – AR Send.req DLPM constraints	38
Table 33 – AR Send.req DLPM actions	39
Table 34 – AR Acknowledge.req DLPM constraints.....	39
Table 35 – AR Acknowledge.req DLPM actions.....	39
Table 36 – DL-UNITDATA.ind DLPM constraints.....	40
Table 37 – DL-UNITDATA.ind DLPM actions.....	40

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**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 6-4: Application layer protocol specification –
Type 4 elements**

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

IEC 61158-6-4 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2019. This edition constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition:

- a) Use of extended data size in an APDU body. This extension is restricted to nodes operating on a P-NET IP network.

The text of this International Standard is based on the following documents:

Draft	Report on voting
65C/1204/FDIS	65C/1245/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

INTRODUCTION

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

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 6-4: Application layer protocol specification – Type 4 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 part of IEC 61158 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 4 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 document specifies interactions between remote applications and defines the externally visible behavior provided by the Type 4 fieldbus application layer in terms of

- the formal abstract syntax defining the application layer protocol data units conveyed between communicating application entities;
- the transfer syntax defining encoding rules that are applied to the application layer protocol data units;
- the application context state machine defining the application service behavior visible between communicating application entities;
- the application relationship state machines defining the communication behavior visible between communicating application entities.

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

- define the wire-representation of the service primitives defined in IEC 61158-5-4, and
- define the externally visible behavior associated with their transfer.

This document specifies the protocol of the Type 4 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 document is to specify the syntax and behavior of the application layer protocol that conveys the application layer services defined in IEC 61158-5-4.

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 series.

1.3 Conformance

This document do not specify individual implementations or products, nor do they 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 are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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 the IEC 61784-1 series and the IEC 61784-2 series 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 61158-3-4:2023, *Industrial communication networks – Fieldbus specifications – Part 3-4: Data-link layer service definition – Type 4 elements*

IEC 61158-4-4:2023, *Industrial communication networks – Fieldbus specifications – Part 4-4: Data-link layer protocol specification – Type 4 elements*

IEC 61158-5-4:2023, *Industrial communication networks – Fieldbus specifications – Part 5-4: Application layer service definition – Type 4 elements*

IEC 61158-6-1, *Industrial communication networks – Fieldbus specifications – Part 6-1: Application layer protocol specification – Type 1 elements*

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) – Part 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 9797-1, *Information technology – Security techniques – Message Authentication Codes (MACs) – Part 1: Mechanisms using a block cipher*

3 Terms, definitions, symbols, abbreviated terms and conventions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1 Referenced terms and definitions

3.1.1 ISO/IEC 7498-1 terms

For the purposes of this document, the following terms as defined in ISO/IEC 7498-1 apply:

- a) application entity
- b) application process
- c) application protocol data unit
- d) application service element
- e) application entity invocation
- f) application process invocation
- g) application transaction
- h) real open system
- i) transfer syntax

3.1.2 ISO/IEC 8822 terms

For the purposes of this document, the following terms as defined in ISO/IEC 8822 apply:

- a) abstract syntax
- b) presentation context

3.1.3 ISO/IEC 9545 terms

For the purposes of this document, the following terms as defined in ISO/IEC 9545 apply:

- a) application-association
- b) application-context
- c) application context name
- d) application-entity-invocation
- e) application-entity-type
- f) application-process-invocation
- g) application-process-type
- h) application-service-element
- i) application control service element

3.1.4 ISO/IEC 8824-1 terms

For the purposes of this document, the following terms as defined in ISO/IEC 8824-1 apply:

- a) object identifier
- b) type

3.1.5 Fieldbus data-link layer terms

For the purposes of this document, the following terms as defined in IEC 61158-3-4 and IEC 61158-4-4 apply.

- a) DL-Time
- b) DL-Scheduling-policy
- c) DLCEP
- d) DLC
- e) DL-connection-oriented mode
- f) DLPDU
- g) DLSDU
- h) DLSAP
- i) network address
- j) node address
- k) node

3.2 Abbreviations and symbols

AE	Application Entity
AL	Application Layer
ALE	Application Layer Entity
APDU	Application Protocol Data Unit
AR	Application Relationship
AREP	Application Relationship End Point
ASE	Application Service Element
Cnf	Confirmation
DL-	(as a prefix) Data-link-
DLCEP	Data-link Connection End Point
DLL	Data-link Layer
DLE	Data-link Entity
DLM	Data-link-management
DLS	Data-link Service
DLSAP	Data-link Service Access Point
DLSDU	DL-service-data-unit
FME	FAL Management Entity
Ind	Indication
IP	Internet Protocol
PDU	Protocol Data Unit
Req	Request
Rsp	Response
SME	System Management Entity
.cnf	Confirm Primitive
.ind	Indication Primitive
.req	Request Primitive
.rsp	Response Primitive