

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial communication networks – Fieldbus specifications –
Part 6-13: Application layer protocol specification – Type 13 elements

Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 6-13: Spécification du protocole de la couche application – Éléments
de type 13





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FIELDBUS SPECIFICATIONS –****Part 6-13: Application layer protocol specification –
Type 13 elements**

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International Standard IEC 61158-6-13 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:

- addition of synchronization feature,
- corrections and
- editorial improvements.

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 ISO/IEC Directives, Part 2.

The 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.

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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 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.

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 6-13: Application layer protocol specification – Type 13 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 13 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 specifies interactions between remote applications and defines the externally visible behavior provided by the Type 13 fieldbus application layer in terms of

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

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

- 1) define the wire-representation of the service primitives defined in IEC 61158-5-13, and
- 2) define the externally visible behavior associated with their transfer.

This standard specifies the protocol of the Type 13 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 61158-5-13.

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 61158-3-13, *Industrial communication networks – Fieldbus specifications – Part 3-13: Data-link layer service definition – Type 13 elements*

IEC 61158-4-13, *Industrial communication networks – Fieldbus specifications – Part 4-13: Data-link layer protocol specification – Type 13 elements*

IEC 61158-5-13, *Industrial communication networks – Fieldbus specifications – Part 5-13: Application layer service definition – Type 13 elements*

ISO/IEC 7498 (all parts), *Information technology – Open Systems Interconnection – Basic Reference Model*

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ISO/IEC 7498-1, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

ISO/IEC 8802-3, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

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 9899, *Information technology – Programming languages – C*

IEEE 754, *IEEE Standard for Floating-Point Arithmetic*

3 Terms, definitions, symbols, abbreviations and conventions

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

3.1 ISO/IEC 7498-1 terms

This standard is partly based on the concepts developed in ISO/IEC 7498-1, and makes use of the following terms defined therein:

- 3.1.1 application entity
- 3.1.2 application process
- 3.1.3 application protocol data unit
- 3.1.4 application service element
- 3.1.5 application entity invocation
- 3.1.6 application transaction
- 3.1.7 transfer syntax

3.2 ISO/IEC 8822 terms

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

- 3.2.1 abstract syntax

3.3 ISO/IEC 9545 terms

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

- 3.3.1 application-context (standards.iteh.ai)
- 3.3.2 application-process-type
- 3.3.3 application-service-element [IEC 61158-6-13:2014](https://standards.iteh.ai/catalog/standards/sist/270da3e1-4469-42d9-9472-5e73ddc57c11/iec-61158-6-13-2014)
- 3.3.4 application control service element <https://standards.iteh.ai/catalog/standards/sist/270da3e1-4469-42d9-9472-5e73ddc57c11/iec-61158-6-13-2014>

3.4 ISO/IEC 8824-1 terms

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

- 3.4.1 any type
- 3.4.2 bitstring type
- 3.4.3 boolean type
- 3.4.4 choice type
- 3.4.5 false
- 3.4.6 integer type
- 3.4.7 module
- 3.4.8 null type
- 3.4.9 object identifier
- 3.4.10 octetstring type
- 3.4.11 production
- 3.4.12 simple type
- 3.4.13 sequence of type
- 3.4.14 sequence type
- 3.4.15 structured type
- 3.4.16 tag
- 3.4.17 tagged type

3.4.18 true

3.4.19 type

3.5 Terms and definitions from IEC 61158-5-13

3.5.1 application relationship

3.5.2 client

3.5.3 error class

3.5.4 publisher

3.5.5 server

3.5.6 subscriber

3.6 Other terms and definitions

The following terms and definitions are used in this standard:

3.6.1

receiving

service user that receives a confirmed primitive or an unconfirmed primitive, or a service provider that receives a confirmed APDU or an unconfirmed APDU

3.6.2

resource

processing or information capability of a subsystem

3.6.3

sending

service user that sends a confirmed primitive or an unconfirmed primitive, or a service provider that sends a confirmed APDU or an unconfirmed APDU

3.6.4

managing node

node that can manage the SCNM mechanism

3.6.5

controlled node

node without the ability to manage the SCNM mechanism

3.7 Abbreviations and symbols

AE	Application entity
AL	Application layer
AP	Application process
APDU	Application protocol data unit
AR	Application relationship
AREP	Application relationship end point
ARPM	Application relationship protocol machine
ASnd	Asynchronous Send (Type 13 frame type)
BNB-PEC	Buffered network-scheduled bi-directional pre-established connection
BNU-PEC	Buffered network-scheduled uni-directional pre-established connection
CmdL	Command layer
CN	Controlled node

cnf	confirmation
DL-	(as a prefix) data-link-
DLCEP	Data-link connection end point
DLL	Data-link layer
DLME	Data-link-management entity
DLSAP	Data-link service access point
DLSDU	DL-service-data-unit
DMPM	DLL mapping protocol machine
DNS	Domain name service
FAL	Fieldbus application layer
ind	indication
IP	Internet protocol (see RFC 791)
MAC	Media access controll
MN	Managing node
NMT	Network management
OD	Object dictionary
PDO	Process data object
PDU	Process data unit
QUB-CL	Queued user-triggered bi-directional connectionless
QUB-COS	Queued user-triggered bi-directional connection-oriented with segmentation
QUU	Queued user-triggered uni-directional
req	request
rsp	response
SDO	Service data object
SeqL	Sequence layer
UDP	User datagram protocol

4 FAL syntax description

4.1 General

This description of the Type 13 abstract syntax uses formalisms similar to ASN.1, although the encoding rules differ from that standard.

4.2 FAL-AR PDU abstract syntax

4.2.1 Top level definition

```

APDU ::= CHOICE {
    [3] Isoc1
    [4] Isoc2
    [5] Asyn1
    [6] Asyn2
}
    
```

4.2.2 Isoc1

```

Isoc1 ::= SEQUENCE {
    message-type
    destination
    source
    reserved
    signaling-flags
    PDO-version
    reserved8
    size
    PDO-payload
}

```

4.2.3 Isoc2

```

Isoc2 ::= SEQUENCE {
    message-type
    destination
    source
    NMT-status
    signaling-flags
    PDO-version
    reserved8
    size
    PDO-payload
}

```

4.2.4 Asyn1

```

Asyn1 ::= SEQUENCE {
    message-type
    destination
    source
    NMT-status
    signaling-flags
    requested-service-ID
    requested-service-target
    fieldbus-version
    reserved8
    pduBody CHOICE{
        [1h...5h] reserved
        [6h] Sync-request
        [7h...FFh] reserved
    }
}

```

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4.2.5 Asyn2

```

Asyn2 ::= SEQUENCE {
    message-type
    destination
    source
    service-ID
    pduBody CHOICE {
        [1h] ident-response
        [2h] status-response
        [3h] NMT-request
        [4h] NMT-command
        [5h] SDO
        [6h] Sync-response
        [A0h...FEh] manufacturer-specific
        [FFh] reserved
    }
}

```

4.2.6 Message-type

message-type ::= Unsigned8

— Contains the context specific APDU tags