

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial communication networks – Fieldbus specifications –
Part 6-17: Application layer protocol specification – Type 17 elements

Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 6-17: Spécification de protocole de la couche d'application – Éléments
de Type 17



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**INDUSTRIAL COMMUNICATION NETWORKS –
 FIELDBUS SPECIFICATIONS –**
Part 6-17: Application layer protocol specification – Type 17 elements

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Type 17:

PCT Application No. PCT/JP2004/011537 [YEC] Communication control method

PCT Application No. PCT/JP2004/011538 [YEC] Communication control method

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International Standard IEC 61158-6-17 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This first edition and its companion parts of the IEC 61158-6 subseries cancel and replace IEC 61158-6:2003. This edition of this part constitutes a technical addition. This part and its Type 17 companion parts also cancel and replace IEC/PAS 62405, published in 2005.

This edition of IEC 61158-6 includes the following significant changes from the previous edition:

- a) deletion of the former Type 6 fieldbus for lack of market relevance;
- b) addition of new types of fieldbuses;
- c) partition of part 6 of the third edition into multiple parts numbered -6-2, -6-3, ...

This bilingual version (2013-09) corresponds to the monolingual English version, published in 2007-12. The text of this standard is based on the following documents:

FDIS	Report on voting
65C/476/FDIS	65C/487/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.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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- withdrawn;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 The revision of this standard will be synchronized with the other parts of the IEC 61158 series.

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.

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 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 6-17: Application layer protocol specification – Type 17 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 17 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 17 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 61158-5-17, and
- 2) define the externally visible behavior associated with their transfer.

This standard specifies the protocol of the Type 17 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 61158-5-17.

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 the IEC 61158-6 series.

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 reference

The following referenced documents are indispensable for the application 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.

IEC 61158-5-17, *Industrial communication networks – Fieldbus specifications - Part 5-17: Application layer service definition – Type 17 elements*

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

ISO/IEC 8824-2, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification*

ISO/IEC 8825-1, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

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*

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3 Definitions

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

3.1 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:

- d) application entity
- e) application protocol data unit
- f) application service element

3.1.2 ISO/IEC 8824-2 terms

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

- a) any type
- b) bitstring type
- c) Boolean type
- d) choice type
- e) false
- f) integer type
- g) null type
- h) octetstring type

- i) sequence of type
- j) sequence type
- k) simple type
- l) structured type
- m) tagged type
- n) true
- o) type
- p) value

3.1.3 ISO/IEC 10731 terms

- a) (N)-connection
- b) (N)-entity
- c) (N)-layer
- d) (N)-service
- e) (N)-service-access-point
- f) confirm (primitive)
- g) indication (primitive)
- h) request (primitive)
- i) response (primitive)

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3.1.4 Other terms and definitions

3.1.4.1 application

function or data structure for which data is consumed or produced
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3.1.4.2 application process

part of a distributed application on a network, which is located on one device and unambiguously addressed

3.1.4.3 application relationship

cooperative association between two or more application-entity-invocations for the purpose of exchange of information and coordination of their joint operation

NOTE This relationship is activated either by the exchange of application-protocol-data-units or as a result of preconfiguration activities

3.1.5 application relationship application service element

application-service-element that provides the exclusive means for establishing and terminating all application relationships

3.1.5.1 application relationship endpoint

context and behavior of an application relationship as seen and maintained by one of the application processes involved in the application relationship

NOTE Each application process involved in the application relationship maintains its own application relationship endpoint.

3.1.5.2 attribute

description of an externally visible characteristic or feature of an object

NOTE The attributes of an object contain information about variable portions of an object. Typically, they provide status information or govern the operation of an object. Attributes may also affect the behaviour of an object. Attributes are divided into class attributes and instance attributes.

3.1.5.3 behaviour

indication of how an object responds to particular events

3.1.5.4 bridge

intermediate equipment that connects two or more segments using a data-link layer relay function

3.1.5.5 channel

single physical or logical link of an input or output application object of a server to the process

3.1.5.6 class

a set of objects, all of which represent the same kind of system component

NOTE A class is a generalisation of an object; a template for defining variables and methods. All objects in a class are identical in form and behaviour, but usually contain different data in their attributes.

3.1.5.7 client

- a) object which uses the services of another (server) object to perform a task
- b) initiator of a message to which a server reacts

3.1.5.8 connection

logical binding between application objects that may be within the same or different devices

NOTE 1 Connections may be either point-to-point or multipoint.

NOTE 2 The logical link between sink and source of attributes and services at different custom interfaces of RT-Auto ASES is referred to as interconnection. There is a distinction between data and event interconnections. The logical link and the data flow between sink and source of automation data items is referred to as data interconnection. The logical link and the data flow between sink (method) and source (event) of operational services is referred to as event interconnection.

3.1.5.9 connection point

buffer which is represented as a subinstance of an Assembly object

3.1.5.10 conveyance path

unidirectional flow of APDUs across an application relationship

3.1.5.11 dedicated AR

AR used directly by the FAL User

NOTE On Dedicated ARs, only the FAL Header and the user data are transferred.

3.1.5.12 device

physical hardware connected to the link

NOTE A device may contain more than one node.

3.1.5.13 domain

part of the RTE network consisting of one or two subnetwork(s)

NOTE Two subnetworks are required to compose a dual-redundant RTE network, and each end node in the domain is connected to both of the subnetworks.

3.1.5.14

domain master

station which performs diagnosis of routes to all other domains, distribution of network time to nodes inside the domain, acquisition of absolute time from the network time master and notification of status of the domain

3.1.5.15

domain number

numeric identifier which indicates a domain

3.1.5.16

end node

producing or consuming node

3.1.5.17

endpoint

one of the communicating entities involved in a connection

3.1.5.18

error

discrepancy between a computed, observed or measured value or condition and the specified or theoretically correct value or condition

3.1.5.19

error class

general grouping for related error definitions and corresponding error codes

3.1.5.20

external bridge

bridge to which neither internal bridges nor RTE stations are connected directly

3.1.5.21

event

an instance of a change of conditions

3.1.5.22

group

- a) <general> a general term for a collection of objects. Specific uses:
- b) <addressing> when describing an address, an address that identifies more than one entity

3.1.5.23

interface

- a) shared boundary between two functional units, defined by functional characteristics, signal characteristics, or other characteristics as appropriate
- b) collection of FAL class attributes and services that represents a specific view on the FAL class

3.1.5.24

interface port

physical connection point of an end node, which has an independent DL-address

3.1.5.25

internal bridge

bridge to which no routers, external bridges or nodes non-compliant with this specification are connected directly

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**3.1.5.26
invocation**

act of using a service or other resource of an application process

NOTE Each invocation represents a separate thread of control that may be described by its context. Once the service completes, or use of the resource is released, the invocation ceases to exist. For service invocations, a service that has been initiated but not yet completed is referred to as an outstanding service invocation. Also for service invocations, an Invoke ID may be used to unambiguously identify the service invocation and differentiate it from other outstanding service invocations.

**3.1.5.27
junction bridge**

bridge to which at least one router, external bridge or node non-compliant with this specification, and to which at least one internal bridge or RTE station is connected

**3.1.5.28
link**

physical communication channel between two nodes

**3.1.5.29
method**

<object> a synonym for an operational service which is provided by the server ASE and invoked by a client

**3.1.5.30
network**

a set of nodes connected by some type of communication medium, including any intervening repeaters, bridges, routers and lower-layer gateways

**3.1.5.31
network time master**

station which distributes network time to domain masters

[IEC 61158-6-17:2007](https://standards.iteh.ai/catalog/standards/sist/78b4ee2-025c-4a20-ad0d-74c8f585339d/iec-61158-6-17-2007)

<https://standards.iteh.ai/catalog/standards/sist/78b4ee2-025c-4a20-ad0d-74c8f585339d/iec-61158-6-17-2007>

**3.1.5.32
node**

single DL-entity as it appears on one local link

**3.1.5.33
non-redundant interface node**

node which has a single interface port

**3.1.5.34
non-redundant station**

station that consists of a single end node

NOTE "non-redundant station" is synonymous with "end node".

**3.1.5.35
object**

abstract representation of a particular component within a device, usually a collection of related data (in the form of variables) and methods (procedures) for operating on that data that have clearly defined interface and behaviour

**3.1.5.36
originator**

client responsible for establishing a connection path to the target

**3.1.5.37
path**

logical communication channel between two nodes, which consists of one or two link(s)