IEC 61158-6-15

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Part 6-15: Application layer protocol specification – Type 15 elements

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COMMISSION

PRICE CODE XD

ICS 35.100.70; 25.040.40

ISBN 2-8318-9493-X

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 6-15: Application layer protocol specification – Type 15 elements

FOREWORD

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International Standard IEC 61158-6-15 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 15 companion parts also cancel and replace IEC/PAS 62030, published in 2005.

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

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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, …

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.

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- withdrawn;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.

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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/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 6-15: Application layer protocol specification – Type 15 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 15 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 15 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 machine defining the application service behavior visible between communicating application entities; and
d) the application relationship state machines defining the communication behavior visible between communicating application entities; and.

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

1) define the wire-representation of the service primitives defined in IEC 61158-5-15, and
2) define the externally visible behavior associated with their transfer.

This standard specify the protocol of the Type 15 IEC 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 61158-5-15.

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.

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

2 Normative references

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 61158-5-15, *Industrial communication networks – Fieldbus specifications – Part 5-15: Application layer service definition – Type 15 elements*

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 8822, *Information technology – Open Systems Interconnection – Presentation service definition*

ISO/IEC 8824, *Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1)*

3 Terms and definitions, abbreviations, symbols and conventions

3.1 Terma and definitions

For the purposes of this document, the following terms as defined in these publications apply:

3.1.1 ISO/IEC 7498-1 terms

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

a) abstract syntax
b) presentation context

3.1.3 ISO/IEC 9545 terms

a) application-association
b) application-context
c) application context name
d) application-entity-invocation
e) application-entity-type

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f) application-process-invocation

g) application-process-type

h) application-service-element

i) application control service element

3.1.4 ISO/IEC 8824 terms

a) object identifier

b) type

3.1.5 IEC/TR 61158-1 terms

The following IEC/TR 61158-1 terms apply.

3.1.5.1 application

function or data structure for which data is consumed or produced

3.1.5.2 application layer interoperability

capability of application entities to perform coordinated and cooperative operations using the services of the FAL

3.1.5.3 application object

object class that manages and provides the run time exchange of messages across the network and within the network device

NOTE Multiple types of application object classes may be defined.

3.1.5.4 application process

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

3.1.5.5 application process identifier

distinguishes multiple application processes used in a device

3.1.5.6 application process object

component of an application process that is identifiable and accessible through an FAL application relationship

NOTE Application process object definitions are composed of a set of values for the attributes of their class.

3.1.5.7 application process object class

class of application process objects defined in terms of the set of their network-accessible attributes and services

3.1.5.8 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.

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3.1.5.9 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.

3.1.5.10 application service element

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

3.1.5.11 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.

3.1.5.12 behaviour

indication of how the object responds to particular events

NOTE Its description includes the relationship between attribute values and services.

3.1.5.13 class

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

NOTE A class is a generalisation of the 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.

3.1.5.14 class attributes

attribute that is shared by all objects within the same class

3.1.5.15 class code

unique identifier assigned to each object class

3.1.5.16 class specific service

service defined by a particular object class to perform a required function which is not performed by a common service

NOTE A class specific object is unique to the object class which defines it.

3.1.5.17 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, such as the role of an AR endpoint in which it issues confirmed service request APDUs to a single AR endpoint acting as a server

3.1.5.18 conveyance path

unidirectional flow of APDUs across an application relationship

3.1.5.19 cyclic

term used to describe events which repeat in a regular and repetitive manner

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