IEC 61158-6-18

Edition 1.0 2007-12

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Part 6-18: Application layer protocol specification – Type 18 elements

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ELECTROTECHNICAL
COMMISSION

PRICE CODE XB

ICS 35.100.70; 25.040.40

ISBN 2-8318-9496-4

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Part 6-18: Application layer service definition – Type 18 elements

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NOTE Use of some of the associated protocol types is restricted by their 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 particular data-link layer protocol type to be used with physical layer and application layer protocols in Type combinations as specified explicitly in the IEC 61784 series. Use of the various protocol types in other combinations may require permission from their respective intellectual-property-right holders.

IEC draws attention to the fact that it is claimed that compliance with this standard may involve the use of patents as follows, where the [xx] notation indicates the holder of the patent right:

Type 18:

3343036/Japan	[MEC]	"Network System for a Programmable Controller"
5896509/USA	[MEC]	"Network System for a Programmable Controller"
246906/Korea	[MEC]	"Network System for a Programmable Controller"
Pending/Germany	[MEC]	"Network System for a Programmable Controller"

IEC takes no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holders of these patent rights are registered with IEC. Information may be obtained from:

[MEC] Mitsubishi Electric Corporation
Corporate Licensing Deivsion
7-3, Marunouchi 2-chome, Chiyoda-ku,
Tokyo 100-8310, Japan

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights other than those identified above. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61158-6-18 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 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, ...

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 6-18: Application layer protocol specification – Type 18 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 18 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 18 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- 5-18, and
2) define the externally visible behavior associated with their transfer.

This standard specifies the protocol of the Type 18 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 61158-5-18.

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 do they 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 61158-5-18, *Industrial communication networks – Fieldbus specifications – Part 5-18: Application layer service definition – Type 18 elements*

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

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

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

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3 Terms and definitions

3.1 Terms and definitions from other ISO/IEC standards

3.1.1 ISO/IEC 7498-1 terms

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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:

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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 terms

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

a) object identifier
b) type

3.2 Other terms and definitions

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

3.2.1
active connection control object
instance of a certain FAL class that abstracts the interconnection facility (as Consumer and Provider) of an automation device

3.2.2
alarm
activation of an event that shows a critical state

3.2.3
alarm ack
acknowledgment of an event that shows a critical state

3.2.4
alarm data object
object(s) which represent critical states referenced by device/slot/subslot/alarm type

3.2.5
allocate
take a resource from a common area and assign that resource for the exclusive use of a specific entity

3.2.6
application
function or data structure for which data is consumed or produced

3.2.7
application layer interoperability
capability of application entities to perform coordinated and cooperative operations using the services of the FAL

3.2.8
application objects
multiple object classes that manage and provide a run time exchange of PDUs across the network and within the network device

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3.2.9
application process
part of a distributed application on a network, which is located on one device and unambiguously addressed

3.2.10
application process identifier
distinguishes multiple application processes used in a device

NOTE Application process identifier is assigned by PROFIBUS International (PI).

3.2.11
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 (see the definition for Application Process Object Class Definition). Application process object definitions may be accessed remotely using the services of the FAL Object Management ASE. FAL Object Management services can be used to load or update object definitions, to read object definitions, and to dynamically create and delete application objects and their corresponding definitions.

3.2.12
application process object class
a class of application process objects defined in terms of the set of their network-accessible attributes and services

3.2.13
application relationship
cooperative association between two or more application-entity-invocations for the purpose of exchange of information and coordination of their joint operation. This relationship is activated either by the exchange of application-protocol-data-units or as a result of preconfiguration activities

3.2.14
application relationship application service element
application-service-element that provides the exclusive means for establishing and terminating all application relationships

3.2.15
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.

3.2.16
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 behavior of an object. Attributes are divided into class attributes and instance attributes.

3.2.17
backup
status of the IO AR, which indicates that it, is in the standby state

3.2.18
behavior
indication of how an object responds to particular events

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3.2.19
channel
representation of a single physical or logical link of an input or output application object of a server to the process in order to support addressing of diagnosis information

NOTE The channel typically represents a single connector or clamp as a real interface of a module or sub-module. This reference is used to identify points of failure within diagnosis PDUs.

3.2.20
channel related diagnosis
information concerning a specific element of an input or output application object, provided for maintenance purposes

EXAMPLE open loop.

3.2.21
class
a set of objects, all of which represent the same kind of system component

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

3.2.22
class attributes
attribute that is shared by all objects within the same class

3.2.23
class code
unique identifier assigned to each object class

3.2.24
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.

3.2.25
clear
status of the IO controller, which indicates that the control algorithm is currently not running

3.2.26
client

a) object which uses the services of another (server) object to perform a task

b) initiator of a PDU to which a server reacts

3.2.27
common profile
a collection of device independent information and functionality providing consistency between all devices

3.2.28
communication data object
object(s) which are parameter of communication relationships and referenced by device/slot/ subslot/ index

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