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Industrial communication networks –Fieldbus specifications – Part 5-28: Application layer service definition – Type 28 elements

Réseaux de communication industriels – Spécifications des bus de terrain – Partie 5-28: Définition des services de la couche application – Éléments de type 28

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Part 5-28: Application layer service definition – Type 28 elements

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Draft	Report on voting
65C/1206/FDIS	65C/1235/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.

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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 service is provided by the application protocol making use of the services available from the data-link or other immediately lower layer. This document defines the application service characteristics that fieldbus applications and/or system management can exploit.

Throughout the set of fieldbus standards, the term "service" refers to the abstract capability provided by one layer of the OSI Basic Reference Model to the layer immediately above. Thus, the application layer service defined in this document is a conceptual architectural service, independent of administrative and implementation divisions.

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 5-28: Application layer service definition – Type 28 elements

1 Scope

1.1 Overview

The fieldbus Application Layer (FAL) provides user programs with a means to access the fieldbus communication environment. In this respect, the FAL can be considered 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 28 fieldbus. The term "time-critical" is used to represent the presence of a time-window, in which one or more specified actions are required to be completed with some defined level of certainty.

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This document defines in an abstract way the externally visible service provided by the different Types of the fieldbus Application Layer in terms of

- an abstract model for defining application resources (objects) capable of being manipulated by users via the use of the FAL service,
- the primitive actions and events of the service,
- the parameters associated with each primitive action and event, and the form which they take, and
- the interrelationship between these actions and events, and their valid sequences.

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

- the FAL user at the boundary between the user and the Application Layer of the Fieldbus Reference Model, and
- Systems Management at the boundary between the Application Layer and Systems Management of the Fieldbus Reference Model.

This document specifies the structure and services of the IEC fieldbus Application Layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498-1) and the OSI Application Layer Structure (ISO/IEC 9545).

FAL services and protocols are provided by FAL application-entities (AE) contained within the application processes. The FAL AE is composed of a set of object-oriented Application Service Elements (ASEs) and a Layer Management Entity (LME) that manages the AE. The ASEs provide communication services that operate on a set of related application process object (APO) classes. One of the FAL ASEs is a management ASE that provides a common set of services for the management of the instances of FAL classes.

Although these services specify, from the perspective of applications, how to request and response are issued and delivered, they do not include a specification of what the requesting and responding applications are to do with them. That is, the behavioural aspects of the applications are not specified; only a definition of what requests and responses they can send/receive is specified. This permits greater flexibility to the FAL users in standardizing such

object behaviour. In addition to these services, some supporting services are also defined in this document to provide access to the FAL to control certain aspects of its operation.

1.2 Specifications

The principal objective of this document is to specify the characteristics of conceptual application layer services suitable for time-critical communications, and thus supplement the OSI Basic Reference Model in guiding the development of application layer protocols for time-critical communications.

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 services standardized as the various types of IEC 61158, and the corresponding protocols standardized in the IEC 61158-6 series.

This document can be used as the basis for formal application programming-interfaces. Nevertheless, it is not a formal programming interface, and any such interface will address implementation issues not covered by this document, including

- the sizes and octet ordering of various multi-octet service parameters, and
- the correlation of paired request and confirm, or indication and response, primitives.

1.3 Conformance

This document 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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There is no conformance of equipment to this application layer service definition standard. Instead, conformance is achieved through implementation of conforming application layer protocols that fulfils the Type 28 application layer services as defined in this document.

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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 61158-1:2023, *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

IEC 61158-4-28:2023, *Industrial communication networks – Fieldbus specifications – Part 4-28: Data-link layer protocol specification – Type 28 elements*

IEC 61158-6-28:2023, *Industrial communication networks – Fieldbus specifications – Part 6-28: Application layer protocol specification – Type 28 elements*

ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

ISO/IEC 7498-3:1997, *Information technology – Open Systems Interconnection – Basic Reference Model: Naming and addressing*

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 10731:1994, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

ISO/IEC/IEEE 8802-3:2021, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Standard for Ethernet*

IETF RFC 791, J. Postel, *Internet Protocol*, September 1981, available at https://www.rfc-editor.org/info/rfc791 [viewed 2022-02-18]

IETF RFC 2460, *S. Deering and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", December 1998*, available at https://www.rfc-editor.org/info/rfc2460 [viewed 2022-02-18]

3 Terms, definitions, symbols, abbreviated terms and conventions

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- 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 given in ISO/IEC 7498-1 apply:

- application entity
- application process
- application protocol data unit
- application service element
- application entity invocation
- application process invocation
- application transaction
- real open system
- transfer syntax

3.1.2 ISO/IEC 8822 terms

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

- abstract syntax

- presentation context

3.1.3 ISO/IEC 9545 terms

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

- application-entity-invocation
- application-entity-type
- application-process-invocation
- application-process-type
- application-service-element

3.1.4 ISO/IEC 8824 terms

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

- object identifier
- type

3.2 Additional terms and definitions for this IEC 61158-5-28

The following terms and definitions apply to this document.

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clock query
get clock information from the management node or terminal node device

3.2.2
clock synchronization
clock calibration of the terminal node device

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3.2.3
control device
device that controls all field devices for logical operations, timing, calculations, etc.

3.2.4
cyclic
events which repeat in a regular and repetitive manner

3.2.5
cyclic time
time of cyclic processing of a device or module

3.2.6
field device
physical entity that is connected to the process or to factory equipment and has at least one signalling element that communicates with other signalling element(s) via a cable

3.2.7
management node
device for allocating and managing Type 28 network physical communication resources

3.2.8
non-RT Data
data insensitive to time deterministic requirements

3.2.9
RT Data
data sensitive to time deterministic requirements

3.2.10
terminal node
device in Type 28 network that communicates based on allocated physical communication resources

3.3 Abbreviations and symbols

AL	Application layer
ALCE	Application layer clock entity
ALDE	Application layer data entity
ALME	Application layer management entity
ALS	Application layer service
AE	Application entity
AP	Application process
APO	AP object
AR	Application relationship
ASE	Application service elements
C/S	Client/Server
DL-	Data-link layer (as a prefix)
DLCE	Data-link clock entity
DLDE	Data-link data entity
DLE	Data-link entity
DLL	Data-link layer
DLS	Data-link service
DLP	Data-link protocol
DLS-user	Data-link service user
DTC	Data transmission channel
DTS	Data transmission service
DTU	Data transmission unit
DLSDU	Data-link service data unit
DLPDU	Data-link protocol data unit
MAC	Medium access control
MN	Management node
NodeID	Node identifier
nRT	non-Real-Time
PhL	Physical layer
RT	Real-Time
RTA	Real-Time acyclic
RTC	Real-Time cyclic
TN	Terminal node

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3.4 Conventions

3.4.1 Overview

The FAL is defined as a set of object-oriented ASEs. Each ASE is specified in a separate subclause. Each ASE specification is composed of two parts, including its class specification and its service specification.

The class specification defines the attributes of the class. The service specification defines the services that are provided by the ASE.

3.4.2 Conventions for class definitions

Class definitions are described using templates. Each template consists of a list of attributes for the class. The general form of the template is shown below:

FAL ASE:			**ASE Name**
CLASS:		**Class Name**	
CLASS ID			**#**
PARENT CLASS:			**Parent Class Name**
ATTRIBUTES:			
1	(o)	Key Attribute:	numeric identifier
2	(o)	Key Attribute:	Name
3	(m)	Attribute:	attribute name(values)
4	(m)	Attribute:	attribute name(values)
4.1	(s)	Attribute:	attribute name(values)
4.2	(s)	Attribute:	attribute name(values)
4.3	(s)	Attribute:	attribute name(values)
5	(c)	Constraint:	constraint expression
5.1	(m)	Attribute:	attribute name(values)
5.2	(o)	Attribute:	attribute name(values)
6	(m)	Attribute:	attribute name(values)
6.1	(s)	Attribute:	attribute name(values)
6.2	(s)	Attribute:	attribute name(values)
SERVICES:			
1	(o)	OpsService	service name
2	(c)	Constraint:	constraint expression
3.1	(o)	OpsService	service name
3	(m)	MgtService:	service name

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(1) The "FAL ASE:" entry is the name of the FAL ASE that provides the services for the class being specified.

(2) The "CLASS:" entry is the name of the class being specified. All objects defined using this template will be an instance of this class. The class may be specified by this document, or by a user of this document.

(3) The "CLASS ID:" entry is a number that identifies the class being specified. This number is unique within the FAL ASE that will provide the services for this class. When qualified by the identity of its FAL ASE, it unambiguously identifies the class within the scope of the FAL. The value "NULL" indicates that the class cannot be instantiated. Class IDs between 1 and 99, 240 and 767 are reserved by this document to identify standardized classes. CLASS IDs between 100 and 199, 768 and 1 279 are allocated for identifying user defined classes.