IEC 61158-5-2

Edition 3.0 2014-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements

Réseaux de communication industriels – Spécifications des bus de terrain – Partie 5-2: Définition des services de la couche application – Eléments de type 2

IEC 61158-5-2:2014-08(en-fr)

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colour inside

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FOREWORD

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Attention is drawn to the fact that the use of the associated protocol type is restricted by its 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 layer protocol type to be used with other layer protocols of the same type, or in other type combinations explicitly authorized by its intellectual-property-right holders.

NOTE Combinations of protocol types are specified in IEC 61784-1 and IEC 61784-2.

International Standard IEC 61158-5-2 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

- Updates of definitions used by the Time Sync ASE;
- Corrections to numbering of services in 6.2;
- Addition of “member” and and object specific services in 6.2.1.2.1, 6.2.1.2.3, 6.2.1.3.1, 6.2.1.3.20 to 6.2.1.3.23, 6.2.1.3.28, and 6.5;
- Updates of Identity ASE in 6.2.1.2.2;
- Updates of Assembly ASE in 6.2.1.2.3;
- Updates of Message Router ASE in 6.2.1.2.4;
- Updates of Time Sync ASE in 6.2.1.2.6;
- Updates of FAL service status codes in 6.2.1.3.3;
- Miscellaneous clarifications of FAL services in 6.2.1.3.4 to 6.2.1.3.19;
- Updates of Connection Manager ASE in 6.2.2;
- Updates of Connection ASE in 6.2.3;
- Removal of obsolete transport classes 4 to 6 in 6.3.1, 6.3.3 and 6.4;
- Miscellaneous editorial corrections.

The text of this standard is based on the following documents:

FDIS	Report on voting
65C/763/FDIS	65C/773/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.

A list of all parts of the IEC 61158 series, published under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC web site.

The committee has decided that the contents of this publication will remain unchanged until the stability 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.

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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 service is provided by the application protocol making use of the services available from the data-link or other immediately lower layer. This standard defines the application service characteristics that fieldbus applications and/or system management may 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 standard is a conceptual architectural service, independent of administrative and implementation divisions.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 5-2: Application layer service definition – Type 2 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 2 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 service provided by the Type 2 fieldbus application layer in terms of

a) an abstract model for defining application resources (objects) capable of being manipulated by users via the use of the FAL service,

b) the primitive actions and events of the service;

c) the parameters associated with each primitive action and event, and the form which they take; and

d) the interrelationship between these actions and events, and their valid sequences.

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

a) the FAL user at the boundary between the user and the application layer of the fieldbus reference model, and

b) Systems Management at the boundary between the application layer and Systems Management of the fieldbus reference model.

This standard specifies the structure and services of the Type 2 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 request and responses 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 behavioral 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 behavior. In addition to these services, some supporting services are also defined in this standard to provide access to the FAL to control certain aspects of its operation.

1.2 Specifications

The principal objective of this standard 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 subparts of IEC 61158-6.

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

a) the sizes and octet ordering of various multi-octet service parameters, and

b) the correlation of paired request and confirm, or indication and response, primitives.

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.

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 fulfill the Type 2 application layer services as defined in this standard.

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 61131-3:2003[1], *Programmable controllers – Part 3: Programming languages*

IEC 61158-1:2014, *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

IEC 61158-3-2:2014, *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*

IEC 61158-4-2:2014, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*

[1] A newer edition of this standard has been published, but only the cited edition applies.

IEC 61158-6-2:2014, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*

IEC 61588:2009, *Precision clock synchronization protocol for networked measurement and control systems*

IEC 61784-3-2, *Industrial communications networks – Profiles – Part 3-2: Functional safety fieldbuses – Additional specifications for CPF 2*

ISO/IEC 646, *Information technology – ISO 7–bit coded character set for information interchange*

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

ISO/IEC 8859-1, *Information technology – 8-bit single-byte coded graphic character sets – Part 1: Latin alphabet No. 1*

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

ISO/IEC 10646, *Information technology – Universal Coded Character Set (UCS)*

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

ISO/IEC/IEEE 60559, *Information technology – Microprocessor Systems – Floating-Point arithmetic*

ISO 639-2, *Codes for the representation of names of languages – Part 2: Alpha-3 code*

ISO 8859-1[2]:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 1: Latin alphabet No. 1*

ISO 8859-2[2]:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 2: Latin alphabet No. 2*

ISO 8859-3[2]:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 3: Latin alphabet No. 3*

ISO 8859-4[2]:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 4: Latin alphabet No. 4*

ISO 8859-5[2]:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 5: Latin/Cyrillic alphabet*

ISO 8859-6[2]:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 6: Latin/Arabic alphabet*

ISO 8859-7[2]:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 7: Latin/Greek alphabet*

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2 A newer edition of this standard has been published by ISO/IEC, but the cited edition is the one used in the referenced IETF standards.

ISO 8859-8[2]:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 8: Latin/Hebrew alphabet*

ISO 8859-9[2]:1989, *Information processing – 8-bit single-byte coded graphic character sets – Part 9: Latin alphabet No. 5*

ISO 11898:1993[3], *Road vehicles – Interchange of digital information – Controller area network (CAN) for high-speed communication*

IETF RFC 1759, *Printer MIB,* available at <http://www.ietf.org>

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

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

3.2 ISO/IEC 8822 terms

a) abstract syntax
b) presentation context

3.3 ISO/IEC 9545 terms

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

3.4 ISO/IEC 8824-1 terms

a) object identifier
b) type

[3] A newer edition of this standard has been published, but only the cited edition applies.

3.5 Type 2 fieldbus data-link layer terms

The following terms, defined in IEC 61158-3-2 and IEC 61158-4-2, apply.

a) DL-time
b) DL-scheduling-policy
c) DLCEP
d) DLC
e) DL-connection-oriented mode
f) DLPDU
g) DLSDU
h) DLSAP
i) fixed tag
j) generic tag
k) link
l) MAC ID
m) network address
n) node address
o) node
p) tag
q) scheduled
r) unscheduled

3.6 Type 2 fieldbus application-layer specific definitions

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

3.6.1
allocate
take a resource from a common area and assign that resource for the exclusive use of a specific entity

3.6.2
application
function or data structure for which data is consumed or produced

3.6.3
application objects
multiple object classes that manage and provide a run time exchange of messages across the network and within the network device

3.6.4
application process
part of a distributed application on a network, which is located on one device and unambiguously addressed

3.6.5
application process object
component of an application process that is identifiable and accessible through an FAL application relationship

3.6.6
application process object class
class of application process objects defined in terms of the set of their network-accessible attributes and services

3.6.7
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 1 to entry: This relationship is activated either by the exchange of application-protocol-data-units or as a result of preconfiguration activities.

3.6.8
application relationship application service element
application-service-element that provides the exclusive means for establishing and terminating all application relationships

3.6.9
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 1 to entry: Each application process involved in the application relationship maintains its own application relationship endpoint.

3.6.10
attribute
description of an externally visible characteristic or feature of an object

Note 1 to entry: 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.

3.6.11
behavior
indication of how an object responds to particular events

3.6.12
Best Master Clock Algorithm
BMCA
algorithm performed by each node to determine the clock that will become the master clock on a subnet and the grandmaster clock for the domain

Note 1 to entry: The algorithm primarily compares priority1, clock quality, priority2, and source identity to determine the best master among available candidates.

3.6.13
boundary clock
clock that has multiple Precision Time Protocol (PTP) ports in a domain and maintains the timescale used in the domain

Note 1 to entry: It may serve as the source of time, i.e., be a master clock, and may synchronize to another clock, i.e., be a slave clock.

[SOURCE: IEC 61588:2009, 3.1.3, modified – second sentence changed to a Note]

3.6.14
class
set of objects, all of which represent the same kind of system component

Note 1 to entry: 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.

3.6.15
class attribute
attribute that is shared by all objects within the same class

3.6.16
class code
unique identifier assigned to each object class

3.6.17
class specific service
service defined by a particular object class to perform a required function which is not performed by a common service

Note 1 to entry: A class specific object is unique to the object class which defines it.

3.6.18
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

3.6.19
clock
node participating in the Precision Time Protocol (PTP) that is capable of providing a measurement of the passage of time since a defined epoch

Note 1 to entry: There are three types of clocks in IEC 61588:2009, boundary, transparent and ordinary clocks.

[SOURCE: IEC 61588:2009, 3.1.4, modified – different Note]

3.6.20
communication objects
components that manage and provide a run time exchange of messages across the network

EXAMPLES Connection Manager object, Unconnected Message Manager (UCMM) object, and Message Router object.

3.6.21
connection
logical binding between application objects that may be within the same or different devices

Note 1 to entry: Connections may be either point-to-point or multipoint.

3.6.22
connection ID
CID
identifier assigned to a transmission that is associated with a particular connection between producers and consumers, providing a name for a specific piece of application information

3.6.23
connection path
octet stream that defines the application object to which a connection instance applies

3.6.24
connection point
buffer which is represented as a subinstance of an Assembly object

3.6.25
consume
act of receiving data from a producer

3.6.26
consumer
node or sink that is receiving data from a producer

3.6.27
consuming application
application that consumes data

3.6.28
cyclic
repetitive in a regular manner

3.6.29
device
physical hardware connected to the link

Note 1 to entry: A device may contain more than one node.

3.6.30
device profile
collection of device dependent information and functionality providing consistency between similar devices of the same device type

3.6.31
domain
logical grouping of clocks that synchronize to each other using the protocol, but that are not necessarily synchronized to clocks in another domain

[SOURCE: IEC 61588:2009, 3.1.7]

3.6.32
end node
producing or consuming node

3.6.33
endpoint
one of the communicating entities involved in a connection

3.6.34
epoch
origin of a time scale

[SOURCE: IEC 61588:2009, 3.1.9]

3.6.35
error
discrepancy between a computed, observed or measured value or condition and the specified or theoretically correct value or condition

3.6.36
event
instance of a change of conditions

3.6.37
frame
denigrated synonym for DLPDU

3.6.38
grandmaster clock
within a domain, clock that is the ultimate source of time for clock synchronization using the PTP protocol

[SOURCE: IEC 61588:2009, 3.1.13]

3.6.39
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

3.6.40
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

3.6.41
invocation
act of using a service or other resource of an application process

Note 1 to entry: 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.

3.6.42
instance
actual physical occurrence of an object within a class that identifies one of many objects within the same object class

EXAMPLE California is an instance of the object class state.

Note 1 to entry: The terms object, instance, and object instance are used to refer to a specific instance.

3.6.43
instance attribute
attribute that is unique to an object instance and not shared by the object class

3.6.44
instantiated
object that has been created in a device

3.6.45
logical device
a certain FAL class that abstracts a software component or a firmware component as an autonomous self-contained facility of an automation device

3.6.46
Lpacket
Link packet
piece of application information that contains a size, control octet, tag, and link data

Note 1 to entry: Peer data-link layers use Lpackets to send and receive service data units from higher layers in the OSI stack.

3.6.47
management information
network-accessible information that supports managing the operation of the fieldbus system, including the application layer

Note 1 to entry: Managing includes functions such as controlling, monitoring, and diagnosing.

3.6.48
master clock
in the context of a single Precision Time Protocol (PTP) communication path, clock that is the source of time to which all other clocks on that path synchronize.

[SOURCE: IEC 61588:2009, 3.1.17]

3.6.49
member
piece of an attribute that is structured as an element of an array

3.6.50
Message Router
object within a node that distributes messaging requests to appropriate application objects

3.6.51
method
<object> synonym for an operational service which is provided by the server ASE and invoked by a client

3.6.52
module
hardware or logical component of a physical device

3.6.53
multipoint connection
connection from one node to many

Note 1 to entry: Multipoint connections allow messages from a single producer to be received by many consumer nodes.

3.6.54
network
set of nodes connected by some type of communication medium, including any intervening repeaters, bridges, routers and lower-layer gateways

3.6.55
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 behavior

3.6.56
object specific service
service unique to the object class which defines it

3.6.57
ordinary clock
clock that has a single Precision Time Protocol (PTP) port in a domain and maintains the timescale used in the domain

Note 1 to entry: It may serve as a source of time, i.e., be a master clock, or may synchronize to another clock, i.e., be a slave clock.

[SOURCE: IEC 61588:2009, 3.1.22, modified – second sentence changed to a Note]

3.6.58
originator
client responsible for establishing a connection path to the target

3.6.59
parent clock
master clock to which a clock is synchronized

[SOURCE: IEC 61588:2009, 3.1.23]

3.6.60
peer
role of an AR endpoint in which it is capable of acting as both client and server

3.6.61
physical device
automation or other network device

3.6.62
point-to-point connection
connection that exists between exactly two application objects

3.6.63
Precision Time Protocol
PTP
protocol defined by IEC 61588:2009

Note 1 to entry: As an adjective, it indicates that the modified noun is specified in or interpreted in the context of IEC 61588:2009.

[SOURCE: IEC 61588:2009, 3.1.28, modified – second sentence changed to a Note]

3.6.64
produce
act of sending data to be received by a consumer

3.6.65
producer
node that is responsible for sending data

3.6.66
property
general term for descriptive information about an object

3.6.67
PTP message
one of the message types defined in IEC 61588:2009

[SOURCE: IEC 61588:2009, 3.1.33]

3.6.68
PTP port
logical access point of a clock for PTP communications to the communications network

[SOURCE: IEC 61588:2009, 3.1.35]

3.6.69
resource
processing or information capability of a subsystem

3.6.70
serial number
unique 32-bit integer value assigned by each manufacturer/vendor to every device having Type 2 communication capabilities

Note 1 to entry: The Vendor ID and serial number jointly form a unique identifier for each device.

3.6.71
server
a) role of an AREP in which it returns a confirmed service response APDU to the client that initiated the request

b) object which provides services to another (client) object

3.6.72
service
operation or function than an object and/or object class performs upon request from another object and/or object class

3.6.73
synchronized clocks
(to a specified uncertainty) two clocks which have the same epoch and for which measurements of the time of a single event at an arbitrary time differ by no more than the specified uncertainty

[SOURCE: IEC 61588:2009, 3.1.40, modified – reworded]

3.6.74
System Time
absolute time value as defined by CPF2 time synchronization in the context of a distributed time system where all devices have a local clock that is synchronized with a common master clock

Note 1 to entry: In the context of CPF2, System Time is a 64-bit integer value in units of nanoseconds with a value of 0 corresponding to the date 1970-01-01.

3.6.75
target
end-node to which a connection is established

3.6.76
transparent clock
device that measures the time taken for a Precision Time Protocol (PTP) event message to transit the device and provides this information to clocks receiving this PTP event message

[SOURCE: IEC 61588:2009, 3.1.46, modified – truncated]

3.6.77
Unconnected Message Manager
UCMM
component within a node that transmits and receives unconnected explicit messages and sends them directly to the Message Router object

3.6.78
unconnected service
messaging service which does not rely on the set up of a connection between devices before allowing information exchanges

3.6.79
vendor ID
identification of each product manufacturer/vendor by a unique number

Note 1 to entry: Vendor IDs are assigned by ODVA, Inc.

3.7 Type 2 abbreviations and symbols

AE	Application Entity
AL	Application layer
APO	Application object
AP	Application process
APDU	Application protocol data unit
AR	Application relationship
AREP	Application relationship end point
ASCII	American standard code for information interchange
ASE	Application service element
CID	Connection ID
CM_API	Actual packet interval
CM_RPI	Requested packet interval
Cnf	Confirmation
CR	Communication relationship
DL-	(as a prefix) data-link-
DLC	Data-link connection
DLCEP	Data-link connection end point
DLL	Data-link layer
DLM	Data-link-management
DLSAP	Data-link service access point
DLSDU	DL-service-data-unit
FAL	Fieldbus application layer
FIFO	First-in first-out
ID	Identifier
IEC	International Electrotechnical Commission
Ind	Indication
IP	Internet protocol
ISO	International Organization for Standardization

I/O	Input/output	
LME	Layer management entity	
O2T	Originator to target (connection characteristics)	
O⇒T	Originator to target (connection characteristics)	
OSI	Open systems interconnect	
PDU	Protocol data unit	
PL	Physical layer	
PTP	Precision Time Protocol	[IEC 61588:2009]
QoS	Quality of service	
REP	Route endpoint	
Req	Request	
Rsp	Response	
SAP	Service access point	
SDU	Service data unit	
SEM	State event matrix	
STD	State transition diagram, used to describe object behavior	
T2O	Target to originator (connection characteristics)	
T⇒O	Target to originator (connection characteristics)	

3.8 Conventions

3.8.1 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, its class specification, and its service specification.

The class specification defines the attributes of the class. The attributes are accessible from instances of the class using the Object Management ASE services specified in Clause 5 of this standard. The service specification defines the services that are provided by the ASE.

3.8.2 General conventions

This standard uses the descriptive conventions given in ISO/IEC 10731.

Bold font is used in this standard to highlight parameter names or important requirement elements from surrounding text.

3.8.3 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
2.1	(o)	OpsService:	service name
3	(m)	MgtService:	service name

(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 standard, or by a user of this standard.

(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 standard to identify standardized classes. CLASS IDs between 100 and 199, 768 and 1 279 are allocated for identifying user defined classes.

(4) The "PARENT CLASS:" entry is the name of the parent class for the class being specified. All attributes defined for the parent class and inherited by it are inherited for the class being defined, and therefore do not have to be redefined in the template for this class.

NOTE The parent-class "TOP" indicates that the class being defined is an initial class definition. The parent class TOP is used as a starting point from which all other classes are defined. The use of TOP is reserved for classes defined by this standard.

(5) The "ATTRIBUTES" label indicate that the following entries are attributes defined for the class.

a) Each of the attribute entries contains a line number in column 1, a mandatory (m) / optional (o) / conditional (c) / selector (s) indicator in column 2, an attribute type label in column 3, a name or a conditional expression in column 4, and optionally a list of enumerated values in column 5. In the column following the list of values, the default value for the attribute may be specified.
If an attribute is optional, its default value (specified in IEC 61158-6-2) shall provide the same behavior as if the attribute was not implemented.

b) Objects are normally identified by a numeric identifier or by an object name, or by both. In the class templates, these key attributes are defined under the key attribute.

c) The line number defines the sequence and the level of nesting of the line. Each nesting level is identified by period. Nesting is used to specify

i) fields of a structured attribute (4.1, 4.2, 4.3),

ii) attributes conditional on a constraint statement (5). Attributes may be mandatory (5.1) or optional (5.2) if the constraint is true. Not all optional attributes require constraint statements as does the attribute defined in (5.2).

iii) the selection fields of a choice type attribute (6.1 and 6.2).

(6) The "SERVICES" label indicates that the following entries are services defined for the class.

a) An (m) in column 2 indicates that the service is mandatory for the class, while an (o) indicates that it is optional. A (c) in this column indicates that the service is conditional.

When all services defined for a class are defined as optional, at least one has to be selected when an instance of the class is defined.

b) The label "OpsService" designates an operational service (1).

c) The label "MgtService" designates an management service (2).

d) The line number defines the sequence and the level of nesting of the line. Each nesting level is identified by period. Nesting within the list of services is used to specify services conditional on a constraint statement.

3.8.4 Conventions for service definitions

3.8.4.1 General

The service model, service primitives, and time-sequence diagrams used are entirely abstract descriptions; they do not represent a specification for implementation.

3.8.4.2 Service parameters

Service primitives are used to represent service user/service provider interactions (ISO/IEC 10731). They convey parameters which indicate information available in the user/provider interaction. In any particular interface, not all parameters need be explicitly stated.

The service specifications of this standard uses a tabular format to describe the component parameters of the ASE service primitives. The parameters which apply to each group of service primitives are set out in tables. Each table consists of up to five columns for the

1) Parameter name,
2) request primitive,
3) indication primitive,
4) response primitive, and
5) confirm primitive.

One parameter (or component of it) is listed in each row of each table. Under the appropriate service primitive columns, a code is used to specify the type of usage of the parameter on the primitive specified in the column:

M parameter is mandatory for the primitive

U parameter is a User option, and may or may not be provided depending on dynamic usage of the service user. When not provided, a default value for the parameter is assumed.

C parameter is conditional upon other parameters or upon the environment of the service user.

— (blank) parameter is never present.

S parameter is a selected item.

Some entries are further qualified by items in brackets. These may be

a) a parameter-specific constraint:

"(=)" indicates that the parameter is semantically equivalent to the parameter in the service primitive to its immediate left in the table.

b) an indication that some note applies to the entry:

"(n)" indicates that the following note "n" contains additional information pertaining to the parameter and its use.

3.8.4.3 Service procedures

The procedures are defined in terms of

- the interactions between application entities through the exchange of fieldbus Application Protocol Data Units, and
- the interactions between an application layer service provider and an application layer service user in the same system through the invocation of application layer service primitives.

These procedures are applicable to instances of communication between systems which support time-constrained communications services within the fieldbus application layer.

4 Common concepts

The common concepts and templates used to describe the application layer service in this standard are detailed in IEC 61158-1, Clause 9.

5 Data type ASE

5.1 General

An overview of the data type ASE and the relationships between data types is provided in IEC 61158-1, 10.2.

5.2 Formal definition of data type objects

The template used to describe the data type class in Clause 5 is detailed in IEC 61158-1, 10.2. This includes the specific ASE structure and the definition of its attributes.

5.3 FAL defined data types

5.3.1 Fixed length types

5.3.1.1 Boolean types

5.3.1.1.1 Boolean

CLASS: **Data type**

ATTRIBUTES:

1	Data type Numeric Identifier	=	1
2	Data type Name	=	Boolean
3	Format	=	FIXED LENGTH
4.1	Octet Length	=	1

This data type expresses a Boolean data type with the values TRUE and FALSE.

5.3.1.1.2 BOOL

This IEC 61131-3 type is the same as Boolean.

5.3.1.2 Bitstring types

5.3.1.2.1 BitString8

CLASS: **Data type**

ATTRIBUTES:

1	Data type Numeric Identifier	=	22
2	Data type Name	=	Bitstring8