IEC 61158-5-28

Edition 1.0 2023-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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



IEC 61158-5-28:2023-03(en-fr)



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, …). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

IEC 61158-5-28

Edition 1.0 2023-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 25.040

ISBN 978-2-8322-6583-3

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

® Registered trademark of the International Electrotechnical Commission
Marque déposée de la Commission Electrotechnique Internationale

CONTENTS

FOREWORD 5
INTRODUCTION 7
1 Scope 8
1.1 Overview 8
1.2 Specifications 9
1.3 Conformance 9
2 Normative references 9
3 Terms, definitions, symbols, abbreviated terms and conventions 10
3.1 Referenced terms and definitions 10
3.1.1 ISO/IEC 7498-1 terms 10
3.1.2 ISO/IEC 8822 terms 10
3.1.3 ISO/IEC 9545 terms 11
3.1.4 ISO/IEC 8824 terms 11
3.2 Additional terms and definitions for this IEC 61158-5-28 11
3.3 Abbreviations and symbols 12
3.4 Conventions 13
3.4.1 Overview 13
3.4.2 Conventions for class definitions 13
3.4.3 Conventions for service definitions 14
4 Concepts 15
5 Data type ASE 15
5.1 General 15
5.1.1 Overview 15
5.1.2 Overview of basic types 16
5.1.3 Overview of fixed-length types 16
5.1.4 Overview of constructed types 17
5.2 AL defined data types 17
5.2.1 Fixed length types 17
5.2.2 String type 19
5.2.3 Structure type 20
6 Type 28 communication model specification 25
6.1 General 25
6.2 Protocol stack for Type 28 fieldbus 26
6.3 Data mapping modelling 27
6.4 Overview of Type 28 communication model 29
6.4.1 General 29
6.4.2 P/S 29
6.4.3 C/S 30
6.5 AL related management information table 30
6.5.1 General 30
6.5.2 Time management information table 31
6.5.3 Network management information table 32
6.6 ASEs 33
6.6.1 Overview 33
6.6.2 RT data ASE 34
6.6.3 nRT data ASE 36

6.6.4 Time ASE 38
6.6.5 Resource ASE 41
6.6.6 Addressing ASE 43
6.6.7 Management ASE 48
6.6.8 Virtualization ASE 55
6.7 Application service 58
6.7.1 Overview 58
6.7.2 Read service 58
6.7.3 Write service 58
Annex A (informative) Example of service data mapping DTU message 60
Annex B (informative) Example of OPC UA data model and Type 28 data model mapping 61
Annex C (informative) Example of RTA service processing 62
Annex D (informative) Type 28 virtualization solution example 63
Bibliography 66

Figure 1 – Data type class hierarchy example 16
Figure 2 – BITMAP data type 20
Figure 3 – AL in fieldbus protocol stack architecture 26
Figure 4 – Type 28 AL protocol architecture 26
Figure 5 – Data mapping modelling object structure 27
Figure 6 – Diagram of mapping data buffers and service data variables 28
Figure 7 – Diagram of P/S model 29
Figure 8 – P/S model of PUSH mode 30
Figure 9 – P/S model of PULL mode 30
Figure 10 – Diagram of C/S communication model 30
Figure 11 – RT data transmission model 35
Figure 12 – Diagram of nRT data request response model 37
Figure 13 – Diagram of nRT data AP interaction based on C/S communication model 38
Figure 14 – Diagram of nRT data AP interaction based on P/S communication model 38
Figure 15 – Time synchronization application interaction process 40
Figure 16 – Time query process 41
Figure 17 – Resource AP interaction based on C/S communication model 43
Figure 18 – Resource ASE local service function diagram 43
Figure 19 – NETWORKID identification field structure 44
Figure 20 – NETWORKID interaction process diagram 46
Figure 21 – Diagram of MAC mapping table service function 46
Figure 22 – IP mapping table service function diagram 47
Figure 23 – Type 28 AL data message mapped to IP payload data payload 47
Figure 24 – Type 28 AL protocol header and IP protocol header mapping 48
Figure 25 – IP data message is mapped to valid data of Type 28 AL data message 48
Figure 26 – Static configuration initialization process 51
Figure 27 – Join the network interaction process 52
Figure 28 – Passively exit the network interaction process 53

Figure 29 – Actively exit network interaction process 54
Figure 30 – Diagram of diagnostic object mapping 54
Figure 31 – Diagram of the logging process 55
Figure 32 – A physical bus divided into two virtual bus domain diagrams 56
Figure 33 – Diagram of virtualized AP interaction based on C/S communication model 57
Figure 34 – Virtualization ASE local implementation diagram 58
Figure A.1 – Data transmission unit message content example 60
Figure B.1 – OPC UA data model and mapping of Type 28 data model 61
Figure C.1 – Example of RTA service processing 62
Figure D.1 – Diagram of Type 28 industrial bus service deployment 63
Figure D.2 – Diagram of networking topology based on the virtualized bus 63
Figure D.3 – Virtual network topology based on logical business function RT1 64

Table 1 – TIMEV type data coding 17
Table 2 – TIMEDATE type coding 18
Table 3 – TIMEOFDAY type coding 18
Table 4 – TIMEDIFFER type coding 19
Table 5 – VISIBLESTRING type data coding 19
Table 6 – Description of time information structure TIMEINFO_S 20
Table 7 – Description of clock option information structure CLOCK_OPTION_INFO_S 21
Table 8 – Description of network configuration parameter structure NETWORK_CFG_PARA_S 22
Table 9 – Description of MAC mapping table NETWORKID_MAC_MAP_TABLE_S 23
Table 10 – Description of IP mapping table structure IP_MAP_TABLE_S 24
Table 11 – Service data mapping table parameter list 29
Table 12 – Time management information table 31
Table 13 – Network management information table 32
Table 14 – Communication models supported by Type 28 AL ASEs 33
Table 15 – Application service interface return value list 33
Table 16 – RT data service interface parameters 34
Table 17 – nRT data service interface parameters 36
Table 18 – Timing service interface parameters 39
Table 19 – Resource service interface parameters 42
Table 20 – Addressing service interface parameters 45
Table 21 – Management service interface parameters 49
Table 22 – Virtual service interface parameters 56
Table 23 – Read service parameters 58
Table 24 – Write service parameters 59
Table 25 – Application service errcode 59
Table D.1 – Virtual bus environment node NETWORKID list 65

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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 the IEC 61784-1 series and the IEC 61784-2 series.

IEC 61158-5-28 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

The text of this International Standard is based on the following documents:

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.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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.

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.

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.

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.

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.

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

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- 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.

3.2.1
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

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

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

(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.

(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 document.

(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.

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 a 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.

3.4.3 Conventions for service definitions

3.4.3.1 General

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

3.4.3.2 Service parameters

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

The service specifications of this document use 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

a) parameter name,

b) request primitive,

c) indication primitive,

d) response primitive, and

e) 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 can be provided or not depending on dynamic usage of the service user. When not provided, a default value for the parameter is assumed.

— (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.

3.4.3.3 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 Concepts

The fundamental concepts and templates used to describe the application layer service in this document follow IEC 61158-1, Clause 9.

5 Data type ASE

5.1 General

5.1.1 Overview

In the communication Type 28 FAL, Data type ASE complies with IEC 61158-1, Clause 10, and the other protocol-specific data types are not defined in this document.

Fieldbus data types specify the machine independent syntax for the data conveyed by each layer services. The fieldbus application supports the definition and transmission of basic and constructed data types.

Basic types are atomic data types that cannot be decomposed into more elemental types. Constructed data types are composed of basic types and other constructed types. Their complexity and the depth of nesting are not constrained by this document.