IEC 61158-5-24

Edition 2.0 2023-03

INTERNATIONAL STANDARD

Industrial communication networks – Fieldbus specifications – Part 5-24: Application layer service definition – Type 24 elements



IEC 61158-5-24:2023-03(en)



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-6580-2

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 5-24: Application layer service definition – Type 24 elements

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IEC 61158-5-24 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This second edition cancels and replaces the first edition published in 2014. This edition constitutes a technical revision.

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

a) modify to the AP type definition in Table 1;
b) modify to the Support list of service for each class of FDC ASE in Table 8.

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

Draft	Report on voting
65C/1203/FDIS	65C/1244/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- withdrawn,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 5-24: Application layer service definition – Type 24 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 document 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 24 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 document defines in an abstract way the externally visible service provided by the different Types of 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 International Standard 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 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 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 subparts of 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 need to address implementation issues not covered by this specification, 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 do they 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 fulfil any given Type of application layer services as defined in this part of IEC 61158.

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 61158-4-24:2023, *Industrial communication networks – Fieldbus specifications – Part 4-24: Data link layer protocol specification – Type 24 elements*

IEC 61158-6-24:2023, *Industrial communication networks – Fieldbus specifications – Part 6-24: Application layer protocol specification – Type 24 elements*

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

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

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 as defined in ISO/IEC 7498-1 apply:

a) abstract syntax;
b) application-entity;
c) application process;
d) application protocol data unit;
e) application-process-invocation;
f) (N)-facility;
g) (N)-function;
h) correspondent-(N)-entities;
i) presentation context;
j) real system;
k) transfer syntax.

3.1.2 ISO/IEC 9545 terms

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

a) application-association;
b) application-context;
c) application-entity-invocation;
d) application-entity-type;
e) application-service-element.

3.1.3 ISO/IEC 8824-1 terms

For the purposes of this document, the following terms as defined in ISO/IEC 8824-1 apply:

a) object identifier.

3.1.4 Terms and definitions from ISO/IEC 10731

For the purposes of this document, the following terms as defined in ISO/IEC 10731 apply:

a) OSI-service-primitive; primitive;

b) OSI-service-provider; provider;

c) OSI-service-user; user.

3.2 Additional terms and definitions

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

3.2.1
alarm
field device status to tell that the device has detected a fatal problem to be solved and cannot continue normal working, through the field device control (FDC) service of the type 24 fieldbus

Note 1 to entry: Any alarm statuses are latched and need some operation to be cleared.

Note 2 to entry: Alarms are classified into three groups; communication alarms, illegal-command-related ones, and application specific ones. But concrete definitions are dependent on implementation of each field devices.

3.2.2
application process object
network representation of a specific aspect of an application process (AP), which is modelled as a network accessible object contained within an AP or within another APO

Note 1 to entry: Refer IEC 61158-1, 9.3.4.

3.2.3
application process context
AP context
shared knowledge or a common set of rules, governing communication of FAL application entities (AEs) and describing the permissible collective communications behavior between the AEs that are party to a specific set of application relationships (ARs)

Note 1 to entry: Data within AP context can be specified by the user in advance, by the option selected while the user uses a field bus management (FSM) service to read out the facility of peer AP, by the automatic negotiation function that the FSM system handles, and so on. The method that is to be adopted depends on the specification of each implementation.

3.2.4
application process type
AP type
description of a classification of application processes (APs) in terms of a set of capabilities for FAL of the type 24 fieldbus

Note 1 to entry: AP types are classified into three ones, C1 master AP, C2 master AP and slave AP, by their application roles in the fieldbus network. See 6.2.

3.2.5
async command
type of a command application protocol data unit (APDU) of the FDC service of the type 24 FAL, which can be issued any time after the previous transaction without consideration of synchronization with the communication cycle

Note 1 to entry: Definitions, which command should be async one or not, are dependent on an application. They can be provided as a registered set of commands and responses or device profiles (see IEC 61158-6-24, 4.4 and Annex A).

3.2.6
asynchronous communication
state or a way of communication for the FDC service of the type 24 FAL, in which a command can be issued any time after the previous transaction without consideration of synchronization with the communication cycle

Note 1 to entry: In this state, sync commands cannot be issued, but async commands can.

3.2.7
attribute
information or parameter contained in variable portions of an object

Note 1 to entry: Typically, they provide status information or govern the operation of an object. Attributes also affect the behavior of an object.

3.2.8
C1 master
AP type that has master facilities for the FDC service of the type 24 FAL, or the device implementing that AP type

Note 1 to entry: Only one C1 master exists in a network of the type 24 fieldbus

3.2.9
C2 master
AP type that has only monitor facilities for the FDC service but requester facilities for message (MSG) service of the type 24 FAL, or the device implementing that AP type

Note 1 to entry: Less than two C2 masters can exist in a network of the type 24 fieldbus

3.2.10
command
PDU issued by a requester or a master to make a responder or a slave execute some functions

3.2.11
communication
process to exchange information in a formal manner between two or more devices, users, APs or entities

3.2.12
transfer
process to convey a PDU from a sender to a receiver

3.2.13
transmission
process to send out and propagate electrical signals or encoded data

3.2.14
communication cycle
period of repetitive activities synchronized with the transmission cycle while the connection establishing for the FDC protocol of the type 24 FAL

Note 1 to entry: Communication cycle can synchronize with a cycle multiplying the transmission cycle by a specified scaling factor.

3.2.15
connection
context or logical binding under specific conditions for the FDC protocol between a master object and a slave object for the type 24 FAL

3.2.16
cyclic
repetitive in a regular manner

3.2.17
cyclic communication
transmission mode in which request PDUs and response PDUs are exchanged repetitively in the scheduled time slots synchronized with a transmission cycle for the lower layer protocol of the type 24 fieldbus

Note 1 to entry: In the AL, the communication cycle arises from the transmission cycle in this mode.

3.2.18
cycle scale counter
counter to generate a communication cycle by means of scaling a primary cycle or a transmission cycle

3.2.19
device ID
part of "device information" to identify the device for a specific product type or model of the type 24 fieldbus

3.2.20
device information
formatted and device-embedded information to characterize a device, which mainly consists of data for device model identification and device-profile specific parameters for the type 24 fieldbus

3.2.21
device profile
collection of device model-common information and functionality providing consistency between different device models among the same kind of devices

3.2.22
dual transfer
transfer mode for the FDC protocol of the type 24 FAL, in which a sender sends a same PDU twice a transaction and a receiver uses them to detect and recover a communication error such as data-corruption or data-loss in cyclic communication mode

3.2.23
event driven communication
transmission mode for the lower layer protocol of the type 24 fieldbus in which a transaction of command-response-exchanging arises as user’s demands

Note 1 to entry: Both the transmission cycle and the communication cycle don’t arise in this mode.

3.2.24
error
abnormal condition or malfunction for communication or any other activities

3.2.25
field device control service
FDC service
time-critical communication service that handles a fixed length command data to control a field device and the corresponding feedback response data in a severe restriction on delay or jitter for the communication timing for the type 24 FAL

3.2.26
field device control protocol
time-critical communication protocol that handles a fixed length command data to control a field device and the corresponding feedback response data in a severe restriction on delay or jitter for the communication timing for the type 24 FAL

3.2.27
master
class or its instance object of FDC application service element (ASE) who plays a role of a command requester for the type 24 FAL

3.2.28
message service
MSG service
communication service that handles the variable length data and not required a severe restriction on response time

3.2.29
monitor
class or its instance object of FDC ASE who plays a role of a watcher or subscriber of commands and response between other communication nodes for the type 24 FAL

3.2.30
monitor slave
variant of slave AP type who has both slave class and monitor class for FDC ASE of the type 24 FAL

3.2.31
network clock
synchronized and periodically running counter that each node in a same network has, which becomes an oscillation source of the transmission cycle

3.2.32
protocol machine
state machine that realizes the protocol as the main function of the entity in each layer

3.2.33
requester
class or its instance object of MSG ASE who plays a role of a command requester or sender for the type 24 FAL

3.2.34
responder
class or its instance object of MSG ASE who plays a role of a command responder or receiver for the type 24 FAL

3.2.35
response
PDU issued by a responder or a slave to inform a result or some status for the received command to a requester or a master

3.2.36
service
operation or process that an object performs upon request from another object

3.2.37
single transfer
normal transfer mode for the FDC protocol of the type 24 FAL in which a sender sends a same PDU once a transaction

3.2.38
slave AP
AP type that has slave facilities for the FDC service of the type 24 FAL, or the device implementing that AP type

3.2.39
slave
FDC slave
class or its instance object of FDC ASE who plays a role of a responder for the type 24 FAL

3.2.40
state machine
logical automatic machine or automaton that has a finite number of states and handles state transition fired by an event as a trigger

3.2.41
sync command
type of command or APDU of the FDC service of the type 24 FAL, which is issued at the synchronized timing with every communication cycle

Note 1 to entry: Definitions which command should be sync one or not are dependent on an application. They can be provided as a registered set of commands and responses or device profiles (see IEC 61158-6-24, 4.4 and Annex A).

3.2.42
synchronous communication
state or a way of communication for the FDC service of the type 24 FAL, in which a command is issued at the synchronized timing with every communication cycle

Note 1 to entry: In this state, both sync commands and async ones can be issued.

Note 2 to entry: In this state, an out-of-synchronization error of APs shall be detected by measures of the watchdog counter.

3.2.43
transmission cycle
period of repetitive activities for the lower layers of the type 24 fieldbus, which of all the slave devices are synchronized with that of a C1 master device by the lower layer protocol

3.2.44
transmission mode
state or a way of transmission for the lower layer protocol of the type 24 fieldbus; cyclic mode, event driven mode

3.2.45
virtual memory space
large data block of APOs for the type 24 FAL which can be read and write with pseudo-memory-addresses to provide consistency between different device models

Note 1 to entry: The virtual memory space includes the device information and other vender specific area. See IEC 61158-6-24, Annex B.

3.2.46
warning
field device status to tell that the device has detected a slight or passing problem but still working normally through the field device control (FDC) service of the type 24 fieldbus

Note 1 to entry: Any warning statuses are latched and need to be operated to clear them.

Note 2 to entry: Warnings are classified into three groups, communication warnings, illegal-command-related ones, and application specific ones. But concrete definitions are dependent on implementation of each field devices.

3.3 Abbreviations and symbols

For the purposes of this document, the following abbreviations and symbols apply.

AE	Application Entity
AL	Application Layer
A-, AL-	Application layer (as a prefix)
AP	Application Process
APDU	Application Protocol Data Unit
API	Application Process Invocation
APO	Application Process Object
APC	Application Process Context (as prefix of a protocol for type 24 fieldbus)
APC SM	Application Process Context State Machine (for type 24 fieldbus)
AR	Application Relationship
AR ASE	Application Relationship Application Service Element
AREP	Application Relationship End Point
ARPM	Application Relationship Protocol Machine (for type 24 fieldbus)
ARPM-FDCM	ARPM for Field Device Control service Master (for type 24 fieldbus)
ARPM-FDCMN	ARPM for Field Device Control service Monitor (for type 24 fieldbus)
ARPM-FDCS	ARPM for Filed Device Control service Slave (for type 24 fieldbus)
ARPM-MSG	ARPM for Message service (for type 24 fieldbus)
ASCII	American Standard code for Information Interchange
ASE	Application Service Element
ASN.1	Abstract Syntax Notation One
Cnf	Confirm primitive
DL	Data-link-layer
DL-	(as a prefix) Data Link-
DLL	Data Link Layer
DLM	Data Link-management
DLPDU	Data Link-Protocol Data Unit
DLSAP	Data Link Service Access Point
DLSDU	DL-service-data-unit
DMPM	Data Link layer Mapping Protocol Machine
FAL	Fieldbus Application Layer
FCS	Frame check sequence
FDC-	Field Device Control (as prefix of a service or a protocol for type 24 fieldbus)
FDC ASE	Field Device Control Application Service Element (for type 24 fieldbus)
FDCPM	Field Device Control Protocol Machine (for type 24 fieldbus)

FDCPM-M	Field Device Control Protocol Machine for Master (for type 24 fieldbus)
FDCPM-MN	Field Device Control Protocol Machine for Monitor (for type 24 fieldbus)
FDCPM-S	Field Device Control Protocol Machine for Slave (for type 24 fieldbus)
FIFO	First In First Out
FSPM	FAL service protocol machine
FSM-	Fieldbus System Management (as prefix of a service for type 24 fieldbus)
FSM ASE	Fieldbus System Management Application Service Element for type 24 fieldbus
HMI	Human-machine Interface
I/O	Input/output
ID	Identifier
IDL	Interface Definition Language
Ind	Indication primitive
LME	Layer Management Entity
Lsb	Least Significant Bit
Msb	Most Significant Bit
MSG	Message (as prefix of a service or a protocol for type 24 fieldbus)
MSG ASE	Message Application Service Element for type 24 fieldbus
MSGPM	Message Protocol Machine for type 24 fieldbus
MSGPM-RQ	MSGPM for Requester for type 24 fieldbus
MSGPM-RS	MSGPM for Responder for type 24 fieldbus
OSI	Open Systems Interconnect
PM	Protocol machine
PDU	Protocol Data Unit
PhL	Ph-layer
QoS	Quality of Service
RAM	Random access memory
Req	Request primitive
Rsp	Response primitive
RSP	Response PDU for FDC service (for type 24 fieldbus)
SAP	Service Access Point
SDN	Send Data with no Acknowledge
SDU	Service Data Unit
SM	State Machine
SMIB	System Management Information Base
UML	Unified Modelling Language

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, its class specification, and its service specification.

The class specification defines the attributes of the class. It is assumed that the attributes are accessible from instances of the class using the Object Management ASE services specified in IEC 61158-1, 9.3. The service specification defines the services provided by the ASE.

The service model and service primitives are entirely abstract descriptions; therefore, they do not represent specifications for implementation.

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

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

- The "ATTRIBUTES" label indicate that the following entries are attributes defined for the class.
  - 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.
  - 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.

  - 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
    - fields of a structured attribute (4.1, 4.2, 4.3),
    - 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), and
    - the selection fields of a choice type attribute (6.1 and 6.2).
- The "SERVICES" label indicates that the following entries are services defined for the class.
  - 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.
  - The label "OpsService" designates an operational service (1).
  - The label "MgtService" designates a management service (2).
  - 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

This document uses the descriptive conventions given in ISO/IEC 10731 about services and their primitives.

<name of service primitive>::= <service name>-<service-primitive-name>.<primitive-type>,

where

<primitive-type>::= request | indication | response | confirm;

<service-name> identifies ASEs providing this type of FAL services;

::= FSM | EVM | FDC | MSG | AR.

3.4.3.2 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 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 parameter name,
- request primitive,
- indication primitive,
- response primitive, and
- 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 The parameter is mandatory

C The parameter is conditional

U The 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.

S The parameter is a selected item.

(blank) The parameter is never present.

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

1) 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, and

2) 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 that support time-constrained communications services within the FAL.

4 Concepts

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

5 Data type ASE

In the communication type 24 FAL, Data type ASE complies with IEC 61158-1, Clause 10, and the other protocol-specific data types are not defined in this document.

The data types used in data fields within APDUs are defined in IEC 61158-6-24 along with the abstract syntax and transfer syntax. And other data types for attributes of object or parameters of service primitives in this document also follow with the definition of IEC 61158-6-24.

6 Communication model specifications

6.1 Type specific concepts

The application layer of the type 24 fieldbus is modelled based on the concept that is described in IEC 61158-1, Clause 5. The structure is as follows:

- the "what" is described by application layer service elements (ASE);
- the "how" is described by application layer relationships (AR).

In the type 24 FAL, the communication models consist of five types of ASE and two types of AR.