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Title: Draft BS EN 61158-X-27 Ed.1.0 Industrial communication networks - Fieldbus specifications and Profiles - Type 27 elements (MECHATROLINK).

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Full document details: 21/30405311 DC

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

PROJECT NUMBER: IEC 61158-X-27 ED1	
DATE OF CIRCULATION: 2021-07-30	CLOSING DATE FOR VOTING: 2021-10-22
SUPERSEDES DOCUMENTS: 65C/969/NP, 65C/988A/RVN	

IEC SC 65C : INDUSTRIAL NETWORKS	
SECRETARIAT: France	SECRETARY: Ms Valérie DEMASSIEUX
OF INTEREST TO THE FOLLOWING COMMITTEES: SC 22G, TC 57, SC 121A	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING Attention IEC-CENELEC parallel voting The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Industrial communication networks - Fieldbus specifications and Profiles - Type 27 elements (MECHATROLINK)

PROPOSED STABILITY DATE: 2028

NOTE FROM TC/SC OFFICERS:

These new IEC 61158-x-27 parts are referred to in the new IEC 61784-2-19, also out for vote as CDV.

NC comments will be addressed during the SC65C/WG9 meeting currently scheduled as face-to-face in Frankfurt on December 6th-8th, 2021.

Corresponding meeting notice will be provided in due time by the convenor, in particular to confirm meeting arrangements (face-to-face or web, depending on pandemic situation).

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INCLUDED SUBPARTS

NOTE 1: These subparts correspond to project IEC 61158-x-27, triggered by 65C/1061/NP, 65C/1062/NP and 65C/1075/RVN, 65C/1076/RVN (new CP 19/4 for CPF 19, based on ISO/IEC 8802-3, and corresponding new Type 27).

NOTE 2: The Contents of each subpart begins on page 2, so that the page numbering will be unchanged when the final International Standard is issued with its IEC-Central-Office-provided cover sheet.

NOTE 3: Unlike other parts of the IEC 61158 series revised concurrently with this IEC 61158-x-27 project, the page numbers of each subpart are NOT prefixed with the Type number of the subpart, because these will be circulated independently from the revised parts of the series until completion of the project.

IEC 61158-5-27 Ed1.0, Industrial communication networks – Fieldbus specifications –
Part 5-27: Application layer service definition – Type 27 elements

IEC 61158-6-27 Ed1.0, Industrial communication networks – Fieldbus specifications –
Part 6-27: Application layer protocol specification – Type 27 elements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 5-27: Application layer service definition – Type 27 elements

FOREWORD

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NOTE Combinations of protocol types are specified in IEC 61784-1 (all parts) and IEC 61784-2 (all parts).

IEC 61158-5-27 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

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

Draft	Report on voting
65C/XXX/FDIS	65C/XXX/RVD

211
212 Full information on the voting for its approval can be found in the report on voting indicated in
213 the above table.

214 The language used for the development of this International Standard is English.

215 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
216 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement,
217 available at www.iec.ch/members_experts/refdocs. The main document types developed by
218 IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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

221 The committee has decided that the contents of this document will remain unchanged until the
222 stability date indicated on the IEC website under webstore.iec.ch in the data related to the
223 specific document. At this date, the document will be

- 224 • reconfirmed,
225 • withdrawn,
226 • replaced by a revised edition, or
227 • amended.

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230

INTRODUCTION

231 This document is one of a series produced to facilitate the interconnection of automation
232 system components. It is related to other standards in the set as defined by the “three-layer”
233 fieldbus reference model described in IEC 61158-1.

234 The application service is provided by the application protocol making use of the services
235 available from the data-link or other immediately lower layer. This standard defines the
236 application service characteristics that fieldbus applications and/or system management may
237 exploit.

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

242

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 5-27: Application layer service definition – Type 27 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 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 27 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 International Standard defines in an abstract way the externally visible service provided by the different Types of 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 International 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 International Standard 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 International 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 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 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 IEC 61784-1 (all parts) and IEC 61784-2 (all parts) 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:—¹, *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

IEC 61158-6-27:—², *Industrial communication networks – Fieldbus specifications – Part 6-27: Application layer protocol specification – Type 27 elements*

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

¹ Under preparation. Stage at the time of publication: IEC/CDV 61158-1:2021.

² Under preparation. Stage at the time of publication: IEC/CDV 61158-6-27:2021.

327 ISO/IEC 8824-1, *Information technology – Abstract Syntax Notation One (ASN.1):*
328 *Specification of basic notation*

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

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

333 **3 Terms, definitions, symbols, abbreviations, and conventions**

334 For the purposes of this document, the following terms, definitions, symbols, abbreviations
335 and conventions apply.

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

- 338 • IEC Electropedia: available at <http://www.electropedia.org/>
- 339 • ISO Online browsing platform: available at <http://www.iso.org/obp>

340 **3.1 Referenced terms and definitions**

341 **3.1.1 ISO/IEC 7498-1 terms**

342 For the purposes of this document, the following terms as defined in ISO/IEC 7498-1 apply:

- 343 a) abstract syntax;
- 344 b) application-entity;
- 345 c) application process;
- 346 d) application protocol data unit;
- 347 e) application-process-invocation;
- 348 f) (N)-facility;
- 349 g) (N)-function;
- 350 h) correspondent-(N)-entities;
- 351 i) presentation context;
- 352 j) real system;
- 353 k) transfer syntax.

354 **3.1.2 ISO/IEC 9545 terms**

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

- 356 a) application-association;
- 357 b) application-context;
- 358 c) application-entity-invocation;
- 359 d) application-entity-type;
- 360 e) application-service-element.

361 **3.1.3 ISO/IEC 8824-1 terms**

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

- 363 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 27 fieldbus

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

Note 2 to entry: Alarms may be 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: Details are given in 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 27 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 27 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 may be provided as a registered set of commands and responses or a device profiles (see IEC 61158-6-27, 4.4 and Annex A).

3.2.6**asynchronous communication**

state or a way of communication for the FDC service of the Type 27 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 may also affect the behaviour of an object.

3.2.8**C1 master**

AP type that has master facilities for the FDC service of the Type 27 FAL, or the device implementing that AP type

Note 1 to entry: Only one C1 master exists in a network of the Type 27 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 27 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 27 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****transfer****transmission**

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

– **transfer**: process to convey a PDU from a sender to a receiver

– **transmission**: process to send out and propagate electrical signals or encoded data

3.2.12**communication cycle**

period of repetitive activities synchronized with the transmission cycle while the connection establishing for the FDC protocol of the Type 27 FAL

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

3.2.13**connection**

context or logical binding under specific conditions for the FDC protocol between a master object and a slave object for the Type 27 FAL

3.2.14**cyclic**

repetitive in a regular manner

3.2.15

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 27 fieldbus

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

3.2.16

cycle scale counter

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

3.2.17

device ID

part of “device information” to identify the device for a specific product type or model of the Type 27 fieldbus

3.2.18

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 27 fieldbus

3.2.19

device profile

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

3.2.20

dual transfer

transfer mode for the FDC protocol of the Type 27 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

3.2.21

event driven communication

transmission mode for the lower layer protocol of the Type 27 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.

3.2.22

error

abnormal condition or malfunction for communication or any other activities

3.2.23

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 27 FAL

3.2.24

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 27 FAL

3.2.25**master**

class or its instance object of FDC application service element (ASE) who plays a role of a command requester for the Type 27 FAL

3.2.26**message service****MSG service**

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

3.2.27**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 27 FAL

3.2.28**monitor slave**

variant of slave AP type who has both slave class and monitor class for FDC ASE of the Type 27 FAL

3.2.29**network clock**

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

3.2.30**protocol machine**

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

3.2.31**requester**

class or its instance object of MSG ASE who plays a role of a command requester or sender for the Type 27 FAL

3.2.32**responder**

class or its instance object of MSG ASE who plays a role of a command responder or receiver for the Type 27 FAL

3.2.33**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

3.2.34**service**

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

3.2.35**single transfer**

normal transfer mode for the FDC protocol of the Type 27 FAL in which a sender sends a same PDU once a transaction

3.2.36**slave AP**

AP type that has slave facilities for the FDC service of the Type 27 FAL, or the device implementing that AP type

3.2.37

Slave

FDC slave

class or its instance object of FDC ASE who plays a role of a responder for the Type 27 FAL

3.2.38

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

3.2.39

sync command

type of command or APDU of the FDC service of the Type 27 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 may be provided as a registered set of commands and responses or a device profiles (see IEC 61158-6-27, 4.4 and Annex A).

3.2.40

synchronous communication

state or a way of communication for the FDC service of the Type 27 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.

3.2.41

transmission cycle

period of repetitive activities for the lower layers of the Type 27 fieldbus, which of all the slave devices are synchronized with that of a C1 master device by the lower layer protocol

3.2.42

transmission mode

state or a way of transmission for the lower layer protocol of the Type 27 fieldbus; cyclic mode, event driven mode

3.2.43

virtual memory space

large data block of APOs for the Type 27 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 61158-6-27, Annex B.

3.2.44

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 27 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 27 fieldbus)
APC SM	Application Process Context State Machine (for Type 27 fieldbus)
AR	Application Relationship
AR ASE	Application Relationship Application Service Element
AREP	Application Relationship End Point
ARPM	Application Relationship Protocol Machine (for Type 27 fieldbus)
ARPM-FDCM	ARPM for Field Device Control service Master (for Type 27 fieldbus)
ARPM-FDCMN	ARPM for Field Device Control service Monitor (for Type 27 fieldbus)
ARPM-FDCS	ARPM for Field Device Control service Slave (for Type 27 fieldbus)
ARPM-MSG	ARPM for Message service (for Type 27 fieldbus)
ASCII	American Standard code for Information Interchange
ASDU	Application Service Data Unit
ASE	Application Service Element
ASN.1	Abstract Syntax Notation One
Cnf	Confirm primitive
CTC	Communication Transmission Control
DL	Data-link-layer
DL-	(as a prefix) Data Link-
DLL	Data Link Layer
DLM	Data Link-management
DLMS	DL-management service
DLPDU	Data Link-Protocol Data Unit
DLSAP	Data Link Service Access Point
DLSDU	DL-service-data-unit
DMPM	Data Link layer Mapping Protocol Machine
E ² PROM	Electrically erasable programmable read only memory
FAL	Fieldbus Application Layer
FCS	Frame check sequence
FDC-	Field Device Control (as prefix of a service or a protocol for Type 27 fieldbus)
FDC ASE	Field Device Control Application Service Element (for Type 27 fieldbus)
FDCPM	Field Device Control Protocol Machine (for Type 27 fieldbus)
FDCPM-M	Field Device Control Protocol Machine for Master (for Type 27 fieldbus)
FDCPM-MN	Field Device Control Protocol Machine for Monitor (for Type 27 fieldbus)
FDCPM-S	Field Device Control Protocol Machine for Slave (for Type 27 fieldbus)
FIFO	First In First Out
FSPM	FAL service protocol machine
FSM-	Fieldbus System Management (as prefix of a service for Type 27 fieldbus)
FSM ASE	Fieldbus System Management Application Service Element for Type 27 fieldbus
FSMS	Fieldbus System management service
FSMUL	Field System Management Underlying Layer
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 27 fieldbus)

MSG ASE	Message Application Service Element for Type 27 fieldbus
MSGPM	Message Protocol Machine for Type 27 fieldbus
MSGPM-RQ	MSGPM for Requester for Type 27 fieldbus
MSGPM-RS	MSGPM for Responder for Type 27 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 27 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

595

596 **3.4 Conventions**

597 **3.4.1 Overview**

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

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

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

606 **3.4.2 Conventions for class definitions**

607 Class definitions are described using templates. Each template consists of a list of attributes
608 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

- 609
- 610 a) The "FAL ASE:" entry is the name of the FAL ASE that provides the services for the class
- 611 being specified.
- 612 b) The "CLASS:" entry is the name of the class being specified. All objects defined using this
- 613 template will be an instance of this class. The class may be specified by this standard, or
- 614 by a user of this standard.
- 615 c) The "CLASS ID:" entry is a number that identifies the class being specified. This number
- 616 is unique within the FAL ASE that will provide the services for this class. When qualified
- 617 by the identity of its FAL ASE, it unambiguously identifies the class within the scope of the
- 618 FAL. The value "NULL" indicates that the class cannot be instantiated.
- 619 d) The "PARENT CLASS:" entry is the name of the parent class for the class being specified.
- 620 All attributes defined for the parent class and inherited by it are inherited for the class
- 621 being defined, and therefore do not have to be redefined in the template for this class.

622 NOTE The parent-class "TOP" indicates that the class being defined is an initial class definition. The parent class

623 TOP is used as a starting point from which all other classes are defined. The use of TOP is reserved for classes

624 defined by this standard.

- 625 e) The "ATTRIBUTES" label indicate that the following entries are attributes defined for the
- 626 class.
- 627 1) Each of the attribute entries contains a line number in column 1, a mandatory (m) /
- 628 optional (o) / conditional (c) / selector (s) indicator in column 2, an attribute type label
- 629 in column 3, a name or a conditional expression in column 4, and optionally a list of
- 630 enumerated values in column 5. In the column following the list of values, the default
- 631 value for the attribute may be specified.
- 632 2) Objects are normally identified by a numeric identifier or by an object name, or by both.
- 633 In the class templates, these key attributes are defined under the key attribute.
- 634 3) The line number defines the sequence and the level of nesting of the line. Each
- 635 nesting level is identified by period. Nesting is used to specify
- 636 i) fields of a structured attribute (4.1, 4.2, 4.3),
- 637 ii) attributes conditional on a constraint statement (5). Attributes may be mandatory
- 638 (5.1) or optional (5.2) if the constraint is true. Not all optional attributes require
- 639 constraint statements as does the attribute defined in (5.2), and
- 640 iii) the selection fields of a choice type attribute (6.1 and 6.2).
- 641 f) The "SERVICES" label indicates that the following entries are services defined for the
- 642 class.

- 1) 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.
- 2) The label "OpsService" designates an operational service (1).
- 3) The label "MgtService" designates a management service (2).
- 4) 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 standard 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 standard 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

- a) the 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 The parameter is mandatory

C The parameter is conditional

U The parameter is a user option, and may or need not be provided 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

- 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

- 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 standard are detailed in IEC 61158-1:2018, Clause 9.

5 Data type ASE

In the communication Type 27 FAL, Data type ASE complies with IEC 61158-1, Clause 10, and the other protocol-specific data types are not defined in this standard.

The data types used in data fields within APDUs are defined in IEC 61158-6-27 along with the abstract syntax and transfer syntax. And other data types for attributes of object or parameters of service primitives in this standard also follow with the definition of IEC 61158-6-27.

6 Communication model specifications

6.1 Type specific concepts

The application layer of the Type 27 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 27 FAL, the communication models consist of five types of ASE and three types of AR.

Of course the FAL function to handle ARs is included within the ASE model as AR ASE. This standard mainly describes "what" is performed by AR ASE. The protocol specification that defines "how" the communication is processed on AR is described in IEC 61158-6.

OSI system management function essentially should be represented as an entity that is independent of each layer management entity (LME) such as ALME and vertically manages all of the layers. In the Type 27, however, it is integrated with the application layer management entity (ALME) to play a role as an ASE or Fieldbus System Management ASE.

6.2 Overview

The Type 27 FAL models an ASE structure and their roles for the fieldbus system based on a network that consists of multiple devices among two AP types. These are master and slave (see Table 1).

To establish a communication system, one or more masters and one or more slaves are required within one network.

Furthermore, five kinds of service entities are provided for the FAL user process in the Type 27 FAL. Figure 1 shows the ASE models for each AP types.

- Field Device Control ASE (FDC ASE);
- Message ASE (MSG ASE);
- Event Management ASE (EVM ASE);
- Fieldbus System Management ASE (FSM ASE);
- Application Relationship ASE (AR ASE).

Object classes that constitute the execution component of these ASE are instantiated within the sequence of AP context creation during the system boot-up. And then the ASE can execute individual services for users by communicating between corresponding objects of the peer ASEs within the network.

Among aforementioned ASEs, there are three ASEs that directly provide the communication function required by FAL user process: FDC ASE provides time critical communication, and MSG ASE can send and receive a user message that consists of large data block with variable length while it does not guarantee the transmission time. FSM ASE can detect the connection nodes by communication processing, implement node-to-node transmission delay measurements, and execute parameter remote settings. This fieldbus type can provide FAL users with four types of communication services with different characteristics by using these three types of ASEs. Also, among these ASEs, FSM ASE contributes to AP context creation and object instantiation within the other ASEs.

AR ASE provides an end point of the application relationship (AR) to convey transmission data (APDU) when an object of the other ASE communicates with a corresponding ASE. The service definition of AR ASE is described in 6.4 along with AR model.

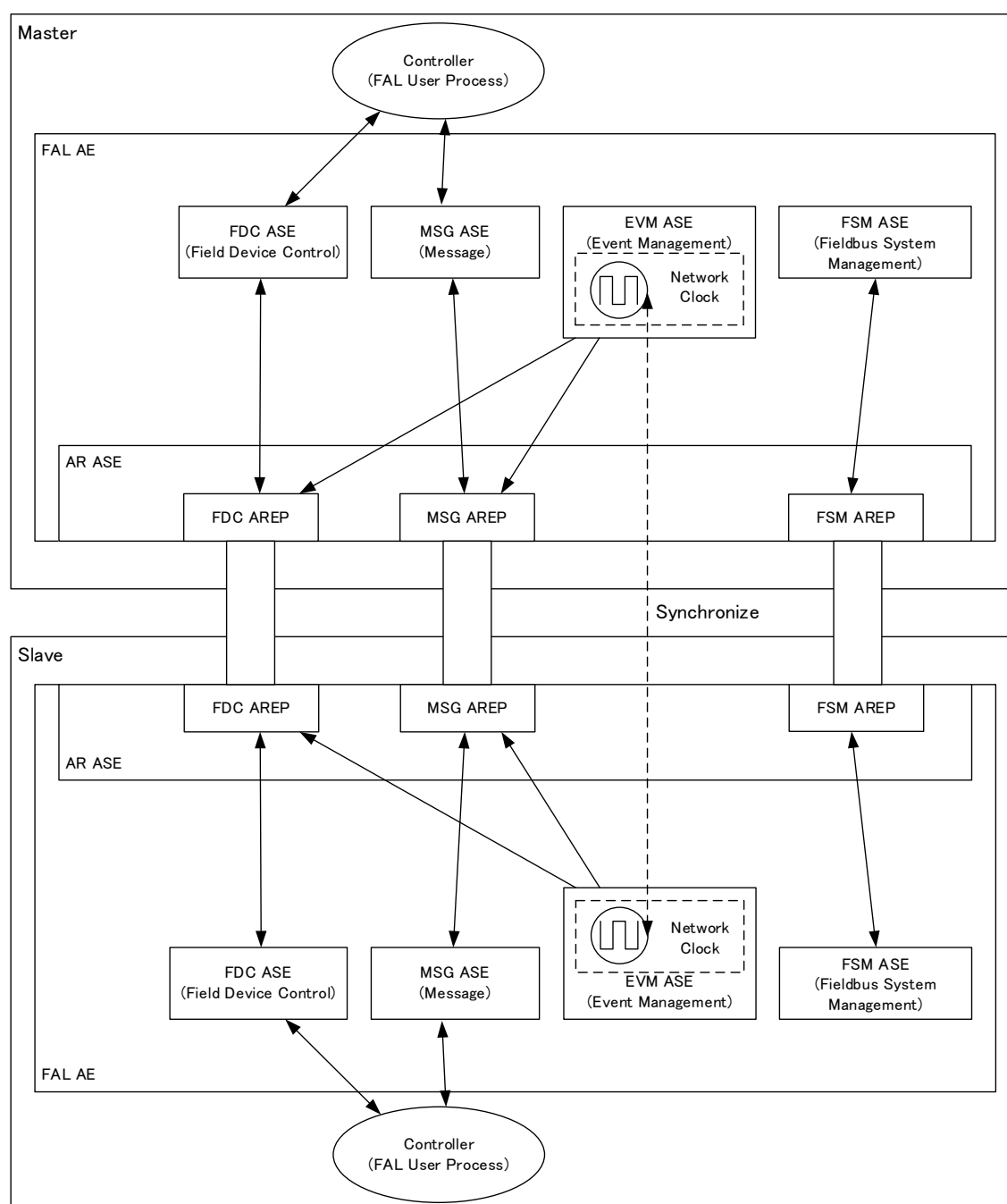
EVM ASE provides a service to deliver the synchronized and fixed-period signal from the network-clock counter generated by the lower layer. This signal is required as a cycle source for real-time communication by FDC ASE. Furthermore, it manages the timing to start the control domain and the timing of communication functions provided by FDC ASE and MSG ASE.

Table 1 – AP type definition

AP type	Example device	AP Components and objects	
master	Machine controller, Robot controller Servo drive	Specific application user process	
		F	FDC ASE (master objects)
		A	MSG ASE (a requester object, a responder object)
		L	AR ASE (FDCMaster-AR objects, Message-AR objects)

AP type	Example device	AP Components and objects	
Slave	Field devices, such as - servo drive - inverter drive - I/O device - encoder device - sensor device		EVM ASE (an event manager object)
			FSM ASE (an FSM object)
		Specific application user process	
		F	FDC ASE (a slave object, monitor objects ^a)
		A	MSG ASE (responder objects)
		L	AR ASE (an FDCslave-AR object, Message-AR objects)
			EVM ASE (an event manager object)
			FSM ASE (an FSM object)

753



754

Figure 1 – FAL ASE model of Type 27

6.3 FAL ASEs

6.3.1 FSM ASE

6.3.1.1 Concepts

6.3.1.1.1 General

As described in 6.2, the object classes to be supported are defined for each AP type in the Type 27 FAL. The maximum number of objects instantiated from the classes should be defined based on the application function and performance of the device as its product specification.

Furthermore, it is required to configure the system by selecting optional function and tuning performance with some parameters for a specific purpose of the application. For example, which object should be activated; which object should be connected to an object in the other device; how long the data length should be, what kind of transmission option should be set, and so on.

The network-system-environment operated for specific purpose or a set of configuration data as mentioned above is called as "AP-context" in this standard.

A fieldbus system management (FSM) ASE is an ASE that provides services for the AP-context creation, initialization of FAL, disable control, and association management among entities and objects by using communication node address, SAPID, AREP ID and so on.

In this communication model, the following conditions shall be met when the device boots up.

a) When the device boots up, all the objects of the maximum number specified in the product specification have been instantiated and the default SAPID have been given to those objects within each ASE in FAL.

b) When the objects or the entities in each layer are instantiated, their statuses are equivalent to those when <s>-Reset.req has issued.

NOTE <s> refers to <service-name> described in 3.4.3.1.

6.3.1.1.2 FAL common services for system management

In the Type 27 FAL, all of FAL objects except ones in FSM ASE support the common services for system management by the FSM ASE. These services are <s>-Reset, <s>-Open and <s>-Enable.

a) <s>-Reset is a service to disable and deactivate the object by reset the state and the attribute values of the object to the initial condition just after boot-up.

b) <s>-Open is a service to initialize the state and the attribute values of the object to the specified value during the process for establishing the targeted AP-context.

NOTE Even under this condition, the main function of the object is continuously disabled. This is a mechanism of the interlock to prevent unintended malfunction of the system during the initialization process.

c) <s>-Enable is a service to enable and activate the main function of the object.

Because the parameters passed in each Open and Enable service differ in each ASE, refer to the subclauses of each ASE for the detailed specification of the services.

6.3.1.1.3 Service overview

FSM ASE provides a set of services to initialize the communication environment. See Table 2. It provides the following services to the FAL user process:

- 797 – initialization of each layer or ASE in FAL;
- 798 – configuring the communication parameter and profile of each layer or ASE.
- 799 Only one FSM ASE object exists in each communication node.

800 **Table 2 – Support list of service for each class of FSM ASE**

Service	Class	Request	indication	response	conform
FSM-Reset	FieldbusSystemManager	M			
FSM-SetContext	FieldbusSystemManager	M			M
FSM-GetContext	FieldbusSystemManager	M			M
FSM-GetTopology	FieldbusSystemManager	U			U
FSM-InformTopology	FieldbusSystemManager	U			U
FSM-ChangeAddress	FieldbusSystemManager	U			U
FSM-Start	FieldbusSystemManager	M			M

801 **6.3.1.2 FieldbusSystemManager class specifications**

802 **6.3.1.2.1 FieldbusSystemManager class definition**

803 The FSM class definition is shown below.

FAL ASE:		Fieldbus System Management ASE	
CLASS:		FieldbusSystemManager	
CLASS ID:		not used	
PARENT CLASS:		TOP	
ATTRIBUTES:			
1	(o)	Key Attribute:	Numeric Identifier -- common FAL attribute
2	(o)	Key Attribute:	Name -- common FAL attribute
3	(o)	Attribute:	User Description -- common FAL attribute
4	(o)	Attribute:	Object Revision -- common FAL attribute
4.1	(o)	Attribute:	Major Revision -- common FAL attribute
4.2	(o)	Attribute:	Minor Revision -- common FAL attribute
5	(m)	Attribute:	SAPID
6	(m)	Attribute:	State -- State# of SM as APCSM
7	(m)	Attribute:	APType
8	(m)	Attribute:	CONTEXT-DATA -- depending on implementation
SERVICES:			
1	(m)	MgtService:	FSM-Reset
2	(m)	OpsService	FSM-SetContext
3	(m)	OpsService	FSM-GetContext
4	(o)	OpsService	FSM-GetTopology
5	(o)	OpsService	FSM-InformTopology
6	(o)	OpsService	FSM-ChangeAddress
7	(m)	OpsService	FSM-Start

804 **6.3.1.2.2 FieldbusSystemManager class attribute definition**

805 **6.3.1.2.2.1 Numeric Identifier**

806 This attribute is one of the common FAL attributes. See IEC 61158-1, 9.7.

807 **6.3.1.2.2.2 Name**

808 This attribute is one of the common FAL attributes. See IEC 61158-1, 9.7.

809 **6.3.1.2.2.3 User Description**

810 This attribute is one of the common FAL attributes. See IEC 61158-1, 9.7.

811 **6.3.1.2.2.4 Object Revision**

812 This attribute one of the common FAL attributes. See IEC 61158-1, 9.7.

6.3.1.2.2.5 SAPID

This attribute contains a code that a user specifies and identifies this object to get the service. It is unique within the system and allocated by system management at the instantiation of the object.

6.3.1.2.2.6 State

This attribute contains a state number of a state machine APC SM (see IEC 61158-6-27, Clause 7), which is the main function of this object.

6.3.1.2.2.7 APTYPE

This attribute contains a code of the AP type (see 6.2) the device belongs to,

- 1 : master;
- 2 : slave.

6.3.1.2.2.8 CONTEXT-DATA

This attribute contains a various system configuration data input that are inputted by a user, configuration information detected in the network directly, system condition at run-time, and so on. The detailed specification and data structure depend on the implementation.

The configuration of data to be set for this attribute, Communication Data Object (CDO), is as described below.

CDO consists of the following two types of objects (see Figure 2).

- Node object;
- Module object.

Node object is an object unique (common) to the node such as communication parameter in the node. Module object is an individual object for module (servo, I/O, etc.) to be implemented to the node.

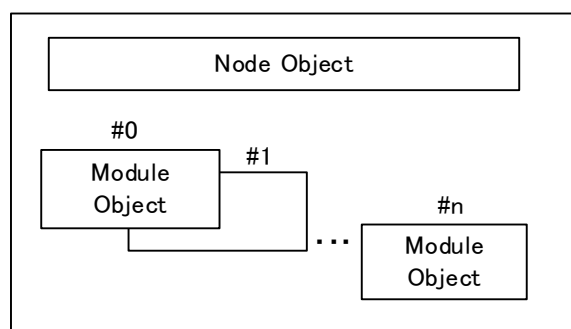


Figure 2 – CDO(Communication Data Object)

For a single-axis node, one module object is implemented for the slave. For a node consolidating multiple axes, module objects for the number of axes to be implemented are implemented.

CDO is implemented as a resource to set the operation condition such as transmission cycle with the remote node and to refer to the node state. Access is made by designating the

address. Some CDOs can handle local objects to be described later. As the common specification of CDO, the value 0 shall mean unsupported or not set.

Overall structure of CDO is as shown in Table 3.

Table 3 – Overall structure of CDO

CDO Address	Description
'0000'H to '41FF'H	Node object
'5000'H to '9FFF'H	Module object (0 to 127)

There are node object categories as shown in Table 4.

Table 4 – Node object categories

CDO Address	Category	Access type
'0000'H to '001F'H	Object information	R (read only)
'0020'H to '002F'H	Object status	R (read only)
'0030'H to '003F'H	Control	R/W (read /write allowed)
'0040'H to '41FF'H	Configuration	R/W (read / write allowed)

There is a module object category as shown in Table 5.

Table 5 – Module object category

CDO Address	Category	Access type
'5000'H to '9FFF'H	Configuration	R/W (read /write allowed)

Details of node objects are as shown from Table 6 to Table 9, and details of module objects are as shown in Table 10. The following tables are described with LSB first.

Table 6 – List of node objects (object information)

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
'0000'H	Protocol version	Unsigned32		0	R		M	M
'0004'H	Reserve	Unsigned8		0	R		M	M
'0005'H	Type	Unsigned4		1: Master 2: Slave	R		M	M
'0005'H	Sync master capability	Unsigned1		0: Unsupported, 1: Supportable a)	R		M	M
'0005'H	Reserve	Unsigned3		0				
'0006'H	Reserve	Unsigned8		0				
'0007'H	Number of implementation ports	Unsigned8		1 to 2	R		M	M
'0008'H	Port 0 attribute	Unsigned2		0: Unimplemented, 1: Implemented, Other: Not used	R		M	M
'0008'H	Port 1 attribute	Unsigned2		The same as Port 0 attribute	R		M	M
...					R			
'0008'H	Port 3 attribute	Unsigned2		The same as Port	R		M	M

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
				0 attribute				
'0009'H	Port 4 attribute	Unsigned2		The same as Port 0 attribute	R		M	M
...					R			
'000B'H	Port 15 attribute	Unsigned2		The same as Port 0 attribute	R		M	M
'000C'H	local MAC address	Unsigned48		b)	R	V(MAC)	M	M
'0012'H	Chip information	Unsigned16		Implementation dependent	R		O	O
'0014'H	transmission cycle lower limit	Unsigned32	ns	16 250 to 80 000 000	R		M	M
'0018'H	transmission cycle lower limit	Unsigned32	ns	16 250 to 80 000 000	R		M	M
'001C'H	Chip ID	Unsigned32		ASCII code4 characters High-order 3characters: Chip type Low-order 1character: Chip version	R		M	M
M: Mandatory, O: Optional, C: Conditional, Blank: Without implementation								
a) When this can be supported, it shall have both the primary and secondary sync master abilities.								
b) In accordance with the rules of IEEE802-2001: Clause9.								

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Table 7 – List of node objects (object status)

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
'0020'H	FSMUL status	Unsigned8		FSMUL status number	R	V(Nd1sts)	M	M
'0021'H to '0023'H	Reserve	Unsigned24		0			M	M
'0024'H	Error status	Unsigned32		0: No error, Other than 0: error detected	R		M	M
'0028'H	Port 0 status	Unsigned2		0: Not connected, 1: M-4 supported device connected, 2: M-4 unsupported device connected, 3: Reserve	R	V(P0sts)	M	M
'0028'H	Port 1 status	Unsigned2		The same as Port 0 status	R	V(P1sts)	M	M
...								
'0028'H	Port 3 status	Unsigned2		The same as Port 0 status	R	V(P3sts)	M	M
'0029'H	Port 4 status	Unsigned2		The same as Port 0 status	R	V(P4sts)	M	M
...								
'002B'H	Port 15 status	Unsigned2		The same as Port	R	V(P15st	M	M

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
				0 status		s)		
'002C'H to '002F'H	Reserve			0				
M: Mandatory, O: Optional, C: Conditional, Blank: Without implementation								

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Table 8 – List of node objects (control)

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
'0030'H	Repeat transfer permission	Unsigned1		0: Ignore, 1: Permit	W		M	M
'0030'H	Control data exchange: Start	Unsigned1		0: Ignore, 1: Start	W		M	M
'0030'H	Control data exchange: Stop	Unsigned1		0: Ignore, 1: Stop	W		M	M
'0030'H	Event driven communication permission	Unsigned1		0: Ignore, 1: Permit	W		M	M
'0030'H	Event driven communication: Stop	Unsigned1		0: Ignore, 1: Stop	W		M	M
'0030'H	Reserve	Unsigned2		0				
'0030'H	FSMUL reset	Unsigned1		0: Ignore, 1: FSMUL reset	W		M	M
'0031'H to '003F'H	Reserve			0				
M: Mandatory, O: Optional, C: Conditional, Blank: Without implementation								
Note: As for the FSMUL control write response, the response shall be returned after the contents of control have been completed. For example, in the case that the repeat transfer permission has been rewritten, the response shall be sent when the transfer method switching process has been completed.								

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Table 9 – List of node objects (configuration)

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
'0040'H	Local station address	Unsigned16		'0001'H to 'FFEF'H	R/W	V(MA)	M	M
'0042'H	Number of control domains: belonging	Unsigned8		1 to 4	R/W	V(Nbdom)	O	M
'0043'H	Number of control domains: managing	Unsigned8		1 to 4	R/W	V(Nmdom)	M	
'0044'H	Transmission delay from the sync master to local station	Unsigned32	ns	0 to 40 000 000	R/W	V(Tdly)	M	M
'0048'H	Transmission delay from the secondary sync master	Unsigned32	ns	0 to 40 000 000	R/W	V(Tdly2)	O	O
'004C'H to '004F'H	Reserve			0			M	M



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Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
'0050'H	Transmission cycle	Unsigned32	ns	15 625 to 64 000 000	R/W	V(Tcycle)	M	M
'0054'H	Sync band width	Unsigned32	ns	0 to 4 000 000	R/W	V(Tsync_w)	M	M
'0058'H	Reserve	Unsigned32	ns	0	R		M	M
'005C'H	IP transmission band width	Unsigned32	ns	0 to 63 999 999	R/W	V(Tip_w)	M	M
'0060'H	Control band width	Unsigned32	ns	0 to 63 999 999	R/W	V(Tctrl_w)	O	O
'0064'H	MAC address of the band master	Unsigned48		a)	R/W	V(MACbm)	M	M
'006A'H	Node address of the band master	Unsigned16		'0001'H to 'FFEF'H	R/W	V(MAbm)	M	M
'006C'H	MAC address of the sync master	Unsigned48		a)	R/W	V(MACsm)	M	M
'0072'H	Node address of the sync master	Unsigned16		'0001'H to 'FFEF'H	R/W	V(MAsm)	M	M
'0074'H	Multicast address common to all the control domains	Unsigned48		a)	R/W	V(MACmlt0)	M	M
'007A'H	Node address of the secondary sync master	Unsigned16		'0001'H to 'FFEF'H	R/W	V(MAsm2)	M	M
'007C'H	Transmission stop count	Unsigned8		3 to 10	R/W	V(Nstop_tx)	M	M
'007D'H	Reserve			0	R		M	M
'007E'H	Guard band width	Unsigned16	ns	'0 to 10 000	R/W	V(Tguard_w)	M	M
'0080'H	MAC address for the multicast: which belongs to the control domain 1	Unsigned48		a)	R/W	V(MACmlt_s1)	C	M
'0086'H	Node address of the master: which belongs to the control domain 1	Unsigned16		'0001'H to 'FFEF'H	R/W	V(MAms_t_s1)	C	M
'0088'H	Slave control data transmission time: which belongs to the control domain 1 (offset time from the control domain starting time)	Unsigned32	us	0 to 63 999 999	R/W	V(Ttxio_s1)	C	M
'008C'H	Control domain starting time: which belongs to the control domain 1	Unsigned32	us	0 to 63 999 999	R/W	V(Tdom_st_s1)	C	M
'0090'H	Control domain band width (time retained) :which belongs to the control domain 1	Unsigned32	us	0 to 63 999 999	R/W	V(Tdom_w_s1)	C	M
'0094'H	Reserve			0	R		M	M

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
to '0097'H								
'0098'H	Message length (data part): which belongs to the control domain 1	Unsigned16		0 to 1 490	R/W	V(Lmsg_s1)	O	M
'009A'H	Validity of Upstream input data transmission: which belongs to the control domain 1	Unsigned1		0:Upstream setting Invalid 1:Upstream setting Valid	R/W	V(TXup_s1)	C	M
'009A'H	Reserve	Unsigned7		0	R		M	M
'009B'H	Reserve	Unsigned8		0	R		M	M
'009C'H	Sync timing (offset time from the control domain starting time): which belongs to the control domain 1	Unsigned32		0 to 63 999 999	R/W	V(Tslv_sync_s1)	C	M
'00A0'H to '00AF'H	Reserve			0	R		M	M
'00B0'H	Local node (node 0) information of the control domain 1 which belongs: node address	Unsigned16	octet	'0001'H to 'FFEF'H	R/W	V(MA_n0_s1)	C	M
'00B2'H	Reserve			0	R		M	M
'00B4'H	Local node (node 0) information of the control domain 1 which belongs: Exponent of division ratio	Unsigned3		0 to 5	R/W	V(Ntcyc_dev_n0_s1)	C	M
'00B4'H	Reserve	Unsigned5		0	R		M	M
'00B5'H	Local node (node 0) information of the control domain 1 which belongs: Transmission cycle including the sync point (Valid when the division ratio >1)	Unsigned8		0 to (Division ratio - 1)	R/W	V(Ntcyc_num_n0_s1)	C	M
'00B6'H	Local node (node 0) information of the control domain 1 which belongs : Upstream port	Unsigned4		0 to 15	R/W	V(Nup_port_n0_s1)	C	M
'00B6'H	Local node (node 0) information of the control domain 1 which belongs : Control domain end node	Unsigned1		0: Not an domain end, 1: domain End	R/W	V(Fdom_end_n0_s1)	C	M

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
'00B6'H	Reserve			0	R		M	M
'00B7'H	Local node (node 0) information of the control domain 1 which belongs: Number of module objects within the node	Unsigned8		0 to 127	R/W	V(Ndev_num_n0_s1)	C	M
'00B8'H to '00BF'H	Reserve			0		R	M	M
'00C0'H to '00CF'H	Other node (node1) information of the control domain 1 which belongs (the same as '00B0'H to '00BF'H) '00B0'H to '00BF'H)				R/W	V(**_n1_s1)	C	C
'00D0'H to '00DF'H	Other node (station2) information of the control domain 1 which belongs (the same as '00B0'H to '00BF'H)				R/W	V(**_n2_s1)	C	C
...								
'08A0'H to '08AF'H	Other node (node127) information of the control domain 1 which belongs (the same as '00B0'H to '00BF'H)				R/W	V(**_n127_s1)	C	C
'08B0'H to '10DF'H	Item about the control domain 2 which belongs (the same as '0080'H to '08AF'H)				R/W	V(**_n1_s2) to V(**_n127_s2)		C
'10E0'H to '190F'H	Item about the control domain 3 which belongs (the same as '0080'H to '08AF'H)				R/W	V(**_n1_s3) to V(**_n127_s3)		C
'1910'H to '213F'H	Item about the control domain 4 which belongs (the same as '0080'H to '08AF'H)				R/W	V(**_n1_s4) to V(**_n127_s4)		C
'2140'H to '21FF'H	Reserve			0	R		M	M
'2200'H	MAC address for multicast of control domain 1 which manages	Unsigned48		a)	R/W	V(MACmlt_m1)	M	
'2206'H	Master node	Unsigned16		'0001'H to	R/W	V(MAms	M	

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
	address of control domain 1 which manages			'FFEF'H		t_m1)		
'2208'H	Slave control data transmission timing in the control domain which manages (offset time from the control domain start time)	Unsigned32		0 to 63 999 999	R/W	V(Ttxio_m1)	M	
'220C'H	Control domain start time in control domain 1 which manages	Unsigned32		0 to 63 999 999	R/W	V(Tdom_st_m1)	M	
'2210'H	Control domain band width (time retained) in control domain 1 which manages	Unsigned32		0 to 63 999 999	R/W	V(Tdom_w_m1)	M	
'2214'H to '2217'H	Reserve			0	R		M	M
'2218'H	Message packet length (data part) in the control domain 1 which manages	Unsigned16		0 to 1 490	R/W	V(Lmsg_m1)	O	
'221A'H	Upstream only input data transmission in the control domain 1 which manages	Unsigned1		0:Upstream setting Invalid 1:Upstream setting Valid	R/W	V(TXup_m1)	M	
'221A'H	Reserve	Unsigned7		0	R		M	M
'221B'H	Reserve	Unsigned8		0	R		M	M
'221C'H	Slave sync timing (offset time from control domain start time) in control domain 1 which manages	Unsigned32	ns	0 to 63 999 999	R/W	V(Tslv_sync_m1)	M	
'2220'H	Sync timing (offset time from control domain start time) in control domain 1 which manages	Unsigned32	ns	0 to 63 999 999	R/W	V(Tmst_sync_m1)	M	
'2224'H	Number of nodes in control domain 1 which manages	Unsigned8		1 to 127	R/W	V(Nnode_m1)	M	
'2225'H	Number of output data transmission times in control domain 1 which manages	Unsigned8		1 to 4	R/W	V(Nout_m1)	O	
'2226'H	Number of maximum retransmission request times in control domain 1 which manages	Unsigned8		0 to 127	R/W	V(Nretry_m1)	O	

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
'2227'H	Number of retry nodes in the control domain 1 which manages	Unsigned8		0 to 127	R/W	V(Nretry_node_m1)	O	
'2228'H	Port 0 downstream setting in the control domain 1 which manages	Unsigned1		0: Downstream setting Invalid 1:Downstream setting Valid	R/W	V(Ftx_down0_m1)	M	
'2228'H	Port 1 downstream setting in the control domain 1 which manages	Unsigned1		0: Downstream Invalid 1:Downstream Valid	R/W	V(Ftx_down1_m1)	M	
...								
'2229'H	Port 15 downstream setting in control domain 1 which manages	Unsigned1		0: Downstream Invalid 1:Downstream Valid	R/W	V(Ftx_down15_m1)	M	
'222A'H	Master control domain end setting in the control domain 1 which manages	Unsigned1		0: Not an domain end, 1: domain End	R/W	V(Fdom_end_mst_m1)	M	
'222B'H	Reserve			0	R		M	M
'222C'H	Input/output data transmission band width in the control domain #1 which manages	Unsigned32	ns	0 to 63 999 999	R/W	V(Tio_w)	M	
'2230'H	Input data resend band width in the control domain #1 which manages	Unsigned32	ns	0 to 63 999 999	R/W	V(Tretry_w)	M	
'2234'H to '223F'H	Reserve			0	R		M	M
'2240'H	Node 0 information of the control domain 1 which manages: Node address	Unsigned16	octet	'0001'H to 'FFEF'H	R/W	V(MA_n0_m1)	M	
'2242'H	Reserve			0	R		M	M
'2243'H	Reserve			0	R		M	M
'2244'H	Node 0 information of the control domain 1 which manages: Small division ratio	Unsigned3		0 to 5	R/W	V(Ntcyc_dev_n0_m1)	M	
'2244'H	Reserve			0	R		M	M
'2245'H	node 0 information of the control domain 1 which manages: Transmission cycle including the sync point (valid when the division ratio >1)	Unsigned8		0 to (division ratio - 1)	R/W	V(Ntcyc_num_n0_m1)	M	
'2246'H	node 0 information of the control domain 1 which manages:	Unsigned4		0 to 15	R/W	V(Nup_port_n0_m1)	M	

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
	Upstream port							
'2246'H	node 0 information of the control domain 1 which manages: Control domain end node	Unsigned1		0: Not an domain end, 1: domain End	R/W	V(Fdom_end_n0_m1)	M	
'2246'H	Reserve			0	R		M	M
'2247'H	Node 0 information of the control domain 1 which manages: Number of module objects within the node	Unsigned8		0 to 127	R/W	V(Ndev_num_n0_m1)	M	
'2248'H	Node 0 information of the control domain 1 which manages: Transmission delay from the sync master	Unsigned32	ns	0 to 40 000 000	R/W	V(Tsmdly_n0_m1)	M	
'224C'H	Node 0 information of the control domain 1 which manages: Transmission delay from the master	Unsigned32	ns	0 to 40 000 000	R/W	V(Tmstdly_n0_m1)	M	
'2250'H to '225F'H	Node 1 information of the control domain 1 which manages (the same as '2240'H to '224F'H)					V(**_n1_m1)	C	
'2260'H to '226F'H	Node 2 information of the control domain 1 which manages (the same as '2240'H to '224F'H)					V(**_n2_m1)	C	
...								
'2A30'H to '2A3F'H	node 127 information of the control domain 1 which manages (the same as '2240'H to '224F'H)				R/W	V(**_n127_m1)	C	
'2A40'H to '327F'H	Item concerning the control domain 2 which manages (the same as '2200'H to '2A3F'H)				R/W	V(**_n1_m2) to V(**_n127_m2)	C	
'3280'H to '3ABF'H	Item concerning the control domain 3 which manages (the same as '2200'H to '2A3F'H)				R/W	V(**_n1_m3) to V(**_n127_m3)	C	
'3AC0'H to '42FF'H	Item concerning the control domain 3 which manages (the same as '2200'H to '2A3F'H)				R/W	V(**_n1_m4) to V(**_n127_m4)	C	

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
'4300'H to '4FFF'H	Reserve			0	R		M	M
M: Mandatory, O: Optional, C: Conditional, Blank: Without implementation								
a) In accordance with the rules of IEEE802-2001: Clause 9.								

858

Table 10 – List of module objects (configuration)

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
Module object of the control domain 1 which belongs								
'5000'H	Node address which belongs to the module 0	Unsigned16		'0001'H to 'FFEF'H	R/W	V(MA_d0_s1)	C	M
'5002'H	Module 0 input data length	Unsigned16		0 to 8 192	R/W	V(Lin_d0_s1)	C	M
'5004'H	Module 0 output data length	Unsigned16		0 to 8 192	R/W	V(Lout_d0_s1)	C	M
'5006'H	Offset of the module 0 input data	Unsigned16		0 to 8 192	R/W	V(Lin_ofst_d0_s1)	C	M
'5008'H	Offset of the module 0 output data	Unsigned16		0 to 8 192	R/W	V(Lout_ofst_d0_s1)	C	M
'500A'H to '500F'H	Reserve			0	R		M	M
'5010'H to '501F'H	Module object of the module 1 (the same as '5000'H to '500F'H)					V(**_d1_s1)	C	C
...								
'57F0'H to '57FF'H	Module object of the module 127 (the same as '5000'H to '500F'H)					V(**_d12_7_s1)	C	C
Module object of the control domain 2 which belongs								
'5800 to '5FFF	(the same as '5000'H to '57FF'H)					V(**_d1_s2) to V(**_d12_7_s2)	C	C
Module object of the control domain 3 which belongs								
'6000 to '67FF	(the same as '5000'H to '57FF'H)					V(**_d1_s3) to V(**_d12_7_s3)	C	C
Module object of the control domain 4 which belongs								
'6800 to '6FFF	(the same as '5000'H to '57FF'H)					V(**_d1_s4) to V(**_d12_7_s4)	C	C

Offset Address	Name	Size	Unit	Range	Access Type	Related variable	Implementation level	
							Master	Slave
'7000 to '7FFF	Reserve			0	R		M	M
Module object of the control domain 1 which manages								
'8000 to '87FF	(the same as '5000'H to '57FF'H)					V(**_d1_m1) to V(**_d12_7_m1)	M	
Module object of the control domain 2 which manages								
'8800 to '8FFF	(the same as '5000'H to '57FF'H)					V(**_d1_m2) to V(**_d12_7_m2)	C	
Module object of the control domain 3 which manages								
'9000 to '97FF	(the same as '5000'H to '57FF'H)					V(**_d1_m3) to V(**_d12_7_m3)	C	
Module object of the control domain 4 which manages								
'9800 to '9FFF	(the same as '5000'H to '57FF'H)					V(**_d1_m4) to V(**_d12_7_m4)	C	
'A000 to 'FFFF	Reserve							
M: Mandatory, O: Optional, C: Conditional, Blank: without implementation								

6.3.1.2.3 FieldbusSystemManager class service definition

6.3.1.2.3.1 FSM-Reset

This service is used to disable the all objects of ASEs in the device through each <s>-Reset service, and to reset the state of the APCSM.

Table 11 shows the parameter of the service.

Table 11 – FSM-Reset

Parameter name	Req
Argument	

Argument

In this service there are no specific parameters.

6.3.1.2.3.2 FSM-GetStatus

This service is used to get the status of the system, error, and etc. The kind of the status that can be acquired depends on implementation.

Table 12 shows the parameter of the service.

870

Table 12 – FSM-GetStatus

Parameter name	Req	Cnf
Argument	M	
INFO-ID	M	
Result (+)		S
Service status		M
INFO-ID		M
INFO-DATA		M
Result (-)		S
Service status		M

871

Argument

The argument contains the parameters of the service request.

INFO-ID

This parameter is the local identifier to specify the desired status data. The contents of the status that can be acquired depend on the real system implementation.

Result(+)

This selection type parameter indicates that the service request succeeded.

Service status

This parameter indicates success.

INFO-ID

This parameter is the local identifier for the desired status. The kind of the status that can be acquired depends on the implementation.

INFO-DATA

This parameter is the status of the system, error, and so on.

Result (-)

This selection type parameter indicates that the service request failed.

Service status

This parameter indicates an following error:

- service not supported.

872

6.3.1.2.3.3 FSM-SetContext

873

This service is used to set CONTEXT-DATA, which is the attribute of FieldbusSystemManager in its own node or in other nodes.

874

875

The information of the communication parameter etc. is included in CONTEXT-DATA, and delivered to all the objects of ASEs in the device through each <s>-Open service. The lower layers are also initialized with this information.

876

877

878

The detail specification of the information depends on the real system implementation.

879

Table 13 shows the parameter of the service.

880

Table 13 – FSM-SetContext

Parameter name	Req	Cnf
Argument	M	
CONTEXT-DATA	M	
DPID	M	
Result (+)		S
Service status		M
CONTEXT-DATA		M
Result (-)		S
Service status		M

881

Argument

The argument contains the parameters of the service request.

CONTEXT-DATA

This parameter contains the device type or model, the communication mode, the system configuration, the communication cycle, the transmission speed, the communication data length, the timer parameter, and the lower layer parameter, and etc. The detail specification of the information depends on the real system implementation.

See 6.3.1.2.2.8. for details of this parameter.

NOTE It is also called "System Management Information Base (SMIB)".

DPID

This parameter is the local/remote identifier for the destination AP or the corresponding local/remote FAL user.

Result(+)

This selection type parameter indicates that the service request succeeded.

Service status

This parameter indicates success.

CONTEXT-DATA

This parameter is read back of the result of the set CONTEXT-DATA.

Result (-)

This selection type parameter indicates that the service request failed.

Service status

This parameter indicates an following error:

- Service not supported.

882 **6.3.1.2.3.4 FSM-GetContext**

883 This service is used to get CONTEXT-DATA, which are the attributes of
884 FieldbusSystemManager in its own node or in other nodes.

885 Table 14 shows the parameter of the service.

886

Table 14 – FSM-GetContext

Parameter name	Req	Cnf
Argument		
DPID		
Result (+)		S
Service status		M
CONTEXT-DATA		M
Result (-)		S
Service status		M

887

Argument

In this service there are no specific parameters for request.

Result(+)

This selection type parameter indicates that the service request succeeded.

Service status

This parameter indicates success.

CONTEXT-DATA

This parameter contains the device type or model, the communication mode, the system configuration, the communication cycle, the transmission speed, the communication data length, the timer parameter, and the lower layer parameter, and etc.

See 6.3.1.2.2.8. for details of this parameter.

DPID

This parameter is the local/remote identifier for the destination AP or the corresponding local/remote FAL user.

Result (-)

This selection type parameter indicates that the service request failed.

Service status

This parameter indicates an following error:

- Service not supported.

888 **6.3.1.2.3.5 FSM-GetTopology**

889 This service is used to read the topology information stored in the master node. This service
890 is used only in the master node.

891 By executing FSMUL-DETECT, which is the service of FSMUL as the internal class of FSM, in
892 the master with the band master function allocated, the connected node information is
893 collected (See 6.3.1.3.1.6). The topology information is configured based on this connected
894 node information.

895 The topology information can be notified from the band master to other masters through the
896 FSM-InfoTopology service. In the master with the notified topology information, the
897 topology information can be read by the FSM-GetTopology service.

898 Table 15 shows the parameter of the service.

899

Table 15 – FSM-GetTopology

Parameter name	Req	Cnf
Argument		
Result (+)		S
Service status		M
Topology Information		M
Result (-)		S
Service status		M

900

Argument

In this service there are no specific parameters for request.

Result(+)

This selection type parameter indicates that the service request succeeded.

Service status

This parameter indicates success.

Topology information

This parameter contains address information of each node, delay time from the sync master and neighbouring node information of each port (MAC address of neighbouring nodes).

Result (-)

This selection type parameter indicates that the service request failed.

Service status

This parameter indicates an following error:

- There is no topology information
- Service not supported.

901 **6.3.1.2.3.6 FSM-InformTopology**

902 This service is used to notify the topology information to the master node. This service is used
903 only in the node with the band master function allocated.

904 By using this service in the band master, an asynchronous notification (neighbouring node list
905 notification) will be sent to the designated master node.

906 Table 16 shows the parameter of the service.

907

Table 16 – FSM-InformTopology

Parameter name	Req	Cnf
Argument		
DPID	M	
Result (+)		S
Service status		M
Result (-)		S

Parameter name	Req	Cnf
Service status		M

908

Argument

In this service there are no specific parameters for request.

DPID

This parameter is the remote identifier for the destination AP or the corresponding remote FAL user.

Result(+)

This selection type parameter indicates that the service request succeeded.

Service status

This parameter indicates success.

Result (-)

This selection type parameter indicates that the service request failed.

Service status

This parameter indicates an following error:

- There is no topology information
- Service not supported.

909 6.3.1.2.3.7 FSM-ChangeAddress

910 This service is used to set the node address to a node, where node address is not set or has
911 a wrong value, via the network from the band master. This service is used only in the node
912 with the band master function allocated.

913 By executing FSMUL-DETECT which is the service of FSMUL as the internal class of FSM, in
914 the master with the band master function allocated, the connected node information is
915 collected (See 6.3.1.3.1.6).

916 Based on this connected node information, the node address and the MAC address of nodes
917 connected are checked, and in the case that setting is required, the FSM-ChangeAddress
918 service is used to designate the MAC address and the node address of the destination node
919 and change the node address.

920 Table 17 shows the parameter of the service.

921 **Table 17 – FSM-ChangeAddress**

Parameter name	Req	Cnf
Argument		
Destination MAC address	M	
New node address	M	
Result (+)		S
Service status		M
Result (-)		S
Service status		M

922

Argument

In this service there are no specific parameters for request.

Destination MAC address

This parameter indicates the MAC address to designate the node address change target node.

New node address

This parameter indicates the node address after executing the change to set to the node designated by Destination MAC address described above.

Result(+)

This selection type parameter indicates that the service request succeeded.

Service status

This parameter indicates success.

Result (-)

This selection type parameter indicates that the service request failed.

Service status

This parameter indicates an following error:

- Service not supported.

6.3.1.2.3.8 FSM-Start

This service is used to activate the every ASE in the node, and the lower layer

All objects of ASEs in the device are enabled through each <s>-Enable service. The lower layers are also activated with appropriate service, which depends on the real system implementation.

Table 18 shows the parameter of the service.

Table 18 – FSM-Start

Parameter name	Req	Cnf
Argument		

Argument

In this service there are no specific parameters.

6.3.1.3 FieldBusSysmteManagerUnderLayer class specification**6.3.1.3.1 Overview****6.3.1.3.1.1 General**

FieldBusSystemManagerUnderLayer class is a class under FieldBusSystemManager.

FSMUL provides the following services to the FSMS- user:

- FSMUL-RESET;
- FSMUL-SET-VALUE;
- FSMUL-GET-VALUE;

- 939 – FSMUL-START-NET;
- 940 – FSMUL-DETECT;
- 941 – FSMUL-RECOG;
- 942 – FSMUL-SW-TRANS-MODE;
- 943 – FSMUL-MEAS-DELAY;
- 944 – FSMUL-SW-EVD;
- 945 – FSMUL-CONFIG;
- 946 – FSMUL-START-SYNC;
- 947 – FSMUL-CLR-ERR;
- 948 – FSMUL-EVENT.

949 **6.3.1.3.1.2 FSMUL-RESET**

950 The FSMS-user employs this service to reset AE. A reset is equivalent to power on. The
951 FSMS-user receives a confirmation that is issued immediately by AE.

952 **6.3.1.3.1.3 FSMUL-SET-VALUE**

953 The FSMS-user employs this service to assign new value to the parameters of the AE. The
954 FSMS-user receives a confirmation whether the specified parameters have been set to the
955 new value.

956 **6.3.1.3.1.4 FSMUL-GET-VALUE**

957 The FSMS-user employs this service to read the value of parameters of the AE. FSMS-user
958 receives a confirmation that contains the current value of the specified parameter.

959 **6.3.1.3.1.5 FSMUL-START-NET**

960 The FSMS-user employs this service to notify the MAC address of its own node to the
961 neighbouring nodes.

962 The FSMS-user receives a confirmation that is issued immediately by AE.

963 **6.3.1.3.1.6 FSMUL-DETECT**

964 The FSMS-user employs this service to collect the information of connected nodes. This
965 service is used only in the node with the band master function allocated.

966 **6.3.1.3.1.7 FSMUL-RECOG**

967 The FSMS-user employs this service to recognize the connection information based on the
968 node information collected by FSMUL-DETECT.

969 **6.3.1.3.1.8 FSUMUL-SW-TRANS-MODE**

970 The FSMS-user employs this service to switch the transfer mode of each node from store and
971 forward to cut-through. This service is used only in the node with the band master function
972 allocated.

973 **6.3.1.3.1.9 FSMUL-MEAS-DELAY**

974 The FSMS-user employs this service to measure the transmission delay between nodes. For
975 example, this is used to measure the transmission delay time from the sync master in the
976 node other than the node which is allocated as the sync master. Also, this is used in the

977 domain master to measure the transmission delay time from the nodes managed by the
978 domain master itself.

979 **6.3.1.3.1.10 FSMUL-SW-EVD**

980 The FSMS-user employs this service to notify the event driven communication start/end. This
981 service is used only in the node with the band master function allocated.

982 **6.3.1.3.1.11 FSMUL-CONFIG**

983 The FSMS-user employs this service in the node allocated as the band master to switch to the
984 status for executing CDO setting before the start of cyclic communication. This service is
985 used only in the node with the band master function allocated.

986 **6.3.1.3.1.12 FSMUL-START-SYNC**

987 The FSMS-user employs this service to notify the cyclic communication start and start the
988 cyclic communication. This service is used only in the node with the band master function
989 allocated.

990 **6.3.1.3.1.13 FSMUL-CLR-ERR**

991 The FSMS-user employs this service to clear the error status of the AE. FSMS-user passes
992 FSMUL-CLR-ERR request primitive to FSMUL to clear the error status of AE. FSMUL passes
993 the confirm primitive to the CTC-user to indicate the success or failure of the corresponding
994 service.

995 **6.3.1.3.1.14 FSUML-EVENT**

996 FSMUL employs this service to inform the FSMS-user about certain events or errors in the AL.

997 **6.3.1.3.2 Detailed specification of services and interactions**

998 **6.3.1.3.2.1 FSMUL-RESET**

999 The FSMS-user passes a FSMUL-RESET request primitive to FSMUL to reset the AE. After
1000 receipt of FSMUL-RESET request primitive FSMUL issues the confirm primitive to the FSMS-
1001 user immediately and then issues the reset request to all sub layers and resets itself.

1002 Table 19 indicates the primitives and parameters of this service.

1003 **Table 19 – FSMUL-RESET**

Parameter name	Req
Argument	

1004

Argument

In this service there are no specific parameters.

1005 **6.3.1.3.2.2 FSMUL-SET-VALUE**

1006 The FSMS-user uses this service to assign the new value of variables of the AE.

1007 The FSMS-user passes a FSMUL-SET-VALUE request primitive to FSMUL to assign a
1008 desired value to one or more specified variables of the AE. After receipt of FSMUL SET

1009 VALUE request primitive, DL-management selects the specified variables and sets the new
1010 values. If the requested service was executed, FSMUL passes a FSMUL-SET-VALUE confirm
1011 primitive to the FSMS-user to indicate the success or failure of the corresponding service
1012 request.

1013 Table 20 indicates the primitives and parameters of this service.

1014 **Table 20 – FSMUL-SET-VALUE**

Parameter name	Req	Cnf
Argument		
Var_ID	M	
Val	M	
Result (+)		S
Result		M
Result (-)		S
Result		M

1015

Argument

The argument contains the parameters of the service request.

Var_ID

This variable is used to specify the parameter in the CDO when requesting reading or writing of the parameter in the CDO. Set the CDO offset address to this variable. See 6.3.1.2.2.8 for details of CDO.

Val

For this variable, set the value to write to the parameter in the CDO, which is specified by Var_ID described above.

Result(+)

This selection type parameter indicates that the service request succeeded.

Result

OK: The write data function was carried out successfully

Result (-)

This selection type parameter indicates that the service request failed.

Result

NG: The write data function was not carried out successfully

1016 **6.3.1.3.2.3 FSMUL-GET-VALUE**

1017 The FSMS-user uses this service to read the variables of the AE. The FSMS-user passes a
1018 FSMUL-GET-VALUE request primitive to FSMUL to read the current value of one or more
1019 specified variables of the AE. After receipt of FSMUL-GET-VALUE request primitive, FSMUL
1020 selects the specified variables and gets their current values. And then FSMUL passes a
1021 FSMUL-GET-VALUE confirm primitive to the FSMS-user to deliver the current value and to
1022 indicate the success or failure of the corresponding service request. This primitive returns as
1023 a variable one or more of the requested variable values.

1024 Table 21 indicates the primitives and parameters of this service.

1025

Table 21 – FSMUL-GET-VALUE

Parameter name	Req	Cnf
Argument	M	
Var_ID		
Result (+)		S
Result		M
Var		M
Result (-)		S
Result		M

1026

Argument

The argument contains the parameters of the service request.

Var_ID

This variable is used to specify the parameter in the CDO when requesting reading or writing of the parameter in the CDO. Set the CDO offset address to this variable. See 6.3.1.2.2.8 for details of CDO.

Result(+)

This selection type parameter indicates that the service request succeeded.

Result

OK: The write data function was carried out successfully

Val

This variable is the value read for the parameter in the CDO, which is specified by Var_ID described above.

Result (-)

This selection type parameter indicates that the service request failed.

Result

NG: The write data function was not carried out successfully

1027

6.3.1.3.2.4 FSMUL-START-NET

1028 The FSMS-user employs this service to notify the MAC address of its own node to the
 1029 neighbouring nodes. Once the FSMS-user passes the FSMUL-START-NET request primitive
 1030 to the FSMUL, all the ports in its own node start sending of neighbouring node notification and
 1031 continue to periodically send from thereon. The sending intervals shall be 200 ms or less
 1032 (recommended).

1033 The nodes that received the neighbouring node notification manage and store the source
 1034 MAC address stored in the neighbouring node notification for each port that received in the
 1035 AE.

1036 Table 22 indicates the primitives and parameters of this service.

1037

Table 22 – FSMUL-START-NET

Parameter name	Req	Cnf
Argument		
Result (+)		S
Result		M
Result (-)		S