

## TECHNICAL REPORT

### Comprehensive Semantic Model for Energy Management

#### COSEM Interface Classes

DLMS UA 1000-1 Ed. **17** Part 2

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Excerpts

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### Status of standardisation

The contents of this edition is the basis of future revisions to:

- IEC 62056-6-2, Electricity Metering Data Exchange – The DLMS/COSEM suite – Part 6-2: COSEM interface classes.

### Revision history

| Version                       | Date                            | Author  | Comment                                                                                                                                                                                                                     |
|-------------------------------|---------------------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Release 1                     | 01 April 1998                   | DLMS UA | Initial version                                                                                                                                                                                                             |
| First Edition                 | 12 Nov. 1998                    | DLMS UA | Considering comments received after R1                                                                                                                                                                                      |
| Second Edition                | 03 May 1999                     | DLMS UA | Major rework, classes and associations added                                                                                                                                                                                |
| Third Edition                 | 29 Feb. 2000                    | DLMS UA | Major rework, adapted to CDVs of IEC TC13, OBIS added                                                                                                                                                                       |
| Fourth Edition                | 25 March 2001                   | DLMS UA | Considering comments to CDVs by IEC National Committees                                                                                                                                                                     |
| Fifth Edition                 | 05 March 2002                   | DLMS UA | Content adapted to IEC International Standards                                                                                                                                                                              |
| Sixth Edition                 | 16th August 2004                | DLMS UA | Content adapted to draft IEC 62056-61 Edition 2, draft IEC 62056-62 (CD versions) and EN 13757-1:2002                                                                                                                       |
| Seventh Edition               | 12 <sup>th</sup> September 2005 | DLMS UA | Content adapted to 13/1341/CDV, draft IEC 62056-61 Edition 2, 13/1342/CDV, draft IEC 62056-62 Edition 2 and comments received on these drafts, as well as on EN 13757-1:2002                                                |
| Eighth Edition                | 14 <sup>th</sup> September 2007 | DLMS UA | Document restructured, editorial errors in Ed. 7.0 corrected.                                                                                                                                                               |
| Ninth Edition                 | 9 <sup>th</sup> February 2009   | DLMS UA | New elements for smart metering and advanced gas volume and energy conversion added.                                                                                                                                        |
| Tenth Edition                 | 26 <sup>th</sup> August 2010    | DLMS UA | Brought in line with Green Book.<br>New interface classes and new versions of interface classes added.<br>New OBIS codes added.                                                                                             |
| Eleventh Edition              | 26th August 2013                | DLMS UA | New interface classes and new versions of existing interface classes added. New OBIS codes added.                                                                                                                           |
| Twelfth Edition               | 10 <sup>th</sup> September 2014 | DLMS UA | New interface classes and new versions of existing interface classes added in support of Security management, Payment Metering, Arbitrator, Compact data, Data protection, Push setup, G3-PLC, M-Bus, New OBIS codes added. |
| Twelfth Edition Corrigendum 1 | 21 <sup>st</sup> December 2015  | DLMS UA | Technical and editorial corrections                                                                                                                                                                                         |
| Edition 12.1                  | 21 <sup>st</sup> December 2015  | DLMS UA | Consolidated edition including the Corrigendum 1.                                                                                                                                                                           |
| Edition 12.2                  | 21 <sup>st</sup> December 2016  | DLMS UA | New or updated interface classes for Function Control, Array Manager, NTP setup, Compact data, GSM-related and HS-PLC networks added. New OBIS codes added                                                                  |

## COSEM Interface Classes

| Version    | Date                           | Author  | Comment                                                                                                                                                                                                                                                                                                                                                                            |
|------------|--------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Edition 13 | 8 <sup>th</sup> May 2019       | DLMS UA | SI units, communication port protection, heat cost allocator, thermal energy, water OBI codes added. Additional codes for reactive power added.                                                                                                                                                                                                                                    |
| Edition 14 | 31 <sup>st</sup> Aug 2020      | DLMS UA | WiSUN, LPWAN, LTE monitoring, Parameter monitor, support for ISO/IEC 14908 PLC networks added; Push IC now V2; Delta values introduced; new clock objects added                                                                                                                                                                                                                    |
| Edition 15 | 23 <sup>rd</sup> December 2021 | DLMS UA | Added IEC 62055-41 Attributes V0, G3-PLC Hybrid RF MAC layer counters V0, G3-PLC Hybrid RF MAC setup V0 and G3-PLC Hybrid 6LoWPAN adaptation layer setup V0<br><br>Push IC now v3, M-Bus client now V2, G3-PLC MAC setup now V2, G3-PLC 6LoWPAN adaptation layer setup now V3,<br><br>Meter point ID object corrected to "61" in 6.3.6<br><br>Classes added to support CoAP in 4.9 |
| Edition 16 | 30 <sup>th</sup> October 2023  | DLMS UA | Adapted existing G3-PLC ICs and added new ICs to support G3-Hybrid<br><br>New "Measurement data monitoring" IC added<br><br>Updated Disconnect control IC<br><br>New "Measurement data monitoring objects" IC<br><br>Measurement algorithm objects table: Add new entries for "Measurement algorithm for distortion power" and "Measurement algorithm for distortion energy"       |
| Edition17  | 28 <sup>th</sup> February 2025 | DLMS UA | See table below.                                                                                                                                                                                                                                                                                                                                                                   |

## COSEM Interface Classes

### List of main technical changes in Edition 17

| Item | Clause     | Description                                                                                                                                                                                          |
|------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.   | 4.3.6.2.1  | Modified minimum value of "profile_entries" from "1" to "0" (according to corrigenda approved in CSWG)                                                                                               |
| 2.   | 4.3.6.2.8  | Modified minimum value of "profile_entries" from "1" to "0" (according to corrigenda approved in CSWG)                                                                                               |
| 3.   | 4.3.10.2.3 | Update to Table 9 to add "last confirmed entry" for MS Byte upper nibble parameters 0x6 to 0x2 (from Contribution 125)                                                                               |
| 4.   | 4.4.8      | Update to Clause 4.4.8 "Push interface class" and sub-clauses to increase clarity of description. No update to version number is required (from Contribution 125)                                    |
| 5.   | 4.5.8      | Updates made to Disconnect control class (class_id = 70) to support a metrologically relevant remote display. Version updated to version =2. Previous version moved to 5.5.2 (from Contribution 130) |
| 6.   | 4.20       | New Clause for Attestation class (from Contribution 109)                                                                                                                                             |
| 7.   | 6.2.28     | Correct OBIS D values (to 3, 4, 5) for G3-PLC hybrid objects (from corrigenda request)                                                                                                               |
| 8.   | 6.2.36     | New OBIS code for Attestation IC (from Contribution 109)                                                                                                                                             |

Excerpts

## INTRODUCTION

### Object modelling and data identification

COSEM was originally developed to address the requirements for interoperability and data security requirements in metering and control applications. The specification is not however limited to metering and control, it can be used to model any type of device that is designed to be connected to a communications network. (The COSEM acronym originally was *Companion Specification for Energy Metering* this no longer applies and has been modified to *Comprehensive Semantic Model for Energy Management* to reflect its wider application.)

COSEM uses *object modelling* techniques to model all functions of devices, without making any assumptions about which functions need to be supported, how those functions are implemented and how the data is transported. The formal specification of COSEM interface classes forms a major part of COSEM.

To process and manage the information it is necessary to uniquely identify all data items in a standard way. The definition of OBIS, the *Object Identification System* is another essential part of COSEM. It is based on DIN 43863-3:1997, *Electricity meters – Part 3: Tariff metering device as additional equipment for electricity meters – EDIS – Energy Data Identification System*. The set of OBIS codes has been considerably extended over the years to meet new requirements.

COSEM models the device as a *server* application – see 4.1.7 – used by *client* applications that retrieve data from, provide control information to, and instigate defined actions within the device via controlled access to the COSEM objects. The *clients* act as agents for third parties, i.e. the business processes of energy market participants.

The standardized COSEM interface *classes* form an extensible library. Manufacturers use elements of this library to design their products that meet a wide variety of requirements.

The server offers means to retrieve the functions supported, i.e. the COSEM objects instantiated. The objects can be organized to *logical devices and application associations* and to provide specific access rights to various clients.

The concept of the standardized interface class library provides different users and manufacturers with a maximum of diversity while ensuring interoperability.

ELECTRICITY METERING DATA EXCHANGE –  
THE DLMS/COSEM SUITE –

Part 2: COSEM interface classes

1 Scope

The DLMS/COSEM specification specifies a data model and communication protocols for data exchange with metering equipment, and more generally, devices for energy measurement, control and management. It follows a three-step approach as illustrated in Figure 1.

Step 1, Modelling: This covers the data model of devices for metering equipment, and more generally, devices for energy measurement, control and management as well as rules for data identification. The data model provides a view of the functionality of the meter, as it is available at its interface(s). It uses generic building blocks to model this functionality. The model does not cover internal, implementation-specific issues.

Step 2, Messaging: This covers the communication services and protocols for mapping the elements of the data model to application protocol data units (APDU).

Step 3, Transporting: This covers the services and protocols for the transportation of the messages through the communication channel.

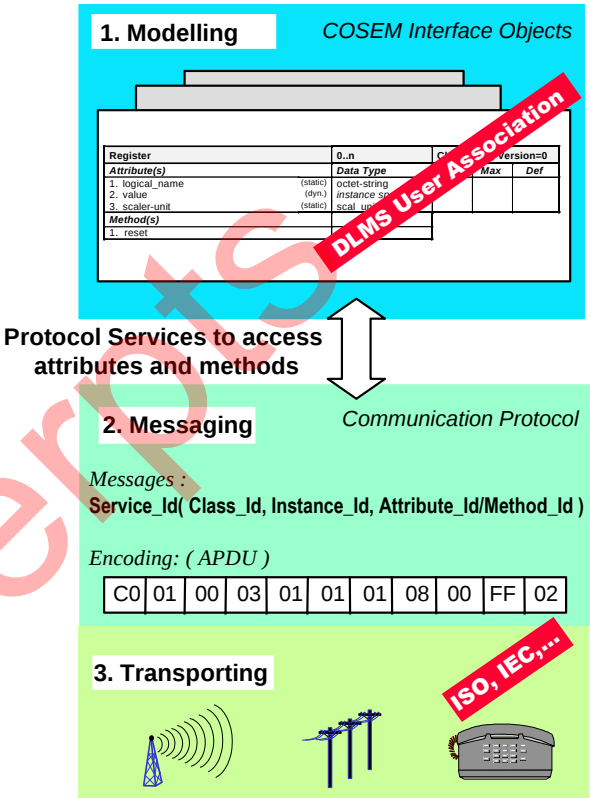


Figure 1 – The three steps approach of DLMS/COSEM: Modelling – Messaging – Transporting

Step 1 is specified in the two parts of this document. The OBIS object identification system is specified in Part 1 (DLMS UA 1000-1 Ed 17 Part 1:2025). This Part 2 specifies the COSEM interface classes (ICs) and the use of interface objects for modelling the various functions of the devices.

Steps 2 and 3 are specified in the Green Book, DLMS UA 1000-2 Ed.11:2021. It specifies communication profiles for various communication media and the protocol layers of these communication profiles. The top layer in any profile is the DLMS/COSEM application layer. It provides services to establish a logical connection between the client and the server(s). It also provides the xDLMS messaging services to access attributes and methods of the

## COSEM Interface Classes

COSEM interface objects. The lower, communication profile specific protocol layers transport the information.

Rules for conformance testing are specified in the “Yellow Book”, DLMS UA 1001-1 “DLMS/COSEM Conformance Test Process”.

Terms are explained in the “White book” DLMS UA 1002, “COSEM Glossary of Terms”.

## 2 Referenced Documents

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.

DIN 43863-3:1997, *Electricity meters – Part 3: Tariff metering device as additional equipment for electricity meters – EDIS – Energy Data Identification System*

DLMS UA 1000-1 Ed 15 Part 1:2021, OBIS Codes, Blue Book Part 1

DLMS UA 1000-1 Ed 17 Part 1:2025, OBIS Codes, Blue Book Part 1

DLMS UA 1000-1 Ed 15 Part 2:2021, COSEM Interface Classes, Blue Book Part 2

DLMS UA 1000-2 Ed. 10:2020, DLMS/COSEM Architecture and Protocols, the “Green Book” Edition 10

DLMS UA 1000-2 Ed.11:2021, DLMS/COSEM Architecture and Protocols, Green Book

DLMS UA 1001-1 DLMS/COSEM Conformance test and certification process, the “Yellow Book”

DLMS UA 1002 COSEM Glossary of terms, the “White Book”

IEC TR 61000-2-8:2002 Electromagnetic compatibility (EMC) – Part 2-8: Environment - Voltage dips and short interruptions on public electric power supply systems with statistical measurement results

IEC 61334-4-32:1996 Distribution automation using distribution line carrier systems – Part 4: Data communication protocols – Section 32: Data link layer – Logical link control (LLC)

IEC 61334-4-41:1996 Distribution automation using distribution line carrier systems – Part 4: Data communication protocols – Section 41: Application protocols – Distribution line message specification

IEC 61334-4-511:2000 Distribution automation using distribution line carrier systems – Part 4-511: Data communication protocols – Systems management – CIASE protocol

IEC 61334-4-512:2001 Distribution automation using distribution line carrier systems – Part 4-512: Data communication protocols – System management using profile 61334-5-1 – Management Information Base (MIB)

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IEC 61334-5-1:2001 Distribution automation using distribution line carrier systems – Part 5-1: Lower layer profiles – The spread frequency shift keying (S-FSK) profile

IEC 62053-23:2003 Electricity metering equipment (a.c.) – Particular requirements – Part 23: Static meters for reactive energy (classes 2 and 3)

IEC TR 62055-21:2005 Technical report Electricity metering - Payment systems- Part 21: Framework for standardization. 2005-8

IEC 62055-41:2018 Electricity metering - Payment systems - Part 41: Standard transfer specification (STS) - Application layer protocol for one-way token carrier systems

IEC 62056-21:2002 Electricity metering – Data exchange for meter reading, tariff and load control – Part 21: Direct local data exchange

IEC 62056-31:1999 Electricity metering – Data exchange for meter reading, tariff and load control – Part 31: Using local area networks on twisted pair with carrier signalling

NOTE This Edition is referenced in the interface class "IEC twisted pair (1) setup" (class\_id: 24, version: 0)

IEC 62056-3-1:2021 Electricity metering data exchange – The DLMS/COSEM suite – Part 3-1: Use of local area networks on twisted pair with carrier signalling

IEC 62056-46:2007, Electricity metering – Data exchange for meter reading, tariff and load control – Part 46: Data link layer using HDLC protocol

NOTE This Edition is referenced in the interface class "IEC twisted pair (1) setup" (class\_id: 24, version = 1)

IEC 62056-7-3:2017, Electricity metering data exchange – The DLMS/COSEM suite – Part 7-3: Wired and wireless M-Bus communication profiles for local and neighbourhood networks

IEC 62056-8-3:2013, Electricity metering data exchange – The DLMS/COSEM suite – Part 8-3: Communication profile for PLC S-FSK neighbourhood networks

IEC 62056-8-4:2018, Electricity metering data exchange - The DLMS/COSEM suite - Part 8-4: Communication profiles for narrow-band OFDM PLC PRIME neighbourhood networks

IEC 62056-8-6: 2017 Electricity metering data exchange – The DLMS/COSEM suite – Part 8-6: High speed PLC ISO/IEC 12139-1 profile for neighbourhood networks

IEC 62056-8-8:2020 Electricity metering data exchange - The DLMS/COSEM suite - Part 8-8: Communication profile for ISO/IEC 14908 series networks

ISO/IEC 8802-2:1998 IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical Link Control

ISO/IEC 12139-1:2009 Information technology —Telecommunications and information exchange between systems — Powerline communication (PLC) — High speed PLC medium access control (MAC) and physical layer (PHY) — Part 1: General requirements

ISO/IEC 14908-1:2012 Interconnection of information technology equipment – Control network protocol Part Protocol stack

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ISO/IEC/IEEE 60559:2011 Information technology – Microprocessor Systems – Floating-Point arithmetic

ISO 4217 Codes for the representation of currencies and funds

ITU-T E.212 (05.2008) SERIES E: OVERALL NETWORK OPERATION, TELEPHONE SERVICE, SERVICE OPERATION AND HUMAN FACTORS - International operation – Maritime mobile service and public land mobile service - The international identification plan for public networks and subscriptions

3GPP TS 24.008 V13.7.0 (2016-10) Technical Specification Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; Mobile radio interface Layer 3 specification; Core network protocols; Stage 3

3GPP TS 24.301 V13.4.0 (2016-01) Technical Specification Group Core Network and Terminals; Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3

3GPP TS 24.301 V13.11.0 (2018-01) Technical Specification Group Core Network and Terminals; Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3

3GPP TS 27.007 V16.1.0 (2019-06) Technical Specification Group Core Network and Terminals; AT command set for User Equipment (UE)

3GPP TS 36.101 V15.4.0 (2019-01) Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception

3GPP TS 36.133 V13.11.0 (2018-03) Technical Specification LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management

3GPP TS 36.133 V14.4.0 (2017-06) Technical Specification LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management

3GPP TS 36.213 V15.5.0 (2019-05) Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures

3GPP TS 36.304 V13.8.0 (2018-01) Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode

3GPP TS 36.321 V15.5.0 (2019-05) Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification

3GPP TS 36.331 V15.5.1 (2019-05) Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification

ITU-T G.9903 Amd. 1:2013 SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS – Access networks – In premises networks – Narrow-band orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks

NOTE This Recommendation is referenced in version 0 of the G3-PLC setup classes.

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## COSEM Interface Classes

ITU-T G.9903:2014 SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS – Access networks – In premises networks –Narrow-band orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks

NOTE This Recommendation is referenced in version 1 of the G3-PLC setup classes.

ITU-T G.9903:2017 SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS - Access networks – In premises networks - Narrowband orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks

NOTE This Recommendation is referenced in current version of the G3-PLC setup classes.

ITU-T G.9903 Amd. 1:2021, SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS - Access networks – In premises networks - Narrowband orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks

NOTE This Recommendation is referenced in version 2 of the G3-PLC setup classes.

ITU-T G.9903 Cor. 1:2023, SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS - Access networks – In premises networks - Narrowband orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks

ITU-T G.9903 Amd. 2:2023, SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS - Access networks – In premises networks - Narrowband orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks

ITU-T G.9904:2012 SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS – Access networks – In premises networks – Narrow-band orthogonal frequency division multiplexing power line communication transceivers for PRIME networks

EN 834:1994 Heat cost allocators for the determination of the consumption of room heating radiators – Appliances with electrical energy supply

EN 1434-1:2015 Heat meters – Part 1: General requirements

EN 1434-2:2015 Heat meters – Part 2: Constructional requirements

EN 13757-1:2014 Communication system for meters – Part 1: Data exchange

EN 13757-2:2018, Communication system for and remote reading of meters – Part 2: Physical and link layer

EN 13757-3:2004, Communication systems for and remote reading of meters – Part 3: Dedicated application layer

NOTE This standard is referenced in the “M-Bus client setup” interface class version 0.

EN 13757-3:2013, Communication systems for and remote reading of meters – Part 3: Dedicated application layer

NOTE This standard is referenced in the M-Bus client setup interface class version 1.

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EN 13757-3:2018, Communication systems for meters – Part 3: Dedicated application layer

NOTE This standard is referenced in the M-Bus client setup interface class version 1.

EN 13757-4:2013, Communication system for and remote reading of meters – Part 4: Wireless meter (Radio meter reading for operation in SRD bands)

EN 13757-4:2019, Communication system for and remote reading of meters – Part 4: Wireless meter (Radio meter reading for operation in SRD bands)

EN 13757-5:2015, Communication systems for meters – Part 5: Wireless M-Bus relaying

EN 13757-7:2018, Communication system for meters – Part 7: Transport and security services

IEEE 802.15.4: 2006 also available as ISO/IEC/IEEE 8802-15-4 Ed 1.0 IEEE 802.15.4-2006 Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (WPANs) – September 2006.

IEEE 802.15.4:2020 IEEE Standard for Low-Rate Wireless Networks

IEEE 802.15.4aa-2022 IEEE Standard for Low-Rate Wireless Networks Amendment 4: Higher Data Rate Extension to IEEE 802.15.4 Smart Utility Network (SUN) Frequency Shift Keying (FSK) Physical Layer (PHY)

ETSI GSM 05.08 Digital cellular telecommunications system (Phase 2+); Radio subsystem link control

ETSI EN 303 204 V2.1.2 (2016-09), Network Based Short Range Devices (SRD); Radio equipment to be used in the 870 MHz to 876 MHz frequency range with power levels ranging up to 500 mW; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU

ANSI C12.19:2012 American National Standard For Utility Industry End Device Data Tables

ZigBee® 053474 ZigBee® Specification. The specification can be downloaded free of charge from <https://www.zigbee.org/zigbee-for-developers/zigbee-pro/>

[FANSPEC] Wi-SUN Alliance: Field Area Network Working Group (FANWG): Technical Profile Specification: Field Area Network: Version 1v26.

[PHYSPEC] Wi-SUN Alliance: PHY Working Group (PHYWG) Wi-SUN PHY Specification Revision 1V02

LoRaWAN 1.0.3 LoRaWAN® Specification v1.0.3 <https://lora-alliance.org/resource-hub/lorawanr-specification-v103>

The following RFCs are available online from the Internet Engineering Task Force (IETF):

<http://www.ietf.org/rfc/std-index.txt>, <http://www.ietf.org/rfc/>

IETF STD 51 The Point-to-Point Protocol (PPP), 1994. (Also RFC 1661, RFC 1662)

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- RFC 768 User Datagram Protocol
- RFC 791 Internet Protocol (Also: IETF STD 0005), 1981
- RFC 793 Transmission Control Protocol
- RFC 1144 Compressing TCP/IP Headers for Low-Speed Serial Links, 1990
- RFC 1213 Management Information Base for Network Management of TCP/IP-based internets: MIB-II
- RFC 1332 The PPP Internet Protocol Control Protocol (IPCP), 1992, Updated by: RFC 3241. Obsoletes: RFC 1172
- RFC 1570 PPP LCP Extensions, 1994
- RFC 1661 The Point-to-Point Protocol (PPP) (Also: IETF STD 0051), 1994, Updated by: RFC 2153, Obsoletes: RFC 1548
- RFC 1662 PPP in HDLC-like Framing, (Also: IETF STD 0051), 1994, Obsoletes: RFC 1549
- RFC 1994 PPP Challenge Handshake Authentication Protocol (CHAP), 1996. Obsoletes: RFC 1334
- RFC 2433 PPP CHAP Extension, 1998
- RFC 2460 Internet Protocol, Version 6
- RFC 2474 Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers, 1998
- RFC 2507 IP Header Compression, 1999
- RFC 2508 Compressing IP/UDP/RTP Headers for Low-Speed Serial Links, 1999
- RFC 2759 Microsoft PPP CHAP Extensions, Version 2, 2000
- RFC 2986 PKCS #10 v1.7: Certification Request Syntax Standard
- RFC 3095 RObust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed, 2001
- RFC 3241 Robust Header Compression (ROHC) over PPP, 2002. Updates: RFC1332
- RFC 3315 Dynamic Host Configuration Protocol for IPv6 (DHCPv6)
- RFC 3513 Internet Protocol Version 6 (IPv6) Addressing Architecture, 2003
- RFC 3544 IP Header Compression over PPP, 2003
- RFC 3748 Extensible Authentication Protocol (EAP), 2004

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RFC 4291 IP Version 6 Addressing Architecture

RFC 4443, Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification

RFC 4944 Transmission of IPv6 Packets over IEEE 802.15.4 Networks

RFC 4861 Neighbor Discovery for IP version 6 (IPv6), 2007

RFC 4944 Internet Engineering Task Force (IETF). RFC 4944: Transmission of IPv6 Packets over IEEE 802.15.4 Networks [online]. Edited by G. Montenegro, N. Kushalnagar and D. Culler. September 2007

RFC 5216 The EAP-TLS Authentication Protocol

RFC 5280 Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile, 2008

RFC 5905 Network Time Protocol Version 4: Protocol and Algorithms Specification, 2010.

RFC 6206 The Trickle Algorithm

RFC 6282 Internet Engineering Task Force (IETF). RFC 6282: Compression Format for IPv6 Datagrams over IEEE 802.15.4-Based Networks [online]. Edited by J. Hui, Ed. September 2011

RFC 6550 RPL: IPv6 Routing Protocol for Low-Power and Lossy Networks

RFC 6775 Neighbor Discovery Optimization for IPv6 over Low-Power Wireless Personal Area Networks (6LoWPANs), 2012

RFC 7731 Multicast Protocol for Low-Power and Lossy Networks (MPL)

RFC 7774 Multicast Protocol for Low-Power and Lossy Networks (MPL), Parameter Configuration Option for DHCPv6

Point-to-Point (PPP) Protocol Field Assignments. Online database. Available from: <http://www.iana.org/assignments/ppp-numbers/ppp-numbers.xhtml>

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### 3 Terms, definitions and abbreviated terms

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

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

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

#### 3.1 Terms and definitions related to the Image transfer process (see 4.4.6)

##### 3.1.1

##### **Image**

binary data of a specified size

Note 1 to entry: An Image can be seen as a container. It may consist of one or multiple elements (image\_to\_activate) which are transferred, verified and activated together.

##### 3.1.2

##### **ImageSize**

size of the whole Image to be transferred

Note 1 to entry: ImageSize is expressed in octets.

##### 3.1.3

##### **ImageBlock**

part of the Image of size ImageBlockSize

Note 1 to entry: The Image is transferred in ImageBlocks. Each block is identified by its ImageBlockNumber.

##### 3.1.4

##### **ImageBlockSize**

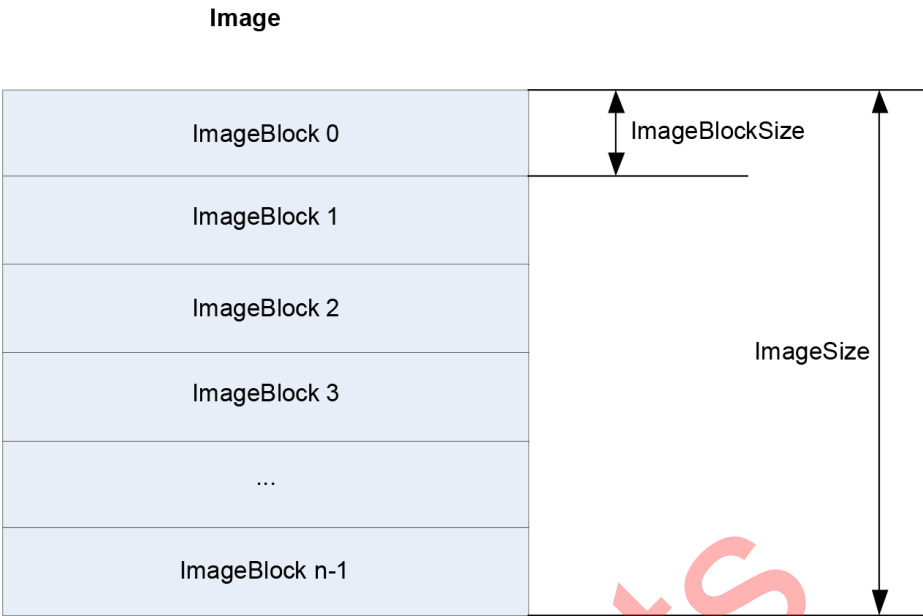
size of ImageBlock expressed in octets

##### 3.1.5

##### **ImageBlockNumber**

identifier of an ImageBlock. ImageBlocks are numbered sequentially, starting from 0

The meaning of the definitions above is illustrated in Figure 2.



**Figure 2 – The meaning of the definitions concerning the Image**

**3.2 Terms and definitions related to the S-FSK PLC setup classes (see 4.10)**

**3.2.1 initiator**

user-element of a client System Management Application Entity (SMAE)

Note 1 to entry: The initiator uses the CIASE and xDLMS ASE and is identified by its system title.

[SOURCE: IEC 61334-4-511:2000, 3.8.1]

**3.2.2 active initiator**

initiator which issues or has last issued a CIASE Register request when the server is in the unconfigured state

[SOURCE: IEC 61334-4-511:2000, 3.9.1]

**3.2.3 new system**

server system which is in the unconfigured state: its MAC address equals "NEW-address"

[SOURCE: IEC 61334-4-511:2000, 3.9.3]

**3.2.4 new system title**

system-title of a new system

Note 1 to entry: This is the system title of a system, which is in the new state.

[SOURCE: IEC 61334-4-511:2000, 3.9.4]

### 3.2.5

#### **registered system**

server system which has an individual valid MAC address (therefore, different from "NEW Address", see IEC 61334-5-1:2001: Medium Access Control)

[SOURCE: IEC 61334-4-511:2000, 3.9.5]

### 3.2.6

#### **reporting system**

server system which issues a DiscoverReport

[SOURCE: IEC 61334-4-511:2000, 3.9.6, modified to correct an error in IEC 61334-4-511]

### 3.2.7

#### **sub-slot**

time needed to transmit two bytes by the physical layer

Note 1 to entry: Timeslots are divided to sub-slots in the RepeaterCall mode of the physical layer.

### 3.2.8

#### **timeslot**

time needed to transmit a physical frame

Note 1 to entry: As specified in IEC 61334-5-1:2001, 3.3.1, a physical frame comprises 2 bytes preamble, 2 bytes start subframe delimiter, 38 bytes PSDU and 3 bytes pause.

## **3.3 Terms and definitions related to the PRIME NB OFDM PLC setup ICs (see 4.12)**

### Definitions related to the physical layer

### 3.3.1

#### **base node**

the master node, which controls and manages the resources of a subnetwork

[SOURCE: ITU-T G.9904:2012, 3.2.1]

### 3.3.2

#### **beacon slot**

the location of the beacon PDU within a frame

[SOURCE: ITU-T G.9904:2012, 3.2.2]

### 3.3.3

#### **node**

any one element of a subnetwork, which is able to transmit to and receive from other subnetwork elements

[SOURCE: ITU-T G.9904:2012, 3.2.9]

### 3.3.4

#### **registration**

the process by which a service node is accepted as member of the subnetwork and allocated a LNID

[SOURCE: ITU-T G.9904:2012, 3.2.12]

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**3.3.5****service node**

any one node of a subnetwork, which is not a base node

[SOURCE: ITU-T G.9904:2012, 3.2.13]

**3.3.6****subnetwork**

a set of elements that can communicate by complying with this specification and share a single base node

[SOURCE: ITU-T G.9904:2012, 3.2.15]

Definitions related to the MAC layer**3.3.7****disconnected state <of a service node>**

this is the initial functional state for all service nodes. When disconnected, a service node is not able to communicate data or switch other nodes' data; its main function is to search for a subnetwork within its reach and try to register on it

[SOURCE: ITU-T G.9904:2012, 8.1]

**3.3.8****terminal state <of a service node>**

when in this functional state a service node is able to establish connections and communicate data, but it is not able to switch other nodes' data

[SOURCE: ITU-T G.9904:2012 8.1]

**3.3.9****switch state <of a service node>**

when in this functional state a service node is able to perform all Terminal functions. Additionally, it is able to forward data to and from other nodes in the same subnetwork. It is a branch point on the tree structure

[SOURCE: ITU-T G.9904:2012, 8.1]

**3.3.10****promotion**

the process by which a service node is qualified to switch (repeat, forward) data traffic from other nodes and act as a branch point on the subnetwork tree structure. A successful promotion represents the transition between Terminal and Switch state. When a service node is in the Disconnected state, it cannot directly transition to Switch state

[SOURCE: ITU-T G.9904:2012, 8.1]

**3.3.11****demotion**

the process by which a service node ceases to be a branch point on the subnetwork tree structure. A successful demotion represents the transition between Switch and Terminal state

[SOURCE: ITU-T G.9904:2012, 8.1]

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### 3.4 Terms and definitions related to the ISO/IEC 14908 setup ICs (see 4.19)

#### 3.4.1

##### **domain**

logical network that is a unit for addressing

Note 1 to entry: Subnet (see below) and node addresses are assigned by the administrator responsible for the domain, and they have meaning only in the context of that domain.

Note 2 to entry: All nodes must be in the same domain to be able to address each other.

#### 3.4.2

##### **node**

abstraction for a physical node that represents the highest degree of address resolvability on a network

Note 1 to entry: A node is identified (addressed) within a subnet by its (logical) node identifier. A physical node may belong to more than one subnet; when it does, it is assigned one (logical) node number for each subnet to which it belongs. A physical node may belong to at most two subnets; these subnets must be in different domains. A node may also be identified (absolutely) within a network by its Unique\_Node\_ID.

#### 3.4.3

##### **subnet**

set of nodes accessible through the same link layer protocol

#### 3.4.4

##### **transaction**

sequence of messages that are correlated together

### 3.5 Terms and definitions related to ZigBee® (see 4.15)

NOTE Terms marked with \* are from the ZigBee® Specification.

#### 3.5.1

##### **CAD**

Consumer Access Device; a ZigBee® gateway device that acts like an IHD within the ZigBee® network, but has an additional connection to a different network (i.e. WiFi)

#### 3.5.2

##### **IHD**

in Home Display; a device that has a screen for the displaying of Energy information to the consumer

#### 3.5.3

##### **install code**

a Hashed (via MMO) Pre-Configured Linked Key (PCLK) that is provided to a Trust Center via out-of-band communications. A new device wishing to join the network would need to send this install code to the Trust Center, which would allow the Trust Center to execute the joining process, using this install code as part of the security information

#### 3.5.4

##### **link key \***

this is a key that is shared exclusively between two, and only two, peer application-layer entities within a PAN

#### 3.5.5

##### **MAC address/IEEE address**

these are used synonymously to represent the EUI-64 code allocated to the ZigBee® Radio

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**3.5.6****ZigBee®**

ZigBee® is a specification for a suite of high level communication protocols used to create personal area networks built from small, low-power digital radios. ZigBee® is based on an IEEE 802.15 standard. Though low-powered, ZigBee® devices often transmit data over longer distances by passing data through intermediate devices to reach more distant ones, creating a mesh network

**3.5.7****ZigBee® client**

this is similar to the role of the DLMS client. For a greater understanding of the interaction between the client and server the ZigBee® PRO specification should be read

**3.5.8****ZigBee® coordinator \***

an IEEE 802.15.4-2003 PAN coordinator that is the principal controller of an IEEE 802.15.4-2003-based network that is responsible for network formation. The PAN coordinator must be a full function device (FFD)

**3.5.9****ZigBee® cluster**

a set of message types related to a certain device function (e.g. metering, ballast control)

**3.5.10****ZigBee® mirror**

a device which echoes data being published by a battery operated ZigBee® device, allowing other network actors to obtain data while the battery operated device is unavailable due to power saving

**3.5.11****ZigBee® PRO**

an alternative name for the ZigBee® 2007 protocol. ZigBee® 2007, now the current stack release, contains two stack profiles, stack profile 1 (simply called ZigBee®), for home and light commercial use, and stack profile 2 (called ZigBee® PRO). ZigBee® PRO offers more features, such as multi-casting, many-to-one routing and high security with Symmetric-Key Key Exchange (SKKE), while ZigBee® (stack profile 1) offers a smaller footprint in RAM and flash. Both offer full mesh networking and work with all ZigBee® application profiles

**3.5.12****ZigBee® router \***

an IEEE 802.15.4-2003 FFD participating in a ZigBee® network, which is not the ZigBee® coordinator but may act as an IEEE 802.15.4-2003 coordinator within its personal operating space, that is capable of routing messages between devices and supporting associations

**3.5.13****ZigBee® server**

this is similar to the role of the DLMS server

Note 1 to entry: For a greater understanding of the interaction between the client and server the ZigBee® PRO specification should be read.

**3.5.14****ZigBee® Trust Center \***

the device trusted by devices within a ZigBee® network to distribute keys for the purpose of network and end-to-end application configuration management

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### 3.6 Terms and definitions related to Payment metering interface classes (see 4.6)

#### 3.6.1

##### **account**

statement of the credits and charges of an individual with reference to a contractual relationship between the said individual and another party; in this case a utility service provider

#### 3.6.2

##### **available**

(credit), total value that may be decremented by charges without further action

#### 3.6.3

##### **charge**

representation of a financial liability on an account

Note 1 to entry: Within this specification charges are modelled in the form of “Charge” objects that define the amount due, collection mechanism, collection periodicity, collection amount and other relevant variables.

Note 2 to entry: There may be one or more instalments payable and their size may be determined explicitly or in terms of a rate of payment per unit of time or of consumption.

Note 3 to entry: Charges may also be levied as a fixed amount per vend.

#### 3.6.4

##### **credit mode**

mode of operation of a meter in a payment system that does not require payment for the consumption in advance

#### 3.6.5

##### **collect**

take payment of an instalment of a charge, accounting for the collection amount determined by the *unit\_charge\_active* attribute of the “Charge” object

#### 3.6.6

##### **commodity**

utility product delivered to a consumer at a service point on their premises under a contract of supply such as electricity, gas, water, and heat

#### 3.6.7

##### **enabled**

when used in the context of “Credit” or “Charge” types; means that the “Credit” or “Charge” type appears in the *credit\_reference\_list* or *charge\_reference\_list* respectively of the “Account” object

#### 3.6.8

##### **emergency credit**

amount of credit administered in a payment metering system working in prepayment mode, representing a short term loan to the consumer

Note 1 to entry: This is a feature of some payment metering systems in which the consumer is able to obtain a limited amount of credit as a short-term loan, often mediated locally by the prepayment unit itself. The word “emergency” indicates urgent need rather than disaster.

#### 3.6.9

##### **Enterprise Resource Planning (ERP) system**

##### **Back Office System**

computer system carrying out the business processing of an organisation (such as an energy supplier), as distinct from the communications system. See also Head End System

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### 3.6.10 friendly credit

period of time with a configurable start and end point, where the meter will not disconnect supply regardless of the status of the *available\_credit*. Also known as non-disconnect period

Note 1 to entry: This function is used in circumstances where it would be inconvenient to obtain needed credit (for example, at night or in the case of a frail elderly consumer).

### 3.6.11 Head End System HES

computer system, connected by a communications network to a population of intelligent devices, whose job is the control and coordination of information flows to and from those devices, typically on behalf of a separate ERP ("back office") system

### 3.6.12 Home Area Network HAN

communications network constructed with the principal aim of connecting devices in one premises

### 3.6.13 in use

state of a "Credit" object that, at the point of query, has a positive *current\_credit\_amount* and that Credit is being consumed by some active Charges represented by "Charge" objects

Note 1 to entry: When the *current\_credit\_amount* reaches zero, the credit status becomes exhausted.

### 3.6.14 load limiting

mode of operation of some payment metering systems (not necessarily in prepayment mode) in which the consumer is able to draw on a supply provided they do not exceed a configured level of demand

Note 1 to entry: The implied purpose is for management of the consumer's finances: where demand is subject to limitation for the benefit of the generation or distribution system the term "load management" is more often used.

### 3.6.15 local communications

mechanism of communicating with the meter over some media, within the vicinity of that meter such as over a HAN or optical port

### 3.6.16 manual entry

entering of a token to the payment metering installation via means of a manual process

### 3.6.17 managed payment mode

specialisation of credit mode that allows operation of an Account, Credit and possibly Charges in a meter where the payment for the service is received by the utility after the service has been consumed

Note 1 to entry: When in managed payment mode tokens are not normally used, however the credit is adjusted using the methods in the "Credit" object.

Note 2 to entry: The meter is allowed to go into an allowable amount of debt before being credited from the client in line with a received cash payment by the utility.

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Note 3 to entry: In this example cash is used as a generic term for a real life payment of currency to the utility which could be executed as legal tender, automated electronic transfer, etc.

### 3.6.18

#### **payment metering installation**

set of payment metering equipment installed and ready for use at a consumer's premise

Note 1 to entry: This includes mounting the equipment as appropriate, and where a multi-device installation is involved, the connection of each unit of equipment as appropriate. It also includes the connection of utility supply network to each supply interface, the connection of the consumer's load interface, and the commissioning of the equipment into an operational state as a payment metering installation.

### 3.6.19

#### **prepayment mode**

mode of operation of a meter in a payment system, whereby the consumer pays for service in advance of consumption

### 3.6.20

#### **post-payment**

method of operation of a payment system whereby a consumer may consume service before paying for it

Note 1 to entry: This term can be used interchangeably with the term *Credit mode* when used in the context of operational modes.

Note 2 to entry: This term is usually used in conjunction with a system description whereas *Credit mode* is used when referring to the operational mode of a meter or account.

### 3.6.21

#### **remote communications**

transportation of a token or other message from a client to a server running a payment metering application process via some form of WAN and access network. This could be point to point, mesh radio, fibre optic connection, etc., and may travel through multiple devices and over multiple protocols before reaching the meter

### 3.6.22

#### **repayable**

credit types such as emergency credit where an amount added to *current\_credit\_amount* of a "Credit" object has to be repaid before the Credit is selectable again

### 3.6.23

#### **reserved credit**

amount of credit that is held in reserve in the account of a payment meter, for use at a later time, at the discretion of the consumer

Note 1 to entry: The mechanism for reserving this credit may be subject to agreement between the utility supplier and the consumer. For example a proportion of every token may be added to the reserve Credit or the supplier might give the consumer an allowance every month, but these arrangements will be project specific.

### 3.6.24

#### **selectable**

specific state of a "Credit" object where the consumer's immediate confirmation is needed before it can be brought into use

Note 1 to entry: For example, Emergency Credit has the nature of a short-term loan and should therefore only be deployed with the consumer's agreement. The term refers respectively to the need to get agreement and to the fact of having received agreement. Only a "Credit" made (1) Selectable can be (2) Selected / Invoked. Not all Credits need to be selected by an external trigger, as in most cases the meter application automatically performs this action.

**3.6.25****selected/invoked**

specific state of a “Credit” object where the value of *current\_credit\_amount* is included in the calculation of *available\_credit* in the related “Account”

Note 1 to entry: This is the state of a Credit before becoming In use and is considered in the *available\_credit* attribute of the “Account”, but is not yet being consumed by any Charge (due to a higher priority Credit being In use).

**3.6.26****service**

provision of a commodity (such as water, electricity gas or heat)

**3.6.27****social credit**

credit that is given free of payment for reasons such as the relief of poverty

Note 1 to entry: Typically such a credit is given at fixed times (e.g. monthly) in limited amounts. This particular type of credit could also be consumption based, such that that the consumer must keep consumption below a limiting threshold in order to use the social credit. This could be controlled by the consumer being disconnected if the limit is breached.

Note 2 to entry: Social credits are modelled of “Credit” objects of type *emergency\_credit*, *time\_based\_credit*, *consumption\_based\_credit*.

**3.6.28****temporary debt**

transient liability to the meter that accrues when *Charges* are collected at a time when all credits are exhausted

Note 1 to entry: This temporary debt amount is accumulated in *amount\_to\_clear* in the “Account” object.

**3.6.29****token**

self-contained package of data related to the purchase of credit or to other system functions, embodied in a token carrier (q.v.). The token forms a link between source and destination of the transaction. The token contents may reflect money, energy, time, etc., in harmony with the currency declared in the meter

Note 1 to entry: Defined in IEC TR 62055-21:2005 as “<Equipment-related definition>[sic] information content including an instruction issued on a token carrier by a vending or management system that is capable of subsequent transfer to and acceptance by a specific payment meter, or one of a group of meters, with appropriate security”.

**3.6.30****token carrier**

means of transferring a token from one system element to another, typically in material “physical” or electronic “virtual” form

Note 1 to entry: In a general sense, the token refers to the instruction and information being transferred, while the token carrier refers to the physical device being used to carry the instruction and information, or to the communications medium in the case of a virtual token carrier.

**3.6.31****token carrier interface**

interface between the token carrier and the payment metering installation

Note 1 to entry: For example, it may be a keypad for numeric tokens, or a physical token carrier acceptor, or a communications connection to a local or remote machine for a virtual token carrier interface.

Note 2 to entry: The token carrier interface may also be used to pass additional information to or from the payment meter, such as for the purposes of payment system management.

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### 3.6.32 top-up credit token

credit purchased by the consumer and capable of being delivered in the form of a token (as well as by other means) in a physical or virtual token carrier

### 3.6.33 vend

operation or transaction resulting in the available credit held on a payment meter to be increased by use of a credit token

Note 1 to entry: Vend would normally relate to a transaction in conjunction with a vending system at a point of sale, resulting in the creation of a token that can be transported by means of a physical or virtual token carrier.

## 3.7 Terms and definitions related to the Arbitrator IC (see 4.5.12)

### 3.7.1 action

operation that can be requested locally or remotely from the server

### 3.7.2 actor

entity requesting an action

Note 1 to entry: It can be the local application process or a client.

### 3.7.3 arbitrator

function modelled in COSEM that can determine, based on pre-configured rules, which action is carried out when multiple actors request potentially conflicting actions to control the same resource

## 3.8 Abbreviated terms

| Abbreviation | Explanation                                              |
|--------------|----------------------------------------------------------|
| 3GPP         | 3 <sup>rd</sup> Generation Partnership Project           |
| 6LoWPAN      | IPv6 over Low-Power Wireless Personal Area Network       |
| AA           | Application Association                                  |
| ABP          | Activation by Personalisation                            |
| AARE         | A-Associate Response – an APDU of the ACSE               |
| AARQ         | A-Associate Request – an APDU of the ACSE                |
| ACSE         | Association Control Service Element                      |
| ADD          | Automated Device Discovery                               |
| APDU         | Application layer protocol data unit                     |
| ADP          | Primary Station Address                                  |
| ADS          | Secondary Station Address                                |
| AGA          | American Gas Association                                 |
| AGA 8        | Method for calculation of compressibility (Gas metering) |
| AGC          | Automatic Gain Control                                   |
| AL           | Application layer                                        |
| AP           | Application process                                      |
| APDU         | Application Protocol Data Unit                           |

## COSEM Interface Classes

| Abbreviation | Explanation                                                                                                                                                       |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| APS          | Application Support Sublayer (ZigBee® term)                                                                                                                       |
| ARFCN        | Absolute radio-frequency channel number                                                                                                                           |
| ASE          | Application Service Element                                                                                                                                       |
| ATM          | Automated Topology Management                                                                                                                                     |
| A-XDR        | Adapted Extended Data Representation (IEC 61334-6)                                                                                                                |
| base_name    | The short_name corresponding to the first attribute ("logical_name") of a COSEM object                                                                            |
| BCD          | Binary Coded Decimal                                                                                                                                              |
| BER          | Bit Error Rate                                                                                                                                                    |
| CBCP         | CallBack Control Protocol (PPP)                                                                                                                                   |
| CC           | Current Credit (S-FSK PLC profile)                                                                                                                                |
| CDMA         | Code Division Multiple Access                                                                                                                                     |
| CENELEC      | European Committee for Electrotechnical Standardization                                                                                                           |
| CHAP         | Challenge Handshake Authentication Protocol                                                                                                                       |
| CIASE        | Configuration Initiation Application Service Element (S-FSK PLC profile)                                                                                          |
| class_id     | Interface class identification code                                                                                                                               |
| CLI          | Calling Line Identity                                                                                                                                             |
| COSEM        | Comprehensive Semantic Model for Energy Management                                                                                                                |
| COSEM object | An instance of a COSEM interface class                                                                                                                            |
| CPAS         | Common Part Adaptation Sublayer                                                                                                                                   |
| CRC          | Cyclic Redundancy Check                                                                                                                                           |
| CSAP         | Client Service Access Point                                                                                                                                       |
| CSD          | Circuit Switched Data                                                                                                                                             |
| CSMA         | Carrier Sense Multiple Access                                                                                                                                     |
| CtoS         | Client to Server challenge                                                                                                                                        |
| CU           | Currently Unused                                                                                                                                                  |
| DC           | Delta credit (S-FSK PLC profile)                                                                                                                                  |
| DC           | Data concentrator                                                                                                                                                 |
| DevAddr      | (Related to LoRaWAN) A 32-bit non-unique identifier assigned to an end-device statically or dynamically after a Join Procedure (depending on the activation mode) |
| DHCP         | Dynamic Host Configuration Protocol                                                                                                                               |
| DIB          | Data Information Block (M-Bus)                                                                                                                                    |
| DIF          | Data Information Field (M-Bus)                                                                                                                                    |
| DL           | Data Link                                                                                                                                                         |
| DLMS         | Device Language Message Specification                                                                                                                             |
| DLMS UA      | DLMS User Association                                                                                                                                             |
| DLPDU        | Data Link Protocol Data Unit                                                                                                                                      |
| DNS          | Domain Name Server                                                                                                                                                |
| DSCP         | Differentiated Services Code Point                                                                                                                                |
| DSSID        | Direct Switch ID                                                                                                                                                  |
| EAP          | Extensible Authentication Protocol                                                                                                                                |
| EARFCN       | Enhanced Absolute radio-frequency channel number                                                                                                                  |
| EDGE         | Enhanced Data rates for GSM Evolution                                                                                                                             |

## COSEM Interface Classes

| Abbreviation | Explanation                                                                                                                                                     |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EMC          | Emergency Credit (in relation to payment metering)                                                                                                              |
| ERP          | Enterprise Resource Planning                                                                                                                                    |
| EUI-48       | 48-bit Extended Unique Identifier                                                                                                                               |
| EUI-64       | 64-bit Extended Unique Identifier                                                                                                                               |
| E-UTRA       | Evolved UMTS Terrestrial Radio Access                                                                                                                           |
| FCC          | Federal Communications Commission                                                                                                                               |
| FFD          | Full-Function Device                                                                                                                                            |
| FIFO         | First-In-First-Out                                                                                                                                              |
| F/R          | Fragmentation and Reassembly                                                                                                                                    |
| FTP          | File Transfer Protocol                                                                                                                                          |
| GCM          | Galois/Counter Mode, an algorithm for authenticated encryption with associated data                                                                             |
| GMT          | Greenwich Mean Time. Replaced by Coordinated Universal Time (UTC).                                                                                              |
| GPRS         | General Packet Radio Service                                                                                                                                    |
| GPS          | Global Positioning System                                                                                                                                       |
| GSM          | Global System for Mobile Communications                                                                                                                         |
| HAN          | Home Area Network                                                                                                                                               |
| HART         | Highway Addressable Remote Transducer see <a href="http://www.hartcomm.org/">http://www.hartcomm.org/</a> (in relation with the Sensor manager interface class) |
| HDLC         | High-level Data Link Control                                                                                                                                    |
| HES          | Head End System                                                                                                                                                 |
| HHT          | Hand Held Terminal                                                                                                                                              |
| HLS          | High Level Security Authentication                                                                                                                              |
| HSDPA        | High-Speed Downlink Packet Access                                                                                                                               |
| HS-PLC       | High-Speed Power Line Carrier                                                                                                                                   |
| IANA         | Internet Assigned Numbers Authority                                                                                                                             |
| IB           | Information Base                                                                                                                                                |
| IC           | Interface Class (COSEM)                                                                                                                                         |
| IC           | Initial credit (S-FSK PLC profile)                                                                                                                              |
| IEC          | International Electrotechnical Commission                                                                                                                       |
| IEEE         | Institute of Electrical and Electronics Engineers                                                                                                               |
| IETF         | Internet Engineering Task Force                                                                                                                                 |
| IPCP         | Internet Protocol Control Protocol                                                                                                                              |
| IPv4         | Internet Protocol version 4                                                                                                                                     |
| IPv6         | Internet Protocol version 6                                                                                                                                     |
| ISO          | International Organization for Standardization                                                                                                                  |
| ISP          | Internet Service Provider                                                                                                                                       |
| IT           | Information Technology                                                                                                                                          |
| ITU-T        | International Telecommunication Union – Telecommunication                                                                                                       |
| KEK          | Key Encryption Key                                                                                                                                              |
| LA           | Local Area                                                                                                                                                      |
| LAC          | Local Area Code                                                                                                                                                 |
| LAN          | Local Area Network                                                                                                                                              |

## COSEM Interface Classes

| Abbreviation | Explanation                                                                                                                       |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------|
| LBD          | (6)LoWPAN Bootstrapping Device                                                                                                    |
| LCID         | Local Connection Identifier                                                                                                       |
| LCP          | Link Control Protocol                                                                                                             |
| LDN          | Logical Device Name                                                                                                               |
| LLC          | Logical Link Control (sublayer)                                                                                                   |
| LLS          | Low Level Security                                                                                                                |
| LN           | Logical Name                                                                                                                      |
| LNID         | Local Node Identifier                                                                                                             |
| LOADng       | 6LoWPAN Ad Hoc On-Demand Distance Vector Routing Next Generation (LOADng)                                                         |
| LQI          | Link Quality Indicator (ZigBee ® term)                                                                                            |
| LSB          | Least Significant Bit                                                                                                             |
| LSID         | Local Switch Identifier                                                                                                           |
| LTE          | Long Term Evolution (Wireless communication)                                                                                      |
| M            | mandatory                                                                                                                         |
| M2M          | Machine to Machine                                                                                                                |
| MAC          | Medium Access Control                                                                                                             |
| M-Bus        | Meter Bus                                                                                                                         |
| MCC          | Mobile Country Code                                                                                                               |
| MD5          | Message Digest Algorithm 5                                                                                                        |
| MIB          | Management Information Base (S-FSK PLC profile)                                                                                   |
| MID          | Measuring Instruments Directive 2004/22/EC of the European Parliament and of the Council                                          |
| MMO          | Matyas-Meyer-Oseas hash (ZigBee ® term)                                                                                           |
| MNC          | Mobile Network Code                                                                                                               |
| MPAN         | (UK term) Meter Point Access Number – reference of the location of the Electricity meter on the electricity distribution network. |
| MPDU         | MAC Protocol Data Unit                                                                                                            |
| MSB          | Most Significant Bit                                                                                                              |
| MSDU         | MAC Service Data Unit                                                                                                             |
| MT           | Mobile Termination                                                                                                                |
| NB           | Narrow-band                                                                                                                       |
| ND           | Neighbour Discovery                                                                                                               |
| NRSRP        | Narrowband Reference Signal Received Power                                                                                        |
| NRSRQ        | Narrowband Reference Signal Received Quality                                                                                      |
| NTP          | Network Time Protocol                                                                                                             |
| o            | optional                                                                                                                          |
| OBIS         | OBject Identification System                                                                                                      |
| OFDM         | Orthogonal Frequency Division Multiplexing                                                                                        |
| OTA          | Over the Air – Refers to Firmware Upgrade using ZigBee ®                                                                          |
| PAN          | Personal Area Network (Term used in relation to G3-PLC <sup>1</sup> ) and ZigBee ®                                                |
| Pad          | Padding                                                                                                                           |
| PAP          | Password Authentication Protocol                                                                                                  |
| PCLK         | Pre-Configured Link Key (ZigBee® term)                                                                                            |

## COSEM Interface Classes

| Abbreviation | Explanation                                                                       |
|--------------|-----------------------------------------------------------------------------------|
| PDU          | Protocol Data Unit                                                                |
| PhL, PHY     | Physical Layer                                                                    |
| PIB          | PLC Information Base                                                              |
| PID          | Program Identifier                                                                |
| PIN          | Personal Identity Number                                                          |
| PLC          | Power Line Carrier                                                                |
| PLMN         | Public Land Mobile Network                                                        |
| PNPDU        | Promotion Needed PDU                                                              |
| POS          | Point Of Sale (Payment metering)                                                  |
| POS          | Personal Operating Space (ZigBee®)                                                |
| PPDU         | Physical Protocol Data Unit                                                       |
| PPP          | Point-to-Point Protocol                                                           |
| PSTN         | Public Switched Telephone Network                                                 |
| QoS          | Quality of Service                                                                |
| RB           | Radio Band                                                                        |
| REJ PDU      | Reject Protocol Data Unit                                                         |
| RFC          | Request for Comments; a document published by the Internet Engineering Task Force |
| RFD          | Reduced Function Device                                                           |
| ROHC         | Robust Header Compression                                                         |
| RREP         | Route Reply                                                                       |
| RREQ         | Route Request                                                                     |
| RRER         | Route Error                                                                       |
| RSRQ         | Reference Signal Received Quality                                                 |
| RSRP         | Reference Signal Received Power                                                   |
| RSSI         | Received Signal Strength Indication (ZigBee® term)                                |
| SAP          | Service Access Point                                                              |
| SAS          | Startup Attribute Set (ZigBee® term )                                             |
| SCP          | Shared Contention Period                                                          |
| SDU          | Service Data Unit                                                                 |
| SE           | Smart Energy                                                                      |
| SEP          | Smart Energy Profile (ZigBee® term )                                              |
| S-FSK        | Spread – Frequency Shift Keying                                                   |
| SHA          | Secure Hash Algorithm                                                             |
| SI           | International System of Units ( <i>Système International d'Unités</i> )           |
| SID          | Switch identifier                                                                 |
| SITP         | Secure Information Transfer Protocol                                              |
| SMS          | Short Message Service                                                             |
| SMTP         | Simple Mail Transfer Protocol                                                     |
| SN           | Short Name                                                                        |
| SNA          | Subnetwork Address                                                                |
| SSAS         | Service Specific Adaptation Sublayer                                              |
| SSCS         | Service Specific Convergence Layer                                                |

## COSEM Interface Classes

| Abbreviation                                                                                | Explanation                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| StoC                                                                                        | Server to Client Challenge                                                                                                                                                                        |
| TAB                                                                                         | In the case of the EURIDIS profiles without DLMS and without DLMS/COSEM: data code.<br>In the case of profiles using DLMS or DLMS/COSEM: value at which the equipment is programmed for Discovery |
| TABi                                                                                        | List of TAB field                                                                                                                                                                                 |
| TCC                                                                                         | Transmission Control Code (IPv4)                                                                                                                                                                  |
| TCP                                                                                         | Transmission Control Protocol                                                                                                                                                                     |
| TFTP                                                                                        | Trivial File Transfer Protocol                                                                                                                                                                    |
| TOU                                                                                         | Time of use                                                                                                                                                                                       |
| TTL                                                                                         | Time To Live                                                                                                                                                                                      |
| UDP                                                                                         | User Datagram Protocol                                                                                                                                                                            |
| UMTS                                                                                        | Universal Mobile Telecommunications System                                                                                                                                                        |
| UNC                                                                                         | Unconfigured (S-FSK PLC profile)                                                                                                                                                                  |
| UTC                                                                                         | Coordinated Universal Time                                                                                                                                                                        |
| VIB                                                                                         | Value Information Block (M-Bus)                                                                                                                                                                   |
| VIF                                                                                         | Value Information Field (M-Bus)                                                                                                                                                                   |
| VZ                                                                                          | Billing period counter (Form <i>Vorwertzähler</i> in German, see DIN 43863-3)                                                                                                                     |
| wake-up                                                                                     | trigger the meter to connect to the communication network to be available to a client (e.g. HES)                                                                                                  |
| WAN                                                                                         | Wide Area Network                                                                                                                                                                                 |
| wM-Bus                                                                                      | Wireless M-Bus                                                                                                                                                                                    |
| ZTC                                                                                         | ZigBee® Trust Center                                                                                                                                                                              |
| <sup>1)</sup> In the case of the G3-PLC technology, PAN may be defined as PLC Area Network. |                                                                                                                                                                                                   |

## 4 The COSEM interface classes

### 4.1 Basic principles

#### 4.1.1 General

This Clause 4.1 describes the basic principles on which the COSEM interface classes (ICs) are built. It also gives a short overview on how interface objects – instantiations of the ICs – are used for communication purposes. Data collection systems, metering equipment, and more generally, devices for energy measurement, control and management from different vendors, following these specifications, can exchange data in an interoperable way.

For specification purposes, this standard uses the technique of object modelling.

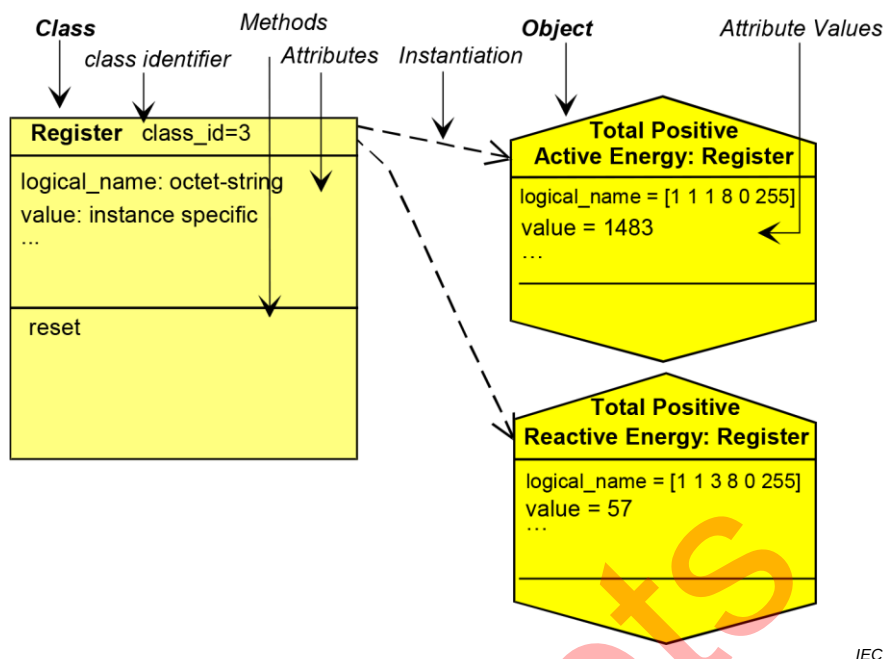
An object is a collection of attributes and methods. Attributes represent the characteristics of an object. The value of an attribute may affect the behaviour of an object. The first attribute of any object is the *logical\_name*. It is one part of the identification of the object. An object may offer a number of methods to either examine or modify the values of the attributes.

Objects that share common characteristics are generalized as an interface class, identified with a *class\_id*. Within a specific IC, the common characteristics (attributes and methods) are described once for all objects. Instantiations of ICs are called COSEM interface objects.

Manufacturers may add proprietary methods and attributes to any object; see 4.1.2.

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Figure 3 illustrates these terms by means of an example:



**Figure 3 – An interface class and its instances**

The IC “Register” is formed by combining the features necessary to model the behaviour of a generic register (containing measured or static information) as seen from the client (data collection system, hand held terminal). The contents of the register are identified by the attribute *logical\_name*. The *logical\_name* contains an OBIS identifier (see DLMS UA 1000-1 Ed 17 Part 1:2025). The actual (dynamic) content of the register is carried by its *value* attribute.

Defining a specific meter means defining several specific objects. In the example of Figure 3, the meter contains two registers; i.e. two specific instances of the IC “Register” are instantiated. Through the instantiation, one COSEM object becomes a “total, positive, active energy register” whereas the other becomes a “total, positive, reactive energy register”.

NOTE The COSEM interface objects (instances of COSEM ICs) represent the behaviour of the meter as seen from the “outside”. Therefore, modifying the value of an attribute – for example resetting the *value* attribute of a register – is always initiated from the outside. Internally initiated changes of the attributes – for example updating the *value* attribute of a register – are not described in this model.

#### 4.1.2 Referencing methods

Attributes and methods of COSEM objects can be referenced in two different ways:

**Using logical names (LN referencing):** In this case, the attributes and methods are referenced via the identifier of the COSEM object instance to which they belong.

The reference for an attribute is: class\_id, value of the *logical\_name* attribute, attribute\_index.

The reference for a method is: class\_id, value of the *logical\_name* attribute, method\_index, where:

## COSEM Interface Classes

- `attribute_index` is used as the identifier of the attribute required. Attribute indexes are specified in the definition of each IC. They are positive numbers starting with 1. Proprietary attributes may be added: these shall be identified with negative numbers;
- `method_index` is used as the identifier of the method required. Method indexes are specified in the definition of each IC. They are positive numbers starting with 1. Proprietary methods may be added: these shall be identified with negative numbers.

**Using short names (SN referencing):** This kind of referencing is intended for use in simple devices. In this case, each attribute and method of a COSEM object is identified with a 13-bit integer. The syntax for the short name is the same as the syntax of the name of a DLMS named variable. See IEC 61334-4-41:1996 and DLMS UA 1000-2 Ed.11:2021, 9.5.

### 4.1.3 Reserved base\_names for special COSEM objects

In order to facilitate access to devices using SN referencing, some short\_names are reserved as base\_names for special COSEM objects. The range for reserved base\_names is from 0xFA00 to 0xFFF8. The following specific base\_names are defined, see Table 1.

**Table 1 – Reserved base\_names for SN referencing**

| Base_name (objectName) | COSEM object                                                                                    |
|------------------------|-------------------------------------------------------------------------------------------------|
| 0xFA00                 | Association SN                                                                                  |
| 0xFB00                 | Script table (instantiation: Broadcast "Script table")                                          |
| 0xFC00                 | SAP assignment                                                                                  |
| 0xFD00                 | "Data" or "Register" object containing the "COSEM logical device name" in the attribute "value" |

### 4.1.4 Class description notation

#### 4.1.4.1 Overview

This subclause 4.1.4 describes the notation used to define the ICs.

A short text describes the functionality and application of the IC. Table 2 provides an overview of the IC including the class name, the attributes, and the methods. Each attribute and method shall be described in detail. The template is shown in Table 2.

**Table 2 – Interface class overview**

| Class name                     | Cardinality  | class_id, version |      |      |            |
|--------------------------------|--------------|-------------------|------|------|------------|
| Attributes                     | Data type    | Min.              | Max. | Def. | Short name |
| 1. logical_name (static)       | octet-string |                   |      |      | x          |
| 2. ... (...)                   | ...          |                   |      |      | x + 0x...  |
| 3. ... (...)                   | ...          |                   |      |      | x + 0x...  |
| Specific methods (if required) | m/o          |                   |      |      |            |
| 1.                             | ...          |                   |      |      | x + 0x...  |
| 2.                             | ...          |                   |      |      | x + 0x...  |
| 3.                             | ...          |                   |      |      | x + 0x...  |

**4.1.4.2 Class name**

Describes the interface class (e.g. "Register", "Clock", "Profile generic"...).

NOTE Interface classes names are mentioned in quotation marks.

**4.1.4.3 Cardinality**

Specifies the number of instances of the IC within a logical device (see 4.1.8).

*value* The IC shall be instantiated exactly "value" times.

*min...max.* The IC shall be instantiated at least "min." times and at most "max." times. If min. is zero (0) then the IC is optional, otherwise (min. > 0) "min." instantiations of the IC are mandatory.

**4.1.4.4 class\_id**

Identification code of the IC (range 0 to 65 535). The class\_id of each object is retrieved together with the logical name by reading the object\_list attribute of an "Association LN" / "Association SN" object.

- class\_id-s from 0 to 8 191 are reserved to be specified by the DLMS UA.
- class\_id-s from 8 192 to 32 767 are reserved for manufacturer specific ICs.
- class\_id-s from 32 768 to 65 535 are reserved for user group specific ICs.

The DLMS UA reserves the right to assign ranges to individual manufacturers or user groups.

class\_id-s 32768 to 32845 are allocated to DKE.

class\_id-s 32850 to 32860 are allocated to the STS Association.

**4.1.4.5 version**

Identification code of the version of the IC. The version of each object is retrieved together with the class\_id and the logical name by reading the object\_list attribute of an "Association LN" / "Association SN" object.

**Within one logical device, all instances of a certain IC shall be of the same version.**

Version numbers are to be allocated by the DLMS User Association.

**4.1.4.6 Attributes**

Specifies the attributes that belong to the IC.

*(dyn.)* Classifies an attribute that carries a process value, which is updated by the meter itself.

*(static)* Classifies an attribute, which is not updated by the meter itself (for example configuration data).

There are some attributes which may be either static or dynamic depending on the application. In these cases this property is not indicated.

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Attribute names use the underscore notation. When mentioned in the text they are in *italic*. Example: *logical\_name*.

#### 4.1.4.7 **logical\_name**

octet-string It is always the first attribute of an IC. It identifies the instantiation (COSEM object) of this IC. The value of the *logical\_name* conforms to OBIS; see Clauses 6 and DLMS UA 1000-1 Ed 17 Part 1:2025.

#### 4.1.4.8 **Data type**

Defines the data type of an attribute; see 4.1.5.

#### 4.1.4.9 **Min.**

Specifies if the attribute has a minimum value.

X The attribute has a minimum value.

<empty> The attribute has no minimum value.

#### 4.1.4.10 **Max.**

Defines if the attribute has a maximum value.

X The attribute has a maximum value.

<empty> The attribute has no maximum value.

#### 4.1.4.11 **Def.**

Specifies if the attribute has a default value. This is the value of the attribute after reset.

X The attribute has a default value.

<empty> The default value is not defined by the IC specification.

#### 4.1.4.12 **Short name**

When Short Name (SN) referencing is used, each attribute and method of object instances has to be mapped to short names.

The base\_name x of each object instance is the DLMS named variable the logical name attribute is mapped to. It is selected in the implementation phase. The IC definition specifies the offsets for the other attributes and for the methods.

#### 4.1.4.13 **Specific methods**

Provides a list of the specific methods that belong to the object.

Method Name () The method has to be described in the subsection "Method description".

NOTE Method names use the underscore notation. When mentioned in the text they are in *italic*. Example: *add\_object*.

**4.1.4.14 m/o**

Defines if the method is mandatory or optional.

*m (mandatory)* The method is mandatory.

*o (optional)* The method is optional.

**4.1.4.15 Attribute description**

Describes each attribute with its data type (if the data type is not simple), its data format and its properties (minimum, maximum and default values).

**4.1.4.16 Method description**

Describes each method and the invoked behaviour of the COSEM object(s) instantiated.

NOTE Services for accessing attributes or methods by the protocol are specified DLMS UA 1000-2 Ed.11:2021, Clause 9.

**4.1.4.17 Selective access**

The xDLMS attribute-related services typically reference the entire attribute. However, for certain attributes selective access to just a part of the attribute may be provided. The part of the attribute is identified by specific selective access parameters. These are defined as part of the attribute specification.

Selective access is available with the following interface class attributes and methods:

- “Profile generic” objects, **buffer** attribute;
- “Association SN” objects, **object\_list** and **access\_rights\_list** attribute;
- “Association LN” objects, **object\_list** attribute;
- “Compact data”, objects, **compact\_buffer** attribute;
- “Push” objects, **push\_object\_list** attribute;
- “Data protection” objects, **protection\_object\_list** attribute **get\_protected\_attributes** method and **set\_protected\_attributes** method.

**4.1.5 Common data types**

Table 3 contains the list of data types usable for attributes of COSEM objects.

|                       |            |                             |        |
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**Table 3 – Common data types**

| Type description           | Tag <sup>a</sup> | Definition                                                                                                                                             | Value range                             |
|----------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| -- simple data types       |                  |                                                                                                                                                        |                                         |
| null-data                  | [0]              |                                                                                                                                                        |                                         |
| boolean                    | [3]              | boolean                                                                                                                                                | TRUE or FALSE                           |
| bit-string                 | [4]              | An ordered sequence of boolean values                                                                                                                  |                                         |
| double-long                | [5]              | Integer32                                                                                                                                              | -2 147 483 648...<br>2 147 483 647      |
| double-long-unsigned       | [6]              | Unsigned32                                                                                                                                             | 0...4 294 967 295                       |
|                            | [7]              | Tag of the "floating-point" type in IEC 61334-4-41:1996, not usable in DLMS/COSEM. See tags [23] and [24]                                              |                                         |
| octet-string               | [9]              | An ordered sequence of octets (8 bit bytes)                                                                                                            |                                         |
| visible-string             | [10]             | An ordered sequence of ASCII characters                                                                                                                |                                         |
|                            | [11]             | Tag of the "time" type in IEC 61334-4-41:1996, not usable in DLMS/COSEM. See tag [27]                                                                  |                                         |
| utf8-string                | [12]             | An ordered sequence of characters encoded as UTF-8                                                                                                     |                                         |
| bcd                        | [13]             | binary coded decimal                                                                                                                                   |                                         |
| integer                    | [15]             | Integer8                                                                                                                                               | -128...127                              |
| long                       | [16]             | Integer16                                                                                                                                              | -32 768...32 767                        |
| unsigned                   | [17]             | Unsigned8                                                                                                                                              | 0...255                                 |
| long-unsigned              | [18]             | Unsigned16                                                                                                                                             | 0...65 535                              |
| long64                     | [20]             | Integer64                                                                                                                                              | - 2 <sup>63</sup> ...2 <sup>63</sup> -1 |
| long64-unsigned            | [21]             | Unsigned64                                                                                                                                             | 0...2 <sup>64</sup> -1                  |
| enum                       | [22]             | The elements of the enumeration type are defined in the <i>Attribute description</i> or <i>Method description</i> section of a COSEM IC specification. | 0...255                                 |
| float32                    | [23]             | OCTET STRING (SIZE(4))                                                                                                                                 | For formatting, see 4.1.6.2.            |
| float64                    | [24]             | OCTET STRING (SIZE(8))                                                                                                                                 |                                         |
| date-time <sup>b</sup>     | [25]             | OCTET STRING SIZE(12))                                                                                                                                 | For formatting, see 4.1.6.1.            |
| date                       | [26]             | OCTET STRING (SIZE(5))                                                                                                                                 |                                         |
| time                       | [27]             | OCTET STRING (SIZE(4))                                                                                                                                 |                                         |
| delta-integer              | [28]             | Integer8                                                                                                                                               | -128...127                              |
| delta-long                 | [29]             | Integer16                                                                                                                                              | -32 768...32 767                        |
| delta-double-long          | [30]             | Integer32                                                                                                                                              | -2 147 483 648...<br>2 147 483 647      |
| delta-unsigned             | [31]             | Unsigned8                                                                                                                                              | 0...255                                 |
| delta-long-unsigned        | [32]             | Unsigned16                                                                                                                                             | 0...65 535                              |
| delta-double-long-unsigned | [33]             | Unsigned32                                                                                                                                             | 0...4 294 967 295                       |
| -- complex data types      |                  |                                                                                                                                                        |                                         |
| array                      | [1]              | The elements of the array are defined in the <i>Attribute</i> or <i>Method description</i> section of a COSEM IC specification.                        |                                         |

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| Type description                                                                                          | Tag <sup>a</sup> | Definition                                                                                                                                                                                                                                                                                                                                                                                                                   | Value range |
|-----------------------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| structure                                                                                                 | [2]              | The elements of the structure are defined in the <i>Attribute or Method description</i> section of a COSEM IC specification.                                                                                                                                                                                                                                                                                                 |             |
| compact array                                                                                             | [19]             | Provides an alternative, compact encoding of complex data.                                                                                                                                                                                                                                                                                                                                                                   |             |
| -- CHOICE                                                                                                 |                  | For some COSEM interface objects attributes, the data type may be chosen at instantiation, in the implementation phase of the COSEM server. The server always shall send back the data type and the value of each attribute, so that together with the logical name an unambiguous interpretation is ensured. The list of possible data types is defined in the "Attribute description" section of a COSEM IC specification. |             |
| <sup>a</sup> The tags are as defined in DLMS UA 1000-2 Ed.11:2021, 9.5                                    |                  |                                                                                                                                                                                                                                                                                                                                                                                                                              |             |
| <sup>b</sup> The type-description for date-time has been harmonised as date-time throughout the document. |                  |                                                                                                                                                                                                                                                                                                                                                                                                                              |             |

Excerpts