

INTERNATIONAL STANDARD



**Electricity metering data exchange – The DLMS/COSEM suite –
Part 5-3: DLMS/COSEM application layer**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 IEC, Geneva, Switzerland

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

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

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

About IEC publications

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

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

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 It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

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

INTERNATIONAL STANDARD



**Electricity metering data exchange – The DLMS/COSEM suite –
Part 5-3: DLMS/COSEM application layer**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 17.220; 35.110; 91.140.50

ISBN 978-2-8322-4599-6

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	11
INTRODUCTION.....	13
1 Scope.....	14
2 Normative references	14
3 Terms, definitions, abbreviated terms and symbols.....	16
3.1 General DLMS/COSEM definitions	16
3.2 Definitions related to cryptographic security	19
3.3 Definitions and abbreviated terms related to the Galois/Counter Mode.....	29
3.4 General abbreviated terms.....	30
3.5 Symbols related to the Galois/Counter Mode	34
3.6 Symbols related the ECDSA algorithm	35
3.7 Symbols related to the key agreement algorithms	35
4 Overview of DLMS/COSEM	35
4.1 Information exchange in DLMS/COSEM	35
4.1.1 General	35
4.1.2 Communication model	36
4.1.3 Naming and addressing	37
4.1.4 Connection oriented operation	40
4.1.5 Application associations	41
4.1.6 Messaging patterns	42
4.1.7 Data exchange between third parties and DLMS/COSEM servers	43
4.1.8 Communication profiles	43
4.1.9 Model of a DLMS/COSEM metering system	45
4.1.10 Model of DLMS/COSEM servers	45
4.1.11 Model of a DLMS/COSEM client	47
4.1.12 Interoperability and interconnectivity in DLMS/COSEM	48
4.1.13 Ensuring interconnectivity: the protocol identification service	48
4.1.14 System integration and meter installation	49
4.2 DLMS/COSEM application layer main features.....	49
4.2.1 General	49
4.2.2 DLMS/COSEM application layer structure.....	49
4.2.3 The Association Control Service Element, ACSE	51
4.2.4 The xDLMS application service element	52
4.2.5 Layer management services	59
4.2.6 Summary of DLMS/COSEM application layer services	59
4.2.7 DLMS/COSEM application layer protocols	60
5 Information security in DLMS/COSEM	60
5.1 Overview.....	60
5.2 The DLMS/COSEM security concept.....	61
5.2.1 Overview	61
5.2.2 Identification and authentication	61
5.2.3 Security context.....	64
5.2.4 Access rights	64
5.2.5 Application layer message security	64
5.2.6 COSEM data security	66
5.3 Cryptographic algorithms	67

5.3.1	Overview	67
5.3.2	Hash function	67
5.3.3	Symmetric key algorithms	68
5.3.4	Public key algorithms	74
5.3.5	Random number generation	85
5.3.6	Compression	86
5.3.7	Security suite	86
5.4	Cryptographic keys – overview	87
5.5	Key used with symmetric key algorithms	87
5.5.1	Symmetric keys types	87
5.5.2	Key information with general-ciphering APDU and data protection	88
5.5.3	Key identification	89
5.5.4	Key wrapping	89
5.5.5	Key agreement	90
5.5.6	Symmetric key cryptoperiods	90
5.6	Keys used with public key algorithms	91
5.6.1	Overview	91
5.6.2	Key pair generation	91
5.6.3	Public key certificates and infrastructure	92
5.6.4	Certificate and certificate extension profile	95
5.6.5	Suite B end entity certificate types to be supported by DLMS/COSEM servers	103
5.6.6	Management of certificates	103
5.7	Applying cryptographic protection	108
5.7.1	Overview	108
5.7.2	Protecting xDLMS APDUs	108
5.7.3	Multi-layer protection by multiple parties	121
5.7.4	HLS authentication mechanisms	122
5.7.5	Protecting COSEM data	125
6	DLMS/COSEM application layer service specification	126
6.1	Service primitives and parameters	126
6.2	The COSEM-OPEN service	128
6.3	The COSEM-RELEASE service	133
6.4	COSEM-ABORT service	136
6.5	Protection and general block transfer parameters	136
6.6	The GET service	141
6.7	The SET service	144
6.8	The ACTION service	148
6.9	The ACCESS service	151
6.9.1	Overview – Main features	151
6.9.2	Service specification	153
6.10	The DataNotification service	158
6.11	The EventNotification service	159
6.12	The TriggerEventNotificationSending service	160
6.13	Variable access specification	161
6.14	The Read service	161
6.15	The Write service	165
6.16	The UnconfirmedWrite service	168
6.17	The InformationReport service	170

6.18	Client side layer management services: the SetMapperTable.request	171
6.19	Summary of services and LN/SN data transfer service mapping	171
7	DLMS/COSEM application layer protocol specification	173
7.1	The control function	173
7.1.1	State definitions of the client side control function	173
7.1.2	State definitions of the server side control function	174
7.2	The ACSE services and APDUs	175
7.2.1	ACSE functional units, services and service parameters	175
7.2.2	Registered COSEM names	179
7.2.3	APDU encoding rules	182
7.2.4	Protocol for application association establishment	182
7.2.5	Protocol for application association release	187
7.3	Protocol for the data transfer services	191
7.3.1	Negotiation of services and options – the conformance block	191
7.3.2	Confirmed and unconfirmed service invocations	192
7.3.3	Protocol for the GET service	193
7.3.4	Protocol for the SET service	197
7.3.5	Protocol for the ACTION service	200
7.3.6	Protocol for the ACCESS service	202
7.3.7	Protocol of the DataNotification service	204
7.3.8	Protocol for the EventNotification service	204
7.3.9	Protocol for the Read service	204
7.3.10	Protocol for the Write service	208
7.3.11	Protocol for the UnconfirmedWrite service	213
7.3.12	Protocol for the InformationReport service	214
7.3.13	Protocol of general block transfer mechanism	215
8	Abstract syntax of ACSE and COSEM APDUs	226
9	COSEM APDU XML schema	239
9.1	General	239
9.2	XML Schema	240
Annex A	(normative) Using the DLMS/COSEM application layer in various communications profiles	261
A.1	General	261
A.2	Targeted communication environments	261
A.3	The structure of the profile	261
A.4	Identification and addressing schemes	261
A.5	Supporting layer services and service mapping	262
A.6	Communication profile specific parameters of the COSEM AL services	262
A.7	Specific considerations / constraints using certain services within a given profile	262
A.8	The 3-layer, connection-oriented, HDLC based communication profile	262
A.9	The TCP-UDP/IP based communication profiles (COSEM_on_IP)	262
A.10	The wired and wireless M-Bus communication profiles	262
A.11	The S-FSK PLC profile	262
Annex B	(normative) SMS short wrapper	263
Annex C	(normative) Gateway protocol	264
C.1	General	264
C.2	The gateway protocol	265
C.3	HES in the WAN/NN acting as Initiator (Pull operation)	266

C.4	End devices in the LAN acting as Initiators (Push operation).....	267
C.4.1	General	267
C.4.2	End device with WAN/NN knowledge	267
C.4.3	End devices without WAN/NN knowledge	268
C.5	Security	268
Annex D (informative)	AARQ and AARE encoding examples.....	269
D.1	General.....	269
D.2	Encoding of the xDLMS InitiateRequest / InitiateResponse APDU	269
D.3	Specification of the AARQ and AARE APDUs	272
D.4	Data for the examples	273
D.5	Encoding of the AARQ APDU	274
D.6	Encoding of the AARE APDU	277
Annex E (informative)	Encoding examples: AARQ and AARE APDUs using a ciphered application context.....	283
E.1	A-XDR encoding of the xDLMS InitiateRequest APDU, carrying a dedicated key.....	283
E.2	Authenticated encryption of the xDLMS InitiateRequest APDU	284
E.3	The AARQ APDU	285
E.4	A-XDR encoding of the xDLMS InitiateResponse APDU	287
E.5	Authenticated encryption of the xDLMS InitiateResponse APDU	288
E.6	The AARE APDU	289
E.7	The RLRQ APDU (carrying a ciphered xDLMS InitiateRequest APDU)	291
E.8	The RLRE APDU (carrying a ciphered xDLMS InitiateResponse APDU)	292
Annex F (informative)	Data transfer service examples	293
F.1	GET / Read, SET / Write examples	293
F.2	ACCESS service example	310
F.3	Compact array encoding example	311
F.3.1	General	311
F.3.2	The specification of compact-array	311
F.3.3	Example 1: Compact array encoding an array of five long-unsigned values.....	313
F.3.4	Example 2: Compact-array encoding of five octet-string values	314
F.3.5	Example 3: Encoding of the buffer of a Profile generic object	314
Annex G (normative)	NSA Suite B elliptic curves and domain parameters.....	317
Annex H (informative)	Example of an End entity signature certificate using P-256 signed with P-256	319
Annex I (normative)	Use of key agreement schemes in DLMS/COSEM	321
I.1	Ephemeral Unified Model C(2e, 0s, ECC CDH) scheme	321
I.2	One-Pass Diffie-Hellman C(1e, 1s, ECC CDH) scheme	324
I.3	Static Unified Model C(0e, 2s, ECC CDH) scheme	329
Annex J (informative)	Exchanging protected xDLMS APDUs between TP and server	333
J.1	General.....	333
J.2	Example 1: Protection is the same in the two directions	333
J.3	Example 2: Protection is different in the two directions	334
Annex K (informative)	Significant technical changes with respect to IEC 62056-5-3:2016	336
Bibliography		339
Index		343

Figure 1 – Client–server model and communication protocols	37
Figure 2 – Naming and addressing in DLMS/COSEM	38
Figure 3 – A complete communication session in the CO environment	40
Figure 4 – DLMS/COSEM messaging patterns	43
Figure 5 – DLMS/COSEM generic communication profile	44
Figure 6 – Model of a DLMS/COSEM metering system.....	45
Figure 7 – DLMS/COSEM server model	46
Figure 8 – Model of a DLMS/COSEM client using multiple protocol stacks	47
Figure 9 – The structure of the DLMS/COSEM application layers	50
Figure 10 – The concept of composable xDLMS messages	57
Figure 11 – Summary of DLMS/COSEM AL services	60
Figure 12 – Authentication mechanisms	62
Figure 13 – Client – server message security concept	65
Figure 14 – End-to-end message security concept.....	66
Figure 15 – Hash function	68
Figure 16 – Encryption and decryption	69
Figure 17 – Message Authentication Codes (MACs).....	70
Figure 18 – GCM functions	71
Figure 19 – Digital signatures	78
Figure 20 – C(2e, 0s) scheme: each party contributes only an ephemeral key pair.....	79
Figure 21 – C(1e, 1s) schemes: party U contributes an ephemeral key pair, and party V contributes a static key pair	81
Figure 22 – C(0e, 2s) scheme: each party contributes only a static key pair.....	83
Figure 23 – Architecture of a Public Key Infrastructure (example)	94
Figure 24 – MSC for provisioning the server with CA certificates	104
Figure 25 – MSC for security personalisation of the server	105
Figure 26 – Provisioning the server with the certificate of the client	106
Figure 27 – Provisioning the client / third party with a certificate of the server.....	107
Figure 28 – Remove certificate from the server.....	107
Figure 29 – Cryptographic protection of information using AES-GCM.....	111
Figure 30 – Structure of service-specific global / dedicated ciphering xDLMS APDUs	113
Figure 31 – Structure of general-glo-ciphering and general-ded-ciphering xDLMS APDUs.....	114
Figure 32 – Structure of general-ciphering xDLMS APDUs.....	115
Figure 33 – Structure of general-signing APDUs	121
Figure 34 – Service primitives.....	126
Figure 35 – Time sequence diagrams	127
Figure 36 – Additional service parameters to control cryptographic protection and GBT	137
Figure 37 – Partial state machine for the client side control function	173
Figure 38 – Partial state machine for the server side control function.....	174
Figure 39 – MSC for successful AA establishment preceded by a successful lower layer connection establishment	184
Figure 40 – Graceful AA release using the A-RELEASE service.....	189
Figure 41 – Graceful AA release by disconnecting the supporting layer	190

Figure 42 – Aborting an AA following a PH-ABORT indication	191
Figure 43 – MSC of the GET service	194
Figure 44 – MSC of the GET service with block transfer	195
Figure 45 – MSC of the GET service with block transfer, long GET aborted	197
Figure 46 – MSC of the SET service	198
Figure 47 – MSC of the SET service with block transfer	198
Figure 48 – MSC of the ACTION service	200
Figure 49 – MSC of the ACTION service with block transfer	202
Figure 50 – ACCESS Service with long response	203
Figure 51 – ACCESS Service with long request and response	203
Figure 52 – MSC of the Read service used for reading an attribute	207
Figure 53 – MSC of the Read service used for invoking a method	207
Figure 54 – MSC of the Read service used for reading an attribute, with block transfer	208
Figure 55 – MSC of the Write service used for writing an attribute	211
Figure 56 – MSC of the Write service used for invoking a method	212
Figure 57 – MSC of the Write service used for writing an attribute, with block transfer	213
Figure 58 – MSC of the UnconfirmedWrite service used for writing an attribute	214
Figure 59 – Partial service invocations and GBT APDUs	217
Figure 60 – GET service with GBT, switching to streaming	219
Figure 61 – GET service with partial invocations, GBT and streaming, recovery of 4 th block sent in the 2 nd stream	220
Figure 62 – GET service with partial invocations, GBT and streaming, recovery of 4 th and 5 th block	221
Figure 63 – GET service with partial invocations, GBT and streaming, recovery of last block	222
Figure 64 – SET service with GBT, with server not supporting streaming, recovery of 3 rd block	223
Figure 65 – ACTION-WITH-LIST service with bi-directional GBT and block recovery	224
Figure 66 – DataNotification service with GBT with partial invocation	225
Figure B.1 – Short wrapper	263
Figure C.1 – General architecture with gateway	264
Figure C.2 – The fields used for pre-fixing the COSEM APDUs	265
Figure C.3 – Pull message sequence chart	266
Figure C.4 – Push message sequence chart	267
Figure I.1 – MSC for key agreement using the Ephemeral Unified Model C(2e, 0s, ECC CDH) scheme	321
Figure I.2 – Ciphered xDLMS APDU protected by an ephemeral key established using the One-pass Diffie-Hellman (1e, 1s, ECC CDH) scheme	325
Figure I.3 – Ciphered xDLMS APDU protected by an ephemeral key established using the Static Unified Model C(0e, 2s, ECC CDH) scheme	330
Figure J.1 – Exchanging protected xDLMS APDUs between TP and server: example 1	334
Figure J.2 – Exchanging protected xDLMS APDUs between TP and server: example 2	335
Table 1 – Client and server SAPs	39
Table 2 – Clarification of the meaning of PDU size for DLMS/COSEM	58

Table 3 – Elliptic curves in DLMS/COSEM security suites	76
Table 4 – Ephemeral Unified Model key agreement scheme summary	80
Table 5 – One-pass Diffie-Hellman key agreement scheme summary	82
Table 6 – Static Unified Model key agreement scheme summary	84
Table 7 – <i>OtherInfo</i> subfields and substrings	85
Table 8 – Cryptographic algorithm ID-s	85
Table 9 – DLMS/COSEM security suites	86
Table 10 – Symmetric keys types	88
Table 11 – Key information with general-ciphering APDU and data protection	89
Table 12 – Asymmetric keys types and their use	91
Table 13 – X.509 v3 Certificate structure	95
Table 14 – X.509 v3 tbsCertificate fields	96
Table 15 – Naming scheme for the Root-CA instance (informative)	97
Table 16 – Naming scheme for the Sub-CA instance (informative)	97
Table 17 – Naming scheme for the end entity instance	98
Table 18 – X.509 v3 Certificate extensions	100
Table 19 – Key Usage extensions	101
Table 20 – Subject Alternative Name values	101
Table 21 – Issuer Alternative Name values	102
Table 22 – Basic constraints extension values	102
Table 23 – Certificates handled by DLMS/COSEM end entities	103
Table 24 – Security policy values (“Security setup” version 1)	108
Table 25 – Access rights values (“Association LN” ver 3 “Association SN” ver 4)	109
Table 26 – Ciphered xDLMS APDUs	110
Table 27 – Security control byte	112
Table 28 – Plaintext and Additional Authenticated Data	112
Table 29 – Use of the fields of the ciphering xDLMS APDUs	116
Table 30 – Example: glo-get-request xDLMS APDU	117
Table 31 – ACCESS service with general-ciphering, One-Pass Diffie-Hellman C(1e, 1s, ECC CDH) key agreement scheme	119
Table 32 – DLMS/COSEM HLS authentication mechanisms	123
Table 33 – HLS example using authentication-mechanism 5 with GMAC	124
Table 34 – HLS example using authentication-mechanism 7 with ECDSA	125
Table 35 – Codes for AL service parameters	128
Table 36 – Service parameters of the COSEM-OPEN service primitives	129
Table 37 – Service parameters of the COSEM-RELEASE service primitives	133
Table 38 – Service parameters of the COSEM-ABORT service primitives	136
Table 39 – Additional service parameters	138
Table 40 – Security parameters	139
Table 41 – APDUs used with security protection types	140
Table 42 – Service parameters of the GET service	142
Table 43 – GET service request and response types	143
Table 44 – Service parameters of the SET service	145

Table 45 – SET service request and response types	146
Table 46 – Service parameters of the ACTION service.....	148
Table 47 – ACTION service request and response types.....	149
Table 48 – Service parameters of the ACCESS service	155
Table 49 – Service parameters of the DataNotification service primitives	158
Table 50 – Service parameters of the EventNotification service primitives	159
Table 51 – Service parameters of the TriggerEventNotificationSending.request service primitive.....	160
Table 52 – Variable Access Specification.....	161
Table 53 – Service parameters of the Read service	162
Table 54 – Use of the Variable_Access_Specification variants and the Read.response choices	163
Table 55 – Service parameters of the Write service	166
Table 56 – Use of the Variable_Access_Specification variants and the Write.response choices	167
Table 57 – Service parameters of the UnconfirmedWrite service.....	169
Table 58 – Use of the Variable_Access_Specification variants.....	169
Table 59 – Service parameters of the InformationReport service.....	170
Table 60 – Service parameters of the SetMapperTable.request service primitives	171
Table 61 – Summary of ACSE services.....	171
Table 62 – Summary of xDLMS services.....	172
Table 63 – Functional Unit APDUs and their fields.....	177
Table 64 – COSEM application context names.....	180
Table 65 – COSEM authentication mechanism names	181
Table 66 – Cryptographic algorithm ID-s	182
Table 67 – xDLMS Conformance block	192
Table 68 – GET service types and APDUs	194
Table 69 – SET service types and APDUs	197
Table 70 – ACTION service types and APDUs	200
Table 71 – Mapping between the GET and the Read services.....	205
Table 72 – Mapping between the ACTION and the Read services.....	206
Table 73 – Mapping between the SET and the Write services (1 of 2).....	209
Table 74 – Mapping between the ACTION and the Write service.....	210
Table 75 – Mapping between the SET and the UnconfirmedWrite services	214
Table 76 – Mapping between the ACTION and the UnconfirmedWrite services	214
Table 77 – Mapping between the EventNotification and InformationReport services.....	215
Table B.1 – Reserved Application Processes	263
Table D.1 – Conformance block	270
Table D.2 – A-XDR encoding of the xDLMS InitiateRequest APDU	271
Table D.3 – A-XDR encoding of the xDLMS InitiateResponse APDU	272
Table D.4 – BER encoding of the AARQ APDU	275
Table D.5 – Complete AARQ APDU	277
Table D.6 – BER encoding of the AARE APDU	278
Table D.7 – The complete AARE APDU	282

Table E.1 – A-XDR encoding of the xDLMS InitiateRequest APDU	284
Table E.2 – Authenticated encryption of the xDLMS InitiateRequest APDU	285
Table E.3 – BER encoding of the AARQ APDU	286
Table E.4 – A-XDR encoding of the xDLMS InitiateResponse APDU	288
Table E.5 – Authenticated encryption of the xDLMS InitiateResponse APDU	289
Table E.6 – BER encoding of the AARE APDU	290
Table E.7 – BER encoding of the RLRQ APDU	291
Table E.8 – BER encoding of the RLRE APDU	292
Table F.1 – The objects used in the examples	293
Table F.2 – Example: Reading the value of a single attribute without block transfer	294
Table F.3 – Example: Reading the value of a list of attributes without block transfer	295
Table F.4 – Example: Reading the value of a single attribute with block transfer	297
Table F.5 – Example: Reading the value of a list of attributes with block transfer	299
Table F.6 – Example: Writing the value of a single attribute without block transfer	302
Table F.7 – Example: Writing the value of a list of attributes without block transfer	303
Table F.8 – Example: Writing the value of a single attribute with block transfer	305
Table F.9 – Example: Writing the value of a list of attributes with block transfer	307
Table F.10 – Example: ACCESS service without block transfer	310
Table G.1 – ECC_P256_Domain_Parameters	317
Table G.2 – ECC_P384_Domain_Parameters	318
Table I.1 – Test vector for key agreement using the Ephemeral Unified Model C(2e, 0s, ECC CDH) scheme	323
Table I.2 – Test vector for key agreement using the One-pass Diffie-Hellman (1e, 1s, ECC CDH) scheme	327
Table I.3 – Test vector for key agreement using the Static-Unified Model (0e, 2s, ECC CDH) scheme	331

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICITY METERING DATA EXCHANGE –
THE DLMS/COSEM SUITE –****Part 5-3: DLMS/COSEM application layer****FOREWORD**

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

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this International Standard may involve the use of a maintenance service concerning the stack of protocols on which the present standard IEC 62056-5-3 is based.

The IEC takes no position concerning the evidence, validity and scope of this maintenance service.

The provider of the maintenance service has assured the IEC that he is willing to provide services under reasonable and non-discriminatory terms and conditions for applicants throughout the world. In this respect, the statement of the provider of the maintenance service is registered with the IEC. Information may be obtained from:

DLMS¹ User Association
Zug/Switzerland
www.dlms.com

¹ Device Language Message Specification.

International Standard IEC 62056-5-3 has been prepared by IEC technical committee 13: Electrical energy measurement and control.

This third edition cancels and replaces the second edition of IEC 62056-5-3, published in 2016. It constitutes a technical revision.

The significant technical changes with respect to the previous edition are listed in Annex K (Informative).

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

FDIS	Report on voting
13/1744/FDIS	13/1747/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 62056 series, published under the general title *Electricity metering data exchange – The DLMS/COSEM suite*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This third edition of IEC 62056-5-3 has been prepared by IEC TC13 WG14 with a significant contribution of the DLMS User Association, its D-type liaison partner.

This edition is in line with DLMS UA 1000-2, the “Green Book” Ed. 8.2:2017. The main new features are the ACCESS service, the new security suites 1 and 2 supporting symmetric key and public key cryptography, the general protection mechanism and the XML schema for COSEM APDUs.

Clause 5 is based on parts of NIST documents. Reprinted courtesy of the National Institute of Standards and Technology, Technology Administration, U.S. Department of Commerce.

ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

Part 5-3: DLMS/COSEM application layer

1 Scope

This part of IEC 62056 specifies the DLMS/COSEM application layer in terms of structure, services and protocols for DLMS/COSEM clients and servers, and defines rules to specify the DLMS/COSEM communication profiles.

It defines services for establishing and releasing application associations, and data communication services for accessing the methods and attributes of COSEM interface objects, defined in IEC 62056-6-2 using either logical name (LN) or short name (SN) referencing.

Annex A (normative) defines how to use the COSEM application layer in various communication profiles. It specifies how various communication profiles can be constructed for exchanging data with metering equipment using the COSEM interface model, and what are the necessary elements to specify in each communication profile. The actual, media-specific communication profiles are specified in separate parts of the IEC 62056 series.

Annex B (normative) specifies the SMS short wrapper.

Annex C (normative) specifies the gateway protocol.

Annex D, Annex E and Annex F (informative) include encoding examples for APDUs.

Annex G (normative) provides NSA Suite B elliptic curves and domain parameters.

Annex H (informative) provides an example of an End entity signature certificate using P-256 signed with P-256.

Annex I (normative) specifies the use of key agreement schemes in DLMS/COSEM.

Annex J (informative) provides examples of exchanging protected xDLMS APDUs between a third party and a server.

Annex K (informative) lists the main technical changes in this edition of the standard.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

IEC 61334-6:2000, *Distribution automation using distribution line carrier systems – Part 6: A-XDR encoding rule*

IEC TR 62051:1999, *Electricity metering – Glossary of terms*

IEC TR 62051-1:2004, *Electricity metering – Data exchange for meter reading, tariff and load control – Glossary of terms – Part 1: Terms related to data exchange with metering equipment using DLMS/COSEM*

IEC 62056-6-2:2017, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-2: COSEM interface classes*

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

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

ISO/IEC 8825-1:2015, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

ISO/IEC 15953:1999, *Information technology – Open Systems Interconnection – Service definition for the Application Service Object Association Control Service Element*

NOTE This standard cancels and replaces ISO/IEC 8649:1996 and its Amd. 1:1997 and Amd. 2:1998, of which it constitutes a technical revision.

ISO/IEC 15954:1999, *Information technology – Open Systems Interconnection – Connection-mode protocol for the Application Service Object Association Control Service Element*

NOTE This standard cancels and replaces ISO/IEC 8650-1:1999 and its Amd. 1:1997 and Amd. 2:1998, of which it constitutes a technical revision.

ITU-T V.44: 2000, *Series v: data communication over the telephone network – Error control – V.44:2000, Data compression procedures*

ITU-T X.509:2008, *Series x: data networks, open system communications and security – Information technology – Open systems interconnection – The Directory: Public-key and attribute certificate frameworks*

ITU-T X.693 (11/2008), *Information technology – ASN.1 encoding rules: XML Encoding Rules (XER)*

ITU-T X.693 Corrigendum 1 (10/2011), *Information technology – ASN.1 encoding rules: XML Encoding Rules (XER) Technical Corrigendum 1*

ITU-T X.694 (11/2008), *Information technology – ASN.1 encoding rules: Mapping W3C XML schema definitions into ASN.1*

ITU-T X.694 Corrigendum 1 (10/2011), *Information technology – ASN.1 encoding rules: Mapping W3C XML schema definitions into ASN.1 Technical Corrigendum 1*

FIPS PUB 180-4:2012, *Secure hash standard (SHS)*

FIPS PUB 186-4:2013, *Digital Signature Standard (DSS)*

FIPS PUB 197:2001, *Advanced Encryption Standard (AES)*

NIST SP 800-21:2005, *Guideline for Implementing Cryptography in the Federal Government*

NIST SP 800-32:2001, *Introduction to Public Key Technology and the Federal PKI Infrastructure*

NIST SP 800-38D:2007, *Recommendation for Block Cipher Modes of Operation: Galois/Counter Mode (GCM) and GMAC*

NIST SP 800-56A Rev. 2: 2013, *Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography*

NIST SP 800-57:2012, *Recommendation for Key Management – Part 1: General (Revision 3)*

NSA1, *Suite B Implementer's Guide to FIPS 186-3 (ECDSA)*, Feb 3rd 2010

NSA2, *Suite B Implementer's Guide to NIST SP800-56A*, 28th July 2009

NSA3, *NSA Suite B Base Certificate and CRL Profile*, 27th May 2008

RFC 3394, *Advanced Encryption Standard (AES) Key Wrap Algorithm*. Edited by J. Schaad (Soaring Hawk Consulting) and R. Housley (RSA Laboratories) September 2002
<http://tools.ietf.org/html/rfc3394>

RFC 4108, *Using Cryptographic Message Syntax (CMS) to Protect Firmware Packages*, 2005,
<http://www.ietf.org/rfc/rfc4108>

RFC 5280, *Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile*, 2008, <http://www.ietf.org/rfc/rfc5280>

3 Terms, definitions, abbreviated terms and symbols

For the purposes of this document, the terms and definitions given in IEC TR 62051:1999, in IEC TR 62051-1, in RFC 4106, and the following 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 General DLMS/COSEM definitions

3.1.1

ACSE APDU

APDU used by the Association Control Service Element (ACSE)

3.1.2

application association

cooperative relationship between two application entities, formed by their exchange of application protocol control information through their use of presentation services

3.1.3

application context

set of application service elements, related options and any other information necessary for the interworking of application entities in an application association

3.1.4

application entity

system-independent application activities that are made available as application services to the application agent, e.g., a set of application service elements that together perform all or part of the communication aspects of an application process