

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Échange des données de comptage de l'électricité – La suite DLMS®/COSEM –
Partie 5-3: Couche application DLMS®/COSEM**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2023 IEC, Geneva, Switzerland

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

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

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

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

About the IEC

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

About IEC publications

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

IEC publications search - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

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

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

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

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

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

A propos de l'IEC

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

A propos des publications IEC

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

Recherche de publications IEC -

webstore.iec.ch/advsearchform

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

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

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

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

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

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

**Échange des données de comptage de l'électricité – La suite DLMS®/COSEM –
Partie 5-3: Couche application DLMS®/COSEM**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 17.220, 35.110, 91.140.50

ISBN 978-2-8322-7223-7

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

CONTENTS

FOREWORD.....	12
INTRODUCTION.....	14
1 Scope.....	15
2 Normative references	15
3 Terms, definitions, abbreviated terms and symbols.....	17
3.1 General DLMS®/COSEM definitions	17
3.2 Definitions related to cryptographic security	22
3.3 Definitions and abbreviated terms related to the Galois/Counter Mode.....	32
3.4 General abbreviated terms.....	34
3.5 Symbols related to the Galois/Counter Mode	38
3.6 Symbols related the ECDSA algorithm	38
3.7 Symbols related to the key agreement algorithms	39
4 Overview of DLMS®/COSEM	39
4.1 Information exchange in DLMS®/COSEM	39
4.1.1 General	39
4.1.2 Communication model	40
4.1.3 Naming and addressing	41
4.1.4 Connection oriented operation.....	44
4.1.5 Application associations	45
4.1.6 Messaging patterns	46
4.1.7 Data exchange between third parties and DLMS®/COSEM servers	47
4.1.8 Communication profiles	48
4.1.9 Model of a DLMS®/COSEM metering system.....	50
4.1.10 Model of DLMS®/COSEM servers.....	50
4.1.11 Model of a DLMS®/COSEM client.....	52
4.1.12 Interoperability and interconnectivity in DLMS®/COSEM	53
4.1.13 Ensuring interconnectivity: the protocol identification service.....	53
4.1.14 System integration and meter installation	53
4.2 DLMS®/COSEM application layer main features	54
4.2.1 General	54
4.2.2 DLMS®/COSEM application layer structure	54
4.2.3 The Association Control Service Element, ACSE	55
4.2.4 The xDLMS application service element	56
4.2.5 Layer management services	64
4.2.6 Summary of DLMS®/COSEM application layer services.....	64
4.2.7 DLMS®/COSEM application layer protocols.....	65
5 Information security in DLMS®/COSEM.....	65
5.1 Overview.....	65
5.2 The DLMS®/COSEM security concept	65
5.2.1 Overview	65
5.2.2 Identification and authentication	66
5.2.3 Security context.....	69
5.2.4 Access rights.....	69
5.2.5 Application layer message security	69
5.2.6 COSEM data security	72
5.3 Cryptographic algorithms	72

5.3.1	Overview	72
5.3.2	Hash function	72
5.3.3	Symmetric key algorithms	73
5.3.4	Public key algorithms	80
5.3.5	Random number generation	90
5.3.6	Compression	91
5.3.7	Security suite	91
5.4	Cryptographic keys – overview	92
5.5	Key used with symmetric key algorithms	92
5.5.1	Symmetric keys types	92
5.5.2	Key information with general-ciphering APDU and data protection	94
5.5.3	Key identification	94
5.5.4	Key wrapping	95
5.5.5	Key agreement	95
5.5.6	Symmetric key cryptoperiods	96
5.6	Keys used with public key algorithms	96
5.6.1	Overview	96
5.6.2	Key pair generation	96
5.6.3	Public key certificates and infrastructure	97
5.6.4	Certificate and certificate extension profile	100
5.6.5	Suite B end entity certificate types to be supported by DLMS®/COSEM servers	108
5.6.6	Management of certificates	108
5.7	Applying cryptographic protection	113
5.7.1	Overview	113
5.7.2	Protecting xDLMS APDUs	113
5.7.3	Multi-layer protection by multiple parties	126
5.7.4	HLS authentication mechanisms	127
5.7.5	Protecting COSEM data	130
6	DLMS®/COSEM application layer service specification	131
6.1	Service primitives and parameters	131
6.2	The COSEM-OPEN service	133
6.3	The COSEM-RELEASE service	138
6.4	COSEM-ABORT service	141
6.5	Protection and general block transfer parameters	141
6.6	The GET service	146
6.7	The SET service	149
6.8	The ACTION service	153
6.9	The ACCESS service	156
6.9.1	Overview – Main features	156
6.9.2	Service specification	158
6.10	The DataNotification service	162
6.11	The EventNotification service	164
6.12	The TriggerEventNotificationSending service	165
6.13	Variable access specification	166
6.14	The Read service	166
6.15	The Write service	170
6.16	The UnconfirmedWrite service	173
6.17	The InformationReport service	175

6.18	Client side layer management services: the SetMapperTable.request	176
6.19	Summary of services and LN/SN data transfer service mapping	176
7	DLMS®/COSEM application layer protocol specification	177
7.1	The control function	177
7.1.1	State definitions of the client side control function	177
7.1.2	State definitions of the server side control function	179
7.2	The ACSE services and APDUs	181
7.2.1	ACSE functional units, services and service parameters	181
7.2.2	Registered COSEM names	184
7.2.3	APDU encoding rules	187
7.2.4	Protocol for application association establishment	187
7.2.5	Protocol for application association release	193
7.3	Protocol for the data transfer services	196
7.3.1	Negotiation of services and options – the conformance block	196
7.3.2	Confirmed and unconfirmed service invocations	197
7.3.3	Protocol for the GET service	199
7.3.4	Protocol for the SET service	202
7.3.5	Protocol for the ACTION service	205
7.3.6	Protocol for the ACCESS service	207
7.3.7	Protocol of the DataNotification service	208
7.3.8	Protocol for the EventNotification service	211
7.3.9	Protocol for the Read service	212
7.3.10	Protocol for the Write service	215
7.3.11	Protocol for the UnconfirmedWrite service	219
7.3.12	Protocol for the InformationReport service	220
7.3.13	Protocol of general block transfer mechanism	221
7.3.14	Protocol of exception mechanism	243
8	Abstract syntax of ACSE and COSEM APDUs	244
9	COSEM APDU XML schema	263
9.1	General	263
9.2	XML Schema	263
Annex A (normative) Using the DLMS®/COSEM application layer in various communications profiles		285
A.1	General	285
A.2	Targeted communication environments	285
A.3	The structure of the profile	285
A.4	Identification and addressing schemes	285
A.5	Supporting layer services and service mapping	286
A.6	Communication profile specific parameters of the COSEM AL services	286
A.7	Specific considerations / constraints using certain services within a given profile	286
A.8	The 3-layer, connection-oriented, HDLC based communication profile	286
A.9	The TCP-UDP/IP based communication profiles (COSEM_on_IP)	286
A.10	The wired and wireless M-Bus communication profiles	286
A.11	The S-FSK PLC profile	286
Annex B (normative) SMS short wrapper		287
Annex C (normative) Gateway protocol		288
C.1	General	288
C.2	The gateway protocol	289

C.3	HES in the WAN/NN acting as Initiator (Pull operation)	290
C.4	End devices in the LAN acting as Initiators (Push operation).....	291
C.4.1	General	291
C.4.2	End device with WAN/NN knowledge	291
C.4.3	End devices without WAN/NN knowledge	291
C.5	Security	291
Annex D	(informative) AARQ and AARE encoding examples	292
D.1	General.....	292
D.2	Encoding of the xDLMS InitiateRequest / InitiateResponse APDU	292
D.3	Specification of the AARQ and AARE APDUs	295
D.4	Data for the examples	296
D.5	Encoding of the AARQ APDU	297
D.6	Encoding of the AARE APDU	300
Annex E	(informative) Encoding examples: AARQ and AARE APDUs using a ciphered application context	306
E.1	A-XDR encoding of the xDLMS InitiateRequest APDU, carrying a dedicated key.....	306
E.2	Authenticated encryption of the xDLMS InitiateRequest APDU	307
E.3	The AARQ APDU	308
E.4	A-XDR encoding of the xDLMS InitiateResponse APDU	310
E.5	Authenticated encryption of the xDLMS InitiateResponse APDU	311
E.6	The AARE APDU	312
E.7	The RLRQ APDU (carrying a ciphered xDLMS InitiateRequest APDU)	314
E.8	The RLRE APDU (carrying a ciphered xDLMS InitiateResponse APDU)	315
Annex F	(informative) Data transfer service examples	316
F.1	GET / Read, SET / Write examples	316
F.2	ACCESS service example	333
F.3	Compact array encoding example	334
F.3.1	General	334
F.3.2	The specification of compact-array	335
F.3.3	Example 1: Compact array encoding an array of five long-unsigned values.....	336
F.3.4	Example 2: Compact-array encoding of five octet-string values	337
F.3.5	Example 3: Encoding of the buffer of a Profile generic object	338
F.4	Profile generic IC buffer attribute encoding examples	339
F.4.1	General	339
F.4.2	Get-response with Profile generic normal encoding example	340
F.4.3	Get-response with Profile generic null-data compressed encoding example.....	342
F.4.4	Get-response with Profile generic compact-array encoding example	345
F.4.5	Get-response with Profile generic null-data and delta-value encoding example.....	347
F.4.6	Comparison of various encoding methods for Get-response APDU	350
F.4.7	Combination of the various encoding methods and V.44 compression	350
Annex G	(normative) NSA Suite B elliptic curves and domain parameters	352
Annex H	(informative) Example of an End entity signature certificate using P-256 signed with P-256	354
H.1	Fields of public key certificates	354
H.2	Example of a Root-CA Certificate using P-256 signed with P-256	355

H.3 Example of an end entity digital signature Certificate using P-256 signed with P-256 356

Annex I (normative) Use of key agreement schemes in DLMS@/COSEM..... 357

 I.1 Ephemeral Unified Model C(2e, 0s, ECC CDH) scheme 357

 I.2 One-Pass Diffie-Hellman C(1e, 1s, ECC CDH) scheme 360

 I.3 Static Unified Model C(0e, 2s, ECC CDH) scheme 363

Annex J (informative) Exchanging protected xDLMS APDUs between TP and server 367

 J.1 General..... 367

 J.2 Example 1: Protection is the same in the two directions 367

 J.3 Example 2: Protection is different in the two directions 368

Annex K (informative) Significant technical changes with respect to IEC 62056-5-3:2017 370

Bibliography..... 373

Figure 1 – Client–server model and communication protocols 41

Figure 2 – Naming and addressing in DLMS@/COSEM 42

Figure 3 – A complete communication session in the CO environment 44

Figure 4 – DLMS@/COSEM messaging patterns 47

Figure 5 – DLMS@/COSEM generic communication profile 49

Figure 6 – Model of a DLMS@/COSEM metering system 50

Figure 7 – DLMS@/COSEM server model..... 51

Figure 8 – Model of a DLMS@/COSEM client using multiple protocol stacks..... 52

Figure 9 – The structure of the DLMS@/COSEM application layers 54

Figure 10 – The concept of composable xDLMS messages 61

Figure 11 – Summary of DLMS@/COSEM AL services 64

Figure 12 – Authentication mechanisms 67

Figure 13 – Client – server message security concept 70

Figure 14 – End-to-end message security concept 71

Figure 15 – Hash function 73

Figure 16 – Encryption and decryption 74

Figure 17 – Message Authentication Codes (MACs)..... 75

Figure 18 – GCM functions 77

Figure 19 – Digital signatures 83

Figure 20 – C(2e, 0s) scheme: each party contributes only an ephemeral key pair..... 85

Figure 21 – C(1e, 1s) schemes: party U contributes an ephemeral key pair, and party V contributes a static key pair 86

Figure 22 – C(0e, 2s) scheme: each party contributes only a static key pair..... 88

Figure 23 – Architecture of a Public Key Infrastructure (example) 99

Figure 24 – MSC for provisioning the server with CA certificates 109

Figure 25 – MSC for security personalisation of the server 110

Figure 26 – Provisioning the server with the certificate of the client 111

Figure 27 – Provisioning the client / third party with a certificate of the server..... 112

Figure 28 – Remove certificate from the server 112

Figure 29 – Cryptographic protection of information using AES-GCM..... 116

Figure 30 – Structure of service-specific global / dedicated ciphering xDLMS APDUs 118

Figure 31 – Structure of general-glo-ciphering and general-ded-ciphering xDLMS APDUs.....	119
Figure 32 – Structure of general-ciphering xDLMS APDUs.....	120
Figure 33 – Structure of general-signing APDUs.....	126
Figure 34 – Service primitives.....	131
Figure 35 – Time sequence diagrams.....	132
Figure 36 – Additional service parameters to control cryptographic protection and GBT.....	142
Figure 37 – Partial state machine for the client side control function.....	178
Figure 38 – Partial state machine for the server side control function.....	180
Figure 39 – MSC for successful AA establishment preceded by a successful lower layer connection establishment.....	189
Figure 40 – Graceful AA release using the A-RELEASE service.....	194
Figure 41 – Graceful AA release by disconnecting the supporting layer.....	195
Figure 42 – Aborting an AA following a PH-ABORT.indication.....	196
Figure 43 – MSC of the GET service.....	199
Figure 44 – MSC of the GET service with block transfer.....	200
Figure 45 – MSC of the GET service with block transfer, long GET aborted.....	202
Figure 46 – MSC of the SET service.....	203
Figure 47 – MSC of the SET service with block transfer.....	203
Figure 48 – MSC of the ACTION service.....	205
Figure 49 – MSC of the ACTION service with block transfer.....	207
Figure 50 – Access Service with long response.....	208
Figure 51 – Access Service with long request and response.....	208
Figure 52 – MSC for the DataNotification service, case 1).....	209
Figure 53 – MSC for the DataNotification service, case 2).....	210
Figure 54 – MSC for the DataNotification service, case 3).....	211
Figure 55 – MSC of the Read service used for reading an attribute.....	214
Figure 56 – MSC of the Read service used for invoking a method.....	214
Figure 57 – MSC of the Read Service used for reading an attribute, with block transfer.....	215
Figure 58 – MSC of the Write service used for writing an attribute.....	218
Figure 59 – MSC of the Write service used for invoking a method.....	218
Figure 60 – MSC of the Write Service used for writing an attribute, with block transfer.....	219
Figure 61 – MSC of the Unconfirmed Write service used for writing an attribute.....	220
Figure 62 – Partial service invocations and GBT APDUs.....	223
Figure 63 – The GBT procedure.....	226
Figure 64 – Send GBT APDU stream sub-procedure.....	230
Figure 65 – Process GBT APDU sub-procedure.....	232
Figure 66 – Check RQ and fill gaps sub-procedure.....	234
Figure 67 – GET service with GBT, switching to streaming.....	235
Figure 68 – GET service with partial invocations, GBT and streaming, recovery of 4 th block sent in the 2 nd stream.....	236
Figure 69 – GET service with partial invocations, GBT and streaming, recovery of 4 th and 5 th block.....	238

Figure 70 – GET service with partial invocations, GBT and streaming, recovery of last block..... 239

Figure 71 – SET service with GBT, with server not supporting streaming, recovery of 3rd block..... 240

Figure 72 – ACTION-WITH-LIST service with bi-directional GBT and block recovery 241

Figure 73 – DataNotification service with GBT with partial invocation..... 243

Figure B.1 – Short wrapper 287

Figure C.1 – General architecture with gateway 288

Figure C.2 – The fields used for pre-fixing the COSEM APDUs 289

Figure C.3 – Pull message sequence chart 290

Figure C.4 – Push message sequence chart 291

Figure I.1 – MSC for key agreement using the Ephemeral Unified Model C(2e, 0s, ECC CDH) scheme 357

Figure I.2 – Ciphered xDLMS APDU protected by an ephemeral key established using the One-pass Diffie-Hellman (1e, 1s, ECC CDH) scheme..... 360

Figure I.3 – Ciphered xDLMS APDU protected by an ephemeral key established using the Static Unified Model C(0e, 2s, ECC CDH) scheme 364

Figure J.1 – Exchanging protected xDLMS APDUs between TP and server: example 1..... 368

Figure J.2 – Exchanging protected xDLMS APDUs between TP and server: example 2..... 369

Table 1 – Client and server SAPs 43

Table 2 – Clarification of the meaning of PDU size for DLMS®/COSEM 63

Table 3 – Elliptic curves in DLMS®/COSEM security suites 81

Table 4 – Ephemeral Unified Model key agreement scheme summary 85

Table 5 – One-pass Diffie-Hellman key agreement scheme summary 87

Table 6 – Static Unified Model key agreement scheme summary 89

Table 7 – *OtherInfo* subfields and substrings 90

Table 8 – Security algorithm ID-s 90

Table 9 – DLMS®/COSEM security suites..... 91

Table 10 – Symmetric keys types..... 93

Table 11 – Key information with general-ciphering APDU and data protection..... 94

Table 12 – Asymmetric keys types and their use..... 96

Table 13 – X.509 v3 Certificate structure 100

Table 14 – X.509 v3 tbsCertificate fields 101

Table 15 – Naming scheme for the Root-CA instance (informative)..... 102

Table 16 – Naming scheme for the Sub-CA instance (informative)..... 102

Table 17 – Naming scheme for the end entity instance 103

Table 18 – X.509 v3 Certificate extensions 105

Table 19 – Key Usage extensions 106

Table 20 – Subject Alternative Name values 106

Table 21 – Issuer Alternative Name values 107

Table 22 – Basic constraints extension values 107

Table 23 – Certificates handled by DLMS®/COSEM end entities..... 108

Table 24 – Security policy values ("Security setup" version 1) 113

Table 25 – Access rights values ("Association LN" ver 3 "Association SN" ver 4).....	114
Table 26 – Ciphered xDLMS APDUs	115
Table 27 – Security control byte.....	117
Table 28 – Plaintext and Additional Authenticated Data	117
Table 29 – Use of the fields of the ciphering xDLMS APDUs	121
Table 30 – Example: glo-get-request xDLMS APDU	122
Table 31 – ACCESS service with general-ciphering, One-Pass Diffie-Hellman C(1e, 1s, ECC CDH) key agreement scheme.....	124
Table 32 – DLMS®/COSEM HLS authentication mechanisms	128
Table 33 – HLS example using authentication-mechanism 5 with GMAC.....	129
Table 34 – HLS example using authentication-mechanism 7 with ECDSA	130
Table 35 – Codes for AL service parameters.....	133
Table 36 – Service parameters of the COSEM-OPEN service primitives	134
Table 37 – Service parameters of the COSEM-RELEASE service primitives	138
Table 38 – Service parameters of the COSEM-ABORT service primitives	141
Table 39 – Additional service parameters	143
Table 40 – Security parameters	144
Table 41 – APDUs used with security protection types.....	145
Table 42 – Service parameters of the GET service	147
Table 43 – GET service request and response types	148
Table 44 – Service parameters of the SET service	150
Table 45 – SET service request and response types.....	151
Table 46 – Service parameters of the ACTION service.....	153
Table 47 – ACTION service request and response types.....	154
Table 48 – Service parameters of the ACCESS service	159
Table 49 – Service parameters of the DataNotification service primitives.....	163
Table 50 – Service parameters of the EventNotification service primitives	164
Table 51 – Service parameters of the TriggerEventNotificationSending.request service primitive.....	165
Table 52 – Variable Access Specification.....	166
Table 53 – Service parameters of the Read service	167
Table 54 – Use of the Variable_Access_Specification variants and the Read.response choices	168
Table 55 – Service parameters of the Write service	171
Table 56 – Use of the Variable_Access_Specification variants and the Write.response choices	172
Table 57 – Service parameters of the UnconfirmedWrite service.....	174
Table 58 – Use of the Variable_Access_Specification variants.....	174
Table 59 – Service parameters of the InformationReport service.....	175
Table 60 – Service parameters of the SetMapperTable.request service primitives	176
Table 61 – Summary of ACSE services.....	176
Table 62 – Summary of xDLMS services	177
Table 63 – Functional Unit APDUs and their fields	182
Table 64 – COSEM application context names.....	186

Table 65 – COSEM authentication mechanism names	186
Table 66 – Cryptographic algorithm ID-s	187
Table 67 – xDLMS Conformance block	197
Table 68 – GET service types and APDUs	199
Table 69 – SET service types and APDUs	202
Table 70 – ACTION service types and APDUs	205
Table 71 – Mapping between the GET and the Read services	212
Table 72 – Mapping between the ACTION and the Read services	213
Table 73 – Mapping between the SET and the Write services	216
Table 74 – Mapping between the ACTION and the Write service	217
Table 75 – Mapping between the SET and the UnconfirmedWrite services	220
Table 76 – Mapping between the ACTION and the UnconfirmedWrite services	220
Table 77 – Mapping between the EventNotification and InformationReport services	221
Table 78 – GBT procedure state variables	228
Table 79 – xDLMS exception mechanism	244
Table B.1 – Reserved Application Processes	287
Table D.1 – Conformance block	293
Table D.2 – A-XDR encoding of the xDLMS InitiateRequest APDU	294
Table D.3 – A-XDR encoding of the xDLMS InitiateResponse APDU	295
Table D.4 – BER encoding of the AARQ APDU	298
Table D.5 – Complete AARQ APDU	300
Table D.6 – BER encoding of the AARE APDU	301
Table D.7 – The complete AARE APDU	305
Table E.1 – A-XDR encoding of the xDLMS InitiateRequest APDU	307
Table E.2 – Authenticated encryption of the xDLMS InitiateRequest APDU	308
Table E.3 – BER encoding of the AARQ APDU	309
Table E.4 – A-XDR encoding of the xDLMS InitiateResponse APDU	311
Table E.5 – Authenticated encryption of the xDLMS InitiateResponse APDU	312
Table E.6 – BER encoding of the AARE APDU	313
Table E.7 – BER encoding of the RLRQ APDU	314
Table E.8 – BER encoding of the RLRE APDU	315
Table F.1 – The objects used in the examples	316
Table F.2 – Example: Reading the value of a single attribute without block transfer	317
Table F.3 – Example: Reading the value of a list of attributes without block transfer	318
Table F.4 – Example: Reading the value of a single attribute with block transfer	320
Table F.5 – Example: Reading the value of a list of attributes with block transfer	322
Table F.6 – Example: Writing the value of a single attribute without block transfer	325
Table F.7 – Example: Writing the value of a list of attributes without block transfer	326
Table F.8 – Example: Writing the value of a single attribute with block transfer	328
Table F.9 – Example: Writing the value of a list of attributes with block transfer	330
Table F.10 – Example: ACCESS service without block transfer	333
Table F.11 – Profile generic buffer – get-response with normal encoding	340
Table F.12 – Profile generic buffer – get-response with null-data compression	342

Table F.13 – Profile generic buffer – get-response with compact-array encoding 345

Table F.14 – Profile generic buffer – Get-response with null-data and delta-value encoding 348

Table F.15 – Comparison of various encoding methods for get-response APDU 350

Table F.16 – Combination of the various encoding methods and V.44 compression for get-response APDU 351

Table G.1 – ECC_P256_Domain_Parameters 352

Table G.2 – ECC_P384_Domain_Parameters 353

Table H.1 – Fields of public key Certificates using P-256 signed with P-256 354

Table I.1 – Test vector for key agreement using the Ephemeral Unified Model C(2e, 0s, ECC CDH) scheme 358

Table I.2 – Test vector for key agreement using the One-pass Diffie-Hellman (1e, 1s, ECC CDH) scheme 361

Table I.3 – Test vector for key agreement using the Static-Unified Model (0e, 2s, ECC CDH) scheme 365

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.

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

This fourth edition cancels and replaces the third edition published in 2017. This edition 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:

Draft	Report on voting
13/1890/FDIS	13/1904/RVD

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

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

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

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

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

IMPORTANT – The "colour inside" logo on the cover page of this document 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 fourth edition of IEC 62056-5-3 has been prepared by IEC TC13 WG14 with a significant contribution of the DLMS® User Association, its A-type liaison partner.

This edition is in line with DLMS® UA 1000-2, the "Green Book" Ed. 10:2020 and DLMS® UA 1000-2, the "Green Book" Ed. 10 Amendment 1 2021.

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
www.dlms.com

¹ Device Language Message Specification.