

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



---

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

**Échange des données de comptage de l'électricité – La suite DLMS/COSEM –  
Partie 8-8: Profil de communication pour réseaux de la série ISO/IEC 14908**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2020 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 Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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](http://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 It also gives information on projects, replaced and withdrawn publications.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](http://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](http://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](mailto:sales@iec.ch).

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries 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](http://std.iec.ch/glossary)

67 000 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.

---

### 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](http://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](http://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](http://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](mailto:sales@iec.ch).

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



---

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

**Échange des données de comptage de l'électricité – La suite DLMS/COSEM –  
Partie 8-8: Profil de communication pour réseaux de la série ISO/IEC 14908**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

---

ICS 17.220; 35.110; 91.140.50

ISBN 978-2-8322-8082-9

**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.....	7
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references .....	10
3 Terms, definitions and abbreviated terms .....	11
3.1 Terms and definitions.....	11
3.2 Abbreviated terms.....	12
4 Targeted communication environments.....	13
5 Use of the communication layers for this profile.....	13
5.1 Information related to the use of the standard specifying the lower layers .....	13
5.2 The structure of the communication profile.....	14
5.3 Lower layers and their use .....	14
5.3.1 Overview .....	14
5.3.2 Physical layer .....	15
5.3.3 Data link layer .....	15
5.3.4 Network layer .....	15
5.3.5 Transport layer .....	15
5.4 Service mapping and Adaptation layer .....	16
5.4.1 Overview .....	16
5.4.2 Adaptation layer .....	16
5.5 Registration and connection management.....	27
6 Identification and addressing schemes .....	27
7 Specific considerations for the application layer services.....	28
7.1 Overview.....	28
7.2 Application Association establishment and release: ACSE services .....	28
7.2.1 Application association establishment.....	28
7.2.2 Application association release.....	29
7.2.3 COSEM-OPEN and COSEM-RELEASE service parameters .....	29
7.3 xDLMS services .....	30
7.4 Security mechanisms .....	30
7.4.1 DLMS/COSEM security.....	30
7.4.2 Adaptation layer security .....	30
7.4.3 Lower layers security .....	30
7.5 Transferring long application messages .....	30
7.6 Media access, bandwidth and timing considerations .....	30
7.7 Other considerations.....	30
8 Communication configuration and management.....	31
9 The COSEM Application Process.....	31
10 Additional considerations for the use of this profile .....	31
Annex A (informative) Examples .....	32
Annex B (normative) Interface classes .....	33
B.1 Interface classes.....	33
B.1.1 ISO/IEC 14908 Identification.....	33
B.1.2 ISO/IEC 14908 Protocol setup .....	33
B.1.3 ISO/IEC 14908 Protocol status .....	34

B.1.4	ISO/IEC 14908 Diagnostic .....	35
B.2	Relation to OBIS .....	37
Annex C (informative)	Implementation guide and migration path .....	38
C.1	General.....	38
C.2	Client-server model.....	38
C.2.1	General .....	38
C.2.2	Clients .....	38
C.2.3	Servers.....	39
C.2.4	Application associations .....	39
C.3	The COSEM objects.....	40
C.3.1	COSEM object model.....	40
C.3.2	Referencing methods.....	41
C.3.3	The object_list.....	42
C.3.4	Mandatory COSEM objects.....	42
C.3.5	Application specific objects.....	42
C.3.6	Utility table objects .....	42
Annex D (informative)	OSGP-AES-128-PSK security suite .....	46
D.1	General.....	46
D.2	Background.....	47
D.2.1	Overview .....	47
D.2.2	System Assumptions .....	47
D.2.3	Threat Model .....	47
D.2.4	Design goals.....	48
D.2.5	Inspiration .....	48
D.3	Terms and definition, abbreviated terms and notation .....	48
D.3.1	Terms and definitions .....	48
D.3.2	Abbreviated terms .....	50
D.3.3	Notation.....	50
D.3.4	Other conventions .....	50
D.4	Cryptographic Primitives .....	51
D.4.1	General .....	51
D.4.2	CMAC.....	51
D.4.3	CCM .....	51
D.5	Cryptographic Functions .....	52
D.5.1	Overview .....	52
D.5.2	OSGP_KDF: Key Derivation Function .....	52
D.5.3	OSGP_MAC: Message Authentication Code Function.....	52
D.5.4	OSGP_MAC_VERIFY: Message Authentication Code Verification Function .....	53
D.5.5	OSGP_AE/OSGP_AD: Authenticated Encryption/Decryption Function .....	53
D.5.6	OSGP_CSPRNG: Cryptographically Secure Pseudo Random Number Generator .....	55
D.6	Keys .....	56
D.7	Secure channel initialization .....	58
D.7.1	Overview .....	58
D.7.2	Secure Channel State (CryptoContext) .....	58
D.7.3	Flow .....	58
D.7.4	Security Suite Negotiation .....	63
D.7.5	LNAP Commissioning .....	64

D.7.6	Error Handling and Intrusion Detection .....	64
D.7.7	Messages .....	64
D.8	Secure Channel Communication .....	67
D.8.1	General .....	67
D.8.2	The General Process .....	68
D.8.3	Unicast communication .....	69
D.8.4	Broadcast Communication .....	73
D.9	Firmware Downloading .....	75
D.10	Key Management .....	76
D.10.1	Renewing the Short-term, Meter-unique Keys .....	76
D.10.2	Renewing the Short-term, Domain-unique Keys .....	76
D.10.3	UpdateDomainKeysRequest .....	77
D.10.4	UpdateDomainKeysResponse .....	77
D.11	Updating the Long-term, Meter-unique Keys .....	77
D.11.1	General .....	77
D.11.2	Key Validity Periods .....	78
D.12	Error Messages .....	78
D.12.1	Overview .....	78
D.12.2	AuthenticationFailure .....	78
D.12.3	SequenceError .....	78
D.13	Security considerations .....	78
D.13.1	Reasoning .....	78
D.13.2	Recommendation and Guidance for Implementers .....	81
Annex E (normative)	Repeating mechanism .....	83
E.1	Overview .....	83
E.2	Terms and definitions .....	83
E.3	Protocol specification .....	84
E.3.1	Overview .....	84
E.3.2	Addressing .....	84
E.3.3	Service types .....	84
E.3.4	Timers .....	84
E.3.5	Request flow .....	85
E.3.6	Response flow .....	85
E.3.7	Authentication .....	85
E.3.8	Examples .....	86
E.3.9	Broadcast .....	87
E.4	Downlink frame format .....	87
E.4.1	Overview .....	87
E.4.2	Proxy parameters of request frame .....	88
E.5	Uplink Frame format .....	92
E.5.1	Overview .....	92
E.5.2	Proxy success .....	92
E.5.3	Repeating Failure .....	93
E.5.4	Authentication failure .....	93
Annex F (informative)	ISO/IEC 14908-3 Registration and monitoring of LNAPs .....	94
F.1	Scope .....	94
F.2	Terms and definitions .....	94
F.3	Metering device lifecycle .....	94
F.4	ATM Protocol .....	95

F.4.1	General .....	95
F.4.2	ATM roles .....	95
F.4.3	Automatic discovery .....	95
F.4.4	Discovery domain .....	96
F.4.5	ATM messages .....	96
F.5	Commissioning .....	100
F.5.1	Overview .....	100
F.5.2	Commissioning operations .....	100
	Bibliography .....	101
Figure 1	– Functional reference architecture .....	13
Figure 2	– Structure of the communication profile .....	14
Figure 3	– Adaptation layer structure .....	17
Figure 4	– Unprotected Adaptation layer PDU structure .....	18
Figure 5	– Protected Adaptation layer PDU structure .....	19
Figure 6	– Adaptation layer services .....	20
Figure 7	– Client and server ADP_DATA services .....	24
Figure D.1	– Key hierarchy diagram .....	56
Figure D.2	– Secure channel establishment .....	59
Figure D.3	– Challenge request .....	60
Figure D.4	– Challenge response .....	60
Figure D.5	– Commission Request .....	61
Figure D.6	– Commission response .....	62
Figure D.7	– Crypto context establishment .....	67
Figure D.8	– Authenticate encryption mechanism .....	68
Figure D.9	– Authenticated decryption .....	69
Figure E.1	– Unacknowledged message exchange .....	86
Figure E.2	– Request / Response message .....	86
Figure E.3	– Error during request transmission .....	86
Figure E.4	– Error during response transmission .....	87
Figure E.5	– Proxy Repeater proxy message .....	87
Figure E.6	– Proxy Agent proxy message format .....	87
Figure E.7	– Proxy Target message format .....	88
Figure E.8	– Normal ProxyTrailer .....	90
Figure E.9	– Alternate Key Proxy Trailer .....	90
Figure E.10	– Proxy SICB field structure .....	90
Figure E.11	– Alternate Key format .....	91
Figure E.12	– ProxySubnetNode Address (Type1) .....	92
Figure E.13	– ProxyUniqueNode_ID Address (Type 2) .....	92
Figure E.14	– ProxyBroadcast Address (Type 3) .....	92
Figure E.15	– ProxySubnetNode Compact Address (Type 5 and 7) .....	92
Figure E.16	– ProxyUniqueNodeCompact Address (Type 6) .....	92
Table 1	– Control field .....	18

Table 2 – Client and Server SAP.....	28
Table 3 – Application associations and data exchange in the DLMS/COSEM over ISO/IEC14908 profile .....	29
Table C.1 – Pre-established association parameters.....	40
Table C.2 – base_name range for tables categories .....	43
Table C.3 – base_names for standard tables BT00 to BT79.....	44
Table D.1 – Security logical layers .....	46
Table D.2 – Key type and their scope .....	57
Table D.3 – Challenge request.....	65
Table D.4 – Challenge response .....	65
Table D.5 – Commission request .....	66
Table D.6 – Commission response structure .....	67
Table D.7 – Request message .....	70
Table D.8 – response message structure .....	70
Table D.9 – Nonce construction .....	70
Table D.10 – Associated Data construction.....	71
Table D.11 – Broadcast message .....	74
Table D.12 – Broadcast nonce .....	74
Table D.13 – Broadcast Associated Data .....	74
Table D.14 – Update Domain Keys request.....	77
Table D.15 – Update Domain Keys response .....	77
Table D.16 – AuthenticationFailure message .....	78
Table D.17 – SequenceError message.....	78
Table D.18 – Example of risks .....	82
Table E.1 – ProxyHeader format.....	88
Table E.2 – ProxyDetailedAddress format.....	89
Table E.3 – ProxyUniformAddress format.....	89
Table E.4 – ProxyTx control format.....	89
Table E.5 – Address Type values.....	90
Table E.6 – Service types .....	91
Table E.7 – Mode types .....	91
Table E.8 – Repeating success response.....	93
Table E.9 – Repeating Failure.....	93
Table E.10 – Authentication failure code.....	93
Table F.1 – ATM Message header structure.....	97
Table F.2 – ATM payloads .....	97
Table F.3 – ATM-query-ID request structure .....	98
Table F.4 – ATM-query-ID response structure.....	98
Table F.5 – ATM-respond-to-query request structure .....	99
Table F.6 – ATM respond-to-query response structure.....	99
Table F.7 – Flags.....	100

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

**ELECTRICITY METERING DATA EXCHANGE –  
THE DLMS/COSEM SUITE –**
**Part 8-8: Communication profile for ISO/IEC 14908 series networks****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.

International Standard IEC 62056-8-8 has been prepared by IEC technical committee 13, Electrical energy measurement and control.

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

CDV	Report on voting
13/1783/CDV	13/1792/RVC

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 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 "<http://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 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

The IEC 62056 DLMS/COSEM suite provides specific communication profile standards for communication media relevant for smart metering.

Such communication profile standards specify how the COSEM data model and the DLMS/COSEM application layer can be used on the lower communication media-specific protocol layers.

Communication profile standards refer to communication standards that are part of the IEC 62056 DLMS/COSEM suite or to any other open communication standard.

This International Standard specifies DLMS/COSEM communication profile using ISO/IEC 14908-1:2012, *Information technology – Control network protocol – Part 1: Protocol stack* and ISO/IEC 14908-3:2012, *Information technology – Control network protocol – Part 3: Power line channel specification*. It applies for devices installed on the neighbourhood area network.

It follows the rules defined in IEC 62056-5-3:2017, Annex A, and in IEC 62056-1-0, and IEC TS 62056-1-1 for its structure.

## **ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –**

### **Part 8-8: Communication profile for ISO/IEC 14908 series networks**

#### **1 Scope**

This part of IEC 62056 describes how the DLMS/COSEM Application layer and the COSEM object model as specified in IEC 62056-5-3:2017, IEC 62056-6-1:2017 and IEC 62056-6-2:2017 can be used over the lower layers specified in the IEC 14908 series, forming a DLMS/COSEM ISO/IEC 14908 communication profile.

This document is part of the IEC 62056 series. Its structure follows IEC 62056-1-0 and IEC TS 62056-1-1.

Annex A (informative) provides examples of representative instances of data exchange.

NOTE This Annex A is included and referenced for consistency with other parts of the IEC 62056 suite, but it is empty.

Annex B (normative) defines COSEM interface classes and related OBIS codes for setting up and managing the DLMS/COSEM communication profile for IEC 14908 networks. These interface classes and OBIS codes will be moved later to IEC 62056-6-2 and IEC 62056-6-1.

Annex C (informative) provides an implementation guide and specifies a migration path from Utility Tables based applications to DLMS/COSEM based applications.

Annex D (informative) specifies the OSGP-AES-128-PSK security suite for optional use on the adaptation layer level.

Annex E (normative) specifies the repeating mechanism over the ISO 14908-3 Power Line Channel network.

Annex F (informative) specifies ISO/IEC 14908-3 Registration and monitoring of LNAPs.

#### **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 62056-5-3:2017, *Electricity metering data exchange – The DLMS/COSEM suite – Part 5-3: DLMS/COSEM application layer*

IEC 62056-6-1:2017, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-1: Object Identification System (OBIS)*

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