

Electricity metering - Data exchange for meter reading, tariff and load control - Part 53: COSEM application layer

Electricity metering - Data exchange for meter
reading, tariff and load control - Part 53: COSEM
application layer

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 62056-53:2007 sisaldab Euroopa standardi EN 62056-53:2007 ingliskeelset teksti. Käesolev dokument on jõustatud 28.05.2007 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN 62056-53:2007 consists of the English text of the European standard EN 62056-53:2007. This document is endorsed on 28.05.2007 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.
--	---

Käsitlusala: This part of IEC 62056 specifies the COSEM application layer in terms of structure, services and protocols for COSEM clients and servers, and defines how to use the COSEM application layer in various 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 62056-62, using either logical name (LN) or short name (SN) referencing. Annex A describes the xDLMS application service element. Annex B defines how to use the COSEM application layer in various communication profiles. Annex C includes encoding examples for APDUs. Annex D gives an explanation of the role of data models and protocols in electricity meter data exchange.	Scope: This part of IEC 62056 specifies the COSEM application layer in terms of structure, services and protocols for COSEM clients and servers, and defines how to use the COSEM application layer in various 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 62056-62, using either logical name (LN) or short name (SN) referencing. Annex A describes the xDLMS application service element. Annex B defines how to use the COSEM application layer in various communication profiles. Annex C includes encoding examples for APDUs. Annex D gives an explanation of the role of data models and protocols in electricity meter data exchange.
--	--

ICS 35.100.70, 91.140.50

Võtmesõnad: electricity meters, energy measurem, information exchange, load control, management, measuring instruments, meter reading, performance, properties, specification (approval), specifications, tariff control, telecounters, transmission protocol

**Electricity metering -
Data exchange for meter reading, tariff and load control
Part 53: COSEM application layer
(IEC 62056-53:2002)**

Equipements de mesure
de l'énergie électrique -
Echange des données pour la lecture
des compteurs, le contrôle des tarifs
et de la charge
Partie 53: Couche application COSEM
(CEI 62056-53:2002)

Messung der elektrischen Energie -
Zählerstandsübertragung,
Tarif- und Laststeuerung
Teil 53: COSEM-Anwendungsschicht
(IEC 62056-53:2002)

This European Standard was approved by CENELEC on 2002-03-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 13/1268/FDIS, future edition 1 of IEC 62056-53, prepared by IEC TC 13, Equipment for electrical energy measurement and load control, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62056-53 on 2002-03-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2003-01-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2005-03-01

The International Electrotechnical Commission (IEC) and CENELEC draw attention to the fact that it is claimed that compliance with this International Standard / European Standard may involve the use of a maintenance service concerning the stack of protocols on which the present standard IEC 62056-53 / EN 62056-53 is based.

The IEC and CENELEC take 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 with 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:

DLMS ¹⁾ User Association
Geneva / Switzerland
www.dlms.ch

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes A, B, and ZA are normative and annexes C and D are informative. Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62056-53:2002 was approved by CENELEC as a European Standard without any modification.

¹⁾ Device Language Message Specification

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-300	2001	International Electrotechnical Vocabulary - Electrical and electronic measurements and measuring instruments Part 311: General terms relating to measurements Part 312: General terms relating to electrical measurements Part 313: Types of electrical measuring instruments Part 314: Specific terms according to the type of instrument	-	-
IEC 61334-4-41	1996	Distribution automation using distribution line carrier systems Part 4: Data communication protocols Section 41: Application protocols - Distribution line message specification	EN 61334-4-41	1996
IEC 61334-6	2000	Part 6: A-XDR encoding rule	EN 61334-6	2000
IEC/TR 62051	1999	Electricity metering - Glossary of terms	-	-
IEC 62056-21	2002	Electricity metering - Data exchange for meter reading, tariff and load control Part 21: Direct local data exchange	EN 62056-21	2002
IEC 62056-42	2002	Part 42: Physical layer services and procedures for connection- oriented asynchronous data exchange	EN 62056-42	2002
IEC 62056-46	2002	Part 46: Data link layer using HDLC protocol	EN 62056-46	2002
IEC 62056-61	2002	Part 61: Object identification system (OBIS)	EN 62056-61	2002
IEC 62056-62	2002	Part 62: Interface classes	EN 62056-62	2002

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO/IEC 8649	1996	Information technology - Open systems interconnection - Service definition for the Association Control Service Element (ACSE)	-	-
ISO/IEC/TR2 8650-1	1996	Information technology - Open systems interconnection - Connection-oriented protocol for the association control service element: Protocol specification	-	-
ISO/IEC 8824	1990	Information technology - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1)	-	-
ISO/IEC 8825	1990	Information technology - Open Systems Interconnection - Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)	-	-
ISO/IEC 13239	2000	Information technology - Telecommunications and information exchange between systems - High-level data link control (HDLC) procedures	-	-

INTERNATIONAL STANDARD

IEC
62056-53

Second edition
2006-12

**Electricity metering –
Data exchange for meter reading,
tariff and load control –**

**Part 53:
COSEM application layer**



Reference number
IEC 62056-53:2006(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** (www.iec.ch)
- **Catalogue of IEC publications**
The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.
- **IEC Just Published**
This summary of recently issued publications (www.iec.ch/online_news/justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information.
- **Customer Service Centre**
If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: custserv@iec.ch
Tel: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

IEC
62056-53

Second edition
2006-12

**Electricity metering –
Data exchange for meter reading,
tariff and load control –**

**Part 53:
COSEM application layer**

© IEC 2006 — Copyright - all rights reserved

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 the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE **XG**

For price, see current catalogue

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms, definitions and abbreviations	8
4 The COSEM communications framework	10
4.1 Client/server type operation, communication profiles	10
4.2 Connection (association) oriented operation	12
5 Overview: the COSEM application layer	12
5.1 Specification method	12
5.2 Application layer structure	12
5.3 Service specification	13
5.4 Layer management services	15
5.5 Protocol specification	15
6 COSEM application layer – Service specification	16
6.1 Summary of services	16
6.2 Application association establishment and release	16
6.3 Special application associations	17
6.4 Data communication	18
6.5 Client COSEM application layer services	19
6.6 Server COSEM application layer services	38
6.7 Summary of COSEM application layer services and service parameters	55
7 COSEM application layer protocol specification	59
7.1 State definitions for the client side control function	59
7.2 State definitions for the server side control function	61
7.3 Protocol for application association establishment/release	62
7.4 Protocol for data communications	74
8 Specification of COSEM data types	89
8.1 The COSEM APDUs	89
8.2 The ACSE APDUs	90
8.3 Useful types	93
8.4 The xDLMS-Initiate.request/response/ConfirmedServiceError PDUs	98
8.5 The conformance block	98
8.6 Definition of APDUs for data communication	99
Annex A (normative) The xDLMS application service element	105
Annex B (normative) Using the COSEM Application Layer in various communication profiles	107
Annex C (informative) AARQ and AARE encoding examples	126
Annex D (informative) Data model and protocol	138
Bibliography.....	139
INDEX	142

Figure 1 – Client/server relationship in COSEM	10
Figure 2 – Exchanging messages via the communication protocol	11
Figure 3 – The COSEM application layer on the top of various lower layer stacks	11
Figure 4 – A complete communication session in the CO environment	12
Figure 5 – The structure of the COSEM application layers	13
Figure 6 – Structure of the COSEM AL when the server is using SN references	15
Figure 7 – Summary of COSEM application layer services	16
Figure 8 – Normal service sequence for the COSEM-OPEN service	17
Figure 9 – Client side services for application association establishment	19
Figure 10 – Client side services for releasing an application association	23
Figure 11 – Client side data communication services	26
Figure 12 – Client side services for event notification	35
Figure 13 – Server side services for application association establishment	38
Figure 14 – Server side services for releasing an application association	40
Figure 15 – Server side data communications services using LN referencing	44
Figure 16 – Partial state machine for the client side control function	60
Figure 17 – Partial state machine for the server side control function	61
Figure 18 – MSC for successful application association establishment preceded by a successful lower layer connection establishment	63
Figure 19 – Graceful association release using the A-RELEASE service	69
Figure 20 – Graceful release of an application association by disconnection the supporting layer	70
Figure 21 – Aborting an application association following a PH-ABORT indication	71
Figure 22 – MSC for a confirmed GET service in case of success	75
Figure 23 – MSC for a confirmed SET service in case of success	75
Figure 24 – MSC for the SET service in case of failure	76
Figure 25 – MSC for the ACTION service (simplest case)	76
Figure 26 – Long data with the GET service in three data blocks	81
Figure 27 – Long data transfer in three data blocks with the SET service	83
Figure 28 – Long data transfer with the ACTION service	85
Figure 29 – MSC for the ReadRequest/Response services	87
Figure B.1 – Identification/addressing scheme in the 3-layer, connection-oriented, HDLC based communication profile	110
Figure B.2 – Data link layer services provided to and used by the client COSEM application layer	111
Figure B.3 – Data link layer services provided to and used by the server COSEM application layer	112
Figure B.4 – Example: EventNotificaton triggered by the client	115
Figure B.5 – Multi-drop configuration and its model	116
Figure B.6 – Master/ Slave operation on the multi-drop bus	116
Figure B.7 – COSEM as a standard Internet application protocol	118
Figure B.8 – Examples for lower-layer protocols in the TCP-UDP/IP based profiles	119
Figure B.9 – Identification/addressing scheme in the TCP-UDP/IP based profile(s)	120
Figure B.10 – Summary of TCP/UDP layer services on the client and server side	121
Figure D.1 – The three-step approach of COSEM	138

Table 1 – Mapping between client side LN and server side SN referencing services	37
Table 2 – Application layer services – summary.....	55
Table 3 – Summary of the service parameters in the COSEM-OPEN service primitives.....	56
Table 4 – Summary of the service parameters in the COSEM-RELEASE service primitives ..	57
Table 5 – Summary of the service parameters in the COSEM-ABORT service primitives	57
Table 6 – Summary of the service parameters in the COSEM GET service primitives	57
Table 7 – Summary of the service parameters in the COSEM SET service primitives.....	58
Table 8 – Summary of the service parameters in the COSEM ACTION service primitives	58
Table 9 – Summary of the service parameters in the COSEM EventNotification service primitives	59
Table 10 – Mapping between the EventNotification and InformationReport services.....	88
Table B.1 – Application associations and data exchange in the 3-layer, connection-oriented, HDLC based profile.....	113
Table B.2 –Application associations and data exchange in the TCP-UDP/IP based profile ..	123

This document is a preview generated by EVS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICITY METERING –
DATA EXCHANGE FOR METER READING,
TARIFF AND LOAD CONTROL –****Part 53: 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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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 62056-53 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 with 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

Geneva / Switzerland

www.dlms.ch

International Standard IEC 62056-53 has been prepared by IEC technical committee 13: Equipment for electrical energy measurement and load control.

¹ Device Language Message Specification

This standard cancels and replaces the first edition which was published in 2002. It constitutes a technical revision. The main changes with respect to the previous edition are as follows:

- the protocol of the COSEM-RELEASE service has been changed: depending on the communication profile used, these services may rely on the ACSE A_RELEASE services;
- the parsing order of the AARQ APDU has been changed;
- handling of repeated application association requests has been simplified;
- the Service_Class parameter of the COSEM-OPEN service is now linked to the response-allowed field of the xDLMS-Initiate.request APDU;
- the Service_Class parameter of COSEM services for data exchange using LN referencing is now linked to bit 6 of the Invoke-Id-And-Priority parameter;
- a new, optional EXCEPTION APDU has been introduced. The server may send back this APDU after an erroneous service request;
- a general part about using the COSEM application layer in various communication profiles has been added;
- the description of using the COSEM Application layer in the 3-layer, connection-oriented, HDLC based communication profile has been amended;
- a new, TCP-UDP/IP based communication profile has been defined.

The text of this standard is based on the following documents:

FDIS	Report on voting
13/1387/FDIS	13/1398/RVD

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

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

A list of all parts of IEC 62056 series, published under the general title *Electricity metering – Data exchange for meter reading, tariff and load control*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site 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 the publication may be issued at a later date.

ELECTRICITY METERING – DATA EXCHANGE FOR METER READING, TARIFF AND LOAD CONTROL –

Part 53: COSEM application layer

1 Scope

This part of IEC 62056 specifies the COSEM application layer in terms of structure, services and protocols for COSEM clients and servers, and defines how to use the COSEM application layer in various 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 62056-62, using either logical name (LN) or short name (SN) referencing.

Annex A describes the xDLMS application service element.

Annex B defines how to use the COSEM application layer in various communication profiles.

Annex C includes encoding examples for APDUs.

Annex D gives an explanation of the role of data models and protocols in electricity meter data exchange.

2 Normative references

The following referenced documents are indispensable for the application 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 60050-300:2001, *International Electrotechnical Vocabulary (IEV) – Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical measurements – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

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

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

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

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

IEC 62056-42:2002, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 42: Physical layer services and procedures for connection-oriented asynchronous data exchange*

IEC 62056-46:2002, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 46: Data link layer using HDLC protocol*
Amendment 1²

IEC 62056-47, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 47: COSEM transport layer for IP networks*

IEC 62056-61, Ed.2, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 61: Object identification system (OBIS)*

IEC 62056-62, Ed.2, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 62: Interface classes*

ISO/IEC 8649:1996, *Information technology – Open Systems Interconnection – Service definition for the Association Control Service Element*

ISO/IEC 8650-1:1996, *Information technology – Open systems interconnection – Connection-oriented protocol for the Association Control Service Element: Protocol specification*

ISO/IEC 8824, *Information technology – Abstract Syntax Notation One (ASN.1)*

ISO/IEC 8825, *Information technology – ASN.1 encoding rules*

ISO/IEC 13239:2002, *Information technology – Telecommunications and information exchange between systems – High-level data link control (HDLC) procedures*

STD0005 – *Internet Protocol*

Author: J. Postel

Date: September 1981

Also: RFC0791, RFC0792, RFC0919, RFC0922, RFC0950, RFC1112

STD0006 – *User Datagram Protocol*

Author: J. Postel

Date: 28 August 1980

Also: RFC0768

STD0007 – *Transmission Control Protocol*

Author: J. Postel

Date: September 1981

Also: RFC0793

See also Bibliography for other related Internet RFCs.

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this part of IEC 62056, the definitions in IEC 60050-300, IEC 62051 and IEC 62051-1 apply.

3.2 Abbreviations

.cnf	.confirm service primitive
.ind	.indication service primitive

² To be published.