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

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE XG

For price, see current catalogue

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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FOREWORD

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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

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 1[2]

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.

.req	.request service primitive
.res	.response service primitive
AA	Application Association
AARE	Application Association REsponse
AARQ	Application Association ReQuest
ACSE	Application Control Service Element
AE	Application Entity
AP	Application Process
APDU	Application layer Protocol Data Unit
API	Application Programming Interface
ARP	Address Resolution Protocol
ASE	Application Service Element
ASO	Application Service Object
ATM	Asynchronous Transfer Mode
A-XDR	Adapted eXtended Data Representation
BER	Basic Encoding Rules
CF	Control function
CO	Connection Oriented
COSEM	COmpanion Specification for Energy Metering
DLMS	Device Language Message Specification
DSAP	Data link Service Access Point
FDDI	Fibre Distributed Data Interface
FTP	File Transfer Protocol
GMT	Greenwich Mean Time
GSM	Global System for Mobile communications
HDLC	High-level Data Link Control
HLS	High Level Security
HTTP	Hypertext Transfer Protocol
IC	Interface Class
IETF	Internet Engineering Task Force
IP	Internet Protocol
LAN	Local Area Network
LLC	Logical Link Control (sub-layer)
LLS	Low Level Security
LPDU	LLC Protocol Data Unit
LSAP	LLC sub-layer Service Access Point
LSB	Least Significant Bit
MAC	Medium Access Control
MD5	Message Digest Algorithm 5
MIB	Management Information Base
MSB	Most Significant Bit
MSC	Message Sequence Chart
OBIS	OBject Identification System

OSI	Open System Interconnection
PDU	Protocol Data Unit
PPP	Point-to-Point Protocol
PSTN	Public Switched Telephone Network
RARP	Reverse Address Resolution Protocol
RFC	Request For Comment
RLRQ	Release Request
RLRE	Release Response
SAP	Service Access Point
SHA-1	Secure Hash Algorithm 1
SNMP	Simple Network Management Protocol
VAA	Virtual Application Association
xDLMS-ASE	extended DLMS Application Service Element

4 The COSEM communications framework

4.1 Client/server type operation, communication profiles

Communication with electricity metering equipment using the COSEM interface object model is based on the **client/server** paradigm where metering equipment[3] plays the server role. In this environment, communication takes place always between a client and a server AP: in other words, the server AP provides remote services to the client AP. These services are provided via exchanging messages (SERVICE.requests/.responses) between the client and the server APs, as shown in Figure 1.

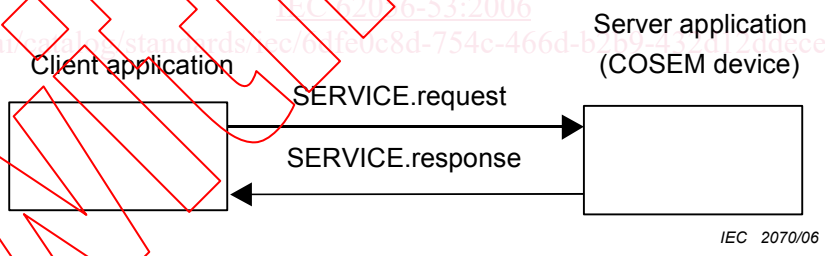

Figure 1 – Client/server relationship in COSEM

In general, the client and the server APs are located in separate devices; exchanging messages is done with the help of the communication protocol as shown in Figure 2.

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[3] The term metering equipment is an abstraction; consequently the equipment playing the role of a server may be any type of equipment for which this abstraction is suitable.

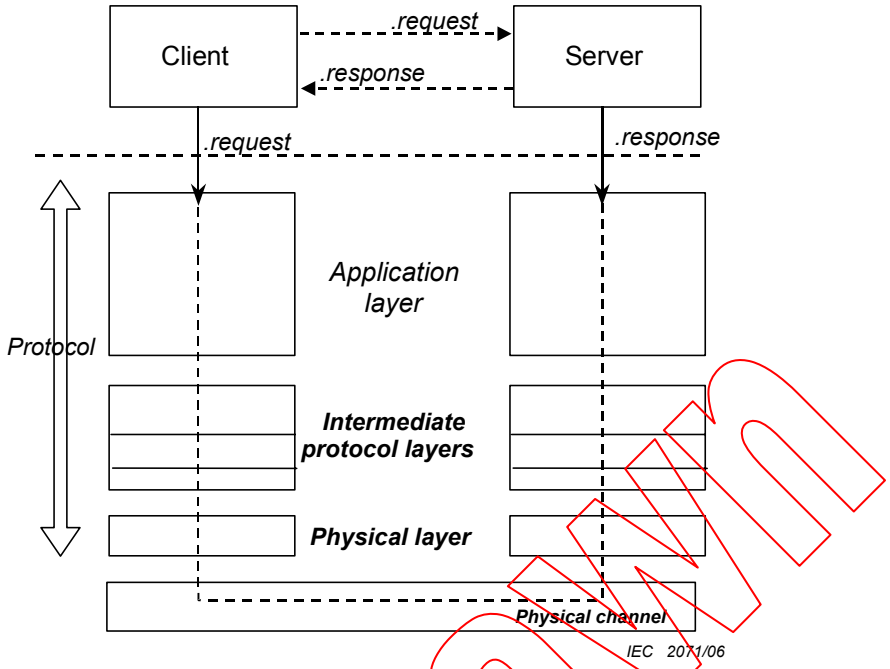

Figure 2 – Exchanging messages via the communication protocol

In general, communication protocols are structured in layers. The client and server COSEM applications use services of the highest protocol layer, that of the application layer: consequently, this is the only protocol layer containing COSEM specific element(s). This is called the xDLMS_ASE. All COSEM interface object related services – the xDLMS application protocol – are provided by this xDLMS_ASE.

Other protocol layers are independent of the COSEM model. Consequently, the COSEM application layer can be placed on the top of a wide variety of lower protocol layer stacks, as shown in Figure 3.

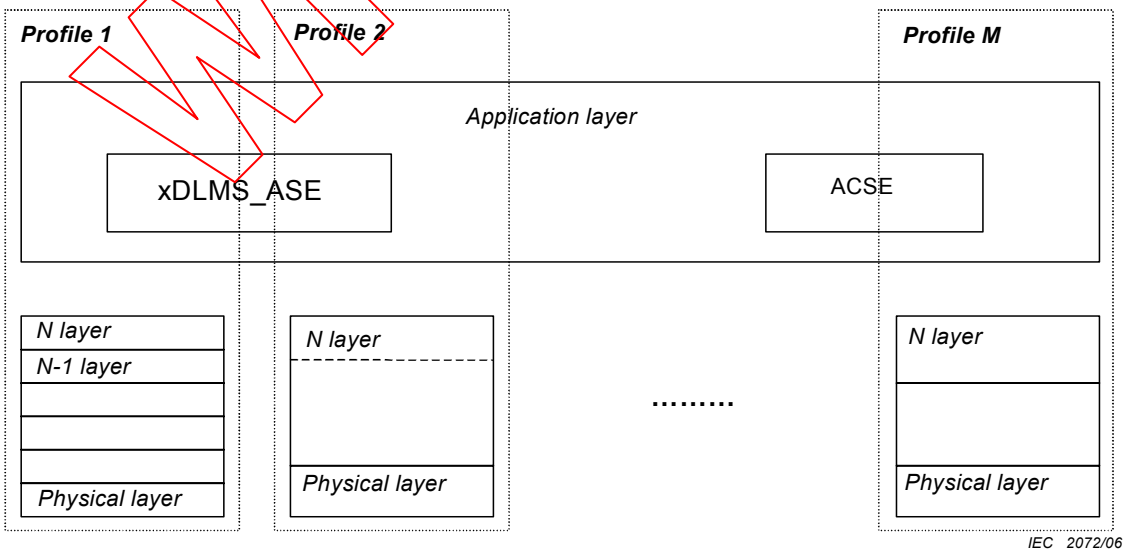

Figure 3 – The COSEM application layer on the top of various lower layer stacks

A complete protocol stack – including the application layer, a physical layer and all protocol layers between these extreme layers – is called a communication profile.

A communication profile is characterized by the protocol layers included, their parameters, and by the type – connection-oriented or connectionless – of the ACSE[4] included in the application layer.

4.2 Connection (association) oriented operation

The xDLMS application protocol is a connection-oriented protocol. It means that the client and server APs can use the services of the xDLMS_ASE only when these APs are associated[5]. Therefore, in this environment a communication session consists of three phases, as shown in Figure 4.

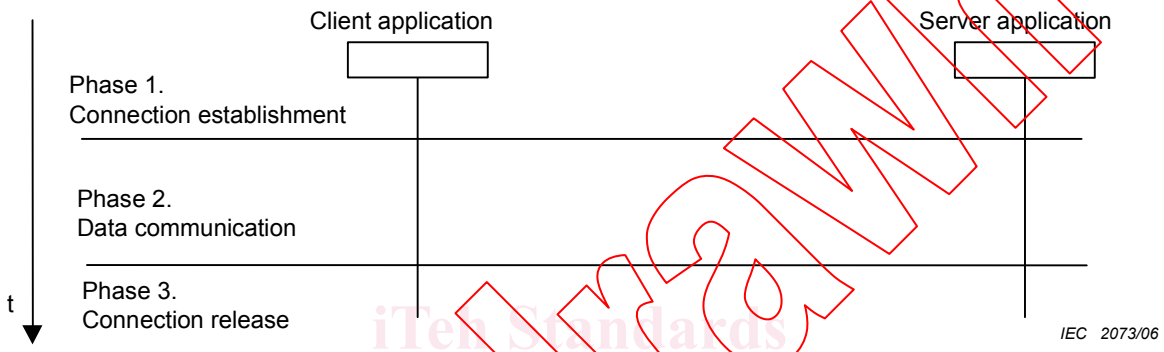

Figure 4 – A complete communication session in the CO environment

In the DLMS/COSEM environment, application association establishment is normally done by using the association request/response services of the standard association control service element. On the other hand, for the purposes of very simple devices, one-way communicating devices and for multicasting and broadcasting, pre-established application associations are also allowed; see 6.3.3. For such associations, there is no need to use the services of the ACSE: a full communication session may include only the data communication phase. (It can be considered that the connection establishment phase has been already done somewhere in the past.)

5 Overview: the COSEM application layer

5.1 Specification method

The COSEM application layer is specified in terms of *structure, services,* and *protocols*.

5.2 Application layer structure

The main component of the client and server COSEM application layers is the COSEM ASO, which provides services to the COSEM AP, and uses services provided by the supporting lower layer.

Both the client and server side COSEM ASO contain three mandatory components:

- the ACSE. The task of this element is to establish, maintain, and release application associations. For the purposes of connection-oriented profiles, the connection-oriented ACSE, specified in ISO/IEC 8649 and ISO/IEC 8650-1 is used;

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[4] ACSE = Association Control Service Element

[5] Application associations can be considered as application level connections.