INTERNATIONAL STANDARD

IEC 62056-53

First edition
2002-02

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

**Part 53:
COSEM application layer**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 53: COSEM application layer

FOREWORD

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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 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:

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.

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

FDIS	Report on voting
13/1268/FDIS	13/1274/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.

[1] Device Language Message Specification.

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This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes A and B form an integral part of this standard.

Annexes C and D are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

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- withdrawn;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

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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.

Data communication services with COSEM interface objects, using Logical name (LN) referencing and Short name (SN) referencing, are specified. COSEM servers use either LN or SN referencing during a given association: this is negotiated during the Application Association establishment. The COSEM client always uses LN referencing. If the client communicates with a server using SN referencing, the LN services are mapped to SN services.

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 – 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/TR2 62051:1999, *Electricity metering – Glossary of terms*

IEC 62056-21, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 21: Direct local data exchange* [2]

IEC 62056-42:2001, *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, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 46: Data link layer using HDLC protocol*

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[2] To be published.

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

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

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

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*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purpose of this part of IEC 62056, the definitions in IEC 60050-300 and IEC/TR 62051, as well as the following, apply.

3.1.1
base_name
the short_name corresponding to the first attribute ("logical_name") of a COSEM interface object

3.1.2
class_id
interface class identification code

3.1.3
client
a station, asking for services

3.1.4
COSEM interface object
an instance of a COSEM interface class

3.1.5
server
a station, delivering services. The tariff device (metering equipment) is normally the server, delivering the requested data or executing the requested tasks.

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3.2 Abbreviations

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
ASE	Application Service Element
ASO	Application Service Object
A-XDR	Adapted eXtended Data Representation
BER	Basic Encoding Rules
CF	Control function
.cnf	confirm service primitive
CO	Connection Oriented
COSEM	COmpanion Specification for Energy Metering
DLMS	Distribution Line Message Specification
DSAP	Data link Service Access Point
GMT	Greenwich Mean Time
HDLC	High-level Data Link Control
HLS	High-Level Security
IC	Interface Class
LLC	Logical Link Control (sub-layer)
LLS	Low Level Security
LPDU	LLC Protocol Data Unit
LSB	Least Significant Bit
LSAP	LLC sub-layer Service Access Point
m	mandatory, used in conjunction with attribute and method definitions
MSB	Most Significant Bit
MSC	Message Sequence Chart
o	optional, used in conjunction with attribute and method definitions
OBIS	OBject Identification System
PDU	Protocol Data Unit
.req	.request service primitive
.res	.response service primitive
SAP	Service Access Point
xDLMS-ASE	extended DLMS Application Service Element

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4 The COSEM communications framework

4.1 Client/server type operation, communication profiles

Communication with electricity metering equipment using the COSEM interface classes 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 application process: in other words, the server application process provides remote services to the client application process. These services are provided via exchanging messages (SERVICE.requests/.responses) between the client and the server application processes, as it is shown in Figure 1.

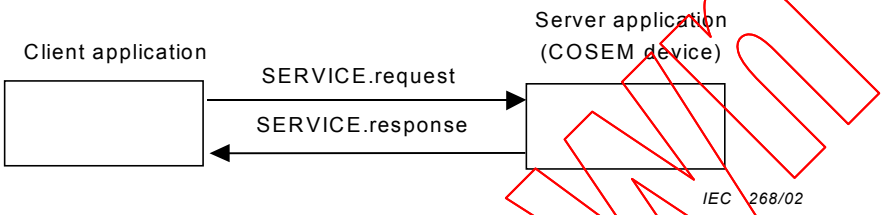

Figure 1 – Client/server relationship in COSEM

In general, the client and the server application processes are located in separate devices, exchanging messages is done with the help of the communications protocol.

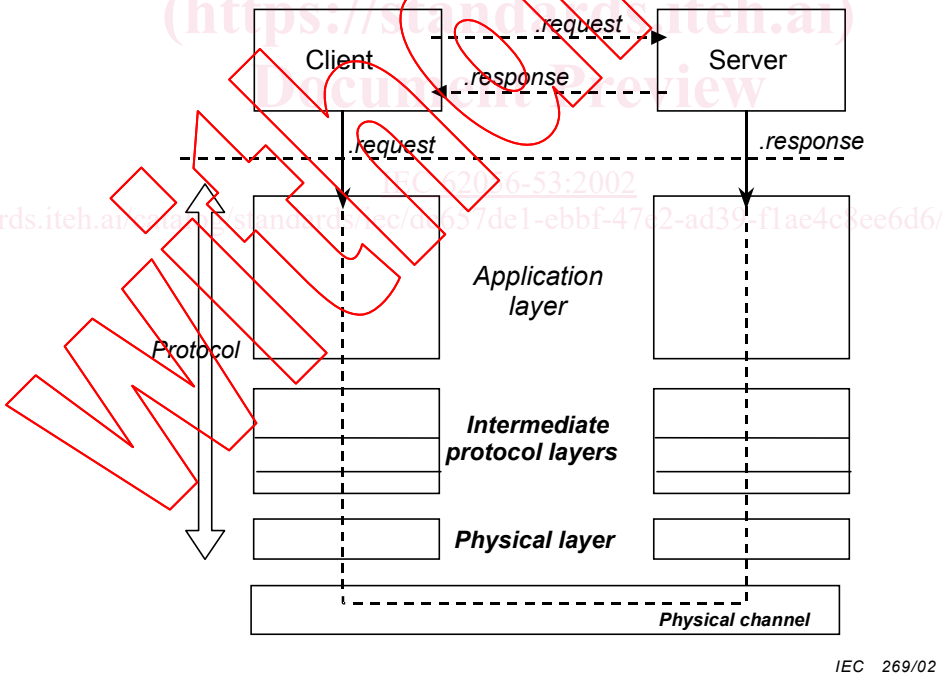

Figure 2 – Exchanging messages via the communications protocol

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[3] The 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.

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 which shall contain 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 from the COSEM model, consequently the COSEM application layer can be placed on the top of a wide variety of lower protocol layer stacks, as it is shown in Figure 3.

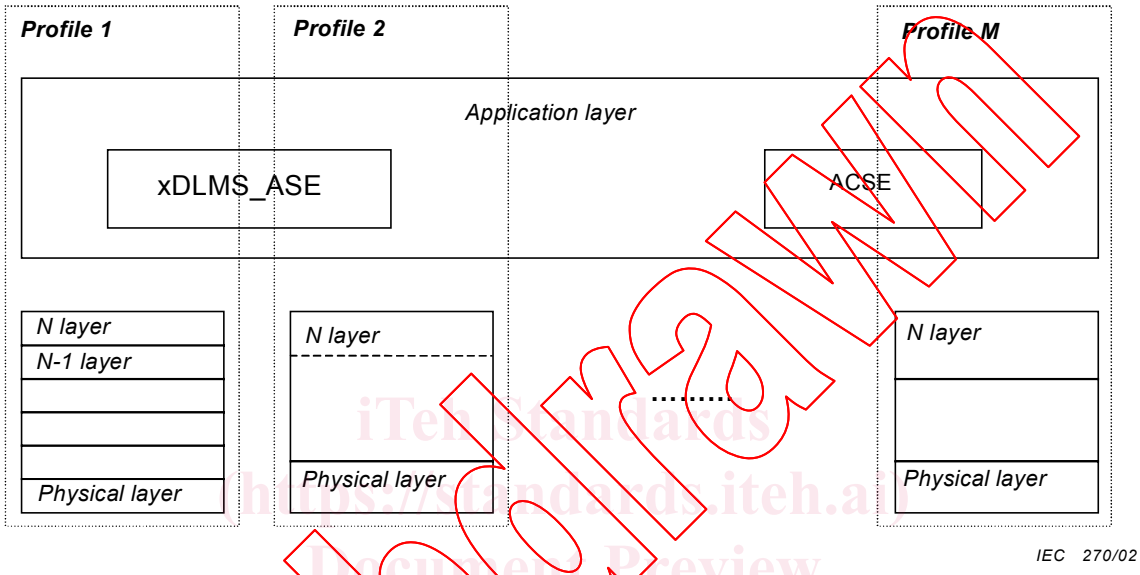

Figure 3 – The COSEM application layer on the top of various lower layer stacks

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

A communications 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 application processes can use the services of the xDLMS_ASE only when these application processes are associated[5]. Therefore, in this environment a communication session consists of three phases, as it is shown on Figure 4.

[4] ACSE = **A**ssociation **C**ontrol Service **E**lement

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

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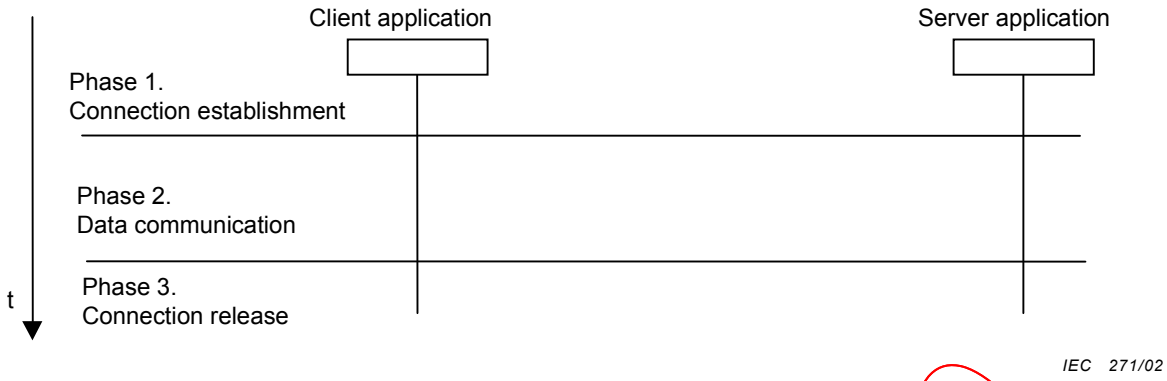

Figure 4 – A complete communications session in the CO environment

In the 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 6.3.2. For these 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 application process, and uses services provided by the supporting lower layer.

Both the client and server side COSEM ASO contains 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/TR2 8650-1 is used;
- the Extended DLMS application service element (xDLMS_ASE). The task of this element is to provide data communication services between COSEM equipment. See also Annex B;
- the Control function (CF). This element specifies how the ASO services invoke the appropriate service primitives of the ACSE and the xDLMS ASE and the services of the supporting layer.

NOTE Both the client and the server COSEM ASO may contain other, optional application protocol components.

Figure 5 shows 'minimal' COSEM ASOs, containing only the three mandatory components.

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