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INTERNATIONAL STANDARD

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Electricity metering data exchange – The DLMS/COSEM suite – Part 7-6: The 3-layer, connection-oriented HDLC based communication profile

Échange des données de comptage de l'électricité – La suite DLMS/COSEM – Partie 7-6: Profil de communication à 3 couches, orienté connexion et basé sur HDLC

IEC 62056-7-6:2013

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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 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
Zug/Switzerland
www.dlms.ch

[1] Device Language Message Specification.

International Standard IEC 62056-7-6 has been prepared by Technical Committee 13, Electrical energy measurement, tariff- and load control.

It is based on IEC 62056-53:2006, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 53: COSEM application layer*, Annex B.2 *The 3-layer, connection-oriented, HDLC based communication profile* and introduces the following significant technical changes:

NOTE IEC 62056-53:2006 contains the specification of the DMS/COSEM communication profiles whereas the new edition, IEC 62056-5-3:—[2], which replaces it, does not.

- The title of the standard has been aligned with the title of other parts of the revised IEC 62056 series;
- A Figure showing the protocol stack has been added to Clause 5.

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

FDIS	Report on voting
13/1527/FDIS	13/1545/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 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.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication will remain unchanged until the stability 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,
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- 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.

2 To be published simultaneously with this part of IEC 62056.

ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

Part 7-6: The 3-layer, connection-oriented HDLC based communication profile

1 Scope

This part of IEC 62056 specifies the DLMS/COSEM 3-layer, connection-oriented HDLC based communication profile.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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 1:2006

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

NOTE See also the Bibliography.

3 Terms, definitions and abbreviations

AA	Application Association
AARQ	A-Associate Request – an APDU of the ACSE
ACSE	Association Control Service Element
AL	Application Layer
APDU	Application Layer Protocol Data Unit
ASO	Application Service Object
Client	A station, asking for services. In the case of the 3-layer, CO HDLC based profile it is the master station
.cnf	confirm service primitive
CO	Connection-oriented
COSEM	Companion Specification for Energy Metering
DLMS	Device Language Message Specification
DLMS UA	DLMS User Association

GSM	Global System for Mobile Communications
HDLC	High-level Data Link Control
HHU	Hand Held Unit
I	Information frame (a HDLC frame type)
.ind	.indication service primitive
LLC	Logical Link Control (Sublayer)
MAC	Medium Access Control (sublayer)
MAC	Message Authentication Code (cryptography)
master	Central station – station which takes the initiative and controls the data flow
NRM	Normal Response Mode
OSI	Open System Interconnection
PDU	Protocol Data Unit
P/F	Poll/Final
PhL	Physical Layer
PSTN	Public Switched Telephone Network
.req	.request service primitive
.res	.response service primitive
RNR	Receive Not Ready (a HDLC frame type)
RR	Receive Ready (a HDLC frame type)
SAP	Service Access Point
SNRM	Set Normal Response Mode (a HDLC frame type)
Server	A station, delivering services. The tariff device (meter) is normally the server, delivering the requested values or executing the requested tasks.
Slave	Station responding to requests of a master station. The tariff device (meter) is normally a slave station.
UA	Unnumbered Acknowledge (a HDLC frame type)
UI	Unnumbered Information (a HDLC frame type)

4 Targeted communication environments

The 3-layer, CO, HDLC-based profile is suitable for local data exchange with metering equipment via direct connection, or remote data exchange via the PSTN or GSM networks with appropriate modems.

5 Structure of the profile

This profile is based on a three-layer (collapsed) OSI protocol architecture:

- the DLMS/COSEM AL, specified in IEC 62056-5-3;
- the data link layer based on the HDLC standard, specified in IEC 62056-46;
- the physical layer; specified in IEC 62056-42.

This three-layer architecture is shown in Figure 1.

The use of the PhL for the purposes of direct local data exchange using an optical port or a current loop physical interface is specified in IEC 62056-21:2002, Annex E.

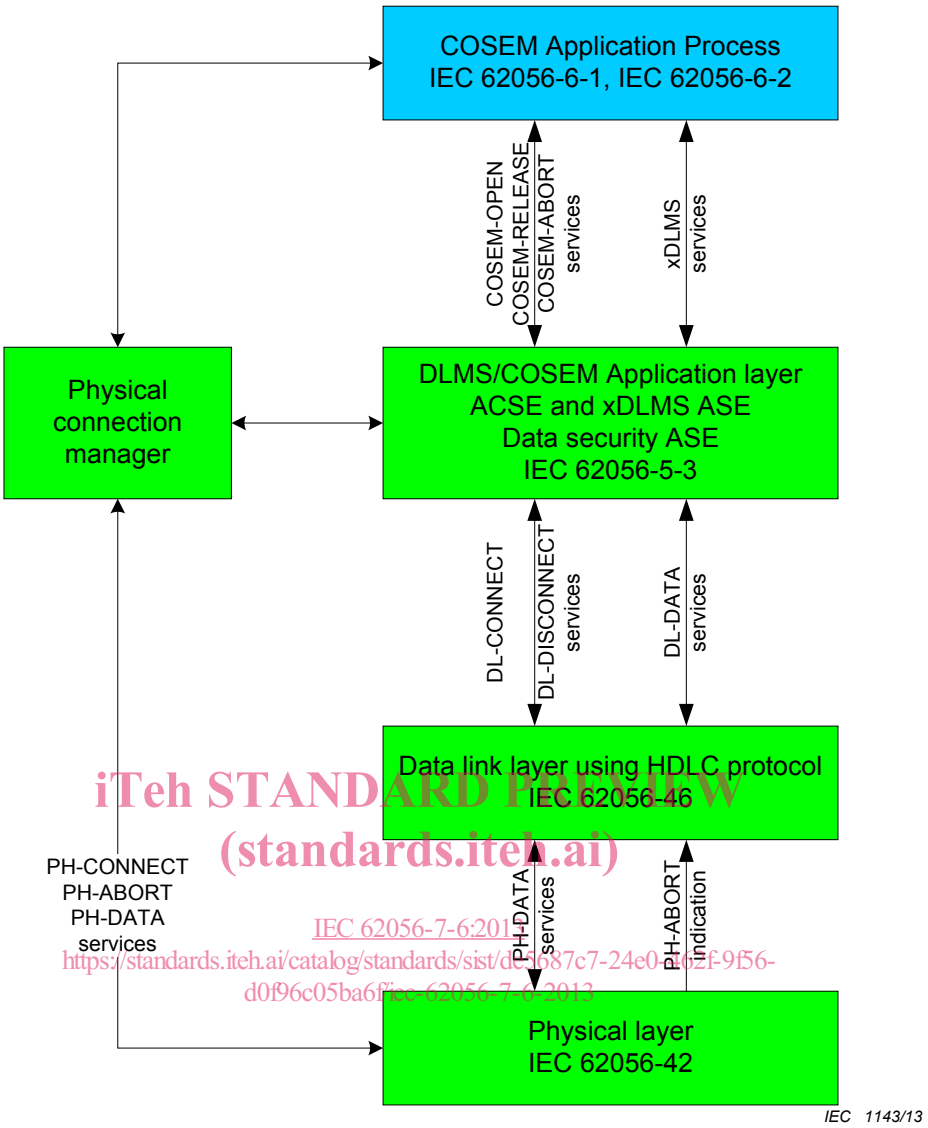

Figure 1 – The DLMS/COSEM 3-layer, connection oriented, HDLC based communication profile

6 Identification and addressing scheme

The HDLC-based data link layer provides services to the DLMS/COSEM AL at Data Link SAP-s, also called as the Data Link- or HDLC addresses.

On the client side, only the client AP needs to be identified. The addressing of the physical device hosting the client APs is done by the PhL (for example by using phone numbers).

On the server side, several physical devices may share a common physical line (multidrop configuration). In the case of direct connection this may be a current loop as specified in IEC 62056-21. In the case of remote connection several physical devices may share a single telephone line. Therefore both the physical devices and the logical devices hosted by the physical devices need to be identified. This is done using the HDLC addressing mechanism as described in 6.4.2 of IEC 62056-46:2002, Amendment 1:2006.

- physical devices are identified by their lower HDLC address;
- logical devices within a physical device are identified by their upper HDLC address;
- a COSEM AA is identified by a doublet, containing the identifiers of the two APs participating in the AA.

For example, an AA between Client_01 (HDLC address = 16) and Server 2 in Host Device 02 (HDLC address = 2392) is identified by the doublet {16, 2392}. Here, “23” is the upper HDLC address and “92” is the lower HDLC address. All values are hexadecimal. This scheme ensures that a particular COSEM AP (client or server) may support more than one AA simultaneously without ambiguity. See Figure 2.

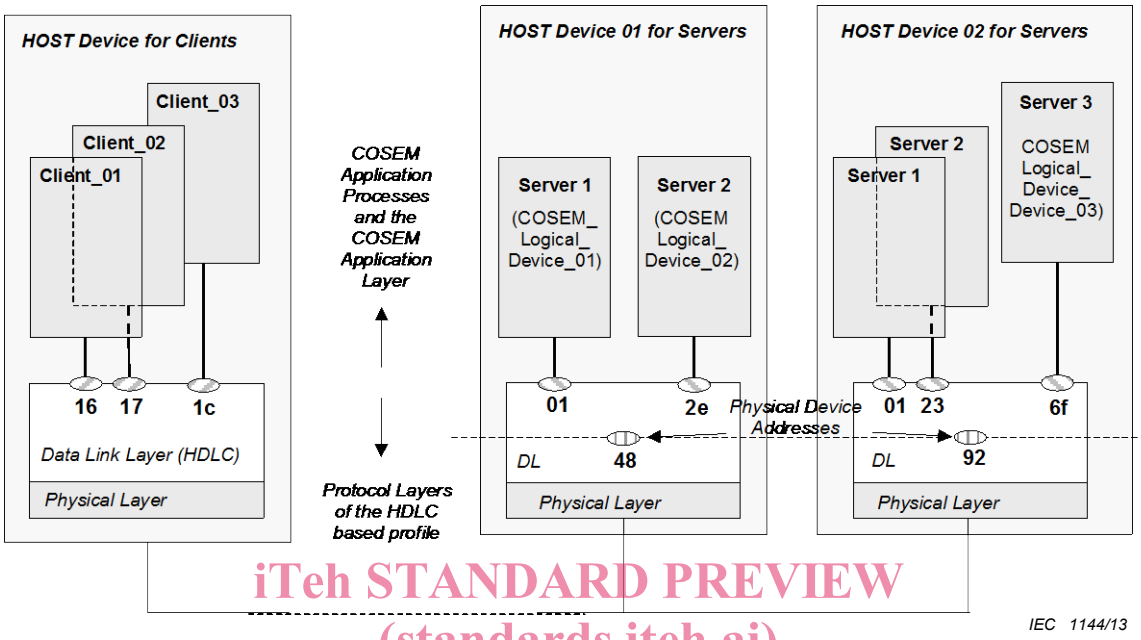

Figure 2 – Identification/addressing scheme in the 3-layer, CO, HDLC-based communication profile

7 Supporting layer services and service mapping

In this profile, the supporting layer of the DLMS/COSEM AL is the HDLC based data link layer. It provides services for:

- data link layer connection management;
- connection-oriented data transfer;
- connection-less data transfer.

Figure 3 summarizes the data link layer services provided for and used by the DLMS/COSEM AL.

The DL-DATA.confirm primitive on the server side is available to support transporting long messages from the server to the client in a transparent manner to the AL. See 9.5.

In some cases, the correspondence between an AL (ASO) service invocation and the supporting data link layer service invocation is straightforward. For example, invocation of a GET.request primitive directly implies the invocation of a DL-DATA.request primitive.

In some other cases, a direct service mapping cannot be established. For example, the invocation of a COSEM-OPEN.request primitive with Service_Class == Confirmed involves a series of actions, starting with the establishment of the lower layer connection with the help of the DL-CONNECT service, and then sending out the AARQ APDU via this newly established connection using a DL-DATA.request service. Examples for service mapping are given in IEC 62056-5-3:—, Clause 7.

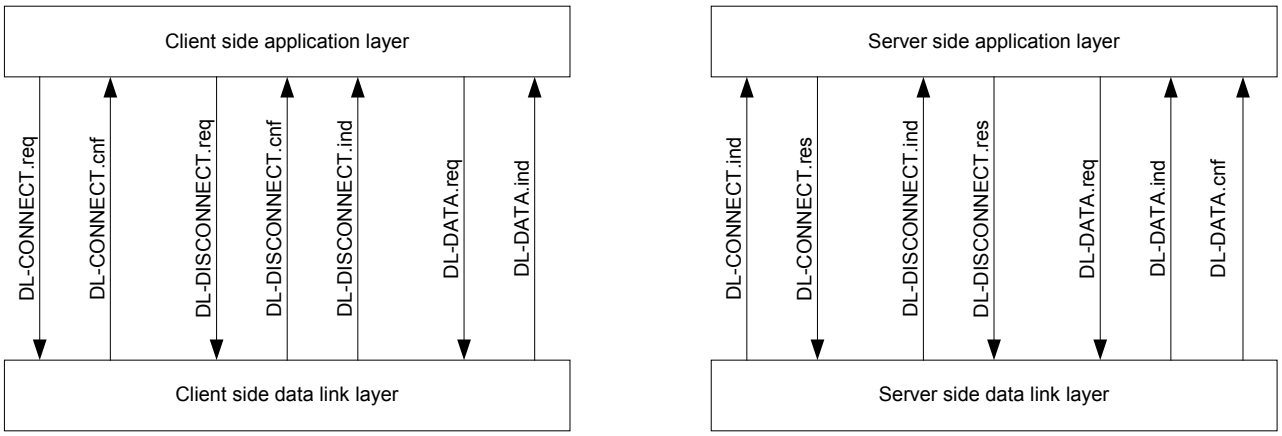

Figure 3 – Summary of data link layer services

8 Communication profile specific service parameters of the DLMS/COSEM AL services

Only the COSEM-OPEN service has communication profile specific parameters, the Protocol_Connection_Parameters parameter. This contains the following data:

- Protocol (Profile) Identifier 3-Layer, connection-oriented, HDLC-based;
- Server_Lower_MAC_Address (COSEM Physical Device Address);
- Server_Upper_MAC_Address (COSEM Logical Device Address);
- Client_MAC_Address;
- Server_LLC_Address;
- Client_LLC_Address

Any server (destination) address parameter may contain special addresses (All-station, No-station, etc.). For more information, see IEC 62056-46.

9 Specific considerations / constraints

9.1 Confirmed and unconfirmed AAs and data transfer service invocations, frame types used

Table 1 summarizes the rules for establishing confirmed and unconfirmed AAs, the type of data transfer services available in such AAs and the HDLC frame types that carry the APDUs. This table clearly shows one of the specific features of this profile: the Service_Class parameter of service invocations is linked to the frame type of the supporting layer:

- If the COSEM-OPEN service – see 6.2 of IEC 62056-5-3:—, – is invoked with Service_Class == Confirmed, then the AARQ APDU is carried by an “I” frame. On the other hand, if it is invoked with Service_Class == Unconfirmed, it is carried by a “UI” frame. Therefore, in this profile, the response-allowed parameter of the xDLMS InitiateRequest APDU has no significance. See also 7.2.4.1 of IEC 62056-5-3:—;
- Similarly, if a data transfer service .request primitive is invoked with Service_Class == Confirmed, then the corresponding APDU is transported by an “I” frame. If it is invoked with Service_class == Unconfirmed, then the corresponding APDU is carried by a “UI” frame. Consequently, Service_Class bit of the Invoke-Id-And-Priority field – see IEC 62056-5-3:—, Clause 8 – is not relevant in this profile.

Table 1 – Application associations and data exchange in the 3-layer, CO, HDLC-based profile

Application association establishment				Data exchange	
Protocol connection parameters	COSEM-OPEN service class	Use	Type of established AA	Service class	Use
Id: HDLC LLC and MAC addresses	Confirmed	1/ Connect data link layer 2/ Exchange AARQ/AARE APDUs transported in "I" frames	Confirmed	Confirmed	"I" frame
				Unconfirmed	"UI" frame
	Unconfirmed	Send AARQ in a "UI" frame	Unconfirmed	Confirmed (not allowed)	-
				Unconfirmed	"UI" frame

9.2 Correspondence between AAs and data link layer connections, releasing AAs

In this profile, a confirmed AA is bound to a supporting data link layer connection, in a one-to-one basis. Consequently:

- establishing a confirmed AA implies the establishment of a connection between the client and server data link layers;
- a confirmed AA in this profile can be non-ambiguously released by disconnecting the corresponding data link layer connection.

On the other hand, in this profile, establishing an unconfirmed AA does not need any lower layer connection: consequently, once established, unconfirmed AAs with servers not supporting the ACSE A-RELEASE service (see 6.3 and 7.2.5 of IEC 62056-5-3:—) cannot be released.

9.3 Service parameters of the COSEM-OPEN / -RELEASE / -ABORT services

Thanks to the possibility to transparently transport higher layer related information within the SNRM and DISC HDLC frames, this profile allows the use of the optional "User_Information" parameter of the COSEM-OPEN – see 6.2 of IEC 62056-5-3:— – and COSEM-RELEASE – see 6.3 of IEC 62056-5-3:— – services:

- the User_Information parameter of a COSEM-OPEN.request primitive, if present, is inserted into the "User data subfield" of the SNRM frame, sent during the data link connection establishment;
- if the SNRM frame received by the server contains a "User data subfield", its contents is passed to the server AP via the User_Information parameter of the COSEM-OPEN.indication primitive;
- the User_Information parameter of a COSEM-RELEASE.request primitive, if present, is inserted into the "User data subfield" of the DISC frame, sent during disconnecting the data link connection;
- if the DISC frame received by the server contains a "User data subfield", its contents is passed to the server AP via the User_Information parameter of the COSEM-RELEASE.indication primitive;
- the User_Information parameter of the COSEM-RELEASE.response primitive, if present, is inserted into the "User data subfield" of the UA or HDLC frame, sent in response to the DISC frame;

- if the UA or DM frame received by the client contains "User data subfield", its contents is passed to the client AP via the User_Information parameter of the COSEM-RELEASE.confirm primitive.

In addition, for the COSEM-ABORT.indication service, the following rule applies:

- the Diagnostics parameter of the COSEM-ABORT.indication primitive – see 6.4 of IEC 62056-5-3:— – may contain an unnumbered send status parameter. This parameter indicates whether, at the moment of the physical abort indication, the data link layer has or does not have a pending Unnumbered Information message (UI). The type and the value of this parameter is a local issue, thus it is not within the scope of this companion specification. See also 5.2.2.3 and 6.2.2.3 of IEC 62056-46:2002, Amendment 1:2006.

9.4 EventNotification service and protocol

This subclause describes the communication profile specific elements of the protocol of the EventNotification service, see 6.9 of IEC 62056-5-3:—.

In this profile, an event is reported always by the server management logical device (mandatory, reserved upper HDLC address 0x01) to the client management AP (mandatory, reserved HDLC address 0x01).

The EventNotificationRequest APDU is sent using connectionless data services, using an UI frame, at the first opportunity, i.e. when the server side data link layer receives the right to talk. The APDU shall fit into a single HDLC frame. To be able to send out the APDU, a physical connection between the physical device hosting the server and a client device must exist, and the server side data link layer needs to receive the token from the client side data link layer.

If there is a data link connection between the client and the server when the event occurs, the server side data link layer may send out the PDU – carrying the EventNotificationRequest APDU – following the reception of an I, a UI or an RR frame from the client. See 6.4.4.7 of IEC 62056-46:2002.

Figure 4 shows the procedure in the case, when there is no physical connection when the event occurs (but this connection to a client device can be established).

NOTE Physical connection cannot be established when the server has only a local interface (for example an optical port as defined in IEC 62056-21) and the HHU, running the client application is not connected, or the server has a PSTN interface, but the telephone line is not available. Handling such cases is implementation specific.