INTERNATIONAL STANDARD

IEC 62056-46

Edition 1.1

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

**Part 46:
Data link layer using HDLC protocol**

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CONTENTS

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

Part 46: Data link layer using HDLC protocol

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[1] Device Language Message Specification.

International Standard IEC 62056-46 has been prepared by IEC technical committee 13: Equipment for electrical energy measurement and load control.

This consolidated version of IEC 62056 consists of the first edition (2002) [documents 13/1267/FDIS and 13/1273/RVD] and its amendment 1 (2006) [documents 13/1376/FDIS and 13/1401/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 1.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

Annexes A, B and C are for information only.

The committee has decided that the contents of the base publication and its amendments 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- withdrawn,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 this publication may be issued at a later date.

INTRODUCTION (to amendment 1)

The amendment takes into account that in the third edition of ISO/IEC 13239, frame type 3 has been added as Annex H.4, as requested by IEC TC 13 WG 14, and that second editions of some parts of the IEC 62056 series are under preparation.

It specifies now that a secondary station may use more than one addressing scheme.

It contains some changes concerning the negotiation of the maximum information length field HDLC parameter for better efficiency.

References have been updated and some editorial errors have also been corrected.

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

Part 46: Data link layer using HDLC protocol

1 Scope

This part of IEC 62056 specifies the data link layer for connection-oriented, HDLC-based, asynchronous communication profile.

In order to ensure a coherent data link layer service specification for both connection-oriented and connectionless operation modes, the data link layer is divided into two sub-layers: the Logical Link Control (LLC) sub-layer and the Medium Access Control (MAC) sub-layer.

This specification supports the following communication environments:

- point-to-point and point-to-multipoint configurations;

- dedicated and switched data transmission facilities;

- half-duplex and full-duplex connections;

- asynchronous start/stop transmission, with 1 start bit, 8 data bits, no parity, 1 stop bit.

Two special procedures are also defined:

- transferring of separately received Service User layer PDU parts from the server to the client in a transparent manner. The server side Service user layer can give its PDU to the data link layer in fragments and the data link layer can hide this fragmentation from the client;

- event reporting, by sending UI frames from the secondary station to the primary station.

Annex B 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/TR 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 62056-42, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 42: Physical layer services and procedures for connection oriented asynchronous data exchange* [1]

IEC 62056-53:2006, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 53: COSEM Application layer*

IEC 62056-61:2006, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 61: OBIS Object identification system*

IEC 62056-62:2006, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 62: Interface classes*

ISO/IEC 8802-2:1998, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control*

ISO/IEC 13239:2002, *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 purposes of this document, the definitions given in IEC 60050-300, IEC 62051 and IEC 62051-1 apply.

3.2   Abbreviations

APDU	Application layer Protocol Data Unit
COSEM	COmpanion Specification for Energy Metering
DISC	DISConnect (an HDLC frame type)
DL	Data Link
DM	Disconnected Mode (an HDLC frame type)
DPDU	Data link Protocol Data Unit
DSAP	Data link Service Access Point
DSDU	Data link Service Data Unit
FCS	Frame Check Sequence
FRMR	FRaMe Reject (an HDLC frame type)
HCS	Header Check Sequence
HDLC	High-level Data Link Control
I	Information (an HDLC frame type)
LLC	Logical Link Control (Sub-layer)
LSAP	LLC sub-layer Service Access Point
LPDU	LLC Protocol Data Unit
LSB	Least Significant Bit
LSDU	LLC Service Data Unit
MAC	Medium Access Control (sub-layer)
MSAP	MAC sub-layer Service Access Point (here it is equal to the HDLC address)
MSB	Most Significant Bit
MSDU	MAC Service Data Unit

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[1] To be published.

NDM	Normal Disconnected Mode
NRM	Normal Response Mode
N(R)	Receive sequence Number
N(S)	Send sequence Number
P/F	Poll/Final bit
PDU	Protocol Data Unit
PH	Physical layer
PSDU	Physical layer Service Data Unit
RNR	Receive Not Ready (an HDLC frame type)
RR	Receive Ready (an HDLC frame type)
SAP	Service Access Point
SDU	Service Data Unit
SNRM	Set Normal Response Mode (an HDLC frame type)
TWA	Two Way Alternate
UA	Unnumbered Acknowledgement (an HDLC frame type)
UI	Unnumbered Information (an HDLC frame type)
UNC	Unbalanced operation Normal response mode Class
USS	Unnumbered Send Status
V(R)	Receive state Variable
V(S)	Send state Variable

4 Overview

4.1 The LLC sub-layer

In the connection-oriented profile the only role of the LLC sub-layer is to ensure consistent Data Link addressing. It can be considered that the LLC sub-layer, defined in ISO/IEC 8802-2 is used in an extended class I operation, where the LLC sub-layer provides the standard connectionless data services via a connection-oriented MAC sub-layer.

The LLC sub-layer provides Data Link (DL) connection/disconnection services to the Service User layer, but it uses the services of the MAC sub-layer to execute these services.

The LLC sub-layer is specified in clause 5.

4.2 The MAC sub-layer

The MAC sub-layer – the major part of this data link layer specification – is based on ISO/IEC 13239 concerning high-level data link control (HDLC) procedures.

This standard includes a number of enhancements compared to the original HDLC, for example in the areas of addressing, error protection and segmentation. These enhancements have been incorporated in a new frame format, which meets the requirements of the environment found in telemetry applications for electricity metering and similar industries.

The MAC sub-layer is specified in clause 6.

4.3 Specification method

Sub-layers of the data link layer are specified in terms of **services** and **protocol**.

Service specifications cover the services required of, or by, the given sub-layer at the logical interfaces with the neighbouring other sub-layer or layer, using connection oriented procedures. Services are the standard way to specify communications between protocol layers. Through the use of four types of transactions, commonly known as service primitives (Request, Indication, Response and Confirm) the service provider co-ordinates and manages the communication between the users. Using service primitives is an abstract, implementation-independent way to specify the transactions between protocol layers. Given this abstract nature of the primitives, their use makes good sense for the following reasons:

- they permit a common convention to be used between layers, without regard to specific operating systems and specific languages;

- they give the implementers a choice of how to implement the service primitives on a specific machine.

Service primitives include service parameters. There are three classes of service parameters:

- parameters transmitted to the peer layer, becoming part of the transmitted frame, for example addresses, control information;

- parameters which have only local significance;

- parameters which are transmitted transparently across the data link layer to the user of the data link.

NOTE   Data link layer management services are explained in Annex C.

This standard specifies values for parameters of the first category only.

The **protocol** specification for a protocol layer includes:

- the specification of the procedures for the transmission of the set of messages exchanged between peer-layers;

- the procedures for the correct interpretation of protocol control information;

- the layer behaviour.

The protocol specification for a protocol layer does not include:

- the structure and the meaning of the information which is transmitted by means of the layer (Information field, User data subfield);

- the identity of the Service User layer;

- the manner in which the Service User layer operation is accomplished as a result of exchanging Data Link messages;

- the interactions that are the result of using the protocol layer.

5   The LLC sub-layer

5.1   The role of the LLC sub-layer

The LLC sub-layer used in this profile is based on ISO/IEC 8802-2. The presence of this sub-layer in the connection-oriented profile is somewhat artificial: the LLC sub-layer is used as a kind of protocol selector, and the 'real' data link layer connection is ensured by the MAC sub-layer. It can be considered that the standard LLC sub-layer is used in an extended class I operation, where the LLC sub-layer provides the standard data-link-connectionless services via a connection-oriented MAC sub-layer. In order to be able to establish the data link connection, the LLC sub-layer provides transparent MAC connection/disconnection services to the service user protocol layer.
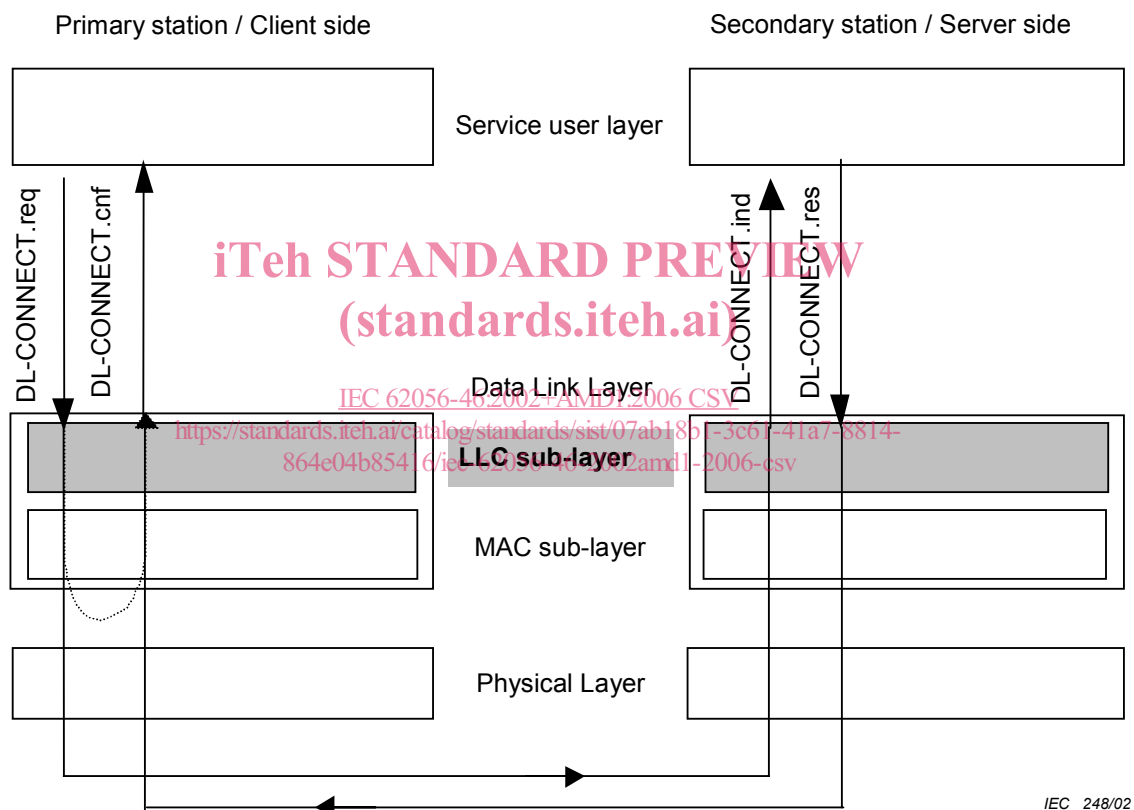
5.2   Service specification for the LLC sub-layer

This subclause specifies the services required of, or by, the LLC sub-layer at the logical interfaces with the Service User layer and the MAC sub-layer, using connection-oriented procedures. As the Service User layer 'sees' the services of the LLC sub-layer as the services of the data link layer, in this standard these services are called data link layer services and the prefix "DL" to designate these services is used.

5.2.1   Setting up the Data Link Connection

Overview

Figure 1 shows the services provided by the primary station (client side) and secondary station (server side) data link layers to the service user layer for data link connection establishment.

Primary station / Client side   Secondary station / Server side

Service user layer

DL-CONNECT.req
DL-CONNECT.cnf
DL-CONNECT.ind
DL-CONNECT.res

Data Link Layer

LLC sub-layer

MAC sub-layer

Physical Layer

IEC 248/02

Figure 1 – Data Link (LLC) services for setting up the Data Link Connection

Data link connection establishment can only be requested by the primary station, so the DL-CONNECT.request and .confirm services are provided only at the client (primary station) side. On the other hand, the DL-CONNECT.indication and .response services are provided only at the server (secondary station) side.

The DL-CONNECT.request service primitive – in case of a locally detected error – can be also locally confirmed.

All these services are in fact, provided by the MAC sub-layer: the LLC sub-layer shall transparently transmit these services to/from the "real" service provider MAC sub-layer as the appropriate MA-CONNECT.xxx service primitive.

5.2.1.1   DL-CONNECT.request

Function

This service primitive is provided only at the client side. The Service User layer invokes this primitive to request set-up of a data link connection.

Service parameters

The semantics of the primitive is as follows:

    DL-CONNECT.request
    (
        Destination_MSAP[1]),
        Source_MSAP,
        User_Information
)

The Destination_MSAP and Source_MSAP parameters identify the referenced data link layer connection. The addressing scheme for the MAC layer is discussed in 6.4.2. The specification of the contents of the optional User_information parameter is not within the scope of this standard.

Use

The client side Service User layer entity invokes the DL-CONNECT.request primitive, when it wants to set up a connection with a peer data link layer.

5.2.1.2   DL-CONNECT.indication

Function

This service primitive is provided only at the server side. The LLC sub-layer uses this primitive to indicate to the Service User layer that the peer data link layer requested a Data Link connection.

Service parameters

The semantics of the primitive is as follows:

    DL-CONNECT.indication
    (
        Destination_MSAP,
        Source_MSAP,
        User_Information
)

The Destination_MSAP and Source_MSAP identify the referenced data link layer connection. The addressing scheme for the MAC layer is discussed in 6.4.2. The specification of the contents of the optional User_information parameter is not within the scope of this standard.

Use

The server side LLC sub-layer generates this primitive following the reception of an MA-CONNECT.indication primitive from the MAC sub-layer.

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[1] MSAP in this environment is equal to the HDLC address.

5.2.1.3   DL-CONNECT.response

Function

This service primitive is provided only at the server side. The Service User layer invokes this service primitive in order to indicate to the local data link layer whether the previously proposed data link connection can be accepted by the service user layer or not.

Service parameters

The semantics of the primitive is as follows:

    DL-CONNECT.response
    (
        Destination_MSAP,
        Source_MSAP,
        Result,
        User_Information
)

The Destination_MSAP and Source_MSAP parameters identify the referenced data link layer connection. The Result parameter (OK, NOK, NO_RESPONSE) indicates whether the proposed connection could be accepted or not, and whether a response frame should be sent or not.

- Result == OK. This means that the received connect request can be accepted by the service user layer.

- Result == NOK. This means that the received connect request cannot be accepted by the service user layer.

- RESULT == NO_RESPONSE: This means that no response to the DL-CONNECT.indication shall be sent.

The User_Information parameter may be present only when the Result is NOK. The specification of its content is not within the scope of this standard.

NOTE   The Result parameter indicates only whether the Data Link Connection can or cannot be accepted by the service user higher layers. The data link layer itself may refuse a proposed connection, (e.g. because it supports only one connection at a given moment, thus it is not able to support a second one) even if the higher layers could accept it (Result==OK).

Use

The server side Service User layer entity invokes the DL-CONNECT.response primitive to indicate the result of a previously received request for connection.

5.2.1.4   DL-CONNECT.confirm

Function

This service primitive is provided only at the client side and it can be originated remotely or locally. The data link layer generates this primitive to indicate to the Service User layer the result of a previously received DL-CONNECT.request service.