

Messung der elektrischen Energie

Zählerstandsübertragung, Tarif- und LaststeuerungTeil 46: Anwendung des HDLC-Protokolls in der Verbindungsschicht
(IEC 62056-46:2002) Deutsche Fassung EN 62056-46:2002, Text in Englisch**DIN****EN 62056-46**

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Electricity metering –
Data exchange for meter reading, tariff and load control –
Part 46: Data link layer using HDLC protocol
(IEC 62056-46:2002); German version EN 62056-46:2002, text in English

Equipements de mesure de l'énergie électrique –
Echange des données pour la lecture des compteurs, le contrôle des tarifs et
de la charge –
Partie 46: Couche liaison utilisant le protocole HDLC
(CEI 62056-46:2002); Version allemande EN 62056-46:2002, texte en anglais

Die Europäische Norm EN 62056-46:2002 hat den Status einer Deutschen Norm.**Beginn der Gültigkeit**

Die EN 62056-46 wurde am 2002-03-01 angenommen.

Nationales Vorwort

Für die vorliegende Norm ist das nationale Arbeitsgremium K 461 „Elektrizitätszähler“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE zuständig.

Die der EN 62056-46 zugrunde liegende Internationale Norm IEC 62056-46 hat das Technische Komitee 13 „Equipment for electrical energy measurement and load control“ der Internationalen Elektrotechnischen Kommission (IEC) unter Mitwirkung des als nationalen Arbeitsgremium zuständigen Komitees 461 „Elektrizitätszähler“ der DKE erarbeitet. Die nationale Federführung lag beim AK 461.0.14 „Datenübertragung“. Die Arbeit dieser Gremien erfolgte unter enger Anknüpfung an die Gremien der DLMS-User-Association mit Sitz in Genf, einer Vereinigung von Anwendern und Herstellern, die das Ziel verfolgt, die zum Themenkreis DLMS (Device Language Message Specification) gehörenden Protokolle in interoperabler Form voranzutreiben.

Die Internationale Norm IEC 62056-46:2002 „ELECTRICITY METERING – DATA EXCHANGE FOR METER READING, TARIFF AND LOAD CONTROL – Part 46: Data Link layer using HDLC protocol“ ist unverändert von CENELEC als Europäische Norm EN 62056-46:2002 und somit in das Deutsche Normenwerk übernommen worden (in der vorliegenden Norm mit veränderten Seitenzahlen).

Fortsetzung Seite 2 und 3
und 69 Seiten EN

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

Norm-Inhalt war veröffentlicht als E DIN EN 62056-46 (VDE 0418 Teil 6-46):2000-10.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird mit der Deutschen Fassung der von CENELEC für EN 62056-46 beschlossenen ergänzenden Festlegungen die Englische Fassung der IEC 62056-46 veröffentlicht. Hinzu kommt, dass die meisten Internationalen Normen, auf die darin verwiesen wird, in ihren englischen Originaltexten als Europäische Normen übernommen und dann ebenso als Deutsche Normen veröffentlicht wurden. Um die Anwendung der vorliegenden Norm zu erleichtern, wurden (wie in den genannten anderen DIN-EN-, DIN-ISO- oder DIN-ISO/IEC-Normen) die nachfolgenden einführenden Vorbemerkungen und Erläuterungen vorangestellt.

Das Präsidium des DIN hat mit Präsidialbeschluss 13/1983 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründen, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für die vorliegende Norm erfüllt.

Die enthaltene IEC-Publikation wurde vom TC 13 „Equipment for electrical energy measurement and load control“ erarbeitet.

Das IEC-Komitee hat entschieden, dass der Inhalt dieser Publikation bis zum Jahr 2006 unverändert bleiben soll. Zu diesem Zeitpunkt wird entsprechend der Entscheidung des Komitees die Publikation

- bestätigt,
- zurückgezogen,
- durch eine Folgeausgabe ersetzt oder
- geändert.

Nationaler Anhang NA (informativ)

Einleitung

Dieser Teil der Reihe IEC 62056 legt die Verbindungsschicht für das verbindungsorientierte asynchrone Datenübermittlungsprofil auf der Grundlage des HDLC-Protokolls fest.

Für die Sicherstellung einer kohärenten Dienstspezifikation der Verbindungsschicht für die verbindungsorientierten und verbindungslosen Betriebsarten wird die Verbindungsschicht in zwei Teilschichten unterteilt: in die Teilschicht für die Steuerung im Übermittlungsabschnitt (LLC – Logical Link Control) und in die Teilschicht der Steuerung für den Mediumzugriff (MAC – Medium Access Control).

Die vorliegende Spezifikation unterstützt folgende Datenübermittlungsumgebungen:

- Punkt-zu-Punkt- und Punkt-zu-Mehrpunkt-Konfigurationen;
- Festgeschaltete und vermittelte Datenübertragungseinrichtungen;
- Halbduplex- und Vollduplex-Verbindungen;
- Asynchrone Start-Stopp-Übertragung mit 1 Startbit, 8 Datenbits, keine Parität, 1 Stoppbit.

Weiterhin werden zwei Sonderprozeduren festgelegt:

- Übertragung von getrennt empfangenen PDU-Teilen der Dienstbenutzerschicht vom Server zum Client in einer transparenten Weise. Die serverseitige Dienstbenutzerschicht kann ihre PDU fragmentiert an die Verbindungsschicht geben und die Verbindungsschicht kann diese Fragmentierung des Client verbergen.
- Ergebnisbericht, durch Senden von UI-Rastern von der Sekundärstation zur Primärstation.

Anhang B gibt eine Erläuterung zur Rolle der Datenmodelle und -protokolle für die Zählerstandübertragung.

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf eine Norm ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils neueste gültige Ausgabe der in Bezug genommenen Norm.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe der Norm.

Der Zusammenhang der zitierten Normen mit den entsprechenden Deutschen Normen ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

IEC hat 1997 die Benummerung der IEC-Publikationen geändert. Zu den bisher verwendeten Normnummern wird jeweils 60000 addiert. So ist zum Beispiel aus IEC 68 nun IEC 60068 geworden.

– Leerseite –

Messung der elektrischen Energie –
Zählerstandsübertragung, Tarif- und Laststeuerung
Teil 46: Anwendung des HDLC-Protokolls in der Verbindungsschicht
(IEC 62056-46:2002)

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HDLC
(CEI 62056-46:2002)

Diese Europäische Norm wurde von CENELEC am 2002-03-01 angenommen. Die CENELEC-Mitglieder sind gehalten, die CEN/CENELEC-Geschäftsordnung zu erfüllen, in der die Bedingungen festgelegt sind, unter denen dieser Europäischen Norm ohne jede Änderung der Status einer nationalen Norm zu geben ist.

Auf dem letzten Stand befindliche Listen dieser nationalen Normen mit ihren bibliographischen Angaben sind beim Zentralsekretariat oder bei jedem CENELEC-Mitglied auf Anfrage erhältlich.

Diese Europäische Norm besteht in drei offiziellen Fassungen (Deutsch, Englisch, Französisch). Eine Fassung in einer anderen Sprache, die von einem CENELEC-Mitglied in eigener Verantwortung durch Übersetzung in seine Landessprache gemacht und dem Zentralsekretariat mitgeteilt worden ist, hat den gleichen Status wie die offiziellen Fassungen.

CENELEC-Mitglieder sind die nationalen elektrotechnischen Komitees von Belgien, Dänemark, Deutschland, Finnland, Frankreich, Griechenland, Irland, Island, Italien, Luxemburg, Malta, den Niederlanden, Norwegen, Österreich, Portugal, Schweden, der Schweiz, Spanien, der Tschechischen Republik, Ungarn und dem Vereinigten Königreich.

CENELEC

Europäisches Komitee für Elektrotechnische Normung
European Committee for Electrotechnical Standardization
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Vorwort

Der Text des Schriftstücks 13/1267/FDIS, zukünftige 1. Ausgabe von IEC 62056-46, ausgearbeitet von dem IEC TC 13 „Equipment for electrical energy measurement and load control“, wurde der IEC-CENELEC Parallelen Abstimmung unterworfen und von CENELEC am 2002-03-01 als EN 62056-46 angenommen.

Nachstehende Daten wurden festgelegt:

- spätestes Datum, zu dem die EN auf nationaler Ebene durch Veröffentlichung einer identischen nationalen Norm oder durch Anerkennung übernommen werden muss (dop): 2003-01-01
- spätestes Datum, zu dem nationale Normen, die der EN entgegenstehen, zurückgezogen werden müssen (dow): 2005-05-01

Die Internationale Elektrotechnische Kommission (IEC) und CENELEC weisen darauf hin, dass die Übereinstimmung mit dieser Internationalen Norm / Europäischen Norm die Inanspruchnahme eines Wartungs-Dienstes hinsichtlich der Protokolle, auf denen die vorliegende Norm IEC 62056-46 / EN 62056-46 beruht, bedeuten kann.

Die IEC und CENELEC nehmen keine Stellung zur Rechtmäßigkeit, zur Gültigkeit und zum Anwendungsbereich dieses Wartungs-Dienstes.

Der Anbieter dieses Wartungs-Dienstes hat IEC zugesichert, dass er bereit ist, Antragstellern in der ganzen Welt Wartungs-Dienste zu vernünftigen und nicht diskriminierenden Geschäftsbedingungen anzubieten. In diesem Zusammenhang ist die Erklärung des Anbieters des Wartungs-Dienstes bei IEC registriert. Informationen sind erhältlich bei:

DLMS¹⁾ User Association
Geneva / Switzerland
www.dlms.ch

Anhänge, die als „normativ“ bezeichnet sind, gehören zum Norm-Inhalt.
Anhänge, die als „informativ“ bezeichnet sind, enthalten nur Informationen.
In dieser Norm ist Anhang ZA normativ und sind die Anhänge A, B und C informativ.
Der Anhang ZA wurde von CENELEC hinzugefügt.

Anerkennungsnotiz

Der Text der Internationalen Norm IEC 62056-46:2002 wurde von CENELEC ohne irgendeine Abänderung als Europäische Norm angenommen.

In der offiziellen Fassung sind unter „Literaturhinweise“ zu den aufgelisteten Normen die nachstehenden Anmerkungen einzutragen:

- IEC 61334-4-41 ANMERKUNG Harmonisiert als EN 61334-4-41:1996 (nicht modifiziert).
- IEC 61334-6 ANMERKUNG Harmonisiert als EN 61334-6:2000 (nicht modifiziert).

¹⁾ Device Language Message Specification

CONTENTS

	Page
1 Scope	5
2 Normative references.....	5
3 Terms, definitions and abbreviations.....	6
4 Overview	7
4.1 The LLC sub-layer	7
4.2 The MAC sub-layer	7
4.3 Specification method	7
5 The LLC sub-layer	8
5.1 The role of the LLC sub-layer	8
5.2 Service specification for the LLC sub-layer	8
5.2.1 Setting up the Data Link Connection	9
5.2.2 Disconnecting the Data Link Connection	12
5.2.3 Data communication	15
5.3 Protocol specification for the LLC sub-layer	19
5.3.1 Overview.....	19
5.3.2 LLC protocol data unit (LPDU) structure.....	19
5.3.3 State transition tables for the LLC sub-layer	20
6 The MAC sub-layer	21
6.1 HDLC selections.....	21
6.2 Service specification for the MAC sub-layer	21
6.2.1 Setting up the MAC connection	21
6.2.2 Disconnecting the MAC connection.....	25
6.2.3 Data communication	29
6.3 Physical layer services used by the MAC sub-layer	31
6.3.1 Overview.....	31
6.3.2 Setting up a physical link	32
6.3.3 Disconnecting the physical link	32
6.3.4 Data communication	32
6.4 Protocol specification for the MAC sub-layer.....	32
6.4.1 The MAC PDU and the HDLC frame.....	32
6.4.2 MAC addressing	34
6.4.3 Command and response frames.....	38
6.4.4 Elements of the procedures	41
6.4.5 State transition diagram for the server MAC sub-layer	56
Annex A (informative) FCS calculation	58
Annex B (informative) Data model and protocol.....	61
Annex C (informative) Data link layer management services	62

	Page
Figure 1 – Data Link (LLC) services for setting up the Data Link Connection.....	9
Figure 2 – Data Link (LLC) services for disconnecting the Data Link Connection.....	12
Figure 3 – Data link layer data communication services	16
Figure 4 – The ISO/IEC 8802-2 LLC protocol data unit format	19
Figure 5 – The used LLC protocol data unit format	19
Figure 6 – MAC sub-layer services for setting up the MAC (DL) connection at the client and server sides.....	22
Figure 7 – MAC sub-layer services for disconnecting the MAC (DL) connection at the client and server sides	25
Figure 8 – MAC sub-layer data communication services.....	29
Figure 9 – Physical layer services used by the MAC sub-layer	32
Figure 10 – MAC sub-layer frame format (HDLC frame format type 3)	32
Figure 11 – Multiple frames	33
Figure 12 – The frame format field	33
Figure 13 – MSC for long MSDU transfer in a transparent manner	50
Figure 14 – Example configuration to illustrate broadcasting	51
Figure 15 – Sending out a pending UI frame with a .response data	52
Figure 16 – Sending out a pending UI frame with a response to a RR frame	53
Figure 17 – Sending out a pending UI frame on receipt of an empty UI frame	53
Figure 18 – State transition diagram for the server MAC sub-layer	57
Figure B.1 – The three-step approach of COSEM.....	61
Figure C.1 – Layer management services	62
Table 1 – State transition table of the client side LLC sub-layer	20
Table 2 – State transition table of the server side LLC sub-layer	20
Table 3 – Table of reserved client addresses	35
Table 4 – Table of reserved server addresses	36
Table 5 – Handling inopportune address lengths	38
Table 6 – Command and response frames	38
Table 7 – Control field format	39
Table 8 – Example for parameter negotiation values with the SNRM/UA frames.....	46
Table 9 – Summary of MAC Addresses for the example	51
Table 10 – Broadcast UI frame handling.....	51

ELECTRICITY METERING – DATA EXCHANGE 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 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⁾

¹⁾ To be published.

IEC 62056-53, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 53 – COSEM Application layer* ¹⁾

IEC 62056-61, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 61 – OBIS Object Identification System* ¹⁾

IEC 62056-62, *Data exchange for meter reading, tariff and load control – Part 62: Interface Classes* ¹⁾

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 13239:2000, *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 found in IEC 60050-300 and IEC/TR 62051 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
NDM	Normal Disconnected Mode
NRM	Normal Response Mode

¹⁾ To be published.

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 (e.g. `Physical_Connection_Type`).
- 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 (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.

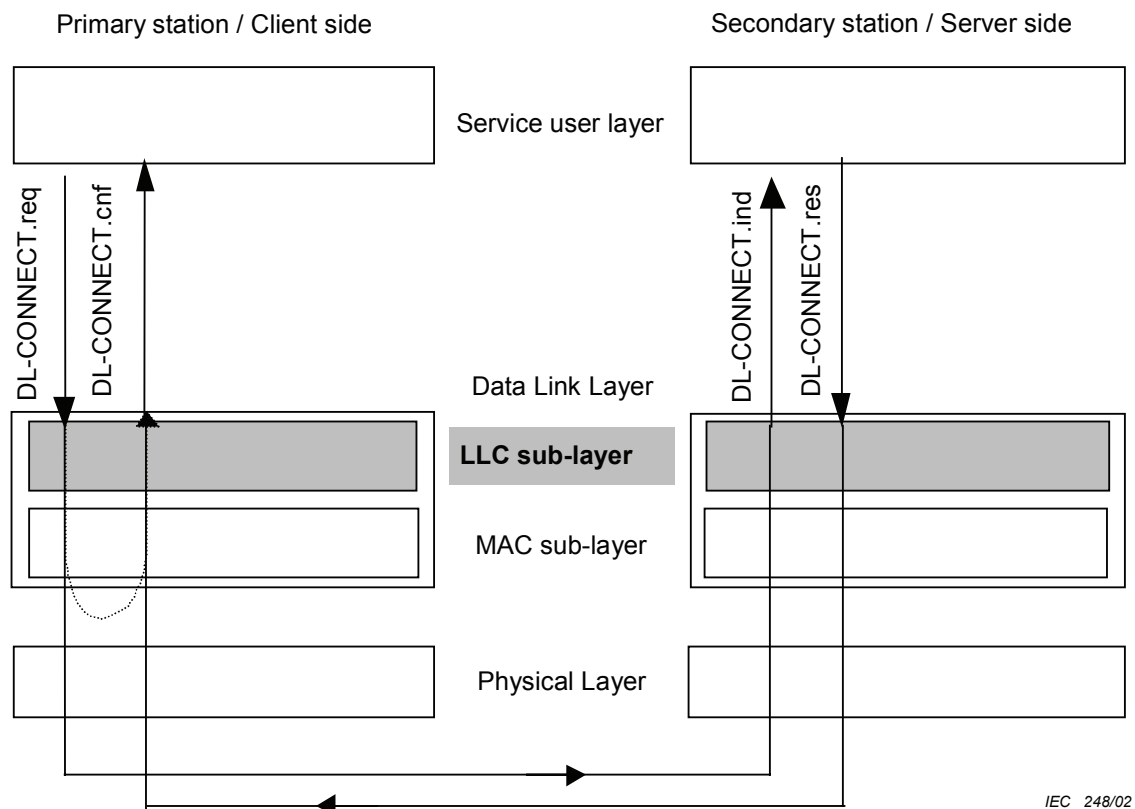


Figure 1 – Data Link (LLC) services for setting up the Data Link Connection

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_MSAP1,
    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.

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:

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

```
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.

Service parameters

The semantics of the primitive is as follows:

```
DL-CONNECT.confirm
(
    Destination_MSAP,
    Source_MSAP,
    Result,
    User_Information
)
```

The Destination_MSAP and Source_MSAP parameters reference data link layer connection, which is confirmed by the service. The Result parameter (OK, NOK-REMOTE, NOK-LOCAL, NO_RESPONSE) indicates the result of the previously invoked DL-CONNECT.request service.

- Result == OK. This means that the connect request was accepted by the remote station.
- Result == NOK-REMOTE. This means that the connect request was not accepted by the remote station.

- Result == NOK-LOCAL. This means that a local error has occurred, for example the service user layer tried to establish an already existing data link connection.
- RESULT == NO_RESPONSE. This means that there was no response from the remote station to the connect request.

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

Use

The LLC sub-layer indicates the reception of an MA-CONNECT.confirm primitive to the Service User layer by using this primitive.

5.2.2 Disconnecting the Data Link Connection

5.2.2.1 Overview

Figure 2 shows the services provided by the client and server side data link layers to the Service User layer for disconnecting a Data Link connection.

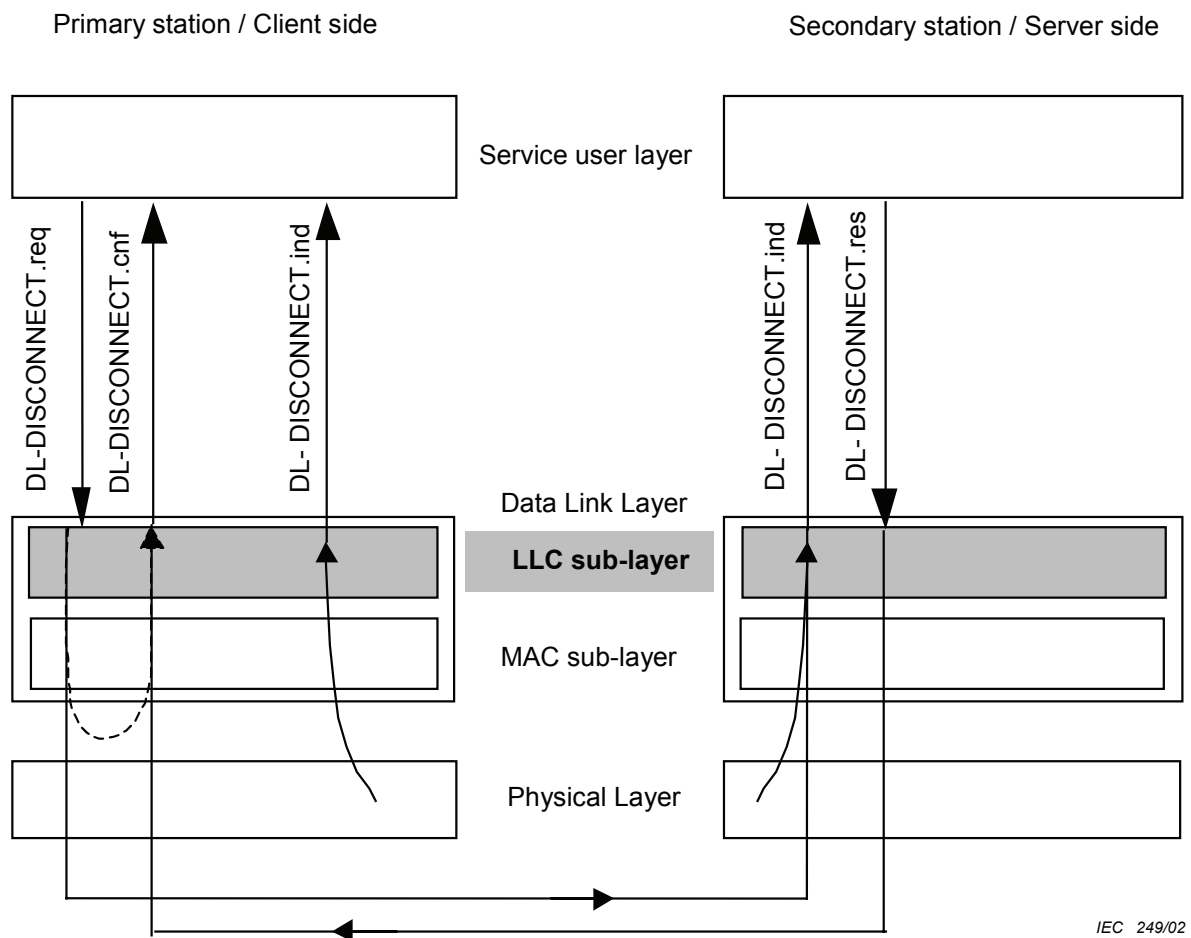


Figure 2 – Data Link (LLC) services for disconnecting the Data Link Connection

Data link disconnection can only be requested by the client device, so the DL-DISCONNECT.request and .confirm services are provided only at the client side. On the other hand, the remotely initiated (by the client) DL-DISCONNECT.indication and .response services are provided only at the server side.

NOTE When this data link layer is used together with the COSEM application layer as defined in IEC 62056-53, DL-DISCONNECT services are used to release existing Application Associations.

Both the client and server side LLC sub-layers provide a locally initiated DL-DISCONNECT.indication service, to signal a non-solicited disconnection, due to an unexpected loss of the data link and/or physical connection.

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

These services are in fact provided by the MAC sub-layer: the LLC sub-layer shall transparently transmit these services to/from the MAC sub-layer as the appropriate MA-DISCONNECT.xxx service primitive.

5.2.2.2 DL-DISCONNECT.request

Function

This service primitive is provided only at the client side. It is invoked by the Service User layer to request disconnecting of an existing Data Link connection.

Service parameters

The semantics of the primitive is as follows:

```
DL-DISCONNECT.request
(
    Destination_MSAP,
    Source_MSAP,
    User information
)
```

The Destination_MSAP and Source_MSAP parameters specify the data link connection to be disconnected. 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 this primitive to request a disconnection of a data link connection to peer data link layer(s).

5.2.2.3 DL-DISCONNECT.indication

Function

This service primitive is provided at the client side and at the server side.

- The server side data link layer generates this primitive to indicate to the Service User layer that the peer data link layer requests the disconnection of a data link connection.
- On both the server and client sides, this primitive is used to indicate that the data link and/or physical connection abort occurred in a non-solicited manner (e.g. the physical line has been disconnected).

Service parameters

The semantics of the primitive is as follows:

```
DL-DISCONNECT.indication
(
    Destination_MSAP,
    Source_MSAP,
```

```
Reason,  
Unnumbered Send Status,  
User Information  
)
```

The Destination_MSAP and Source_MSAP parameters specify the local and remote MSAPs of the terminated connection.

The Reason parameter (REMOTE, LOCAL_PHY, LOCAL_DL) indicates the reason for the DL-DISCONNECT.indication invocation.

- Reason == REMOTE. This means that the data link layer received a disconnection request from the client side. This case may happen only at the server side.
- Reason == LOCAL_DL. This means that there was a fatal data link connection failure.
- Reason == LOCAL_PHY. This means that there was a fatal physical connection failure.

The value of the USS parameter indicates whether at the moment of the DL-DISCONNECT.indication service invocation the data link layer has (USS==TRUE) or does not have (USS==FALSE) pending UI message(s).

The User Information field may be present only when Reason == REMOTE. The specification of the contents of this parameter is not within the scope of this standard.

Use

The LLC sub-layer generates this primitive following the reception of an MA-DISCONNECT.indication primitive.

5.2.2.4 DL-DISCONNECT.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 data link layer whether the previously proposed data link disconnection can be accepted by the Service User layer or not. As in this environment the server has no right to refuse the disconnection, the response depends only whether the referenced Data Link connection is existing or not.

Service parameters

The semantics of the primitive is as follows:

```
DL-DISCONNECT.response  
(  
    Destination_MSAP,  
    Source_MSAP,  
    Result  
)
```

The Destination_MSAP and Source_MSAP parameters specify the local and remote MSAPs involved in the connection being disconnected. The Result parameter can have values OK, NOK and NO_RESPONSE.

- Result == OK. This means that the received disconnect request refers to an existing higher layer connection.
- Result == NOK. This means that the received disconnect request refers to a non-existing higher layer connection.
- RESULT == NO_RESPONSE: This means that no response to the DL-DISCONNECT.indication shall be sent.

Use

The server side Service User layer invokes the DL-DISCONNECT.response primitive to indicate the result of a previously received request for disconnecting the data link connection.

5.2.2.5 DL-DISCONNECT.confirm*Function*

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

Service parameters

The semantics of the primitive is as follows:

```
DL-DISCONNECT.confirm
(
    Destination_MSAP,
    Source_MSAP,
    Result
)
```

The Destination_MSAP and Source_MSAP parameters specify the local and remote MSAPs of the terminated connection. The Result parameter (OK, NOK, NO_RESPONSE) indicates the result of the attempt to close the data link connection.

- Result == OK. This means that the disconnect request was accepted by the remote station.
- Result == NOK. This means that the disconnect request was not accepted by the remote station.
- Result == NO_RESPONSE. This means that there was no response from the remote station to the disconnect request.

Use

The client side LLC sub-layer indicates the reception of an MA-DISCONNECT.confirm primitive to the Service User layer using this primitive.

5.2.3 Data communication**5.2.3.1 Overview**

Figure 3 shows the data communication services provided by the data link layer to the Service User layer to exchange data.

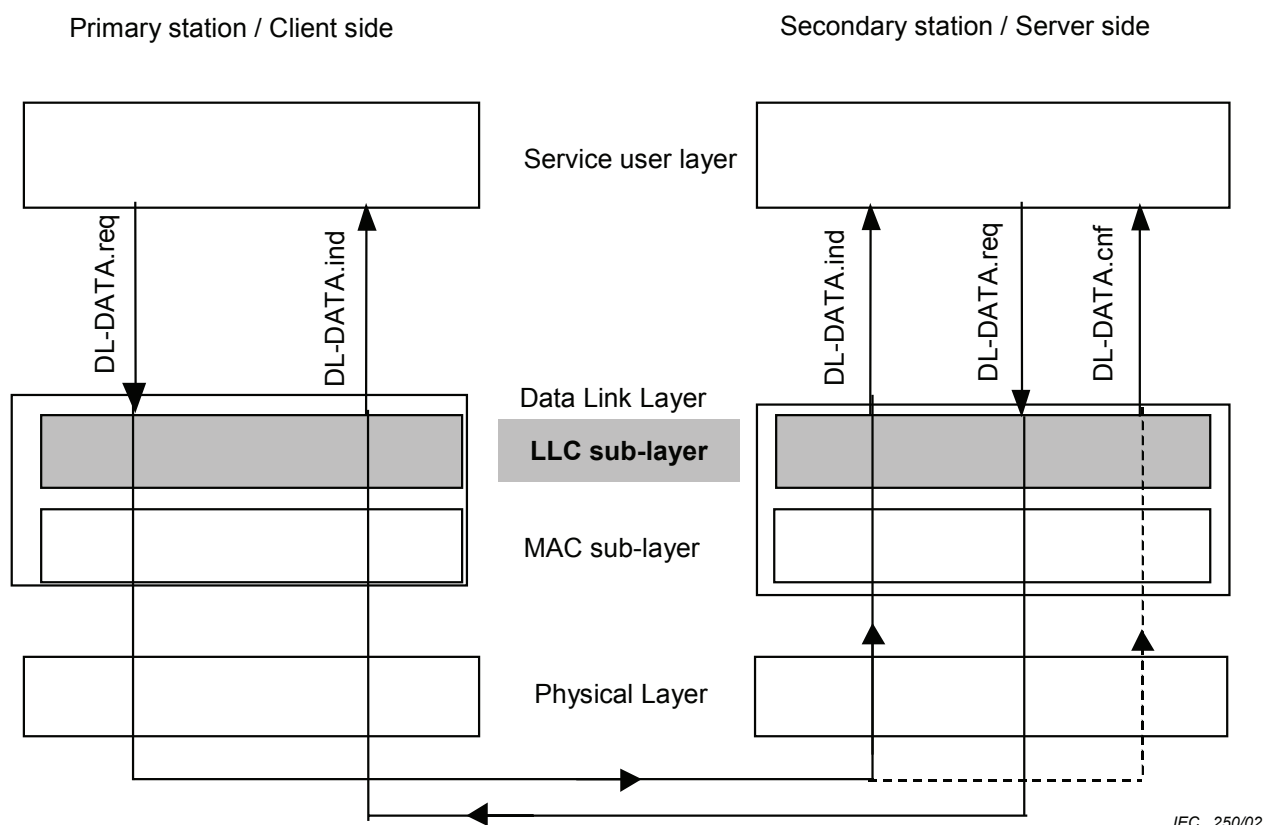


Figure 3 – Data link layer data communication services

In addition to the two standard .request and .indication services, a DL-DATA.confirm service is also provided at the server side. This service is necessary for transparent long message transfers, specified in 6.4.4.5.

5.2.3.2 DL-DATA.request

Function

The Service User layer invokes this primitive when data need to be transmitted to the peer layer entity(ies).

Service parameters

The semantics of the primitive is as follows:

```
DL-DATA.request
(
  Destination_LSAP,
  Source_LSAP,
  LLC_Quality,
  Destination_MSAP,
  Source_MSAP,
  Frame_type,
  Data
)
```

The Source_LSAP and Destination_LSAP parameters specify the referenced data link layer connection ¹⁾. The value of the LLC_Quality parameter is used as the Control field of the PDU²⁾. See also 5.3.2.

The Source_MSAP and Destination_MSAP parameters specify the local and remote MSAPs involved in the data unit transmission. The Destination_MSAP can be an individual address, a group address, or a special HDLC address (ALL_STATION, NO_STATION, etc.). Please refer to 6.4.2.4.

The Frame_Type parameter indicates for the data link layer which type of frame shall be sent. Valid frame types are different for the client and server sides. Client side valid frame types are I_COMPLETE and UI. On the server side valid frame types are I_COMPLETE, I_FIRST_FRAGMENT, I_FRAGMENT, I_LAST_FRAGMENT, and UI. See also 6.4.3.

The Data parameter contains the Service User LSDU to be transferred to the peer layer. This parameter may be empty (e.g. when Frame_type == UI, but the UI frame contains no data).

Use

The DL-DATA.request primitive is invoked by the Service User layer entity to request sending of a protocol data unit to a single peer application entity or, in the case of multicasting and broadcasting, to multiple peer application entities.

The receipt of this primitive shall cause the LLC sub-layer to append the LLC specific fields (the two LLC addresses and the LLC_Quality parameter)³⁾ to the received LSDU, and to pass the properly formed LPDU to the MAC sub-layer (by invoking the MA-DATA.request primitive) for transferring it to the peer LLC sub-layer.

5.2.3.3 DL-DATA.indication

Function

This primitive is used to transfer the received data from the data link layer to its Service User layer.

Service parameters

The semantics of the primitive is as follows:

```
DL-DATA.indication
(
    Destination_LSAP,
    Source_LSAP,
    LLC_Quality,
    Destination_MSAP,
    Source_MSAP,
    Frame_type,
    Data
)
```

The Source_LSAP and Destination_LSAP identify the referenced data link layer connection. The value of the LLC_Quality parameter is used as the Control field of the PDU. See also 5.3.2.

¹⁾ For COSEM purposes, the value of the Destination_LSAP parameter is constant and equal to E6H. The value of the Source_LSAP parameter is E6H or E7H depending on whether the Data field corresponds to a command or to a response.

²⁾ For COSEM purposes, the value of the LLC_Quality parameter is set to 0, and reserved for future use.

³⁾ When Frame_type == I_FRAGMENT or I_LAST_FRAGMENT, no LLC specific field is appended to the LSDU.

The Source_MSAP and Destination_MSAP parameters specify the local and remote MSAPs involved in the data unit transmission. The Destination_MSAP can be an individual address, a group address, or a special HDLC address (ALL_STATION, NO_STATION, etc.). Please refer to 6.4.2.4.

The Frame_Type parameter indicates for the Service User layer which type of frame has been received. Valid frame types are I_COMPLETE and UI. See also 6.4.3.

The Data parameter contains the Service User layer protocol data unit sent by the peer.

Use

The DL-DATA.indication primitive is used to indicate to the Service User layer entity the receipt of a protocol data unit from a peer layer entity.

This primitive is generated following the reception of an MA-DATA.indication service issued by the local MAC sub-layer. First, the LLC sub-layer shall check the LLC addresses. If these are correct, it shall remove the LLC specific fields (the two LLC addresses and the LLC_Quality parameter) from the received LPDU, and shall pass the remaining, properly formatted LSDU to the service user protocol layer with the help of the DL-DATA.indication service primitive. Otherwise the received LPDU shall be discarded.

5.2.3.4 DL-DATA.confirm

Function

This service primitive is provided only at the server side. The data link layer generates this primitive to indicate to the Service User layer the result of a previously received DL-DATA.request service, when this .request service has been invoked with Frame_type = I_FIRST_FRAGMENT, I_FRAGMENT or I_LAST_FRAGMENT. The DL-DATA.confirm service primitive is generated when the previously requested LSDU has been successfully sent to the peer data link layer.

Service parameters

The semantics of the primitive is as follows:

```
DL-DATA.confirm
(
    Destination_LSAP,
    Source_LSAP,
    Destination_MSAP,
    Source_MSAP,
    Frame_type,
    Result
)
```

The Destination_LSAP and Source_LSAP parameters identify the referenced data link layer connection.

The Destination_MSAP and Source_MSAP parameters identify the remote and local MSAP-s involved in the data unit transmission.

The Frame_Type parameter indicates the type of the frame which is confirmed. Valid frame types are I_FIRST_FRAGMENT, I_FRAGMENT and I_LAST_FRAGMENT.

The value of the Result parameter indicates the result of the transmission of the received LSDU. Possible values are OK and NOK.