

INTERNATIONAL STANDARD

Electricity metering – Data exchange for meter reading, tariff and load control –
Part 46: Data link layer using HDLC protocol

(<https://standards.iteh.ai>)
Document Preview

[IEC 62056-46:2002](https://standards.iteh.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002)

<https://standards.iteh.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2007 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.
If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

[IEC 62056-46:2002](https://standards.iteh.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002)

<https://standards.iteh.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002>



IEC 62056-46

Edition 1.1 2007-02
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

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

Document Preview

[IEC 62056-46:2002](https://standards.iteh.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002)

<https://standards.iteh.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 91.140.50; 35.100.20

ISBN 978-2-8322-8958-8

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms, definitions and abbreviations	8
4 Overview	9
4.1 The LLC sub-layer.....	9
4.2 The MAC sub-layer.....	9
4.3 Specification method	10
5 The LLC sub-layer.....	10
5.1 The role of the LLC sub-layer	10
5.2 Service specification for the LLC sub-layer.....	11
5.2.1 Setting up the Data Link Connection.....	11
5.2.2 Disconnecting the Data Link Connection.....	14
5.2.3 Data communication	18
5.3 Protocol specification for the LLC sub-layer.....	22
5.3.1 Overview	22
5.3.2 LLC protocol data unit (LPDU) structure	22
5.3.3 State transition tables for the LLC sub-layer	23
6 The MAC sub-layer.....	24
6.1 HDLC selections.....	24
6.2 Service specification for the MAC sub-layer.....	25
6.2.1 Setting up the MAC connection.....	25
6.2.2 Disconnecting the MAC connection.....	28
6.2.3 Data communication	33
6.3 Physical layer services used by the MAC sub-layer	35
6.3.1 Overview	35
6.3.2 Setting up a physical link.....	36
6.3.3 Disconnecting the physical link	36
6.3.4 Data communication	36
6.4 Protocol specification for the MAC sub-layer	36
6.4.1 The MAC PDU and the HDLC frame	36
6.4.2 MAC addressing	38
6.4.3 Command and response frames	42
6.4.4 Elements of the procedures	45
6.4.5 State transition diagram for the server MAC sub-layer	60
Annex A (informative) FCS calculation	62
Annex B (informative) Data model and protocol	65
Annex C (informative) Data link layer management services	66

Figure 1 – Data Link (LLC) services for setting up the Data Link Connection	11
Figure 2 – Data Link (LLC) services for disconnecting the Data Link Connection	15
Figure 3 – Data link layer data communication services	19
Figure 4 – The ISO/IEC 8802-2 LLC protocol data unit format.....	22
Figure 5 – The used LLC protocol data unit format.....	22
Figure 6 – MAC sub-layer services for setting up the MAC (DL) connection at the client and server sides	25
Figure 7 – MAC sub-layer services for disconnecting the MAC (DL) connection at the client and server sides	29
Figure 8 – MAC sub-layer data communication services	33
Figure 9 – Physical layer services used by the MAC sub-layer.....	36
Figure 10 – MAC sub-layer frame format (HDLC frame format type 3).....	36
Figure 11 – Multiple frames	37
Figure 12 – The frame format field	37
Figure 13 – MSC for long MSDU transfer in a transparent manner	54
Figure 14 – Example configuration to illustrate broadcasting.....	55
Figure 15 – Sending out a pending UI frame with a .response data	56
Figure 16 – Sending out a pending UI frame with a response to a RR frame	57
Figure 17 – Sending out a pending UI frame on receipt of an empty UI frame	57
Figure 18 – State transition diagram for the server MAC sub-layer.....	61
Figure B.1 – The three-step approach of COSEM	65
Figure C.1 – Layer management services	66
Table 1 – State transition table of the client side LLC sub-layer	23
Table 2 – State transition table of the server side LLC sub-layer.....	24
Table 3 – Table of reserved client addresses	40
Table 4 – Table of reserved server addresses	40
Table 5 – Handling inopportune address lengths.....	42
Table 6 – Command and response frames	42
Table 7 – Control field format.....	43
Table 8 – Example for parameter negotiation values with the SNRM/UA frames	50
Table 9 – Summary of MAC Addresses for the example.....	55
Table 10 – Broadcast UI frame handling	55

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 46: Data link layer using HDLC protocol

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

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 62056-46 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:

DLMS¹ User Association
Geneva / Switzerland
www.dlms.ch

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights other than those identified above. IEC shall not be held responsible for identifying any or all such patent rights.

¹ Device Language Message Specification.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 62056 edition 1.1 contains 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].

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

International Standard IEC 62056-46 has been prepared by IEC technical committee 13: Equipment for electrical energy measurement and load control. Annexes A, B and C are for information only.

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.

ITeh Standards
(<https://standards.iteh.ai>)
Document Preview

A bilingual version of this publication may be issued at a later date.

[IEC 62056-46:2002](https://standards.iteh.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002)

<https://standards.iteh.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002>

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.

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[IEC 62056-46:2002](https://standards.itih.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002)

<https://standards.itih.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002>

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 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

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.

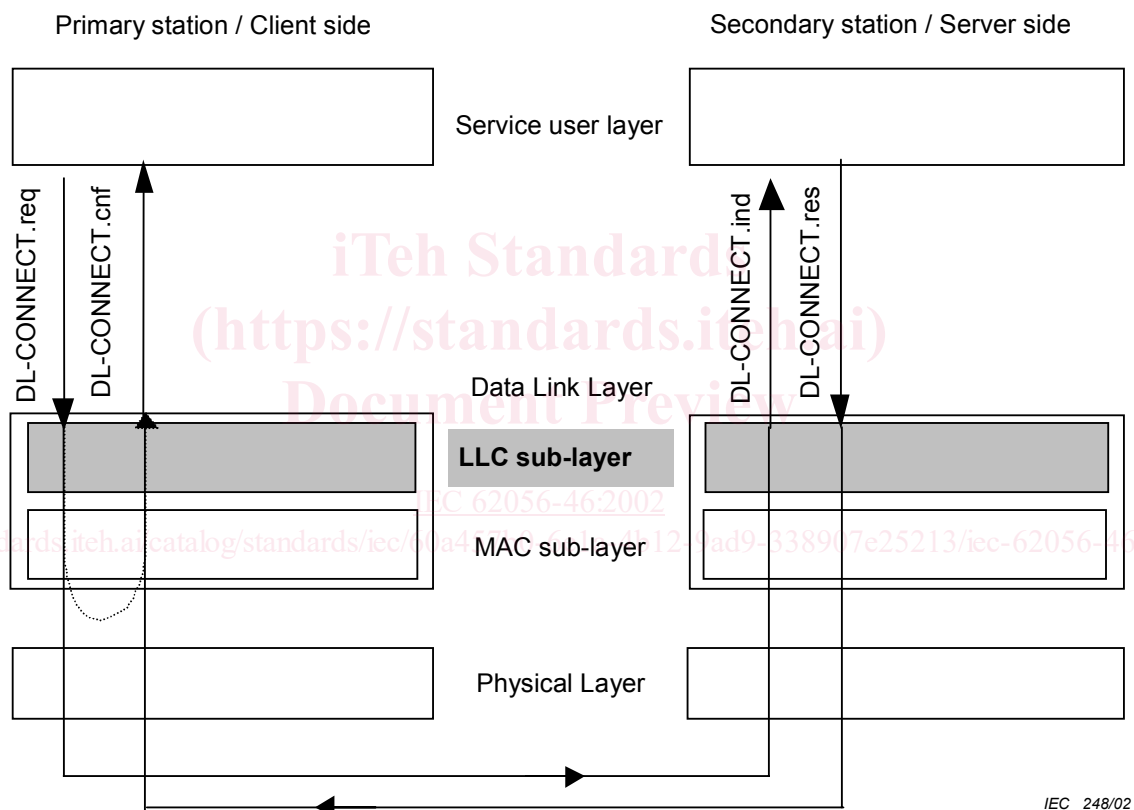
5.2 Service specification for the LLC sub-layer

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.



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_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.

[IEC 62056-46:2002](https://standards.iteh.ai/catalog/standards/iec/60a457b0-6e1a-4b12-9ad9-338907e25213/iec-62056-46-2002)

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.

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