BS EN IEC 61158-4-25:2019

BSI Standards Publication

# Industrial communication networks - Fieldbus specifications

Part 4-25: Data-link layer protocol specification - Type 25 elements

Documents
Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

# National foreword

This British Standard is the UK implementation of EN IEC 61158-4-25:2019. It is identical to IEC 61158-4-25:2019.

The UK participation in its preparation was entrusted to Technical Committee GEL/65, Measurement and control.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2019
Published by BSI Standards Limited 2019

ISBN 978 0 580 99210 0

ICS 35.100.20; 25.040.40; 35.110

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2019.

**Amendments/corrigenda issued since publication**

| Date | Text affected |
|---|---|

Documents
Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN IEC 61158-4-25

June 2019

ICS 25.040.40; 35.100.20; 35.110

English Version

# Industrial communication networks - Fieldbus specifications - Part 4-25: Data-link layer protocol specification - Type 25 elements (IEC 61158-4-25:2019)

Réseaux de communication industriels - Spécifications des bus de terrain - Partie 4-25: Spécification du protocole de la couche liaison de données - Éléments de type 25 (IEC 61158-4-25:2019)

Industrielle Kommunikationsnetze - Feldbusse - Teil 4-25: Protokollspezifikation des Data Link Layer (Sicherungsschicht) - Typ 25-Elemente (IEC 61158-4-25:2019)

This European Standard was approved by CENELEC on 2019-05-15. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

© 2019 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. EN IEC 61158-4-25:2019 E

Documents Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

## European foreword

The text of document 65C/946/FDIS, future edition 1 of IEC 61158-4-25, prepared by SC 65C "Industrial networks" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61158-4-25:2019.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2020-02-15
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-05-15

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

## Endorsement notice

The text of the International Standard IEC 61158-4-25:2019 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61158-1:2019 NOTE Harmonized as EN IEC 61158-1:2019 (not modified)



Documents
Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

# Annex ZA
(normative)

## Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| ISO/IEC 7498-1 | - | Information technology - Open Systems-Interconnection - Basic reference model: The basic model | | - |
| ISO/IEC 7498-3 | - | Information technology - Open Systems-Interconnection - Basic reference model: Naming and addressing | | - |
| ISO/IEC 10731 | - | Information technology - Open Systems-Interconnection - Basic Reference Model - Conventions for the definition of OSI services | | - |
| ISO/IEC/IEEE 8802-2017 3 | | Standard for Ethernet | - | - |
| IEEE Std 802.1D | - | IEEE Standard for Local and Metropolitan-Area Networks - Media access Control (MAC) Bridges | | - |
| IEEE Std 802.1Q | - | IEEE Standard for Local and Metropolitan-Area Networks - Bridges and Bridged Networks | | - |



Documents
Document Sharing Hub
Full document details: BS EN IEC 61158-4-25:2019

*This page deliberately left blank*

Documents
Document Sharing Hub

CONTENTS

FOREWORD ..... 5
INTRODUCTION ..... 7
1 Scope ..... 8
1.1 General ..... 8
1.2 Specifications ..... 8
1.3 Procedures ..... 8
1.4 Applicability ..... 9
1.5 Conformance ..... 9
2 Normative references ..... 9
3 Terms, definitions, symbols, abbreviations and conventions ..... 9
3.1 Reference model terms and definitions ..... 10
3.2 Service convention terms and definitions ..... 11
3.3 Terms and definitions ..... 11
3.4 Symbols and abbreviations ..... 13
3.5 Common conventions ..... 14
3.6 Additional Type 25 conventions ..... 16
3.6.1 Primitive conventions ..... 16
3.6.2 State machine conventions ..... 16
4 Overview of the DL-protocol ..... 17
4.1 General ..... 17
4.2 Overview of the medium access control ..... 17
4.2.1 General ..... 17
4.2.2 Network topology ..... 18
4.2.3 Priority control with VLAN ..... 19
4.2.4 The maximum delivery delay in Type 25 network ..... 20
4.2.5 Traffic control for real-time communication ..... 21
4.3 Service assumed from PhL ..... 21
4.4 DL Layer architecture ..... 22
4.5 Local parameters and variables ..... 23
4.5.1 Overview ..... 23
4.5.2 Variables, parameter, counter and timer ..... 23
5 General structure and encoding of PhPDUs and DLPDU and related elements of procedure ..... 24
5.1 Overview ..... 24
5.2 Common MAC frame structure, encoding and elements of procedure ..... 24
5.2.1 MAC frame structure ..... 24
5.2.2 Elements of the MAC frame ..... 25
6 DLPDU-specific structure, encoding and elements of procedure ..... 27
6.1 General ..... 27
6.2 Structure of the RCL DLPDU ..... 27
6.2.1 RCL header ..... 27
7 DLE elements of procedure ..... 29
7.1 Overview ..... 29
7.2 RCL communication control (RCLC) ..... 29
7.2.1 General ..... 29
7.2.2 Primitive definitions ..... 29

AVA Documents
Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

7.2.3 RCLC state machine ..... 32
7.2.4 Function of RCLC ..... 48
7.3 Real-time communication control (RTC) ..... 48
7.3.1 General ..... 48
7.3.2 Primitive definitions ..... 48
7.3.3 RTC state machine ..... 50
7.3.4 Function of RTC ..... 51
7.4 Transmit/Receive control (TRC) ..... 52
7.4.1 General ..... 52
7.4.2 Primitive definitions ..... 52
7.4.3 TRC state machine ..... 52
7.4.4 Function of TRC ..... 57
7.5 DLL management protocol (DLM) ..... 58
7.5.1 Overview ..... 58
7.5.2 Primitive definitions ..... 58
7.5.3 DLM state machine (DLM_SM) ..... 59
Bibliography ..... 61

Figure 1 – Relationships of DLSAPs, DLSAP-addresses and group DL-addresses ..... 16
Figure 2 – Ring control in Type 25 network ..... 18
Figure 3 – Communication ranges of Type 25 frames ..... 19
Figure 4 – Priority control with VLAN of Type 25 network ..... 20
Figure 5 – The mechanism of transmission delay in a node ..... 20
Figure 6 – The maximum delay in Type 25 network ..... 21
Figure 7 – Data-Link layer internal architecture ..... 22
Figure 8 – Type 25 fieldbus DLPDU frame format ..... 25
Figure 9 – RCL frame format ..... 26
Figure 10 – State transition diagram of RHE_SM-A ..... 33
Figure 11 – State transition diagram of RHE_SM-B ..... 36
Figure 12 – The state diagram of RCLNode_SM ..... 39
Figure 13 – The state diagram of RCLTR_SM ..... 46
Figure 14 – The state diagram of RTTR_SM ..... 51
Figure 15 – The state diagram of TRC_SM ..... 52
Figure 16 – The state diagram of DLM_SM ..... 59

Table 1 – State transition descriptions ..... 16
Table 2 – Descriptions of state machine elements ..... 17
Table 3 – Conventions used in state machine ..... 17
Table 4 – Characteristics of the node states ..... 18
Table 5 – Characteristic of the frame classes ..... 19
Table 6 – VLAN priority mapping of Type 25 network ..... 19
Table 7 – Data-link layer components ..... 22
Table 8 – Destination address format ..... 25
Table 9 – VLAN tag format ..... 26
Table 10 – Types and classes of RCL frames ..... 27

AVA Documents Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

Table 11 – Structure of RCL header ..... 28
Table 12 – Class field format ..... 28
Table 13 – Destination address field format ..... 28
Table 14 – Source address field format ..... 29
Table 15 – CMD field format ..... 29
Table 16 – The primitives and parameters for DLS-user interface ..... 30
Table 17 – Parameters used with primitives exchanged between RCLC and DLS-user ..... 30
Table 18 – The primitives and parameters for TRC interface ..... 31
Table 19 – Parameters used with primitives exchanged between RCLC and TRC ..... 31
Table 20 – The primitives and parameters for DLM interface ..... 32
Table 21 – Parameters used with primitives exchanged between RCLC and DLM ..... 32
Table 22 – Transitions of RHE_SM-A at RCL communication ..... 33
Table 23 – Transitions of RHE_SM-B at RCL communication ..... 36
Table 24 – Transitions of RCLNode_SM at RCL communication ..... 39
Table 25 – Transitions of RCLTR_SM at RCL communication ..... 47
Table 26 – RCLC function table ..... 48
Table 27 – The primitives and parameters for DLS-user interface ..... 49
Table 28 – Parameters used with primitives exchanged between RTC and DLS-user ..... 49
Table 29 – The primitives and parameters for TRC interface ..... 49
Table 30 – Parameters used with primitives exchanged between RTC and TRC ..... 50
Table 31 – The primitives and parameters for DLM interface ..... 50
Table 32 – Parameters used with primitives exchanged between RTC and DLM ..... 50
Table 33 – Transitions of RTTR_SM at RT communication ..... 51
Table 34 – RTC function table ..... 51
Table 35 – The primitives and parameters for DLM interface ..... 52
Table 36 – Parameters used with primitives exchanged between TRC and DLM ..... 52
Table 37 – Transitions of TRC_SM ..... 53
Table 38 – TRC function table ..... 57
Table 39 – Primitives exchanged between DLM and DLS-user ..... 58
Table 40 – Parameters used with primitives exchanged between DLM and DLS-user ..... 59
Table 41 – Transitions of DLM_SM ..... 60

Documents
Document Sharing Hub
Full document details: BS EN IEC 61158-4-25:2019

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

# INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

## Part 4-25: Data-link layer protocol specification – Type 25 elements

## 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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
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.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61158-4-25 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this International Standard is based on the following documents:

| FDIS | Report on voting |
|---|---|
| 65C/946/FDIS | 65C/955/RVD |

Full information on the voting for the approval of this International 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.

AVA Documents Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

A list of all parts in the IEC 61158 series, published under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC website.

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

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

Documents
Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

# INTRODUCTION

This document is one of a series produced to facilitate the interconnection of automation system components. It is related to other standards in the set as defined by the “three-layer” fieldbus reference model described in IEC 61158-1.

The data-link protocol provides the data-link service by making use of the services available from the physical layer. The primary aim of this document is to provide a set of rules for communication expressed in terms of the procedures to be carried out by peer data-link entities (DLEs) at the time of communication. These rules for communication are intended to provide a sound basis for development in order to serve a variety of purposes:

a) as a guide for implementers and designers;

b) for use in the testing and procurement of equipment;

c) as part of an agreement for the admittance of systems into the open systems environment;

d) as a refinement to the understanding of time-critical communications within OSI.

This document is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this document together with other standards positioned within the OSI or fieldbus reference models, otherwise incompatible systems may work together in any combination.

NOTE Use of some of the associated protocol types is restricted by their intellectual-property-right holders. In all cases, the commitment to limited release of intellectual-property-rights made by the holders of those rights permits a particular data-link layer protocol type to be used with physical layer and application layer protocols in Type combinations as specified explicitly in the profile parts. Use of the various protocol types in other combinations may require permission from their respective intellectual-property-right holders.

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning Type 25 elements and possibly other types given in this document as follows:

| | |
|---|---|
| JP4074631 [HI] | Transmission line system, frame transmitter therein, and transmission line switching method |
| JP4653800 [HI] | Transmission line system, frame transmission apparatus, method and program for switching transmission line in transmission line system |
| JP4944986 [HI] | Transmission line system and transmission line construction method |
| CN1964307 [HI] | Transfer path system and frame transfer device in same system, transfer path handover method and system |
| CN101515887 [HI] | Transmission line system, frame transmitter therein, transmission line switching method and program |

IEC takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured the IEC that he/she is willing to negotiate licences either free of charge or under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with IEC. Information may be obtained from:

[HI] Hitachi, Ltd.
Intellectual Property Division
20-2, Saiwai-cho 1-chome, Hitachi-shi,
Ibaraki-ken, 317-0073 Japan

Attention is drawn to the possibility that some of the elements of this document 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.

ISO (www.iso.org/patents) and IEC (http://patents.iec.ch) maintain on-line data bases of patents relevant to their standards. Users are encouraged to consult the data bases for the most up to date information concerning patents.

AVA Documents
Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

# INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

# Part 4-25: Data-link layer protocol specification – Type 25 elements

## 1 Scope

### 1.1 General

The data-link layer provides basic time-critical messaging communications between devices in an automation environment.

This protocol provides communication opportunities to all participating data-link entities

a) in a synchronously-starting cyclic manner, according to a pre-established schedule, and

b) in a cyclic or acyclic asynchronous manner, as requested each cycle by each of those data-link entities.

Thus this protocol can be characterized as one which provides cyclic and acyclic access asynchronously but with a synchronous restart of each cycle.

### 1.2 Specifications

This document specifies

a) procedures for the timely transfer of data and control information from one data-link user entity to a peer user entity, and among the data-link entities forming the distributed datalink service provider;

b) procedures for giving communications opportunities to all participating DL-entities, sequentially and in a cyclic manner for deterministic and synchronized transfer at cyclic intervals up to one millisecond;

c) procedures for giving communication opportunities available for time-critical data transmission together with non-time-critical data transmission without prejudice to the time-critical data transmission;

d) procedures for giving cyclic and acyclic communication opportunities for time-critical data transmission with prioritized access;

e) procedures for giving communication opportunities based on ISO/IEC/IEEE 8802-3 medium access control, with provisions for nodes to be added or removed during normal operation;

f) the structure of the fieldbus DLPDUs used for the transfer of data and control information by the protocol of this document, and their representation as physical interface data units.

### 1.3 Procedures

The procedures are defined in terms of

a) the interactions between peer DL-entities (DLEs) through the exchange of fieldbus DLPDUs;

b) the interactions between a DL-service (DLS) provider and a DLS-user in the same system through the exchange of DLS primitives;

c) the interactions between a DLS-provider and a Ph-service provider in the same system through the exchange of Ph-service primitives.

AVA Documents Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

### 1.4 Applicability

These procedures are applicable to instances of communication between systems which support time-critical communications services within the data-link layer of the OSI or fieldbus reference models, and which require the ability to interconnect in an open systems interconnection environment.

Profiles provide a simple multi-attribute means of summarizing an implementation's capability, and thus its applicability to various time-critical communications needs.

### 1.5 Conformance

This document also specifies conformance requirements for systems implementing these procedures. This document does not contain tests to demonstrate compliance with such requirements.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE All parts of the IEC 61158 series, as well as IEC 61784-1 and IEC 61784-2 are maintained simultaneously. Cross-references to these documents within the text therefore refer to the editions as dated in this list of normative references.

ISO/IEC 7498-1, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

ISO/IEC 7498-3, *Information technology – Open Systems Interconnection – Basic Reference Model: Naming and addressing*

ISO/IEC/IEEE 8802-3:2017, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Standard for Ethernet*

ISO/IEC 10731, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

IEEE Std 802.1D, *IEEE Standard for Local and metropolitan area networks – Media access Control (MAC) Bridges*, available at http://www.ieee.org [viewed 2018-09-17]

IEEE Std 802.1Q, *IEEE Standard for Local and metropolitan area networks – Bridges and Bridged Networks*, available at http://www.ieee.org [viewed 2018-09-17]

## 3 Terms, definitions, symbols, abbreviations and conventions

For the purposes of this document, the following terms, definitions, symbols, abbreviations and conventions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

Documents
Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

### 3.1 Reference model terms and definitions

This document is based in part on the concepts developed in ISO/IEC 7498-1 and ISO/IEC 7498-3, and makes use of the following terms defined therein:

| | | |
|---|---|---|
| **3.1.1** | **DL-address** | [ISO/IEC 7498-3] |
| **3.1.2** | **DL-address-mapping** | [ISO/IEC 7498-1] |
| **3.1.3** | **called-DL-address** | [ISO/IEC 7498-3] |
| **3.1.4** | **calling-DL-address** | [ISO/IEC 7498-3] |
| **3.1.5** | **centralized multi-end-point-connection** | [ISO/IEC 7498-1] |
| **3.1.6** | **DL-connection** | [ISO/IEC 7498-1] |
| **3.1.7** | **DL-connection-end-point** | [ISO/IEC 7498-1] |
| **3.1.8** | **DL-connection-end-point-identifier** | [ISO/IEC 7498-1] |
| **3.1.9** | **DL-connection-mode transmission** | [ISO/IEC 7498-1] |
| **3.1.10** | **DL-connectionless-mode transmission** | [ISO/IEC 7498-1] |
| **3.1.11** | **correspondent (N)-entities**<br>correspondent DL-entities (N=2)<br>correspondent Ph-entities (N=1) | [ISO/IEC 7498-1] |
| **3.1.12** | **DL-duplex-transmission** | [ISO/IEC 7498-1] |
| **3.1.13** | **(N)-entity**<br>DL-entity (N=2)<br>Ph-entity (N=1) | [ISO/IEC 7498-1] |
| **3.1.14** | **DL-facility** | [ISO/IEC 7498-1] |
| **3.1.15** | **flow control** | [ISO/IEC 7498-1] |
| **3.1.16** | **(N)-layer**<br>DL-layer (N=2)<br>Ph-layer (N=1) | [ISO/IEC 7498-1] |
| **3.1.17** | **layer-management** | [ISO/IEC 7498-1] |
| **3.1.18** | **DL-local-view** | [ISO/IEC 7498-3] |
| **3.1.19** | **DL-name** | [ISO/IEC 7498-3] |
| **3.1.20** | **naming-(addressing)-domain** | [ISO/IEC 7498-3] |
| **3.1.21** | **peer-entities** | [ISO/IEC 7498-1] |
| **3.1.22** | **primitive name** | [ISO/IEC 7498-3] |
| **3.1.23** | **DL-protocol** | [ISO/IEC 7498-1] |
| **3.1.24** | **DL-protocol-connection-identifier** | [ISO/IEC 7498-1] |
| **3.1.25** | **DL-protocol-data-unit** | [ISO/IEC 7498-1] |
| **3.1.26** | **DL-relay** | [ISO/IEC 7498-1] |
| **3.1.27** | **reset** | [ISO/IEC 7498-1] |
| **3.1.28** | **responding-DL-address** | [ISO/IEC 7498-3] |
| **3.1.29** | **routing** | [ISO/IEC 7498-1] |
| **3.1.30** | **segmenting** | [ISO/IEC 7498-1] |
| **3.1.31** | **(N)-service**<br>DL-service (N=2)<br>Ph-service (N=1) | [ISO/IEC 7498-1] |
| **3.1.32** | **(N)-service-access-point**<br>DL-service-access-point (N=2)<br>Ph-service-access-point (N=1) | [ISO/IEC 7498-1] |

Documents
Document Sharing Hub
Full document details: BS EN IEC 61158-4-25:2019

**3.1.33 DL-service-access-point-address** [ISO/IEC 7498-3]

**3.1.34 DL-service-connection-identifier** [ISO/IEC 7498-1]

**3.1.35 DL-service-data-unit** [ISO/IEC 7498-1]

**3.1.36 DL-simplex-transmission** [ISO/IEC 7498-1]

**3.1.37 DL-subsystem** [ISO/IEC 7498-1]

**3.1.38 systems-management** [ISO/IEC 7498-1]

**3.1.39 DLS-user-data** [ISO/IEC 7498-1]

## 3.2 Service convention terms and definitions

This document also makes use of the following terms defined in ISO/IEC 10731 as they apply to the data-link layer:

**3.2.1 acceptor**

**3.2.2 asymmetrical service**

**3.2.3 confirm (primitive);**
requestor.deliver (primitive)

**3.2.4 deliver (primitive)**

**3.2.5 DL-confirmed-facility**

**3.2.6 DL-facility**

**3.2.7 DL-local-view**

**3.2.8 DL-mandatory-facility**

**3.2.9 DL-non-confirmed-facility**

**3.2.10 DL-provider-initiated-facility**

**3.2.11 DL-provider-optional-facility**

**3.2.12 DL-service-primitive;**
primitive

**3.2.13 DL-service-provider**

**3.2.14 DL-service-user**

**3.2.15 DLS-user-optional-facility**

**3.2.16 indication (primitive);**
acceptor.deliver (primitive)

**3.2.17 multi-peer**

**3.2.18 request (primitive);**
requestor.submit (primitive)

**3.2.19 requestor**

**3.2.20 response (primitive);**
acceptor.submit (primitive)

**3.2.21 submit (primitive)**

**3.2.22 symmetrical service**

## 3.3 Terms and definitions

**3.3.1**
**blocking**
port state which does not participate in frame communication

**3.3.2**
**class**
identifiers that designate communication range of the RCL frame and the other frames

AVA Documents Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

**3.3.3**
**control communication**
non-real-time acyclic data communication for higher priority applications and node control communication

**3.3.4**
**cyclic communication**
periodic data communication for real-time communication

**3.3.5**
**DLCEP-address**
DL-address which designates either

a) one peer DL-connection-end-point, or

b) one multi-peer publisher DL-connection-end-point and implicitly the corresponding set of subscriber DL-connection-end-points where each DL-connection-end-point exists within a distinct DLSAP and is associated with a corresponding distinct DLSAP-address.

**3.3.6**
**DLSAP**
distinctive point at which DL-services are provided by a single DL-entity to a single higher-layer entity

**3.3.7**
**DL(SAP)-address**
either an individual DLSAP-address, designating a single DLSAP of a single DLS-user, or a group DL-address potentially designating multiple DLSAPs, each of a single DLS-user

Note 1 to entry: This terminology is chosen because ISO/IEC 7498-3 does not permit the use of the term DLSAP-address to designate more than a single DLSAP at a single DLS-user.

**3.3.8**
**(individual) DLSAP-address**
DL-address that designates only one DLSAP within the extended link

Note 1 to entry: A single DL-entity may have multiple DLSAP-addresses associated with a single DLSAP.

**3.3.9**
**extended link**
DL-subnetwork, consisting of the maximal set of links interconnected by DL-relays, sharing a single DL-name (DL-address) space, in which any of the connected DL-entities may communicate, one with another, either directly or with the assistance of one or more of those intervening DL-relay entities

**3.3.10**
**frame**
denigrated synonym for DLPDU

**3.3.11**
**group DL-address**
DL-address that potentially designates more than one DLSAP within the extended link

Note 1 to entry: A single DL-entity may have multiple group DL-addresses associated with a single DLSAP. A single DL-entity also may have a single group DL-address associated with more than one DLSAP.

**3.3.12**
**information communication**
non-real-time acyclic data communication for low priority applications

AVA Documents
Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

**3.3.13**
**logical link down**
link status at which the port is in a blocking state and does not communicate all kinds of frames except RCL frames

**3.3.14**
**logical link up**
link status at which the port communicates all kinds of frames

**3.3.15**
**node**
single DL-entity as it appears on one local link

**3.3.16**
**physical link down**
link status at which the port does not communicate the frames due to link down status defined in ISO/IEC/IEEE 8802-3

**3.3.17**
**receiving DLS-user**
DL-service user that acts as a recipient of DLS-user-data

Note 1 to entry: A DL-service user can be concurrently both a sending and receiving DLS-user.

**3.3.18**
**ring control (RCL) communication**
control communication of Type 25 DLL ring network using RCL frames and non-real-ime

**3.3.19**
**sending DLS-user**
DL-service user that acts as a source of DLS-user-data

**3.3.20**
**station**
synonym for node

**3.3.21**
**station address**
identifier address that designates the node of Type 25 network

## 3.4 Symbols and abbreviations

NOTE Many symbols and abbreviations are common to more than one protocol Type; they are not necessarily used by all protocol Types.

| | |
|---|---|
| DL- | Data-link layer (as a prefix) |
| DLC | DL-connection |
| DLCEP | DL-connection-end-point |
| DLE | DL-entity (the local active instance of the data-link layer) |
| DLL | DL-layer |
| DLM | DL-management |
| DLME | DL-management Entity (the local active instance of DL-management) |
| DLMS | DL-management service |
| DLPCI | DL-protocol-control-information |
| DLPDU | DL-protocol-data-unit |
| DLS | DL-service |

Documents
Document Sharing Hub
Full document details: BS EN IEC 61158-4-25:2019

| | |
|---|---|
| DLSAP | DL-service-access-point |
| DLSDU | DL-service-data-unit |
| EGA | Edge-A node |
| EGB | Edge-B node |
| FIFO | First-in first-out (queuing method) |
| ISL | Isolate node |
| ITM | Intermediate node |
| LCA | Loop condition alert (Type 25 frame type) |
| LCC | Loop condition check (Type 25 frame type) |
| LCN | Loop condition notify (Type 25 frame type) |
| LLD | Logical link down |
| LLU | Logical link up |
| LNA | Loop notify answer (Type 25 frame type) |
| NNB | No neighborhood state |
| OSI | Open systems interconnection |
| Ph- | Physical layer (as a prefix) |
| PhE | Ph-entity (the local active instance of the Physical layer) |
| PhL | Ph-layer |
| PhS | Ph-service |
| PLD | Physical link down |
| PLU | Port A (B) link up state |
| QoS | Quality-of-service |
| RCL | Ring control |
| RCLC | RCL communication control |
| RHE | Rapid hello (Type 25 frame type) |
| RT | Real time |
| RTC | RT communication control |
| SCR | Station condition report (Type 25 frame type) |
| TRC | Transmit/Receive control |
| WLU | Wait link up state |

### 3.5 Common conventions

This document uses the descriptive conventions given in ISO/IEC 10731.

The service model, service primitives, and time-sequence diagrams used are entirely abstract descriptions; they do not represent a specification for implementation.

Service primitives, used to represent service user/service provider interactions (see ISO/IEC 10731), convey parameters that indicate information available in the user/provider interaction.

This document uses a tabular format to describe the component parameters of the DLS primitives. The parameters that apply to each group of DLS primitives are set out in tables throughout the remainder of this document. Each table consists of up to six columns, containing the name of the service parameter, and a column each for those primitives and parameter transfer directions used by the DLS:

AVA Documents Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019

- the request primitive's input parameters;
- the request primitive's output parameters;
- the indication primitive's output parameters;
- the response primitive's input parameters;
- the confirm primitive's output parameters.

NOTE The request, indication, response and confirm primitives are also known as requestor.submit, acceptor.deliver, acceptor.submit, and requestor.deliver primitives, respectively (see ISO/IEC 10731).

One parameter (or part of it) is listed in each row of each table. Under the appropriate service primitive columns, a code is used to specify the type of usage of the parameter on the primitive and parameter direction specified in the column:

**M** – parameter is mandatory for the primitive;
**U** – parameter is a user option and may or may not be provided depending on the dynamic usage of the DLS-user. When not provided, a default value for the parameter is assumed;
**C** – parameter is conditional upon other parameters or upon the environment of the DLS user;
(blank) – parameter is never present.

Some entries are further qualified by items in brackets. These may be

a) a parameter-specific constraint

**(=)** indicates that the parameter is semantically equivalent to the parameter in the service primitive to its immediate left in the table;

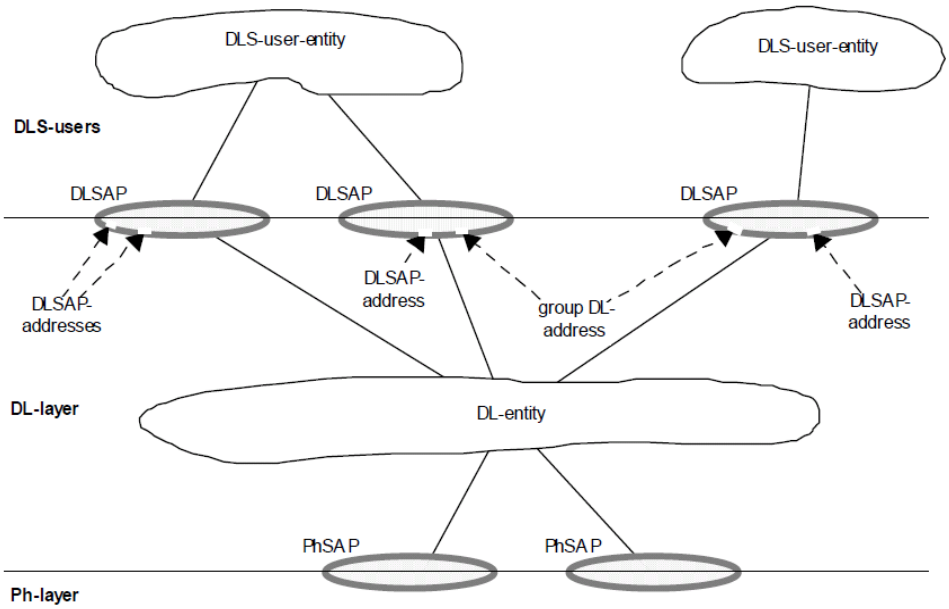
b) an indication that some note applies to the entry

**(n)** indicates that the following note n contains additional information pertaining to the parameter and its use.

In any particular interface, not all parameters need be explicitly stated. Some may be implicitly associated with the DLSAP at which the primitive is issued.

Figure 1 shows the relationships of DLSAPs, DLSAP-addresses and group DL-addresses.

Documents
Document Sharing Hub
Full document details: BS EN IEC 61158-4-25:2019




NOTE 1 DLSAPs and PhSAPs are depicted as ovals spanning the boundary between two adjacent layers.

NOTE 2 DL-addresses are depicted as designating small gaps (points of access) in the DLL portion of a DLSAP.

NOTE 3 A single DL-entity can have multiple DLSAP-addresses and group DL-addresses associated with a single DLSAP.

**Figure 1 – Relationships of DLSAPs, DLSAP-addresses and group DL-addresses**

In the diagrams which illustrate these interfaces, dashed lines indicate cause-and-effect or time-sequence relationships, and wavy lines indicate that events are roughly contemporaneous.

## 3.6 Additional Type 25 conventions

### 3.6.1 Primitive conventions

The following notation, a shortened form of the primitive classes defined in 3.2, is used in the figures.

**req** request primitive
**ind** indication primitive
**cnf** confirm primitive (confirmation)
**rsp** response primitive

### 3.6.2 State machine conventions

The protocol sequences are described by means of state machines.

In state diagrams, states are represented as boxes and state transitions are shown as arrows.

Names of states and transitions of the state diagram correspond to the names in the state table. The textual listing of the state transitions is structured as shown in Table 1.

**Table 1 – State transition descriptions**

| # | Current state | Event /condition => actions | Next state |
|---|---|---|---|

AVA Documents Document Sharing Hub

Full document details: BS EN IEC 61158-4-25:2019