

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Industrial communication networks – Fieldbus specifications –
Part 3-2: Data-link layer service definition – Type 2 elements**

**Réseaux de communications industriels – Spécifications des bus de terrain –
Partie 3-2 : Définition du service de la couche de liaison de données –
Éléments de type 2**

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
1.1 Overview.....	7
1.2 Specifications.....	7
1.3 Conformance.....	7
2 Normative references.....	8
3 Terms, definitions, symbols, abbreviations and conventions.....	8
3.1 Reference model terms and definitions.....	8
3.2 Service convention terms and definitions.....	10
3.3 Common data-link service terms and definitions.....	11
3.4 Additional Type 2 data-link specific definitions.....	12
3.5 Common symbols and abbreviations.....	15
3.6 Additional Type 2 symbols and abbreviations.....	15
3.7 Common conventions.....	15
4 Connection-mode and connectionless-mode data-link service.....	16
4.1 Overview.....	16
4.2 Facilities of the data-link service.....	20
4.3 Model of the data-link service.....	21
4.4 Sequence of primitives.....	23
4.5 Connection-mode data transfer.....	25
4.6 Connectionless-mode data transfer.....	27
4.7 Queue maintenance.....	30
4.8 Tag filter.....	32
5 DL-management Services.....	33
5.1 Sequence of primitives.....	33
5.2 Link synchronization.....	34
5.3 Synchronized parameter change.....	34
5.4 Event reports.....	36
5.5 Bad FCS.....	38
5.6 Current moderator.....	38
5.7 Enable moderator.....	39
5.8 Power-up and online.....	40
5.9 Listen only.....	41
5.10 Time distribution.....	42
Bibliography.....	44
INDEX.....	45
Figure 1 – Relationships of DLSAPs, DLSAP-addresses and group DL-addresses.....	11
Figure 2 – NUT structure.....	17
Figure 3 – Medium access during scheduled time.....	18
Figure 4 – Medium access during unscheduled time.....	19
Figure 5 – Queue model for the peer and multipoint DLS, DLSAPs and their DLCEPs.....	20
Figure 6 – Queue model of a multipoint DLS between a sending DLS-user and one or more receiving DLS-users.....	22
Figure 7 – DLS primitive time-sequence diagram.....	24

Figure 8 – State transition diagram for sequences of DLS primitives at one DLSAP.....	25
Figure 9 – Sequence of primitives for a successful connection-mode transfer	27
Figure 10 – Sequence of primitives for an unsuccessful connection-mode transfer.....	27
Figure 11 – Sequence of primitives for a successful connectionless-mode transfer	30
Figure 12 – Sequence of primitives for an unsuccessful connectionless-mode transfer.....	30
Figure 13 – Sequence of primitives for a queue maintenance request	32
Figure 14 – Sequence of primitives for a tag filter request.....	33
Figure 15 – Sequence of primitives for a local link synchronization	34
Figure 16 – Sequence of primitives for a DLM-get/set parameters request	36
Figure 17 – Sequence of primitives for a DLM-tMinus change request.....	36
Figure 18 – Sequence of primitives for a DLM-event indication	38
Figure 19 – Sequence of primitives for a DLM-bad-FCS indication	38
Figure 20 – Sequence of primitives for a DLM-current-moderator indication	39
Figure 21 – Sequence of primitives for a DLM-enable-moderator request.....	40
Figure 22 – Sequence of primitives for a DLM-power-up indication.....	41
Figure 23 – Sequence of primitives for a DLM-online request.....	41
Figure 24 – Sequence of primitives for a DLM-listen-only request	42
Table 1 – Summary of connection-mode and connectionless-mode primitives and parameters	24
Table 2 – DL-connection-mode transfer primitives and parameters	26
Table 3 – DL-connectionless-mode transfer primitives and parameters	28
Table 4 – Fixed tag services available to the DLS-user	29
Table 5 – DL-queue maintenance primitives and parameters	31
Table 6 – DL-connectionless-mode tag filter primitives and parameters	32
Table 7 – Summary of DL-management primitives and parameters	33
Table 8 – Link synchronization primitives and parameters.....	34
Table 9 – Synchronized parameter change primitives and parameters	35
Table 10 – DLMS-configuration-data	36
Table 11 – Event report primitives and parameters	37
Table 12 – DLMS events being reported	37
Table 13 – Bad FCS primitives and parameters	38
Table 14 – Current moderator primitives and parameters.....	39
Table 15 – Enable moderator primitives and parameters.....	39
Table 16 – Power-up and online primitives and parameters.....	40
Table 17 – Listen-only primitives and parameters	41
Table 18 – DLMS time and time quality parameters	42
Table 19 – Time distribution source quality.....	43

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 3-2: Data-link layer service definition – Type 2 elements**

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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 IEC 61784 series. Use of the various protocol types in other combinations may require permission of their respective intellectual-property-right holders.

International Standard IEC 61158-3-2 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This first edition and its companion parts of the IEC 61158-3 subseries cancel and replace IEC 61158-3:2003. This edition of this part constitutes a minor revision. This part and its companion Type 2 parts also cancel and replace IEC/PAS 62410, published in 2005.

This edition includes the following significant changes with respect to the previous edition:

- a) deletion of the former Type 6 fieldbus, and the placeholder for a Type 5 fieldbus data-link layer, for lack of market relevance;
- b) addition of new types of fieldbuses;

c) division of this part into multiple parts numbered 3-1, 3-2, ..., 3-19.

This bilingual version (2013-07) corresponds to the monolingual English version, published in 2007-12.

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

FDIS	Report on voting
65C/473/FDIS	65C/484/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication 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.

NOTE The revision of this standard will be synchronized with the other parts of the IEC 61158 series.

The list of all the parts of the IEC 61158 series, under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC web site.

INTRODUCTION

This standard 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/TR 61158-1.

Throughout the set of fieldbus standards, the term “service” refers to the abstract capability provided by one layer of the OSI Basic Reference Model to the layer immediately above. Thus, the data-link layer service defined in this standard is a conceptual architectural service, independent of administrative and implementation divisions.

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(<https://standards.itih.ai>)
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IEC 61158-3-2:2007
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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 3-2: Data-link layer service definition – Type 2 elements

1 Scope

1.1 Overview

This part of IEC 61158 provides common elements for basic time-critical messaging communications between devices in an automation environment. The term “time-critical” is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the time window risks failure of the applications requesting the actions, with attendant risk to equipment, plant and possibly human life.

This standard defines in an abstract way the externally visible service provided by the Type 2 fieldbus data-link layer in terms of

- a) the primitive actions and events of the service;
- b) the parameters associated with each primitive action and event, and the form which they take; and
- c) the interrelationship between these actions and events, and their valid sequences.

The purpose of this standard is to define the services provided to:

- the Type 2 fieldbus application layer at the boundary between the application and data-link layers of the fieldbus reference model;
- systems management at the boundary between the data-link layer and systems management of the fieldbus reference model.

Type 2 DL-service provides both a connected and a connectionless subset of those services specified in ISO/IEC 8886.

1.2 Specifications

The principal objective of this standard is to specify the characteristics of conceptual data-link layer services suitable for time-critical communications and thus supplement the OSI Basic Reference Model in guiding the development of data-link protocols for time-critical communications. A secondary objective is to provide migration paths from previously-existing industrial communications protocols.

This specification may be used as the basis for formal DL-Programming-Interfaces. Nevertheless, it is not a formal programming interface, and any such interface will need to address implementation issues not covered by this specification, including:

- a) the sizes and octet ordering of various multi-octet service parameters;
- b) the correlation of paired request and confirm, or indication and response, primitives.

1.3 Conformance

This standard does not specify individual implementations or products, nor does it constrain the implementations of data-link entities within industrial automation systems.

There is no conformance of equipment to this data-link layer service definition standard. Instead, conformance is achieved through implementation of the corresponding data-link protocol that fulfills the Type 1 data-link layer services defined in this standard.

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.

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 8886, *Information technology – Open Systems Interconnection – Data link service definition*

ISO/IEC 10731:1994, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

3 Terms, definitions, symbols, abbreviations and conventions

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

3.1 Reference model terms and definitions

This standard 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	[ISO/IEC 7498-1]
	correspondent DL-entities (N=2)	
	correspondent Ph-entities (N=1)	
3.1.12	DL-duplex-transmission	[ISO/IEC 7498-1]

3.1.13	(N)-entity DL-entity (N=2) 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 DL-layer (N=2) 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 DL-service (N=2) Ph-service (N=1)	[ISO/IEC 7498-1]
3.1.32	(N)-service-access-point DL-service-access-point (N=2) Ph-service-access-point (N=1)	[ISO/IEC 7498-1]
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 standard 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 Common data-link service terms and definitions

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

3.3.1

DL-segment, link, local link

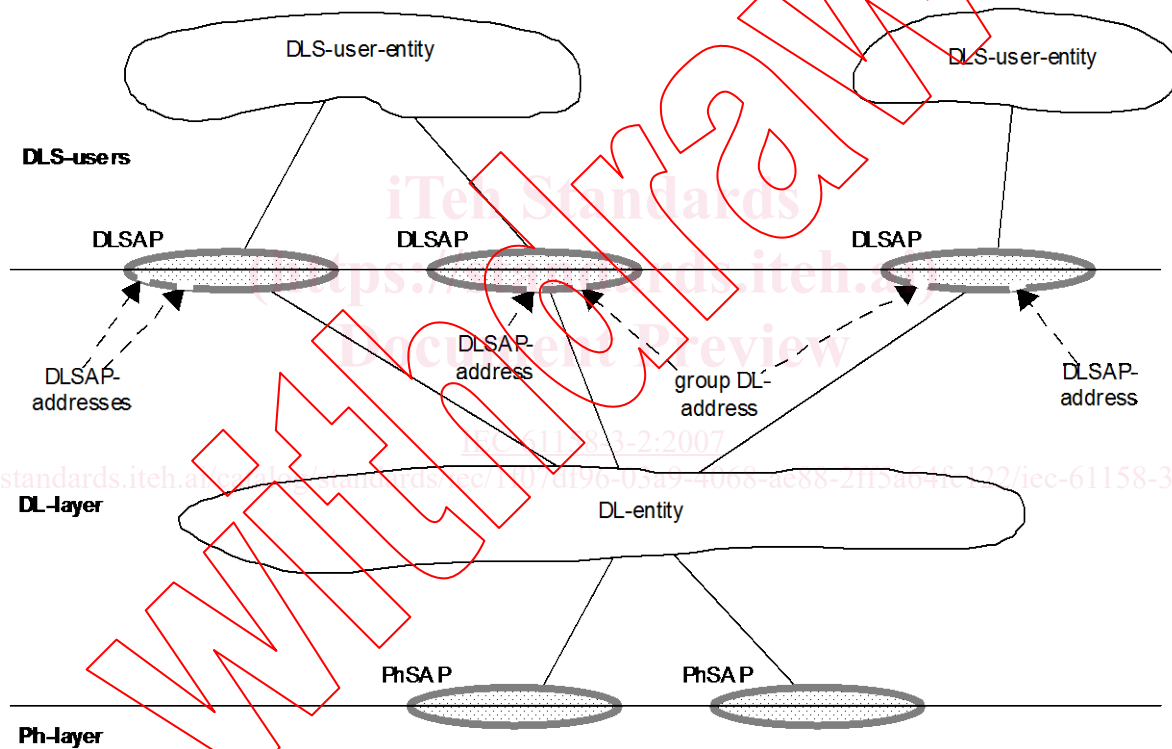
single DL-subnetwork in which any of the connected DLEs may communicate directly, without any intervening DL-relaying, whenever all of those DLEs that are participating in an instance of communication are simultaneously attentive to the DL-subnetwork during the period(s) of attempted communication

3.3.2

DLSAP

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

NOTE This definition, derived from ISO/IEC 7498-1, is repeated here to facilitate understanding of the critical distinction between DLSAPs and their DL-addresses.



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 may have multiple DLSAP-addresses and group DL-addresses associated with a single DLSAP.

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

3.3.3

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 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.

3.3.4

(individual) DLSAP-address

DL-address that designates only one DLSAP within the extended link

NOTE A single DL-entity may have multiple DLSAP-addresses associated with a single DLSAP.

3.3.5

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

NOTE An extended link may be composed of just a single link.

3.3.6

frame

denigrated synonym for DLPDU

3.3.7

group DL-address

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

NOTE 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.

3.3.8

node

single DL-entity as it appears on one local link

3.3.9

receiving DLS-user

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

NOTE A DL-service user can be concurrently both a sending and receiving DLS-user.

3.3.10

sending DLS-user

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

3.4 Additional Type 2 data-link specific definitions

3.4.1

application

function or data structure for which data is subscribed or published

3.4.2

behavior

indication of how the object responds to particular events. Its description includes the relationship between attribute values and services

3.4.3

bridge, DL-router

DL-relay entity which performs selective store-and-forward and routing functions to connect two or more separate DL-subnetworks (links) to form a unified DL-subnetwork (the extended link)

3.4.4

cyclic

term used to describe events which repeat in a regular and repetitive manner