

INTERNATIONAL STANDARD

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**Industrial communication networks – Fieldbus specifications –
Part 3-25: Data-link layer service definition – Type 25 elements**

**Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 3-25: Définition des services de la couche liaison de données – Éléments
de type 25**





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FIELDBUS SPECIFICATIONS –**

**Part 3-25: Data-link layer service definition –
Type 25 elements**

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

FDIS	Report on voting
65C/945/FDIS	65C/954/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.

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

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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.

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 document is a conceptual architectural service, independent of administrative and implementation divisions.

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 3-25: Data-link layer service definition – Type 25 elements

1 Scope

1.1 General

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 International Standard defines in an abstract way the externally visible service provided by the Type 25 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 document is to define the services provided to the Type 25 fieldbus application layer at the boundary between the application and data-link layers of the fieldbus reference model;

- the Type 25 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.

1.2 Specifications

The principal objective of this document 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, and
- b) the correlation of paired request and confirm, or indication and response, primitives.

1.3 Conformance

This document 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 fulfils the Type 25 data-link layer services defined in this document.

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, *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 802.1Q, *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>

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 correspondent DL-entities (N=2) correspondent Ph-entities (N=1)	[ISO/IEC 7498-1]
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 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 at which the port does not participate in frame communication

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3.3.2**class**

identifier that designates the communication range of the RCL frames and the other frames

3.3.3**control communication**

acyclic data communication for high time-critical applications

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

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

3.3.7**DL(SAP)-address** <https://standards.iteh.ai/catalog/standards/sist/d2c30413-f955-4ea4-ae4d-55c6ca5871a2/iec-61158-3-25-2019>

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 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**

acyclic data communication for low time-critical applications

3.3.13**node**

single DL-entity as it appears on one local link

3.3.14**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.

3.3.15**ring control (RCL) communication**

non-real-time communication for control and reconfiguration in Type 25 DLL network using RCL frames

3.3.16**sending DLS-user**

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

3.3.17**station**

synonym for node

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3.3.18**station address**

identifier address that designates the node of Type 25 network

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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
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

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3.5 Common conventions

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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:

- 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: