

INTERNATIONAL STANDARD

**Industrial communication networks – Fieldbus specifications –
Part 3-4: Data-link layer service definition – Type 4 elements**

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
1.1 General.....	7
1.2 Specifications	7
1.3 Conformance	7
2 Normative references	8
3 Terms, definitions, symbols, abbreviated terms and conventions	8
3.1 Reference model terms and definitions	8
3.2 Service convention terms and definitions	9
3.3 Data-link service terms and definitions.....	10
3.4 Symbols and abbreviations	12
3.5 Conventions.....	13
4 Data-link service and concepts	14
4.1 Overview.....	14
4.1.1 General	14
4.1.2 Overview of DL-naming (addressing).....	14
4.2 Types and classes of data-link service.....	15
4.3 Functional classes	15
4.4 Facilities of the connectionless-mode data-link service	15
4.5 Model of the connectionless-mode data-link service.....	15
4.5.1 General	15
4.5.2 Unconfirmed request	15
4.5.3 Confirmed request	16
4.6 Sequence of primitives.....	16
4.6.1 Constraints on sequence of primitives	16
4.6.2 Relation of primitives at the end-points of connectionless service	17
4.6.3 Sequence of primitives at one DLSAP.....	18
4.7 Connectionless-mode data transfer functions.....	18
4.7.1 General	18
4.7.2 Types of primitives and parameters	18
5 DL-management service	21
5.1 Scope and inheritance	21
5.2 Facilities of the DL-management service.....	21
5.3 Model of the DL-management service	21
5.4 Constraints on sequence of primitives.....	21
5.5 Set.....	22
5.5.1 Function	22
5.5.2 Types of parameters	22
5.6 Get	23
5.6.1 Function	23
5.6.2 Types of parameters.....	23
5.7 Action	23
5.7.1 Function	23
5.7.2 Types of parameters	24
5.7.3 Sequence of primitives	24

5.8	Event	25
5.8.1	Function	25
5.8.2	Types of parameters	25
	Bibliography.....	26
	Figure 1 – Relationship of PhE, DLE and DLS-users	14
	Figure 2 – Confirmed and unconfirmed UNITDATA request time-sequence diagram	17
	Figure 3 – Repeated confirmed request time-sequence diagram	17
	Figure 4 – State transition diagram for sequences of primitives at one DLSAP	18
	Figure 5 – Sequence of primitives for the DLM action service	21
	Table 1 – Summary of DL-connectionless-mode primitives and parameters	17
	Table 2 – Unitdata transfer primitives and parameters	18
	Table 3 – Control-status error codes	20
	Table 4 – Summary of DL-management primitives and parameters	22
	Table 5 – DLM-Set primitive and parameters	22
	Table 6 – DLM-Get primitive and parameters	23
	Table 7 – DLM-Action primitive and parameters	24
	Table 8 – DLM-Event primitive and parameters	25

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 3-4: Data-link layer service definition – Type 4 elements

FOREWORD

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NOTE Combinations of protocol Types are specified in the IEC 61784-1 series and the IEC 61784-2 series.

IEC 61158-3-4 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2019. This edition constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition:

- a) Use of extended data size for DLS-user data. This extension is restricted to nodes operating on a P-NET IP network.

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

Draft	Report on voting
65C/1201/FDIS	65C/1242/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A 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.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

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 3-4: Data-link layer service definition – Type 4 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 document defines in an abstract way the externally visible services provided by the Type 4 fieldbus data-link layer in terms of

- a) the primitive actions and events of the services;
- 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 4 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 document can 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 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 fulfills the Type 4 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 the IEC 61784-1 series and the IEC 61784-2 series 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 10731:1994, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

3 Terms, definitions, symbols, abbreviated terms and conventions

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

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

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://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	[7498-3]
3.1.2	DL-address-mapping	[7498-1]
3.1.3	called-DL-address	[7498-3]
3.1.4	calling-DL-address	[7498-3]
3.1.5	centralized multi-end-point-connection	[7498-1]
3.1.6	correspondent (N)-entities correspondent DL-entities (N=2) correspondent Ph-entities (N=1)	[7498-1]
3.1.7	DL-connection	[7498-1]
3.1.8	DL-connection-end-point	[7498-1]
3.1.9	DL-connection-end-point-identifier	[7498-1]
3.1.10	DL-connection-mode transmission	[7498-1]
3.1.11	DL-connectionless-mode transmission	[7498-1]
3.1.12	DL-duplex-transmission	[7498-1]

3.1.13	(N)-entity	[7498-1]
	DL-entity (N=2)	
	Ph-entity (N=1)	
3.1.14	DL-facility	[7498-1]
3.1.15	flow control	[7498-1]
3.1.16	(N)-layer	[7498-1]
	DL-layer (N=2)	
	Ph-layer (N=1)	
3.1.17	layer-management	[7498-1]
3.1.18	DL-local-view	[7498-3]
3.1.19	DL-name	[7498-3]
3.1.20	naming-(addressing)-domain	[7498-3]
3.1.21	primitive name	[7498-3]
3.1.22	DL-protocol	[7498-1]
3.1.23	DL-protocol-connection-identifier	[7498-1]
3.1.24	DL-protocol-data-unit	[7498-1]
3.1.25	DL-relay	[7498-1]
3.1.26	Reset	[7498-1]
3.1.27	responding-DL-address	[7498-3]
3.1.28	routing	[7498-1]
3.1.29	segmenting	[7498-1]
3.1.30	(N)-service	[7498-1]
	DL-service (N=2)	
	Ph-service (N=1)	
3.1.31	(N)-service-access-point	[7498-1]
	DL-service-access-point (N=2)	
	Ph-service-access-point (N=1)	
3.1.32	DL-service-access-point-address	[7498-3]
3.1.33	DL-service-connection-identifier	[7498-1]
3.1.34	DL-service-data-unit	[7498-1]
3.1.35	DL-simplex-transmission	[7498-1]
3.1.36	DL-subsystem	[7498-1]
3.1.37	systems-management	[7498-1]
3.1.38	DLS-user-data	[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 **confirm (primitive);
requestor.deliver (primitive)**
- 3.2.3 **deliver (primitive)**
- 3.2.4 **DL-confirmed-facility**
- 3.2.5 **DL-facility**
- 3.2.6 **DL-local-view**
- 3.2.7 **DL-mandatory-facility**
- 3.2.8 **DL-non-confirmed-facility**
- 3.2.9 **DL-service-primitive;
primitive**
- 3.2.10 **DL-service-provider**
- 3.2.11 **DL-service-user**
- 3.2.12 **DLS-user-optional-facility**
- 3.2.13 **indication (primitive);
acceptor.deliver (primitive)**
- 3.2.14 **request (primitive);
requestor.submit (primitive)**
- 3.2.15 **requestor**
- 3.2.16 **response (primitive);
acceptor.submit (primitive)**
- 3.2.17 **submit (primitive)**

3.3 Data-link service terms and definitions

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

3.3.1

broadcast-node-address

address used to designate all DLEs on a link

Note 1 to entry: All DLEs on a link receive all DLPDUs where the first node-address is equal to the broadcast-node-address. Such DLPDUs are always unconfirmed, and their receipt is never acknowledged. The value of the broadcast-node-address is 126.

3.3.2

destination-DL-route

sequence of DL-route-elements, describing the complete route to the destination

Note 1 to entry: This includes both the destination DLSAP and a local component meaningful to the destination DLS-user.

3.3.3

DL-route-element

octet holding a node DL-address or an address used by the DLS-user