

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

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

**Réseaux de communication industriels – Spécifications des bus de terrain –  
Partie 3-4: Définition des services de la couche liaison de données – Eléments  
de type 4**

IEC 61158-3-4:2014

<https://standards.iteh.ai/standards/iec/61158-3-4/2014>



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**INDUSTRIAL COMMUNICATION NETWORKS –  
FIELDBUS SPECIFICATIONS –****Part 3-4: Data-link layer service definition –  
Type 4 elements**

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

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

This second edition cancels and replaces the first edition published in 2007. This edition constitutes an editorial revision with only minor editorial changes.

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

- a) editorial improvements;
- b) editorial corrections.

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

FDIS	Report on voting
65C/759/FDIS	65C/769/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.

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

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 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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WITHDRAWN

## INTRODUCTION

This part of IEC 61158 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 standard 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 standard 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 standard 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 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 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	<b>DL-address</b>	[7498-3]
3.1.2	<b>DL-address-mapping</b>	[7498-1]
3.1.3	<b>called-DL-address</b>	[7498-3]
3.1.4	<b>calling-DL-address</b>	[7498-3]
3.1.5	<b>centralized multi-end-point-connection</b>	[7498-1]
3.1.6	<b>DL-connection</b>	[7498-1]
3.1.7	<b>DL-connection-end-point</b>	[7498-1]
3.1.8	<b>DL-connection-end-point-identifier</b>	[7498-1]
3.1.9	<b>DL-connection-mode transmission</b>	[7498-1]
3.1.10	<b>DL-connectionless-mode transmission</b>	[7498-1]
3.1.11	<b>correspondent (N)-entities</b>	[7498-1]
	<b>correspondent DL-entities (N=2)</b>	
	<b>correspondent Ph-entities (N=1)</b>	
3.1.12	<b>DL-duplex-transmission</b>	[7498-1]
3.1.13	<b>(N)-entity</b>	[7498-1]
	<b>DL-entity (N=2)</b>	
	<b>Ph-entity (N=1)</b>	

<b>3.1.14</b>	<b>DL-facility</b>	[7498-1]
<b>3.1.15</b>	<b>flow control</b>	[7498-1]
<b>3.1.16</b>	<b>(N)-layer</b>	[7498-1]
	<b>DL-layer (N=2)</b>	
	<b>Ph-layer (N=1)</b>	
<b>3.1.17</b>	<b>layer-management</b>	[7498-1]
<b>3.1.18</b>	<b>DL-local-view</b>	[7498-3]
<b>3.1.19</b>	<b>DL-name</b>	[7498-3]
<b>3.1.20</b>	<b>naming-(addressing)-domain</b>	[7498-3]
<b>3.1.21</b>	<b>primitive name</b>	[7498-3]
<b>3.1.22</b>	<b>DL-protocol</b>	[7498-1]
<b>3.1.23</b>	<b>DL-protocol-connection-identifier</b>	[7498-1]
<b>3.1.24</b>	<b>DL-protocol-data-unit</b>	[7498-1]
<b>3.1.25</b>	<b>DL-relay</b>	[7498-1]
<b>3.1.26</b>	<b>reset</b>	[7498-1]
<b>3.1.27</b>	<b>responding-DL-address</b>	[7498-3]
<b>3.1.28</b>	<b>routing</b>	[7498-1]
<b>3.1.29</b>	<b>segmenting</b>	[7498-1]
<b>3.1.30</b>	<b>(N)-service</b>	[7498-1]
	<b>DL-service (N=2)</b>	
	<b>Ph-service (N=1)</b>	
<b>3.1.31</b>	<b>(N)-service-access-point</b>	[7498-1]
	<b>DL-service-access-point (N=2)</b>	
	<b>Ph-service-access-point (N=1)</b>	
<b>3.1.32</b>	<b>DL-service-access-point-address</b>	[7498-3]
<b>3.1.33</b>	<b>DL-service-connection-identifier</b>	[7498-1]
<b>3.1.34</b>	<b>DL-service-data-unit</b>	[7498-1]
<b>3.1.35</b>	<b>DL-simplex-transmission</b>	[7498-1]
<b>3.1.36</b>	<b>DL-subsystem</b>	[7498-1]
<b>3.1.37</b>	<b>systems-management</b>	[7498-1]
<b>3.1.38</b>	<b>DLS-user-data</b>	[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 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

#### **3.3.4**

##### **DLSAP**

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

**3.3.5****DL(SAP)-address**

individual DLSAP-address, designating a single DLSAP of a single DLS-user

**3.3.6****DLS-user address**

uniquely identifies a DLS-user locally

**3.3.7****frame**

denigrated synonym for DLPDU

**3.3.8****full DL-route**

combination of a destination-DL-route and a source-DL-route

**3.3.9****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

**3.3.10****maximum-indication-delay**

indicates to the DLS-user the maximum time interval for the DLS-user to prepare a response after receiving an indication requiring a response

Note 1 to entry: If the DLS-user is unable to prepare a response within maximum-indication-delay, the DLS-user is required to issue a DL-UNITDATA request with a DLSDU type indicating ACKNOWLEDGE. As a result the DLE will transmit an acknowledging DLPDU on the link.

**3.3.11****maximum-retry-time**

indicates to the DLE for how long time retransmission of the request may be performed, as a result of Wait acknowledges from the remote DLE or DLS-user

**3.3.12****no-confirm-node-address**

indicates that a request or response is unconfirmed

Note 1 to entry: The value of the no-confirm-node-address is 0

**3.3.13****node**

single DL-entity as it appears on one local link

**3.3.14****node-address**

uniquely identifies a DLE on a link

Note 1 to entry: The value of a Node-address is in the range of 0-127. The values 0, 126 and 127 are reserved for special purposes

**3.3.15****normal class device**

device which replies to requests from other normal class devices, and initiates transmissions

Note 1 to entry: Such a device can act as a server (responder) and as a client (requestor) – this is also called a peer.

**3.3.16**

**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.

**3.3.17**

**sending DLS-user**

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

**3.3.18**

**service-node-address**

an address reserved for service purposes only

Note 1 to entry: All DLEs on a link receive all DLPDUs where the first Node-address is equal to the service-node-address. Such DLPDUs can be Confirmed or Unconfirmed, and their receipt may or may not be acknowledged. The service-node-address can be used on links with only two DLEs – the requesting Normal class DLE and the responding simple-class or normal-class DLE. The value of the service-node-address is 127.

**3.3.19**

**simple-class device**

device which replies to requests from normal class devices

Note 1 to entry: Such a device can act as a server or responder only.

**3.3.20**

**source-DL-route**

holds a sequence of DL-route-elements, describing the complete route back to the source

**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.

**3.4.1 DL-** Data-link layer (as a prefix)

**3.4.2 DLC** DL-connection

**3.4.3 DLCEP** DL-connection-end-point

**3.4.4 DLE** DL-entity (the local active instance of the data-link layer)

**3.4.5 DLL** DL-layer

**3.4.6 DLPCI** DL-protocol-control-information

**3.4.7 DLPDU** DL-protocol-data-unit

**3.4.8 DLM** DL-management

**3.4.9 DLME** DL-management Entity (the local active instance of DL-management)

**3.4.10 DLMS** DL-management Service

**3.4.11 DLS** DL-service

**3.4.12 DLSAP** DL-service-access-point

**3.4.13 DLSDU** DL-service-data-unit

**3.4.14 FIFO** First-in first-out (queuing method)

**3.4.15 OSI** Open systems interconnection