

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Industrial communication networks – Fieldbus specifications –  
Part 3-19: Data-link layer service definition – Type 19 elements**

**Réseaux de communication industriels – Spécifications des bus de terrain –  
Partie 3-19: Définition des services de la couche liaison de données – Eléments  
de type 19**

IEC 61158-3-19:2014

<https://standards.iteh.ai/standards/iec/b6210ca4-196f-4a26-93ed-658077895e6a/iec-61158-3-19-2014>



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FIELDBUS SPECIFICATIONS –****Part 3-19: Data-link layer service definition –  
Type 19 elements**

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

International Standard IEC 61158-3-19 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision. The main changes with respect to the previous edition are listed below:

- introducing connections based on a producer-consumer model;
- introducing additional mechanisms to realize features such as timestamping and oversampling;
- improving the hotplug and redundancy features;
- improving the phase switching and the error handling;
- editorial improvements.

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

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## 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 3-19: Data-link layer service definition – Type 19 elements

### 1 Scope

#### 1.1 General

This standard 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 19 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 19 fieldbus application layer at the boundary between the application and data-link layers of the fieldbus reference model, and
- 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 standard 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 standard does not specify individual implementations or products, nor do they 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 19 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, *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>	
3.1.14	<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>peer-entities</b>	[7498-1]
<b>3.1.22</b>	<b>primitive name</b>	[7498-3]
<b>3.1.23</b>	<b>DL-protocol</b>	[7498-1]
<b>3.1.24</b>	<b>DL-protocol-connection-identifier</b>	[7498-1]
<b>3.1.25</b>	<b>DL-protocol-data-unit</b>	[7498-1]
<b>3.1.26</b>	<b>DL-relay</b>	[7498-1]
<b>3.1.27</b>	<b>reset</b>	[7498-1]
<b>3.1.28</b>	<b>responding-DL-address</b>	[7498-3]
<b>3.1.29</b>	<b>routing</b>	[7498-1]
<b>3.1.30</b>	<b>segmenting</b>	[7498-1]
<b>3.1.31</b>	<b>(N)-service</b>	[7498-1]
	<b>DL-service (N=2)</b>	
	<b>Ph-service (N=1)</b>	
<b>3.1.32</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>3.1.33</b>	<b>DL-service-access-point-address</b>	[7498-3]
<b>3.1.34</b>	<b>DL-service-connection-identifier</b>	[7498-1]
<b>3.1.35</b>	<b>DL-service-data-unit</b>	[7498-1]
<b>3.1.36</b>	<b>DL-simplex-transmission</b>	[7498-1]
<b>3.1.37</b>	<b>DL-subsystem</b>	[7498-1]
<b>3.1.38</b>	<b>systems-management</b>	[7498-1]
<b>3.1.39</b>	<b>DL-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 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 DL-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 Data-link service terms and definitions

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

#### 3.3.1 communication cycle

fixed time period between two master synchronization telegrams in which real-time telegrams are transmitted in the RT channel and non real-time telegrams are transmitted in the IP channel

#### 3.3.2 cycle time

duration of a communication cycle

**3.3.3**

**cyclic communication**

periodic exchange of telegrams

**3.3.4**

**cyclic data**

part of a telegram, which does not change its meaning during cyclic operation of the network

**3.3.5**

**device**

a slave in the communication network, (e.g., a power drive system as defined in the IEC 61800 standard family, I/O stations as defined in the IEC 61131 standard family).

**3.3.6**

**device status**

four adjacent octets inside the acknowledge telegram containing status information for each device

**3.3.7**

**DL-segment**

**link**

**local link**

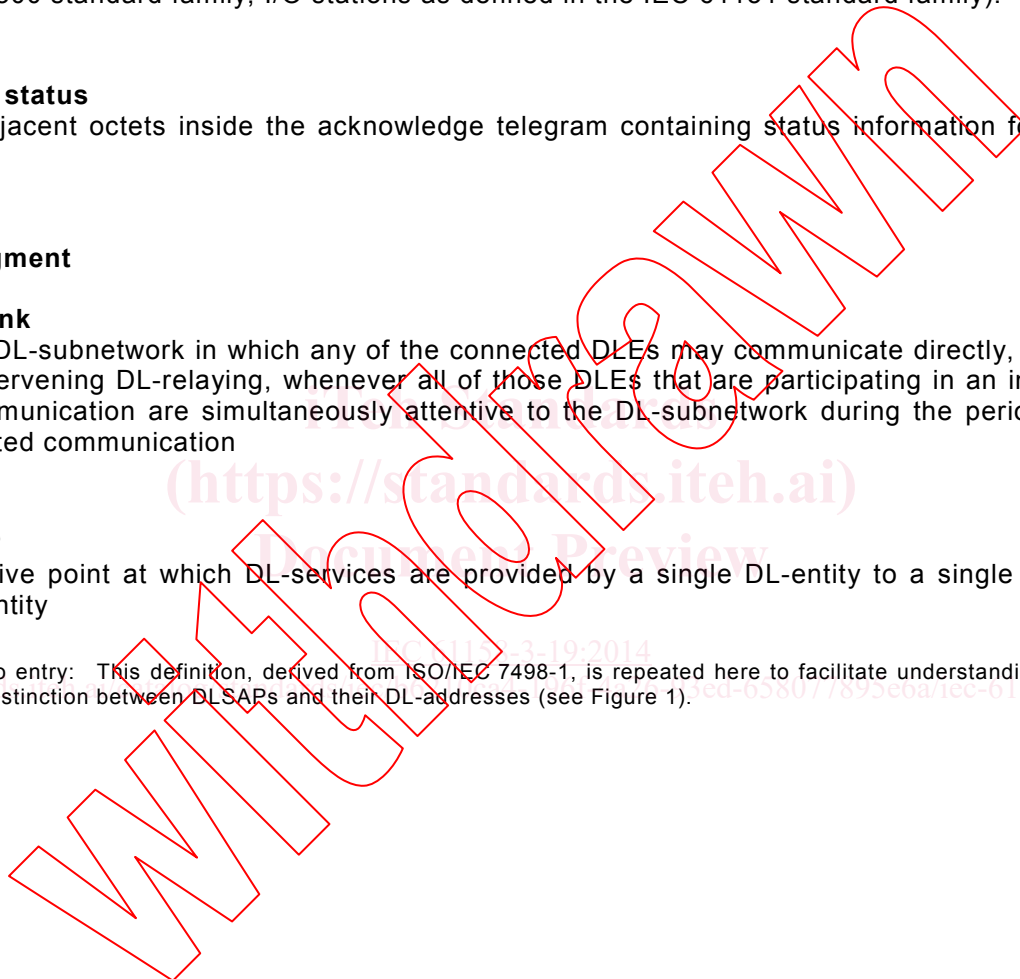
single DL-subnetwork in which any of the connected DLEs may communicate directly, without any intervening DL-relaying, whenever all of those DLEs that are participating in an instance of communication are simultaneously attentive to the DL-subnetwork during the period(s) of attempted communication

**3.3.8**

**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 (see Figure 1).

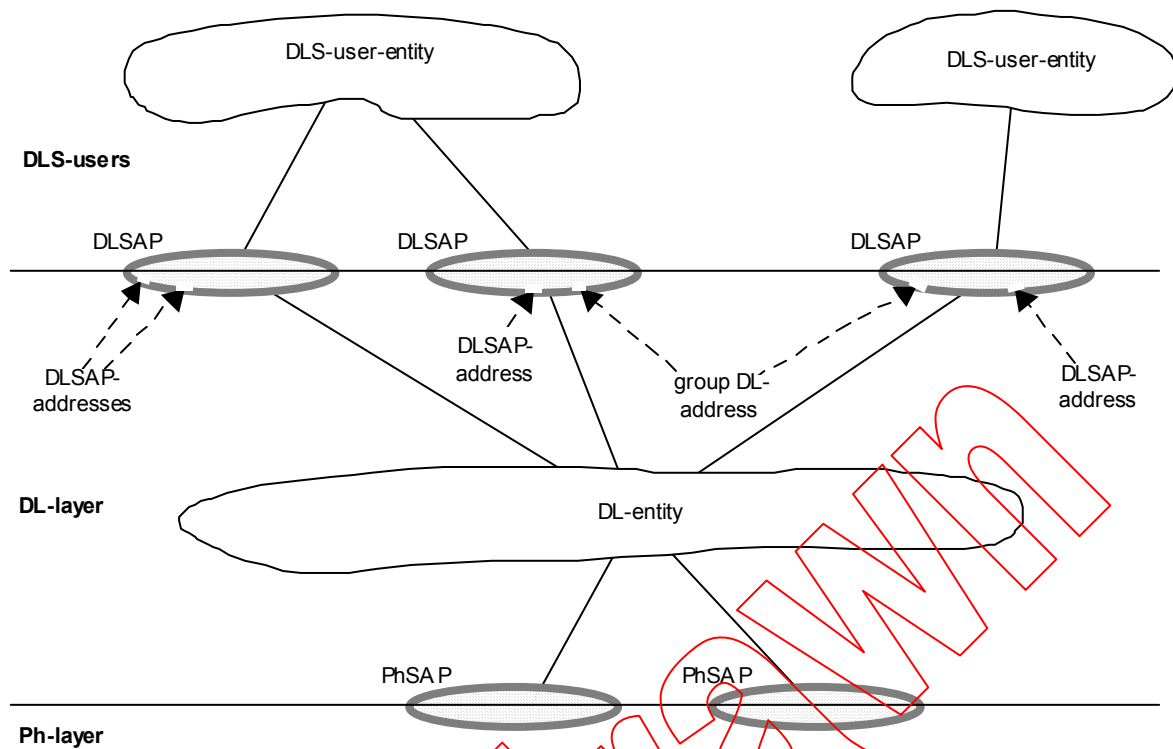


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NOTE 1 DLSAPs and PhSAPs are depicted as ovals spanning the boundary between two adjacent layers.

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**

### 3.3.9 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.

### 3.3.10 (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.

### 3.3.11 element

part of IDNs – each IDN has 7 elements, whereas each one has a specific meaning (e.g., number, name, data)

### 3.3.12 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 1 to entry: An extended link may be composed of just a single link.

**3.3.13****frame**

denigrated synonym for DLPDU

**3.3.14****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.

**3.3.15****identification number****IDN**

designation of operating data under which a data block is preserved with its attribute, name, unit, minimum and maximum input values, and the data

**3.3.16****master**

node, which assigns the other nodes (i.e., slaves) the right to transmit

**3.3.17****node**

single DL-entity as it appears on one local link

**3.3.18****protocol**

convention about the data formats, time sequences, and error correction in the data exchange of communication systems

**3.3.19****receiving DLS-user**

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

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

**3.3.20****sending DLS-user**

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

**3.3.21****service channel****SVC**

non-real-time transmission of information upon master request during RT channel

**3.3.22****slave**

node, which is assigned the right to transmit by the master

**3.3.23****topology**

physical network architecture with respect to the connection between the stations of the communication system

**3.4 Symbols and abbreviations**

AT	Acknowledge telegram
CA	Procedure command acknowledgment