

BS EN 61158-3-13:2008



BSI Standards Publication

# Industrial communication networks — Fieldbus specifications —

Part 3-13: Data-link layer service definition — Type 13 elements

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This British Standard is the UK implementation of EN 61158-3-13:2008. It is identical to IEC 61158-3-13:2007. Together with all of the other sections of BS EN 61158-3, it supersedes BS EN 61158-3:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AMT/7, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English version

**Industrial communication networks -  
Fieldbus specifications -  
Part 3-13: Data-link layer service definition -  
Type 13 elements  
(IEC 61158-3-13:2007)**

Réseaux de communication industriels -  
Spécifications des bus de terrain -  
Partie 3-13: Définition des services  
des couches de liaison de données -  
Éléments de type 13  
(CEI 61158-3-13:2007)

Industrielle Kommunikationsnetze -  
Feldbusse -  
Teil 3-13: Dienstfestlegungen des  
Data Link Layer (Sicherungsschicht) -  
Typ 13-Elemente  
(IEC 61158-3-13:2007)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 65C/473/FDIS, future edition 1 of IEC 61158-3-13, prepared by SC 65C, Industrial networks, of IEC TC 65, Industrial-process measurement, control and automation, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61158-3-13 on 2008-02-01.

This and the other parts of the EN 61158-3 series supersede EN 61158-3:2004.

With respect to EN 61158-3:2004 the following changes were made:

- deletion of Type 6 fieldbus, and the placeholder for a Type 5 fieldbus data-link layer, for lack of market relevance;
- addition of new fieldbus types;
- partition into multiple parts numbered 3-1, 3-2, ..., 3-19.

The following dates were fixed:

- latest date by which the EN has to be implemented  
at national level by publication of an identical  
national standard or by endorsement (dop) 2008-11-01
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2011-02-01

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

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 61158-3-13:2007 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

|                |                                                       |
|----------------|-------------------------------------------------------|
| IEC 61158-4-13 | NOTE Harmonized as EN 61158-4-13:2008 (not modified). |
| IEC 61158-5-13 | NOTE Harmonized as EN 61158-5-13:2008 (not modified). |
| IEC 61158-6-13 | NOTE Harmonized as EN 61158-6-13:2008 (not modified). |
| IEC 61784-2    | NOTE Harmonized as EN 61784-2:2008 (not modified).    |

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## **Annex ZA** (normative)

### **Normative references to international publications with their corresponding European publications**

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

| <u>Publication</u> | <u>Year</u>     | <u>Title</u>                                                                                                                   | <u>EN/HD</u>      | <u>Year</u>        |
|--------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------|
| ISO/IEC 7498-1     | - <sup>1)</sup> | Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model                                 | EN ISO/IEC 7498-1 | 1995 <sup>2)</sup> |
| ISO/IEC 7498-3     | - <sup>1)</sup> | Information technology - Open Systems Interconnection - Basic Reference Model: Naming and addressing                           | -                 | -                  |
| ISO/IEC 10731      | - <sup>1)</sup> | Information technology - Open Systems Interconnection - Basic reference model - Conventions for the definition of OSI services | -                 | -                  |

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<sup>1)</sup> Undated reference.

<sup>2)</sup> Valid edition at date of issue.

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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/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.

## INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

### Part 3-13: Data-link layer service definition – Type 13 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 13 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 13 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 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 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 13 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 — Basic Reference Model: The Basic Model

ISO/IEC 7498-3, Information technology – Open Systems Interconnection – Basic Reference Model — 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:

|                                                     |          |
|-----------------------------------------------------|----------|
| <b>3.1.1 DL-address</b>                             | [7498-3] |
| <b>3.1.2 DL-address-mapping</b>                     | [7498-1] |
| <b>3.1.3 called-DL-address</b>                      | [7498-3] |
| <b>3.1.4 calling-DL-address</b>                     | [7498-3] |
| <b>3.1.5 centralized multi-end-point-connection</b> | [7498-1] |
| <b>3.1.6 DL-connection</b>                          | [7498-1] |
| <b>3.1.7 DL-connection-end-point</b>                | [7498-1] |
| <b>3.1.8 DL-connection-end-point-identifier</b>     | [7498-1] |
| <b>3.1.9 DL-connection-mode transmission</b>        | [7498-1] |
| <b>3.1.10 DL-connectionless-mode transmission</b>   | [7498-1] |
| <b>3.1.11 correspondent (N)-entities</b>            | [7498-1] |
| <b>correspondent DL-entities (N=2)</b>              |          |
| <b>correspondent Ph-entities (N=1)</b>              |          |
| <b>3.1.12 DL-duplex-transmission</b>                | [7498-1] |
| <b>3.1.13 (N)-entity</b>                            | [7498-1] |
| <b>DL-entity (N=2)</b>                              |          |
| <b>Ph-entity (N=1)</b>                              |          |
| <b>3.1.14 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] |
|               | DL-layer (N=2)                           |          |
|               | Ph-layer (N=1)                           |          |
| <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] |
|               | DL-service (N=2)                         |          |
|               | Ph-service (N=1)                         |          |
| <b>3.1.32</b> | <b>(N)-service-access-point</b>          | [7498-1] |
|               | DL-service-access-point (N=2)            |          |
|               | Ph-service-access-point (N=1)            |          |
| <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>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 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 Data-link service terms and definitions****3.3.1**

**application process**  
application layer task

**3.3.2****async-only CN**

CN that is accessed only by polling

### 3.3.3

**asynchronous period**

second part of the Type 13 cycle, starting with a start of asynchronous (SoA) frame

### 3.3.4

**basic Ethernet mode**

mode that provides legacy Ethernet communication

### 3.3.5

**continuous**

communication class where isochronous communication takes place every cycle (the opposite to multiplexed)

### 3.3.6

**controlled node**

network node without the ability to manage the SCNM mechanism

### 3.3.7

**cycle time**

time between two consecutive start of cyclic (SoC) frames

NOTE The Cycle Time includes the time for data transmission and some idle time before the beginning of the next cycle.

### 3.3.8

**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

### 3.3.9

**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

### 3.3.10

**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.

### 3.3.11

**DL(SAP)-address**

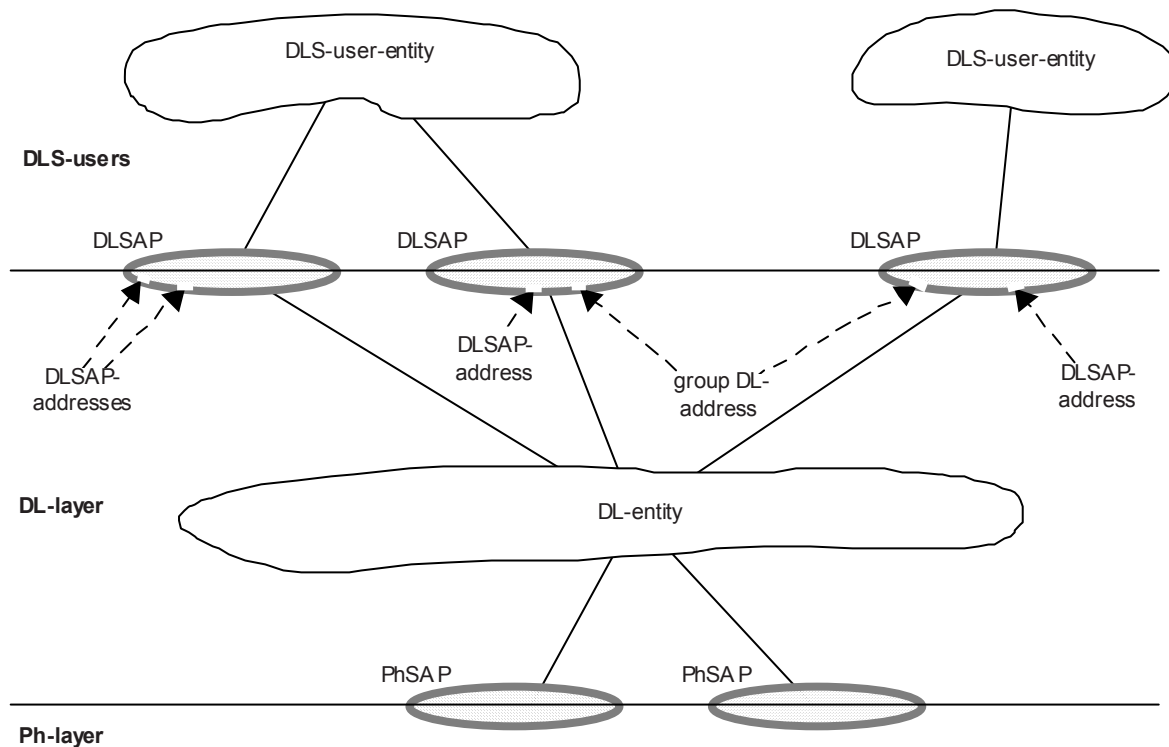
either an individual DLSAP-address, designating a single DLSAP of a single DLS-user, or a group DL-address potentially designating multiple DLSAPs, each of a single DLS-user.

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.

**3.3.12****(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.



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**

**3.3.13****frame**

denigrated synonym for DLPDU

**3.3.14****isochronous data**

data which is transmitted every cycle (or every  $n^{\text{th}}$  cycle in case of multiplexed isochronous data)

**3.3.15****isochronous period**

period within each cycle that offers deterministic operation through being reserved for the exchange of (continuous or multiplexed) isochronous data

**3.3.16****legacy Ethernet**

Ethernet as standardized in ISO/IEC 8802-3 (non-deterministic operation in non-time-critical environments)