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Industrial communication networks - Fieldbus specifications - Part 4-21: Data-link layer protocol specification - Type 21 elements

Táto norma obsahuje anglickú verziu európskej normy.  
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 09/19

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English Version

**Industrial communication networks - Fieldbus specifications -  
Part 4-21: Data-link layer protocol specification - Type 21  
elements  
(IEC 61158-4-21:2019)**

Réseaux de communication industriels - Spécifications des  
bus de terrain - Partie 4-21: Spécification du protocole de la  
couche de liaison de données - Eléments de Type 21  
(IEC 61158-4-21:2019)

Industrielle Kommunikationsnetze - Feldbusse - Teil 4-21:  
Protokollspezifikation des Data Link Layer  
(Sicherheitsschicht) - Typ 21-Elemente  
(IEC 61158-4-21:2019)

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**EN IEC 61158-4-21:2019 (E)****European foreword**

The text of document 65C/946/FDIS, future edition 2 of IEC 61158-4-21, 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 approved by CENELEC as EN IEC 61158-4-21:2019.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2020-02-15
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-05-15

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

- |                     |  |
|---------------------|--|
| IEC 61158-1:2019    | NOTE Harmonized as EN IEC 61158-1:2019 (not modified)    |
| IEC 61158-2:2014    | NOTE Harmonized as EN 61158-2:2014 (not modified)        |
| IEC 61158-5-21:2019 | NOTE Harmonized as EN IEC 61158-5-21:2019 (not modified) |
| IEC 61784-2:2019    | NOTE Harmonized as EN IEC 61784-2:2019 (not modified)    |
| IEC 61918:2018      | NOTE Harmonized as EN IEC 61918:2018 (not modified)      |

## Annex ZA (normative)

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

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 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-3-21	2019	Industrial communication networks Fieldbus specifications - Part 3-21: Data-link layer service definition - Type 21 elements	-EN IEC 61158-3-21	2019
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		-
ISO/IEC/IEEE 8802-2017		Standard for Ethernet	-	-



IEC 61158-4-21

Edition 2.0 2019-04

# INTERNATIONAL STANDARD

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**Industrial communication networks – Fieldbus specifications –  
Part 4-21: Data-link layer protocol specification – Type 21 elements**





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IEC 61158-4-21

Edition 2.0 2019-04

# INTERNATIONAL STANDARD

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**Industrial communication networks – Fieldbus specifications –  
Part 4-21: Data-link layer protocol specification – Type 21 elements**

INTERNATIONAL  
ELECTROTECHNICAL  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –  
FIELD BUS SPECIFICATIONS –****Part 4-21: Data-link layer protocol specification –  
Type 21 elements**

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

International Standard IEC 61158-4-21 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 2010. This edition constitutes a technical revision.

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

- added Frame control Value, DLM function and DLL constants;
- changed NCM\_RETRY\_RNMS to NCM\_CHECK\_NET\_INTEGRITY\_REQ;
- updated DLM state table;
- miscellaneous editorial corrections.

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

FDIS	Report on voting
65C/946/FDIS	65C/955/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 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.

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

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

A bilingual version of this publication may be issued at a later date.

## 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.

The data-link protocol provides the data-link service by making use of the services available from the physical layer. The primary aim of this document is to provide a set of rules for communication expressed in terms of the procedures to be carried out by peer data-link entities (DLEs) at the time of communication. These rules for communication are intended to provide a sound basis for development in order to serve a variety of purposes:

- a) as a guide for implementors and designers;
- b) for use in the testing and procurement of equipment;
- c) as part of an agreement for the admittance of systems into the open systems environment;
- d) as a refinement to the understanding of time-critical communications within OSI.

This document is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this document together with other standards positioned within the OSI or fieldbus reference models, otherwise incompatible systems may work together in any combination.

**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 profile parts. Use of the various protocol types in other combinations may require permission of their respective intellectual-property-right holders.

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KR 0789444	[LS]	A communication packet processing apparatus and method for ring topology Ethernet network capable of preventing permanent packet looping
KR 0732510	[LS]	Network system
KR 0870670	[LS]	Method for determining a Ring Manager Node

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## **INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –**

### **Part 4-21: Data-link layer protocol specification – Type 21 elements**

## **1 Scope**

### **1.1 General**

The DLL provides basic time-critical data communications between devices in an automated environment. Type 21 provides priority-based cyclic and acyclic data communication using an internal collision-free, full-duplex dual-port Ethernet switch technology. For wide application in various automation applications, Type 21 does not restrict the cyclic/acyclic scheduling policy in the DLL.

### **1.2 Specifications**

This document describes:

- a) procedures for the timely transfer of data and control information from one data link user entity to a peer user entity, and among the data link entities forming the distributed data link service provider;
- b) procedures for giving communication opportunities based on ISO/IEC/IEEE 8802-3 MAC, with provisions for nodes to be added or removed during normal operation;
- c) structure of the fieldbus data link protocol data units (DLPDUs) used for the transfer of data and control information by the protocol of this document, and their representation as physical interface data units.

### **1.3 Procedures**

The procedures are defined in terms of:

- a) the interactions between peer data link entities (DLEs) through the exchange of fieldbus DLPDUs;
- b) the interactions between a data link service (DLS) provider and a DLS-user in the same system through the exchange of DLS primitives;
- c) the interactions between a DLS-provider and a physical layer service provider in the same system through the exchange of Ph-service primitives.

### **1.4 Applicability**

These procedures are applicable to instances of communication between systems that support time-critical communications services in the data link layer of the OSI or fieldbus reference models, and that require the ability to interconnect in an open systems interconnection environment. Profiles provide a simple multi-attribute means of summarizing an implementation's capabilities, and thus its applicability to various time-deterministic communications needs.

### **1.5 Conformance**

This document also specifies conformance requirements for systems implementing these procedures. This document does not contain tests to demonstrate compliance with such requirements.



## 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.

IEC 61158-3-21:2019, *Industrial Communication Networks – Fieldbus specifications – Part 3-21: Data-link layer service definition – Type 21 elements*

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 8802-3:2017, *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*

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