



BSI Standards Publication

Industrial communication networks - Fieldbus specifications

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

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National foreword

This British Standard is the UK implementation of EN IEC 61158-4-21:2019. It is identical to IEC 61158-4-21:2019. It supersedes BS EN 61158-4-21:2012, which will be withdrawn on 15 May 2022.

The UK participation in its preparation was entrusted to Technical Committee GEL/65/3, 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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Date	Text affected
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Industrial communication networks - Fieldbus specifications -
Part 4-21: Data-link layer protocol specification - Type 21
elements
(IEC 61158-4-21:2019)

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

This European Standard was approved by CENELEC on 2019-05-15. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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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- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-05-15

This document supersedes EN 61158-4-21:2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61158-4-21:2019 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 61158-1:2019	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)

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(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.

<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	-	-

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CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
1.1 General.....	10
1.2 Specifications	10
1.3 Procedures	10
1.4 Applicability	10
1.5 Conformance	10
2 Normative references	11
3 Terms, definitions, symbols and abbreviations.....	11
3.1 Reference model terms and definitions	11
3.2 Service convention terms and definitions	13
3.3 Common terms and definitions.....	14
3.4 Additional Type 21 definitions	17
3.5 Common symbols and abbreviations	17
3.6 Additional Type 21 symbols and abbreviations.....	18
4 Overview of the data-link protocol.....	19
4.1 General.....	19
4.2 Overview of medium access control	19
4.3 Service assumed from the physical layer	19
4.4 DLL architecture	20
4.4.1 General	20
4.4.2 DLL management (DLM) interface support function	21
4.5 Data type	22
4.5.1 General	22
4.5.2 Boolean.....	22
4.5.3 Unsigned integer	22
4.5.4 Signed integer	23
4.5.5 Octet String	23
4.5.6 Visible String.....	23
4.5.7 Time of day	24
4.6 Local parameters and variables	24
4.6.1 General	24
4.6.2 DLE configuration parameters	24
4.6.3 Queues to support data transfer	25
4.6.4 Variables to support SAP management.....	26
4.6.5 Variables to support local device information management.....	27
4.6.6 Variables and counter to support network information management.....	31
4.6.7 Variables and counter to support a device path information management.....	35
4.6.8 Variables, counters, timers, and queues to support path table management.....	39
5 General structure and encoding.....	39
5.1 Overview	39
5.2 MAPDU structure and encoding	39
5.3 Common MAC frame structure, encoding and elements of procedure.....	40
5.3.1 MAC frame structure.....	40

This is a preview of "BS EN IEC 61158-4-21...". [Click here to purchase the full version from the ANSI store.](#)

5.3.2	Elements of the MAC frame	40
5.3.3	Elements of the Type 21 DLPDU	41
5.4	Order of bit transmission	49
5.5	Invalid DLPDU	49
6	DLPDU structure and procedure	49
6.1	General.....	49
6.2	Common DLPDU Field	49
6.2.1	General	49
6.2.2	Version	50
6.2.3	Length	50
6.3	DL-DATA Transfer	50
6.3.1	DT DLPDU.....	50
6.4	DL-SPDATA Transfer.....	53
6.4.1	SPDT DLPDU	53
6.5	Network control messages	54
6.5.1	General	54
6.5.2	NCM_LA DLPDU	54
6.5.3	NCM_AT DLPDU	56
6.5.4	NCM_LS DLPDU	57
6.5.5	NCM_RS DLPDU.....	58
6.5.6	NCM_AR_DLPDU.....	59
6.5.7	NCM_AR DLPDU structure	59
7	DLE elements of procedure	60
7.1	Overall structure	60
7.2	DL-protocol machine (DLPM).....	61
7.2.1	Overview	61
7.2.2	Primitive definitions	61
7.2.3	DLPM state table	64
7.2.4	DLPM functions	68
7.3	DLL management Protocol.....	69
7.3.1	Overview	69
7.3.2	Primitive definitions	69
7.3.3	DLM state table	72
7.3.4	DLM functions	96
8	Constants and error codes.....	105
8.1	General.....	105
8.2	Constants	106
8.3	Data-link layer error codes.....	107
	Bibliography.....	108
	Figure 1 – Interaction of PhS primitives with DLE.....	20
	Figure 2 – Data-link layer architecture	21
	Figure 3 – Relationships of DLSAPs, DLSAP-addresses, and group DL-addresses.....	26
	Figure 4 – Common MAC frame format for Type 21 DLPDU.....	40
	Figure 5 – MAC frame format for other protocols.....	40
	Figure 6 – Version and Length field	41
	Figure 7 – DST_addr field.....	42

This is a preview of "BS EN IEC 61158-4-21...". [Click here to purchase the full version from the ANSI store.](#)

Figure 8 – SRC_addr field.....	43
Figure 9 – Frame Control Field	43
Figure 10 – Extension field	46
Figure 11 – DSAP field	47
Figure 12 – Source service access point field	48
Figure 13 – Length of group mask and extension information.....	48
Figure 14 – Group mask option field	48
Figure 15 – Common DLPDU field	50
Figure 16 – Building a DT DLPDU.....	50
Figure 17 – DT DLPDU structure	50
Figure 18 – SPDT DLPDU structure	53
Figure 19 – NCM_LA DLPDU structure	55
Figure 20 – DLL structure and elements	60
Figure 21 – State transition diagram of the DLPM	64
Figure 22 – State transition diagram of DLM	73
Table 1 – DLL components	20
Table 2 – UNSIGNEDn data type	22
Table 3 – INTEGERn data type.....	23
Table 4 – DLE configuration parameters	25
Table 5 – Queues to support data transfer	25
Table 6 – Variables to support SAP management	26
Table 7 – Variables to support device information management.....	27
Table 8 – DL–entity identifier	28
Table 9 – Device Flags	28
Table 10 – DLM state.....	28
Table 11 – Device Unique Identification	29
Table 12 – Unique identification of device connected to R-port1	29
Table 13 – Unique identification of device connected to R-port2	29
Table 14 – MAC address.....	29
Table 15 – Port information.....	30
Table 16 – Protocol version	30
Table 17 – Device type	31
Table 18 – Device description.....	31
Table 19 – Hop count.....	31
Table 20 – Variables to support managing network information.....	32
Table 21 – Topology	32
Table 22 – Collision count.....	32
Table 23 – Device count	33
Table 24 – Topology change count	33
Table 25 – Last topology change time.....	33
Table 26 – RNMP device UID	33
Table 27 – RNMS device UID	34

This is a preview of "BS EN IEC 61158-4-21...". [Click here to purchase the full version from the ANSI store.](#)

Table 28 – LNM device UID for R-port1	34
Table 29 – LNM device UID for R-port2	34
Table 30 – Network flags	35
Table 31 – Variables and counter to support managing path information.....	36
Table 32 – Hop count for R-port1 direction.....	36
Table 33 – Hop count for R-port2 direction.....	37
Table 34 – Preferred R-port	37
Table 35 – Destination R-port	37
Table 36 – In net count	38
Table 37 – In net time	38
Table 38 – Out net count	39
Table 39 – Out net time	39
Table 40 – Version and Length	42
Table 41 – Destination DL–entity identifier.....	42
Table 42 – Source DL–entity identifier	43
Table 43 – Frame control.....	44
Table 44 – Extension	47
Table 45 – Destination service access point	47
Table 46 – source service access point.....	48
Table 47 – DT DLPDU parameters	51
Table 48 – Primitives exchanged between DLS-user and DLE to send a DT DLPDU.....	52
Table 49 – Primitives exchanged between DLS-user and DLEs to receive a DT DLPDU	53
Table 50 – SPDT DLPDU Parameters.....	53
Table 51 – Primitive exchanged between DLS-User and DLEs to send an SPDT DLPDU	54
Table 52 – Primitives exchanged between DLS-user and DLEs to receive an SPDT DLPDU	54
Table 53 – NCM_LA DLPDU parameters.....	55
Table 54 – NCM_AT DLPDU parameters	56
Table 55 – NCM_LS DLPDU parameters.....	57
Table 56 – NCM_RS DLPDU parameters	58
Table 57 – NCM_AR DLPDU parameters	59
Table 58 – Primitives exchanged between DLPM and DLS-user	61
Table 59 – Parameters exchanged between DLPM and DLS-user.....	62
Table 60 – Primitives exchanged between DLPM and DLM.....	63
Table 61 – Parameters used with primitives exchanged between DLPM and DLM.....	64
Table 62 – DLPM state table.....	65
Table 63 – DLPM functions table	68
Table 64 – Primitives exchanged between DLM and DLS-user.....	70
Table 65 – Parameters used with primitives exchanged between DLM and DLS-user.....	71
Table 66 – Primitive exchanged between DLM and DMAC	71
Table 67 – Parameters used with primitives exchanged between DLM and DMAC	72
Table 68 – Primitive exchanged between DLM and DPHY.....	72
Table 69 – Parameters used with primitives exchanged between DLM and DPHY.....	72

This is a preview of "BS EN IEC 61158-4-21...". [Click here to purchase the full version from the ANSI store.](#)

Table 70 – DLM state table	74
Table 71 – DLM function table	96
Table 72 – DLL constants	106
Table 73 – Type 21 DLL error codes	107

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –**

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

FOREWORD

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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.

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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.

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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.

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning Type 21 elements and possibly other types given in Subclause 4.1, 4.2 and 7.3 as follows:

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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 LS Tower 1026-6
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 Republic of Korea

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ISO (www.iso.org/patents) and IEC (http://www.iec.ch/tctools/patent_decl.htm) maintain on-line data bases of patents relevant to their standards. Users are encouraged to consult the data bases for the most up to date information concerning patents.

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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.