



SLOVENSKI STANDARD

SIST EN IEC 61158-4-28:2023

01-november-2023

Industrijska komunikacijska omrežja - Specifikacije za procesna vodila - 4-28. del: Specifikacija protokola na ravni podatkovnih povezav - Elementi tipa 28 (IEC 61158-4-28:2023)

Industrial communication networks - Fieldbus specifications - Part 4-28: Data-link layer protocol specification - Type 28 elements (IEC 61158-4-28:2023)

Industrielle Kommunikationsnetze - Feldbusse - Teil 4-28: Protokollspezifikation des Data Link Layer (Sicherheitsschicht) - Typ 28-Elemente (IEC 61158-4-28:2023)

Réseaux de communication industriels - Spécifications des bus de terrain - Partie 4-28: Spécification du protocole de la couche liaison de données - Éléments de type 28 (IEC 61158-4-28:2023)

[SIST EN IEC 61158-4-28:2023](https://standards.iteh.ai/SIST/61158-4-28-2023)

<https://standards.iteh.ai/SIST/61158-4-28-2023> Ta slovenski standard je istoveten z: [EN IEC 61158-4-28:2023](https://standards.iteh.ai/IEC/61158-4-28-2023) [/sist-en-iec-61158-4-28-2023](https://standards.iteh.ai/SIST/61158-4-28-2023)

ICS:

25.040.40	Merjenje in krmiljenje industrijskih postopkov	Industrial process measurement and control
35.100.20	Podatkovni povezovalni sloj	Data link layer
35.110	Omreževanje	Networking

SIST EN IEC 61158-4-28:2023

en,fr,de

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN IEC 61158-4-28

April 2023

ICS 25.040

English Version

**Industrial communication networks - Fieldbus specifications -
Part 4-28: Data-link layer protocol specification - Type 28
elements
(IEC 61158-4-28:2023)**

Réseaux de communication industriels - Spécifications des
bus de terrain - Partie 4-28: Spécification du protocole de la
couche liaison de données - Éléments de type 28
(IEC 61158-4-28:2023)

Industrielle Kommunikationsnetze - Feldbusse - Teil 4-28:
Protokollspezifikation des Data Link Layer
(Sicherheitsschicht) - Typ 28-Elemente
(IEC 61158-4-28:2023)

This European Standard was approved by CENELEC on 2023-04-11. 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.

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

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

[SIST EN IEC 61158-4-28:2023](https://standards.iteh.ai/catalog/standards/sist/31b31bb8-0887-4324-af4a-1132e1ec90bd/sist-en-iec-61158-4-28-2023)

<https://standards.iteh.ai/catalog/standards/sist/31b31bb8-0887-4324-af4a-1132e1ec90bd/sist-en-iec-61158-4-28-2023>



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN IEC 61158-4-28:2023 (E)**European foreword**

The text of document 65C/1206/FDIS, future edition 1 of IEC 61158-4-28, 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 61158-4-28:2023.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2024-01-11 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2026-04-11 document have to be withdrawn

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.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 61158-4-28:2023 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 standard indicated:

IEC 61158-1 NOTE Approved as EN IEC 61158-1

<https://standards.iteh.ai/document/iec/61158-4-28-2023>
IEC 61158-5-28 NOTE Approved as EN IEC 61158-5-28

IEC 61158-6-28 NOTE Approved as EN IEC 61158-6-28¹

IEC 61784-1 (series) NOTE Approved as EN IEC 61784-1 (series)²

IEC 61784-2 (series) NOTE Approved as EN IEC 61784-2 (series)³

¹ To be published. Stage at time of publication: prEN IEC 61158-6-28:2023.

² To be published. Stage at the time of publication: FprEN IEC 61784-1-X:2023.

³ To be published. Stage at the time of publication: FprEN IEC 61784-2-X:2023.

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.cencenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-2	2023	Industrial communication networks - Fieldbus specifications - Part 2: Physical layer specification and service definition	EN IEC 61158-2	2023
IEC 61158-3-28	2023	Industrial communication networks - Fieldbus specifications - Part 3-28: Data-link layer service definition - Type 28 elements	EN IEC 61158-3-28	2023
ISO/IEC 7498-1	1994	Information technology - Open Systems Interconnection - Basic reference model: The basic model	-	-
ISO/IEC 7498-3	1997	Information technology - Open Systems Interconnection - Basic reference model: Naming and addressing	-	-
ISO/IEC 8886	1996	Information technology - Open Systems Interconnection - Data link service definition	-	-
ISO/IEC 10731	1994	Information technology - Open Systems Interconnection - Basic Reference Model - Conventions for the definition of OSI services	-	-
ISO/IEC/IEEE 8802-3	2021	Telecommunications and exchange between information technology systems - Requirements for local and metropolitan area networks - Part 3: Standard for Ethernet	-	-



IEC 61158-4-28

Edition 1.0 2023-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Industrial communication networks – Fieldbus specifications –
Part 4-28: Data-link layer protocol specification – Type 28 elements**

**Réseaux de communication industriels – Spécifications des bus de terrain –
Partie 4-28: Spécification du protocole de la couche liaison de données –
Éléments de type 28**

[SIST EN IEC 61158-4-28:2023](https://standards.iteh.ai/catalog/standards/sist/31b31bb8-0887-4324-af4a-1132e1ec90bd/sist-en-iec-61158-4-28-2023)

<https://standards.iteh.ai/catalog/standards/sist/31b31bb8-0887-4324-af4a-1132e1ec90bd/sist-en-iec-61158-4-28-2023>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 25.040

ISBN 978-2-8322-6557-4

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
1.1 General.....	8
1.2 Specifications	8
1.3 Procedures	8
1.4 Applicability	8
1.5 Conformance	8
2 Normative references	9
3 Terms, definitions, symbols, abbreviated terms and conventions	9
3.1 Reference model terms and definitions	9
3.2 Service convention terms and definitions	11
3.3 Common terms and definitions.....	12
3.4 Additional Type 28 terms and definitions.....	13
3.5 Additional Type 28 symbols and abbreviations.....	15
4 Overview of the DL-protocol	16
4.1 DLL protocol architecture	16
4.2 DLL working mechanism	18
4.2.1 Node	18
4.2.2 Addressing	18
4.2.3 Multicast.....	19
4.2.4 Resource mapping and scheduling.....	19
5 DLPDU structure	21
5.1 Universal DLPDU structure.....	21
5.2 Basic configuration DLPDU.....	23
5.3 Address assignment DLPDU.....	25
5.4 Multicast assignment DLPDU.....	25
5.5 Resource allocation DLPDU.....	26
5.6 Access notification DLPDU	28
5.7 Resource application DLPDU.....	29
5.8 Resource release DLPDU	30
5.9 Status query DLPDU.....	30
5.10 Status response DLPDU	31
5.11 Announcement DLPDU	32
5.12 Clock synchronization DLPDU.....	33
5.13 Common DLPDU.....	34
6 Working procedure	35
6.1 Initialization procedure.....	35
6.1.1 Basic configuration	35
6.1.2 Resource mapping configuration.....	35
6.2 DLL node management procedure	37
6.2.1 DLL maintenance.....	37
6.2.2 Node join	38
6.2.3 Node query.....	39
6.2.4 Node leave	39
6.3 Data transmission procedure	40

6.4	Clock synchronization procedure	42
7	State machine	44
7.1	DLDE state machine	44
7.2	DLME state machine	47
7.3	DLCE state machine	48
8	Error handling.....	49
8.1	General.....	49
8.2	Possible sources and characteristics of errors	49
8.3	Error handling of MN / TN	50
8.4	PhL error source	50
8.4.1	General	50
8.4.2	Lost connection	50
8.4.3	CRC error	50
8.4.4	Buffer overflow	50
8.4.5	Symbol resource conflict.....	50
8.4.6	Symbol resource insufficient.....	50
Annex A (informative)	Example for NodeID and MAC address mapping	51
Annex B (informative)	Example for multicast group working mechanism.....	52
Bibliography	53
Figure 1	– Relationships of DLSAPs, DLSAP-addresses and group DL-addresses	12
Figure 2	– Bitmap data type diagram.....	15
Figure 3	– DLL in Type 28 protocol stack architecture.....	16
Figure 4	– Relationship of the fieldbus DLL to other fieldbus layers and to users of the fieldbus DLS	17
Figure 5	– Type 28 DLL protocol architecture diagram	17
Figure 6	– Resource mapping between DLL and PhL.....	20
Figure 7	– DLL resource mapping message queue scheduling diagram	21
Figure 8	– Universal DLPDU structure	22
Figure 9	– Basic configuration DLPDU structure	23
Figure 10	– General configuration block structure	24
Figure 11	– Address allocation DLPDU structure.....	25
Figure 12	– Multicast assignment DLPDU structure.....	26
Figure 13	– Resource allocation DLPDU structure	27
Figure 14	– Access notification DLPDU structure	28
Figure 15	– Resource application DLPDU structure.....	29
Figure 16	– Resource release DLPDU structure	30
Figure 17	– Status query DLPDU structure	31
Figure 18	– Status response DLPDU structure.....	31
Figure 19	– Announcement DLPDU structure	32
Figure 20	– Clock synchronization DLPDU structure	34
Figure 21	– Common DLPDU structure	35
Figure 22	– Resource mapping configuration diagram.....	36
Figure 23	– Initial access configuration procedure diagram	37
Figure 24	– The random access configuration procedure diagram.....	38

Figure 25 – Node leave procedure diagram.....	40
Figure 26 – DLS data sending procedure diagram.....	41
Figure 27 – DLS data receiving procedure diagram.....	42
Figure 28 – Clock synchronization delay measurement procedure diagram.....	43
Figure 29 – Clock register structure diagram.....	43
Figure 30 – Clock synchronization procedure.....	44
Figure 31 – DLDE state machine	45
Figure 32 – DLME state machine	47
Figure 33 – DLCE state machine	48
Figure B.1 – Multicast working mechanism diagram	52
Table 1 – NodeID address assignment of Type 28 DLL.....	18
Table 2 – NodeID and MAC address mapping table	18
Table 3 – Members of multicast group mapping table.....	19
Table 4 – DLDE state transition	46
Table 5 – DLME state machine state transition	48
Table 6 – DLCE state machine state transition.....	49
Table A.1 – Example of NodeID and MAC address mapping table saved on TN	51

iTech Standards
 (<https://standards.iteh.ai>)
 Document Preview

[SIST EN IEC 61158-4-28:2023](https://standards.iteh.ai/catalog/standards/sist/31b31bb8-0887-4324-af4a-1132e1ec90bd/sist-en-iec-61158-4-28-2023)

<https://standards.iteh.ai/catalog/standards/sist/31b31bb8-0887-4324-af4a-1132e1ec90bd/sist-en-iec-61158-4-28-2023>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 4-28: Data-link layer protocol specification –
Type 28 elements**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

Attention is drawn to the fact that the use of the associated protocol type is restricted by its 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 layer protocol type to be used with other layer protocols of the same type, or in other type combinations explicitly authorized by its intellectual-property-right holders.

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

IEC 61158-4-28 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

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

Draft	Report on voting
65C/1206/FDIS	65C/1235/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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.

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 implementers 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 standard positioned within the OSI or fieldbus reference models, otherwise incompatible systems could work together in any combination.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[SIST EN IEC 61158-4-28:2023](https://standards.iteh.ai/catalog/standards/sist/31b31bb8-0887-4324-af4a-1132e1ec90bd/sist-en-iec-61158-4-28-2023)

<https://standards.iteh.ai/catalog/standards/sist/31b31bb8-0887-4324-af4a-1132e1ec90bd/sist-en-iec-61158-4-28-2023>

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-28: Data-link layer protocol specification – Type 28 elements

1 Scope

1.1 General

The data-link layer provides several types of messaging communications between devices in an automation environment.

This part of IEC 61158 provides a means of connecting devices through a partial mesh network, such that most failures of an interconnection between two devices can be circumvented. In common practice, the devices are interconnected in a non-redundant hierarchical manner reflecting application needs.

1.2 Specifications

This document specifies

- 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) the structure of the fieldbus 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 DL-entities (DLEs) through the exchange of the fieldbus DLPDUs;
- b) the interactions between a DL-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 Ph-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 which support time-critical communications services within the data-link layer of the OSI or the fieldbus reference models, and which require the ability to interconnect in an open systems interconnection environment.

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.