

© Copyright SEK Svensk Elstandard. Reproduction in any form without permission is prohibited.

Industriell processtyrning – Fältbuss – Del 3-2: Definition av tjänster i datalänksskiktet – Delar i fältbuss, Typ 2

*Industrial communication networks –
Fieldbus specifications –
Part 3-2: Data-link layer service definition –
Type 2 elements*

Som svensk standard gäller europastandarden EN IEC 61158-3-2:2023. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 61158-3-2:2023.

Nationellt förord

Europastandarden EN IEC 61158-3-2:2023

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 61158-3-2, Third edition, 2023 - Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 61158-3-2, utg 2:2014 med eventuella tillägg, ändringar och rättelser gäller ej fr o m 2026-04-13.

ICS 25.040.40; 35.100.20; 35.110.00

Denna standard är fastställd av SEK Svensk Elstandard,
som också kan lämna upplysningar om **sakinnehållet** i standarden.
Postadress: Box 1284, 164 29 KISTA
Telefon: 08 - 444 14 00.
E-post: sek@elstandard.se. Internet: www.elstandard.se

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

English Version

Industrial communication networks - Fieldbus specifications -
Part 3-2: Data-link layer service definition - Type 2 elements
(IEC 61158-3-2:2023)

Réseaux de communication industriels - Spécifications des
bus de terrain - Partie 3-2: Définition des services de la
couche liaison de données - Eléments de type 2
(IEC 61158-3-2:2023)

Industrielle Kommunikationsnetze - Feldbusse - Teil 3-2:
Dienstfestlegungen des Data Link Layer
(Sicherheitsschicht) - Typ 2-Elemente
(IEC 61158-3-2:2023)

This European Standard was approved by CENELEC on 2023-04-13. 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.



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

European foreword

The text of document 65C/1201/FDIS, future edition 3 of IEC 61158-3-2, 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 61158-3-2:2023.

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) 2024-01-13
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2026-04-13

This document supersedes EN 61158-3-2:2014 and all of its amendments and corrigenda (if any).

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.

This document has been prepared under a Standardization Request given to CENELEC by the European Commission and the European Free Trade Association.

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 61158-3-2:2023 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 |
| IEC 61158-2 | NOTE Approved as EN 61158-2 |
| IEC 61158-5-2 | NOTE Approved as EN IEC 61158-5-2 |
| IEC 61158-6-2 | NOTE Approved as EN IEC 61158-6-2 |
| IEC 61784-1 (series) | NOTE Approved as EN IEC 61784-1 (series) ¹ |
| IEC 61784-2 (series) | NOTE Approved as EN IEC 61784-2 (series) ² |

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

² To be published. Stage at 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.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-4-2	2023	Industrial communication networks - Fieldbus specifications - Part 4-2: Data-link layer protocol specification - Type 2 elements	EN IEC 61158-4-2	2023
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 8886	-	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	-	-



IEC 61158-3-2

Edition 3.0 2023-03

INTERNATIONAL STANDARD

**Industrial communication networks – Fieldbus specifications –
Part 3-2: Data-link layer service definition – Type 2 elements**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 35.100.20; 35.110

ISBN 978-2-8322-6558-1

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
1.1 General.....	9
1.2 Specifications	9
1.3 Conformance	9
2 Normative references	10
3 Terms, definitions, symbols, abbreviated terms and conventions	10
3.1 Reference model terms and definitions	10
3.2 Service convention terms and definitions	12
3.3 Common data-link service terms and definitions	12
3.4 Additional Type 2 data-link specific definitions	14
3.5 Common symbols and abbreviations	16
3.6 Additional Type 2 symbols and abbreviations	17
3.7 Common conventions.....	17
4 Connection-mode and connectionless-mode data-link service	18
4.1 Overview.....	18
4.1.1 Data transfer services.....	18
4.1.2 DL-management services	22
4.1.3 Timing services	22
4.2 Facilities of the data-link service	22
4.3 Model of the data-link service	23
4.3.1 General	23
4.3.2 DLS-instance identification	23
4.3.3 Model of abstract queue concepts	23
4.3.4 QoS features	24
4.3.5 DLS-TxStatus	25
4.3.6 Receive queues	25
4.4 Sequence of primitives.....	25
4.4.1 Constraints on sequence of primitives	25
4.4.2 Relation of primitives at DLSAPs	26
4.4.3 Sequence of primitives at one DLSAP.....	27
4.5 Connection-mode data transfer	27
4.5.1 General	27
4.5.2 Function	27
4.5.3 Types of primitives and parameters	27
4.5.4 Sequence of primitives	29
4.6 Connectionless-mode data transfer.....	29
4.6.1 General	29
4.6.2 Function	29
4.6.3 Types of primitives and parameters	30
4.6.4 Sequence of primitives	32
4.7 Queue maintenance.....	32
4.7.1 Function	32
4.7.2 Types of primitives and parameters	32
4.7.3 Request primitive.....	33
4.7.4 Confirmation primitive.....	33

4.7.5	Sequence of primitives	33
4.8	Tag filter	34
4.8.1	Function	34
4.8.2	Types of primitives and parameters	34
4.8.3	Sequence of primitives	35
5	DL-management services	35
5.1	Sequence of primitives	35
5.2	Link synchronization	36
5.2.1	Function	36
5.2.2	Types of primitives and parameters	36
5.2.3	Sequence of primitives	37
5.3	Synchronized parameter change	37
5.3.1	Function	37
5.3.2	Types of primitives and parameters	37
5.3.3	Sequence of primitives	39
5.4	Event reports	40
5.4.1	Function	40
5.4.2	Types of primitives and parameters	40
5.4.3	Sequence of primitives	41
5.5	Bad FCS	41
5.5.1	Function	41
5.5.2	Types of primitives and parameters	41
5.5.3	Sequence of primitives	41
5.6	Current moderator	42
5.6.1	Function	42
5.6.2	Types of primitives and parameters	42
5.6.3	Sequence of primitives	42
5.7	Enable moderator	42
5.7.1	Function	42
5.7.2	Types of primitives and parameters	42
5.7.3	Sequence of primitives	43
5.8	Power-up and online	43
5.8.1	Function	43
5.8.2	Types of primitives and parameters	43
5.8.3	Sequence of primitives	44
5.9	Listen only	44
5.9.1	Function	44
5.9.2	Types of primitives and parameters	45
5.9.3	Sequence of primitives	45
5.10	Time distribution	45
5.10.1	Function	45
5.10.2	Types of primitives and parameters	45
	Bibliography	48
	Figure 1 – Relationships of DLSAPs, DLSAP-addresses and group DL-addresses	13
	Figure 2 – NUT structure	19
	Figure 3 – Medium access during scheduled time	20
	Figure 4 – Medium access during unscheduled time	21

Figure 5 – Queue model for the peer and multipoint DLS, DLSAPs and their DLCEPs	22
Figure 6 – Queue model of a multipoint DLS between a sending DLS-user and one or more receiving DLS-users	24
Figure 7 – DLS primitive time-sequence diagram	26
Figure 8 – State transition diagram for sequences of DLS primitives at one DLSAP	27
Figure 9 – Sequence of primitives for a successful connection-mode transfer	29
Figure 10 – Sequence of primitives for an unsuccessful connection-mode transfer	29
Figure 11 – Sequence of primitives for a successful connectionless-mode transfer	32
Figure 12 – Sequence of primitives for an unsuccessful connectionless-mode transfer	32
Figure 13 – Sequence of primitives for a queue maintenance request	34
Figure 14 – Sequence of primitives for a tag filter request	35
Figure 15 – Sequence of primitives for a local link synchronization	37
Figure 16 – Sequence of primitives for a DLM-get/set parameters request	39
Figure 17 – Sequence of primitives for a DLM-tMinus change request	39
Figure 18 – Sequence of primitives for a DLM-event indication	41
Figure 19 – Sequence of primitives for a DLM-bad-FCS indication	42
Figure 20 – Sequence of primitives for a DLM-current-moderator indication	42
Figure 21 – Sequence of primitives for a DLM-enable-moderator request	43
Figure 22 – Sequence of primitives for a DLM-power-up indication	44
Figure 23 – Sequence of primitives for a DLM-online request	44
Figure 24 – Sequence of primitives for a DLM-listen-only request	45
 Table 1 – Summary of connection-mode and connectionless-mode primitives and parameters	26
Table 2 – DL-connection-mode transfer primitives and parameters	28
Table 3 – DL-connectionless-mode transfer primitives and parameters	30
Table 4 – Fixed tag services available to the DLS-user	31
Table 5 – DL-queue maintenance primitives and parameters (single flush)	33
Table 6 – DL-queue maintenance primitives and parameters (flush by QoS)	33
Table 7 – DL-connectionless-mode tag filter primitives and parameters	34
Table 8 – Summary of DL-management primitives and parameters	36
Table 9 – Link synchronization primitives and parameters	37
Table 10 – Synchronized parameter change primitives and parameters (set configuration)	38
Table 11 – Synchronized parameter change primitives and parameters (get configuration)	38
Table 12 – Synchronized parameter change primitives and parameters (start countdown)	38
Table 13 – Synchronized parameter change primitives and parameters (tMinus)	38
Table 14 – DLMS-configuration-data	39
Table 15 – Event report primitives and parameters	40
Table 16 – DLMS events being reported	40
Table 17 – Bad FCS primitives and parameters	41
Table 18 – Current moderator primitives and parameters	42
Table 19 – Enable moderator primitives and parameters	43

Table 20 – Power-up primitives and parameters.....	43
Table 21 – Online primitives and parameters	44
Table 22 – Listen-only primitives and parameters	45
Table 23 – DLMS time and time quality parameters	46
Table 24 – Time distribution source quality	46

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 3-2: Data-link layer service definition –
Type 2 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 61158-3-2 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This third edition cancels and replaces the second edition published in 2014 and Amendment 1:2019. This edition constitutes a technical revision.

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

- a) update of normative and bibliographic references;
- b) use of more inclusive terminology ("master" replaced by "active" or "supervisor");
- c) miscellaneous editorial corrections.

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

Draft	Report on voting
65C/1201/FDIS	65C/1242/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 the parts of the IEC 61158 series, 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.

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 document is a conceptual architectural service, independent of administrative and implementation divisions.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 3-2: Data-link layer service definition – Type 2 elements

1 Scope

1.1 General

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 document defines in an abstract way the externally visible service provided by the Type 2 fieldbus data-link layer in terms of:

- the primitive actions and events of the service;
- the parameters associated with each primitive action and event, and the form which they take; and
- the interrelationship between these actions and events, and their valid sequences.

The purpose of this document is to define the services provided to:

- the Type 2 fieldbus application layer at the boundary between the application and data-link layers of the fieldbus reference model;
- systems management at the boundary between the data-link layer and systems management of the fieldbus reference model.

Type 2 DL-service provides both a connected and a connectionless subset of those services specified in ISO/IEC 8886.

1.2 Specifications

The principal objective of this document 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 document can 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:

- the sizes and octet ordering of various multi-octet service parameters;
- the correlation of paired request and confirm, or indication and response, primitives.

1.3 Conformance

This document does not specify individual implementations or products, nor does it 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 2 data-link layer services defined in this document.

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 the IEC 61784-1 series and the IEC 61784-2 series 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 61158-4-2:2023, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 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 8886, *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*