

INTERNATIONAL STANDARD



**Industrial communication networks – Fieldbus specifications –
Part 3-24: Data-link layer service definition – Type 24 elements**

[IEC 61158-3-24:2023](https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023)

<https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

[IEC 61158-3-24:2023](https://standards.iteh.ai/catalog/standards/sist/a57a1215-734e-4a2b-9187-7a1511373814/iec-61158-3-24-2023)

<https://standards.iteh.ai/catalog/standards/sist/a57a1215-734e-4a2b-9187-7a1511373814/iec-61158-3-24-2023>



IEC 61158-3-24

Edition 2.0 2023-03

INTERNATIONAL STANDARD



**Industrial communication networks – Fieldbus specifications –
Part 3-24: Data-link layer service definition – Type 24 elements**

[IEC 61158-3-24:2023](https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023)

<https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 35.100.20; 35.110

ISBN 978-2-8322-6563-5

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

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
1.1 General.....	8
1.2 Specifications	8
1.3 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	10
3.3 Additional Type 24 data-link specific definitions	10
3.4 Common symbols and abbreviations	13
3.5 Additional type 24 symbols and abbreviations	14
3.6 Common conventions.....	14
3.7 Additional Type 24 conventions.....	15
4 Data-link service and concepts	15
4.1 Overview.....	15
4.2 DLS-user services.....	16
4.2.1 General	16
4.2.2 Write data	16
4.2.3 Read data.....	16
4.2.4 Send data with acknowledge service (SDA).....	16
4.2.5 Send data with no-acknowledge service (SDN).....	17
4.2.6 Event.....	17
4.2.7 Get status.....	17
4.3 Overview of interactions.....	17
4.4 Detailed specification of services and interactions	19
4.4.1 Write data.....	19
4.4.2 Read data.....	20
4.4.3 Send data with acknowledge	21
4.4.4 Send data with no-acknowledge (SDN).....	22
4.4.5 Cyclic Event	23
5 DL-management service	23
5.1 Overview.....	23
5.1.1 General	23
5.1.2 Reset.....	23
5.1.3 Set value	24
5.1.4 Get value.....	24
5.1.5 Evaluate delay.....	24
5.1.6 Set communication mode.....	24
5.1.7 Start communication	24
5.1.8 Clear error status.....	24
5.1.9 DLM Event.....	24
5.2 Overview of interactions.....	24
5.3 Detailed specification of services and interactions	26
5.3.1 Reset.....	26

5.3.2	Set value	27
5.3.3	Get value	32
5.3.4	Evaluate delay	34
5.3.5	Set communication mode	35
5.3.6	Start communication	37
5.3.7	Clear error	38
5.3.8	DLM error event	39
	Bibliography	40
Figure 1	– Sequence of primitive for set data and read data service	18
Figure 2	– Sequence of primitive for send data with acknowledge service	18
Figure 3	– Sequence of primitive for send data with no-acknowledge service	19
Figure 4	– Sequence of primitives for event service	19
Figure 5	– Sequence of primitives for Reset service	25
Figure 6	– Sequence of primitives for Set/get value service	25
Figure 7	– Sequence of primitives for Evaluate delay service	26
Figure 8	– Sequence of primitives for Start communication service	26
Figure 9	– Sequence of primitives for Event and Clear error status service	26
Table 1	– The list of DLS service primitives and parameters	17
Table 2	– Write data primitives and parameters	19
Table 3	– Values of result for write data service	20
Table 4	– Read data primitives and parameters	20
Table 5	– Values of result for read data service	20
Table 6	– SDA primitives and parameters	21
Table 7	– Values of result for SDA service	21
Table 8	– SDN primitives and parameters	22
Table 9	– Values of result for SDN service	22
Table 10	– Event primitives and parameters	23
Table 11	– Values of Event_ID for event service	23
Table 12	– The list of DLMS service primitives and parameters	24
Table 13	– Set value primitive and parameters	27
Table 14	– The list of parameter Var_ID of Set value request	27
Table 15	– Data type and range of variables	28
Table 16	– List of the values of variable Cyc_sel	29
Table 17	– List of the values of variable T_{unit}	30
Table 18	– Structure example of each element of variable IO_Map	30
Table 19	– Data type and range of each element	31
Table 20	– List of the values of variable Line code	31
Table 21	– List of the values of variable Baud rate	31
Table 22	– List of the values of variable Line code and Baud rate	31
Table 23	– Values of result for Set value service	32
Table 24	– Get value primitive and parameters	32
Table 25	– The list of parameter Var_ID of Get value request	33

Table 26 – Data type and range of variables	33
Table 27 – Error factor assign.....	34
Table 28 – Values of result for Get value service	34
Table 29 – Evaluate delay primitive and parameters	35
Table 30 – Values of result for Set value service	35
Table 31 – Set communication mode primitives and parameters	36
Table 32 – Range of T_{M_unit}	37
Table 33 – Values of result for set communication mode service.....	37
Table 34 – Start communication service primitives and parameter	37
Table 35 – Values of result for start communication service	38
Table 36 – Clear error primitive and parameters	38
Table 37 – Values of result for clear error service	38
Table 38 – DLM error event primitive and parameters	39
Table 39 – Value and definition of Err_Event_ID	39

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC 61158-3-24:2023](https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023)

<https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 3-24: Data-link layer service definition –
Type 24 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 61158-3-24 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 second edition cancels and replaces the first edition published in 2014. This edition constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

- addition of a new cyclic transmission mode which called "no time slot type" in Clause 4;
- addition of some parameters for Table 14 and Table 15 in Clause 5.3.2.2;
- in Subclause 5.3.5.2, addition of some parameters for Table 31 and addition of a new Table 32.

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 2023

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

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.

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC 61158-3-24:2023](https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023)

<https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023>

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 3-24: Data-link layer service definition – Type 24 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 24 fieldbus data-link layer in terms of

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

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

- the Type 24 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.

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, and
- 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 24 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.

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 10731:2005, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

ISO/IEC 19501:2005, *Information technology – Open Distributed Processing – Unified Modeling Language (UML) Version 1.4.2*

3 Terms, definitions, symbols, abbreviated terms and conventions

For the purposes of this document, the following terms, definitions, symbols, abbreviated terms and conventions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1 Reference model terms and definitions

This document 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.

3.1.1	acknowledgement	[ISO/IEC 7498-1]
3.1.2	correspondent (N)-entities correspondent DL-entities (N=2) correspondent Ph-entities (N=1)	[ISO/IEC 7498-1]
3.1.3	DL-address	[ISO/IEC 7498-3]
3.1.4	DL-protocol	[ISO/IEC 7498-1]
3.1.5	DL-protocol-data-unit	[ISO/IEC 7498-1]
3.1.6	DL-service-data-unit	[ISO/IEC 7498-1]
3.1.7	DLS-user	[ISO/IEC 7498-1]
3.1.8	DLS-user-data	[ISO/IEC 7498-1]

3.1.9	event	[ISO/IEC 19501]
3.1.10	layer-management	[ISO/IEC 7498-1]
3.1.11	primitive name	[ISO/IEC 7498-1]
3.1.12	reset	[ISO/IEC 7498-1]
3.1.13	segmenting	[ISO/IEC 7498-1]
3.1.14	state	[ISO/IEC 19501]
3.1.15	state machine	[ISO/IEC 19501]
3.1.16	systems-management	[ISO/IEC 7498-1]
3.1.17	transition	[ISO/IEC 19501]
3.1.18	(N)-entity DL-entity (N=2) Ph-entity (N=1)	[ISO/IEC 7498-1]
3.1.19	(N)-layer DL-layer (N=2) Ph-layer (N=1)	[ISO/IEC 7498-1]
3.1.20	(N)-service DL-service (N=2) Ph-service (N=1)	[ISO/IEC 7498-1]
3.1.21	(N)-service-access-point DL-service-access-point (N=2) Ph-service-access-point (N=1)	[ISO/IEC 7498-1]

3.2 Service convention terms and definitions

This document also makes use of the following terms defined in ISO/IEC 10731 as they apply to the data-link layer:

- 3.2.1 confirm (primitive)**
- 3.2.2 DL-service-primitive;
primitive**
- 3.2.3 DL-service-provider**
- 3.2.4 DL-service-user**
- 3.2.5 indication (primitive)**
- 3.2.6 request (primitive)**
- 3.2.7 requestor**
- 3.2.8 response (primitive)**

3.3 Additional Type 24 data-link specific definitions

For the purposes of this document, the following terms and definitions apply.

3.3.1**acknowledge**

acknowledgement

3.3.2**acyclic transmission**

non-periodic exchange of telegrams

3.3.3**C1 master**

one of the network device type that initiates and control cyclic transmission

3.3.4**C1 message**

message communication that C1 master operates as initiator to exchange messages with slave or C2 master

3.3.5**C2 master**

one of the network device types that has the function of monitoring all process data transmitted through the network and initiate message communication

3.3.6**C2 message**

message communication that C2 master operates as initiator to exchange messages with slave or C1 master

3.3.7**cyclic transmission**

periodic exchange of telegrams

[IEC 61158-3-24:2023](https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023)

[https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-](https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023)

[61158-3-24-2023](https://standards.iteh.ai/catalog/standards/sist/a37a1215-734e-4a2b-9f87-7af311373814/iec-61158-3-24-2023)

3.3.8**data**

generic term used to refer to any information carried over a fieldbus

3.3.9**device**

physical entity connected to the fieldbus composed of at least one communication element (the network element) and which has a control element and/or a final element (transducer, actuator, etc.)

3.3.10**event driven mode**

transmission mode for the application layer protocol of the communication type 24 in which a transaction of command-response-exchanging arises as user's demands

3.3.11**frame**

synonym for DLPDU

3.3.12**initiator**

network device that initiates the exchange of process data or message

3.3.13**interface**

shared boundary between two functional units, defined by functional characteristics, signal characteristics, or other characteristics as appropriate