



IEC 61158-3-2

Edition 1.0 2007-12

INTERNATIONAL STANDARD

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

X

ICS 35.100.20; 25.040.40

ISBN 2-8318-9411-5

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
1.1 Overview.....	7
1.2 Specifications.....	7
1.3 Conformance.....	7
2 Normative references.....	8
3 Terms, definitions, symbols, abbreviations and conventions.....	8
3.1 Reference model terms and definitions.....	9
3.2 Service convention terms and definitions.....	10
3.3 Common data-link service terms and definitions.....	11
3.4 Additional Type 2 data-link specific definitions.....	12
3.5 Common symbols and abbreviations.....	15
3.6 Additional Type 2 symbols and abbreviations.....	15
3.7 Common conventions.....	15
4 Connection-mode and connectionless-mode data-link service.....	16
4.1 Overview.....	16
4.2 Facilities of the data-link service.....	20
4.3 Model of the data-link service.....	21
4.4 Sequence of primitives.....	23
4.5 Connection-mode data transfer.....	25
4.6 Connectionless-mode data transfer.....	27
4.7 Queue maintenance.....	30
4.8 Tag filter.....	32
5 DL-management Services.....	33
5.1 Sequence of primitives.....	33
5.2 Link synchronization.....	34
5.3 Synchronized parameter change.....	34
5.4 Event reports.....	36
5.5 Bad FCS.....	38
5.6 Current mode transfer.....	38
5.7 Enable mode transfer.....	39
5.8 Power up and online.....	40
5.9 Listen only.....	41
5.10 Time distribution.....	42
Bibliography.....	44
INDEX.....	45
Figure 1 – Relationships of DLSAPs, DLSAP-addresses and group DL-addresses.....	11
Figure 2 – NUT structure.....	17
Figure 3 – Medium access during scheduled time.....	18
Figure 4 – Medium access during unscheduled time.....	19
Figure 5 – Queue model for the peer and multipoint DLS, DLSAPs and their DLCEPs.....	20
Figure 6 – Queue model of a multipoint DLS between a sending DLS-user and one or more receiving DLS-users.....	22
Figure 7 – DLS primitive time-sequence diagram.....	24

Figure 8 – State transition diagram for sequences of DLS primitives at one DLSAP.....	25
Figure 9 – Sequence of primitives for a successful connection-mode transfer	27
Figure 10 – Sequence of primitives for an unsuccessful connection-mode transfer.....	27
Figure 11 – Sequence of primitives for a successful connectionless-mode transfer	30
Figure 12 – Sequence of primitives for an unsuccessful connectionless-mode transfer.....	30
Figure 13 – Sequence of primitives for a queue maintenance request.....	32
Figure 14 – Sequence of primitives for a tag filter request.....	33
Figure 15 – Sequence of primitives for a local link synchronization	34
Figure 16 – Sequence of primitives for a DLM-get/set parameters request	36
Figure 17 – Sequence of primitives for a DLM-tMinus change request.....	36
Figure 18 – Sequence of primitives for a DLM-event indication	38
Figure 19 – Sequence of primitives for a DLM-bad-FCS indication	38
Figure 20 – Sequence of primitives for a DLM-current-moderator indication	39
Figure 21 – Sequence of primitives for a DLM-enable-moderator request.....	40
Figure 22 – Sequence of primitives for a DLM-power-up indication.....	41
Figure 23 – Sequence of primitives for a DLM-online request.....	41
Figure 24 – Sequence of primitives for a DLM-listen-only request	42
Table 1 – Summary of connection-mode and connectionless-mode primitives and parameters	24
Table 2 – DL-connection-mode transfer primitives and parameters	26
Table 3 – DL-connectionless-mode transfer primitives and parameters	28
Table 4 – Fixed tag services available to the DLS-user	29
Table 5 – DL-queue maintenance primitive and parameters	31
Table 6 – DL-connectionless-mode tag filter primitives and parameters	32
Table 7 – Summary of DL-management primitives and parameters	33
Table 8 – Link synchronization primitives and parameters.....	34
Table 9 – Synchronized parameter change primitives and parameters	35
Table 10 – DLMS-configuration data	36
Table 11 – Event report primitives and parameters	37
Table 12 – DLMS events being reported	37
Table 13 – Bad FCS primitives and parameters	38
Table 14 – Current moderator primitives and parameters.....	39
Table 15 – Enable moderator primitives and parameters.....	39
Table 16 – Power-up and online primitives and parameters.....	40
Table 17 – Listen-only primitives and parameters	41
Table 18 – DLMS time and time quality parameters	42
Table 19 – Time distribution source quality.....	43

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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.

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 IEC 61784 series. Use of the various protocol types in other combinations may require permission of their respective intellectual-property-right holders.

International Standard IEC 61158-3-2 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This first edition and its companion parts of the IEC 61158-3 subseries cancel and replace IEC 61158-3:2003. This edition of this part constitutes a minor revision. This part and its companion Type 2 parts also cancel and replace IEC/PAS 62410, published in 2005.

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

- a) deletion of the former Type 6 fieldbus, and the placeholder for a Type 5 fieldbus data-link layer, for lack of market relevance;
- b) addition of new types of fieldbuses;

c) division of this part into multiple parts numbered 3-1, 3-2, ..., 3-19.

The text of this standard is based on the following documents:

FDIS	Report on voting
65C/473/FDIS	65C/484/RVD

Full information on the voting for the approval of this 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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

NOTE The revision of this standard will be synchronized with the other parts of the IEC 61158 series.

The 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.

INTRODUCTION

This standard 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/TR 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 standard is a conceptual architectural service, independent of administrative and implementation divisions.

Currently in preview, click buy full version

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

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

1 Scope

1.1 Overview

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

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

The purpose of this standard 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 standard 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 specification may 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:

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

1.3 Conformance

This standard 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 1 data-link layer services defined in this standard.

2 Normative references

The following referenced documents are indispensable for the application 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.

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*