

This is a preview - click here to buy the full publication



IEC 61158-3-21

Edition 1.0 2010-08

INTERNATIONAL STANDARD

**Industrial communication networks – Fieldbus specifications –
Part 3 21: Data-link layer service definition – Type 21 elements**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE



ICS 25.04.40; 35.100.20; 35.110

ISBN 978-2-88912-079-6

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.....	8
3.2 Service convention terms and definitions.....	10
3.3 Data link service terms and definitions.....	10
3.4 Symbols and abbreviations.....	13
3.5 Conventions.....	14
4 Data-link layer services and concepts.....	15
4.1 General.....	15
4.2 Detailed description of the data service.....	19
4.3 Detailed description of the sporadic data service.....	21
4.4 Detailed description of network control message service.....	23
5 Data link management services.....	26
5.1 General.....	26
5.2 Data link management service (DLMS) facilities.....	26
5.3 Data link management service (DLMS).....	26
5.4 Overview of interactions.....	27
5.5 Detailed specification of service and interactions.....	29
6 MAC control service.....	37
6.1 General.....	37
6.2 MAC control service.....	37
6.3 Overview of interactions.....	37
6.4 Detailed specification of service and interactions.....	38
7 Ph-control service.....	40
7.1 General.....	40
7.2 Ph-control service.....	40
7.3 Overview of interactions.....	40
7.4 Detailed specification of service and interactions.....	41
Bibliography.....	44
Figure 1 – Full-duplex flow control.....	16
Figure 2 – Sequence diagram of DL-DATA service.....	16
Figure 3 – Sequence diagram of DL-SPDATA service.....	17
Figure 4 – Sequence diagram of NCM service primitive.....	17
Figure 5 – Relationships of DLSAPs, DLSAP-addresses, and group DL-addresses.....	18
Figure 6 – DL-DATA service.....	19
Figure 7 – Sequence diagram of Reset, Set-value, Get-value, SAP-allocation, SAP-deallocation, Get-SAP information and Get-diagnostic information service primitives.....	28
Figure 8 – Sequence diagram of Event service primitive.....	29

Figure 9 – Sequence diagram of MAC-reset and MAC-forward-control service primitive.....	38
Figure 10 – Sequence diagram of Ph-reset and Ph-get-link-status service primitive.....	41
Figure 11 – Sequence diagram of Ph-link-status-change service primitive	41
Table 1 – Destination DL-address	18
Table 2 – Primitives and parameters used in DL-DATA service	20
Table 3 – DL-DATA Primitives and Parameters	20
Table 4 – Primitives and parameters used in DL-SPDATA service	22
Table 5 – DL-SPDATA Primitives and Parameters	22
Table 6 – Primitives and parameters used on DL-NCM_SND service	23
Table 7 – DL-NCM_SND Primitives and Parameters	24
Table 8 – Summary of Network Control Message Type	25
Table 9 – Summary of DL-management primitives and parameters	28
Table 10 – DLM-RESET primitives and parameters.....	29
Table 11 – DLM-SET_VALUE primitives and parameters	30
Table 12 – DLM-GET_VALUE primitives and parameters.....	31
Table 13 – DLM-SAP_ALLOC primitives and parameters	32
Table 14 – DLM-SAP_DEALLOC primitives and parameters	33
Table 15 – DLM-GET_SAP_INFO primitives and parameters	33
Table 16 – DLM-GET_DIAG primitives and parameters.....	34
Table 17 – DLM-EVENT primitives and parameters.....	35
Table 18 – DLM event identifier	36
Table 19 – DLM-GET_PATH primitives and parameters	36
Table 20 – Summary of MAC control primitives and parameters.....	38
Table 21 – MAC-RESET primitives and parameters	38
Table 22 – MAC-FW_CTRL primitives and parameters	39
Table 23 – Summary of Ph-control primitives and parameters.....	40
Table 24 – Ph-RESET primitives and parameters.....	41
Table 25 – Ph-GET_LINK_STATUS primitives and parameters	42
Table 26 – Ph-LINK_STATUS_CHANGE primitives and parameters	43

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 3-21: Data-link layer service definition – Type 21 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.

NOTE 1 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 profile parts. Use of the various protocol types in other combinations may require permission of their respective intellectual-property-right holders.

International Standard IEC 61158-3-21:2010 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This standard cancels and replaces IEC/PAS 62573 published in 2008. This first edition constitutes a technical revision.

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

FDIS	Report on voting
65C/604/FDIS	65C/618/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.

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.

NOTE 2 The revision of this standard will be synchronized with the other parts of the IEC 61158 series.

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/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.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 3-21: Data-link layer service definition – Type 21 elements

1 Scope

1.1 Overview

This part of IEC 61158 provides the common elements for basic time-critical messaging communications between devices in an automation environment. The term “time-critical” in this context means the prioritized full-duplex collision-free time-deterministic communication, of which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the required time risks the 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 21 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 that they take; and
- c) the interrelationships between these actions and events, and their valid sequences.

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

- The Type 21 application layer at the boundary between the application and DLLs of the fieldbus reference model;
- Systems management at the boundary between the DLL and the systems management of the fieldbus reference model.

1.2 Specifications

The principal objective of this standard is to specify the characteristics of conceptual DLL services suitable for time-critical communications, and to 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 standard may be used as the basis for formal data link programming interfaces. Nevertheless, it is not a formal programming interface, and any such interface will need to address implementation issues not covered by this standard, including:

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

1.3 Conformance

This standard does not specify individual implementations or products, nor do they 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 fulfils the Type 21 DLL 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.

IEC 61158-2:2010¹, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-4-21:2010¹, *Industrial communication networks – Fieldbus specifications – Part 4-21: Data-link layer protocol specification – Type 21 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 8802-3:2000, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

ISO/IEC 10731:1994, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

¹ To be published.