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Part 4-3: Data-link layer protocol specification – Type 3 elements

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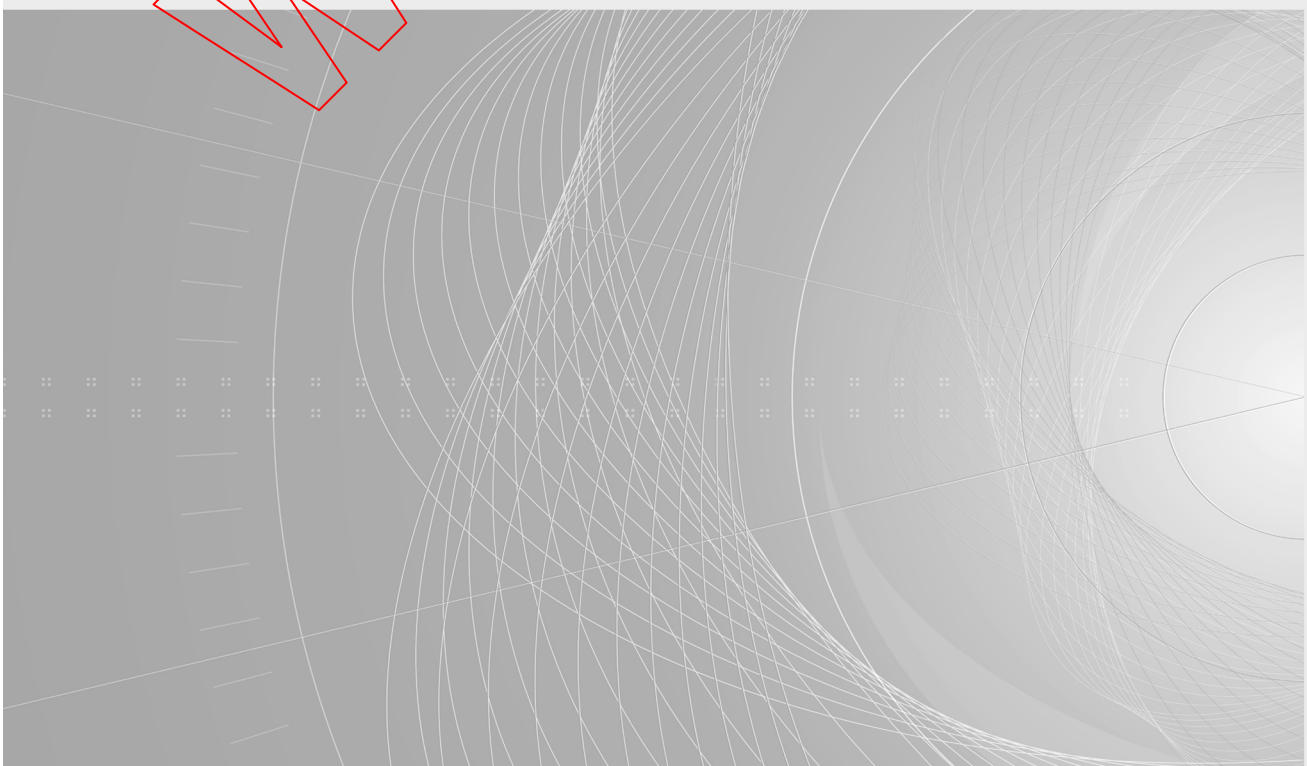

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Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-3: Data-link layer protocol specification – Type 3 elements

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International Standard IEC 61158-4-3 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

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

- Corrections in Table A.15 and Table A.16;
- Expired patent removed and added new patents.

This bilingual version (2012-07) corresponds to the monolingual English version, published in 2010-08.

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

FDIS	Report on voting
65C/605/FDIS	65C/619/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.

The French version has not been voted upon.

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- withdrawn;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

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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.

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 standard 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 implementors 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 standard is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this standard together with other standards positioned within the OSI or fieldbus reference models, otherwise incompatible systems may work together in any combination.

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

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning Type 3 elements and possibly other types given in the normative elements of this standard.

The following patent rights for Type 3 have been announced by [SI]:

Publication	Title
EP0604668-A1 (06.07.1994); EP0604668-B1 (18.02.1998)	Logical ring with monitoring of rotation time
EP0604669-A1 (06.07.1994); EP0604669-B1 (01.04.1998)	Bus system with monitoring of the activity state of participants

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-3: Data-link layer protocol specification – Type 3 elements

1 Scope

1.1 General

The data-link layer provides basic time-critical messaging communications between devices in an automation environment.

This protocol provides communication opportunities to a pre-selected "master" subset of data-link entities in a cyclic asynchronous manner, sequentially to each of those data-link entities. Other data-link entities communicate only as permitted and delegated by those master data-link entities.

For a given master, its communications with other data-link entities can be cyclic, or acyclic with prioritized access, or a combination of the two.

This protocol provides a means of sharing the available communication resources in a fair manner. There are provisions for time synchronization and for isochronous operation.

1.2 Specifications

This standard 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 standard, 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 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 fieldbus reference models, and which require the ability to interconnect in an open systems interconnection environment.

Profiles provide a simple multi-attribute means of summarizing an implementation's capabilities, and thus its applicability to various time-critical communications needs.

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1.5 Conformance

This standard also specifies conformance requirements for systems implementing these procedures. This standard does not contain tests to demonstrate compliance with such requirements.

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 61158-2:2010[1], *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 2: Physical layer specification and service definition*

IEC 61158-3-3:2007, *Industrial communication networks – Fieldbus specifications – Part 3-3: Data link service definition – Type 3 elements*

ISO/IEC 2022, *Information technology – Character code structure and extension techniques*

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

ISO 1177, *Information processing – Character structure for start/stop and synchronous character oriented transmission*

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3 Terms, definitions, symbols and abbreviations

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

3.1 Reference model terms and definitions

This standard 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 called-DL-address [ISO/IEC 7498-3]

3.1.2 calling-DL-address [ISO/IEC 7498-3]

3.1.3 centralized multi-end-point-connection [ISO/IEC 7498-3]

3.1.4 correspondent (N)-entities [ISO/IEC 7498-3]
correspondent DL-entities (N=2)
correspondent Ph-entities (N=1)

3.1.5 demultiplexing [ISO/IEC 7498-3]

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[1] To be published.

3.1.6 DL-address [ISO/IEC 7498-3]

3.1.7 DL-address-mapping [ISO/IEC 7498-3]

3.1.8 DL-connection [ISO/IEC 7498-3]

3.1.9 DL-connection-end-point [ISO/IEC 7498-3]

3.1.10 DL-connection-end-point-identifier [ISO/IEC 7498-3]

3.1.11 DL-connection-mode transmission [ISO/IEC 7498-3]

3.1.12 DL-connectionless-mode transmission [ISO/IEC 7498-3]

3.1.13 DL-data-sink [ISO/IEC 7498-3]

3.1.14 DL-data-source [ISO/IEC 7498-3]

3.1.15 DL-duplex-transmission [ISO/IEC 7498-3]

3.1.16 DL-facility [ISO/IEC 7498-3]

3.1.17 DL-local-view [ISO/IEC 7498-3]

3.1.18 DL-name [ISO/IEC 7498-3]

3.1.19 DL-protocol [ISO/IEC 7498-3]

3.1.20 DL-protocol-connection-identifier [ISO/IEC 7498-3]

3.1.21 DL-protocol-control-information [ISO/IEC 7498-3]

3.1.22 DL-protocol-data-unit [ISO/IEC 7498-3]

3.1.23 DL-protocol-version-identifier [ISO/IEC 7498-3]

3.1.24 DL-relay [ISO/IEC 7498-3]

3.1.25 DL-service-connection-identifier [ISO/IEC 7498-3]

3.1.26 DL-service-data-unit [ISO/IEC 7498-3]

3.1.27 DL-simplex-transmission [ISO/IEC 7498-3]

3.1.28 DL-subsystem [ISO/IEC 7498-3]

3.1.29 DL-user-data [ISO/IEC 7498-3]

3.1.30 flow control [ISO/IEC 7498-3]

3.1.31 layer-management [ISO/IEC 7498-3]

3.1.32 multiplexing [ISO/IEC 7498-3]

3.1.33 naming-(addressing)-authority [ISO/IEC 7498-3]

3.1.34 naming-(addressing)-domain [ISO/IEC 7498-3]

3.1.35 naming-(addressing)-subdomain [ISO/IEC 7498-3]

3.1.36 (N)-entity [ISO/IEC 7498-3]
DL-entity
Ph-entity

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