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Industrial communication networks – Fieldbus specifications – Part 4-3: Data-link layer protocol specification – Type 3 elements

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FOREWORD

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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 IEC 61784-1 and IEC 61784-2.

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 fourth edition cancels and replaces the third edition published in 2014. This edition constitutes a technical revision.

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

- corrections in Table 3;
- corrections in Table A.15;
- spelling and grammar.

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

FDIS	Report on voting
65C/946/FDIS	65C/955/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the 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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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.

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 document 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 document is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this document 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.

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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 document 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 document, 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.

1.5 Conformance

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

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 IEC 61784-1 and IEC 61784-2 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 61131-3, *Programmable controllers – Part 3: Programming languages*

IEC 61158-2:2014, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-3-3:2014, *Industrial communication networks – Fieldbus specifications – Part 3-3: Data link service definition – Type 3 elements*

ISO/IEC 646, *Information technology – ISO 7-bit coded character set for information interchange*

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*

3 Terms, definitions, symbols and abbreviations

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

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

- IEC Electropedia: available at <http://www.electropedia.org
- ISO Online browsing platform: available at <http://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	**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** **correspondent DL-entities (N=2)** **correspondent Ph-entities (N=1)**	[ISO/IEC 7498-3]
3.1.5	**demultiplexing**	[ISO/IEC 7498-3]
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

3.1.37 (N)-interface-data-unit [ISO/IEC 7498-3]
DL-service-data-unit (N=2)
Ph-interface-data-unit (N=1)

3.1.38 (N)-layer [ISO/IEC 7498-3]
DL-layer (N=2)
Ph-layer (N=1)

3.1.39 (N)-service [ISO/IEC 7498-3]
DL-service (N=2)
Ph-service (N=1)

3.1.40 (N)-service-access-point [ISO/IEC 7498-3]
DL-service-access-point (N=2)
Ph-service-access-point (N=1)

3.1.41 (N)-service-access-point-address [ISO/IEC 7498-3]
DL-service-access-point-address (N=2)
Ph-service-access-point-address (N=1)

3.1.42 peer-entities [ISO/IEC 7498-3]

3.1.43 Ph-interface-control-information [ISO/IEC 7498-3]

3.1.44 Ph-interface-data [ISO/IEC 7498-3]

3.1.45 primitive name [ISO/IEC 7498-3]

3.1.46 reassembling [ISO/IEC 7498-3]

3.1.47 recombining [ISO/IEC 7498-3]

3.1.48 reset [ISO/IEC 7498-3]

3.1.49 responding-DL-address [ISO/IEC 7498-3]

3.1.50 routing [ISO/IEC 7498-3]

3.1.51 segmenting [ISO/IEC 7498-3]

3.1.52 sequencing [ISO/IEC 7498-3]

3.1.53 splitting [ISO/IEC 7498-3]

3.1.54 synonymous name [ISO/IEC 7498-3]

3.1.55 systems-management [ISO/IEC 7498-3]

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: