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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial communication networks – Fieldbus specifications – Part 4-24: Data-link layer protocol specification – Type 24 elements

Réseaux de communication industriels – Spécifications des bus de terrain – Partie 4-24: Spécification du protocole de la couche liaison de données – Éléments de type 24

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Part 4-24: Data-link layer protocol specification – Type 24 elements

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

- addition of a new cyclic transmission mode which called "no time slot type" in Subclause 4.3.2.4;
- addition of a new frame format for no time slot type in Subclause 5.4;
- addition of a new DLE element procedure for no time slot type in Subclause 6.2.3.2.4, 6.3.3.2.2.4, 6.3.3.3.2.4;
- addition of a new DLM protcol machine for no time slot type in Subclause 7.5, 7.6; and
- spelling and grammar.

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

Draft	Report on voting
65C/1202/FDIS	65C/1243/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

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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 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:

- as a guide for implementers and designers;
- for use in the testing and procurement of equipment;
- as part of an agreement for the admittance of systems into the open systems environment;
- 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 could work together in any combination.

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-24: Data-link layer protocol specification – Type 24 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 all participating data-link entities:

- in a synchronously-starting cyclic manner, according to a pre-established schedule, or
- in an acyclic manner, as requested by each of those data-link entities.

Thus, this protocol can be characterized as one which provides cyclic and acyclic access asynchronously but with a synchronous restart of each cycle.

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1.2 Specifications

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- 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 datalink service provider;
- procedures for giving communications opportunities to all participating DL-entities (DLEs), sequentially and in a cyclic manner for deterministic and synchronized transfer at cyclic intervals up to 64 ms;
- procedures for giving communication opportunities available for time-critical data transmission together with non-time-critical data transmission without prejudice to the time-critical data transmission;
- procedures for giving cyclic and acyclic communication opportunities for time-critical data transmission with prioritized access;
- procedures for giving communication opportunities based on ISO/IEC/IEEE 8802-3 medium access control, with provisions for nodes to be added or removed during normal operation;
- 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

- the interactions between peer DL-entities through the exchange of fieldbus DLPDUs;
- the interactions between a DL-service (DLS) provider and a DLS-user in the same system through the exchange of DLS primitives;
- the interactions between a DLS-provider and a Ph-service provider in the same system through the exchange of Ph-service primitives.

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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 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.

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ISO/IEC 7498-3, *Information technology – Open Systems Interconnection – Basic Reference Model: Naming and addressing*

ISO/IEC/IEEE 8802-3:2021, *Information technology – Telecommunications and exchange between information technology systems — Requirements for local and metropolitan area networks –Part 3: Standard for Ethernet*

ISO/IEC 9899, *Information technology – Programming languages – C*

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

ISO/IEC 13239:2002, *Information technology – Telecommunications and information exchange between systems – High-level data link control (HDLC) procedures*

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

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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**	[ISO/IEC 7498-1]
	correspondent DL-entities (N=2)	
	correspondent Ph-entities (N=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**	[ISO/IEC 7498-1]
	DL-entity (N=2)	
	Ph-entity (N=1)	
3.1.19	**(N)-layer**	[ISO/IEC 7498-1]
	DL-layer (N=2)	

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Ph-layer (N=1)

(N)-service [ISO/IEC 7498-1]

DL-service (N=2)

Ph-service (N=1)

(N)-service-access-point [ISO/IEC 7498-1]

DL-service-access-point (N=2)

Ph-service-access-point (N=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

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)

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3.3 Common terms and definitions

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

3.3.1
acyclic transmission
non-periodic exchange of telegrams

3.3.2
C1 master
one of the network device types that initiates and controls cyclic transmission

3.3.3
C1 message
message communication that C1 master operates as initiator to exchange messages with slave or C2 master

3.3.4
C2 master
one of the network device types that has the function of monitoring all process data transmitted through the network and can initiate message communication

3.3.5
C2 message
message communication that C2 master operates as initiator to exchange messages with the slave or the C1 master

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