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## Industrial communication networks – Fieldbus specifications – Part 4-1: Data-link layer protocol specification – Type 1 elements

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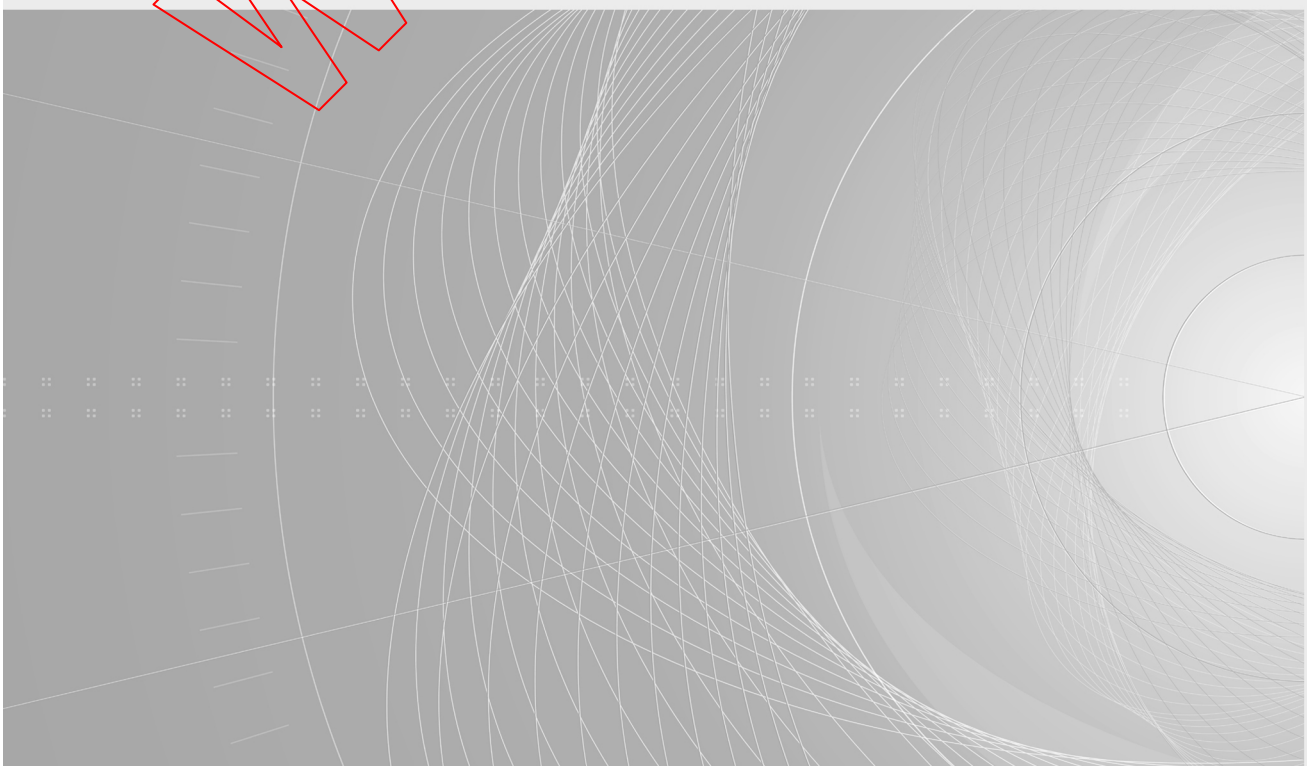

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# INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

## Part 4-1: Data-link layer protocol specification – Type 1 elements

FOREWORD

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IEC draws attention to the fact that it is claimed that compliance with this standard may involve the use of patents as follows, where the [xx] notation indicates the holder of the patent right:

Type 1 time synchronization and possibly other Types:

JP Hei4-35096 [YC] Communication control method

IEC takes no position concerning the evidence, validity and scope of these patent rights.

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International Standard IEC 61158-4-1 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 61158-4 subseries cancel and replace IEC 61158-4:2003. This edition of this part constitutes an editorial revision.

This edition of IEC 61158-4 includes the following significant changes from 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 -4-1, -4-2, …, -4-19.

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

| FDIS | Report on voting |
|---|---|
| 65C/474/FDIS | 65C/485/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.

NOTE Slight variances from the directives have been allowed by the IEC Central Office to provide continuity of subclause numbering with prior editions.

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.

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# 0 Introduction

## 0.1 General

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.

## 0.2 Nomenclature for references within this standard

Clauses, including annexes, can be referenced in their entirety, including any subordinate subclauses, as "Clause N" or "Annex N", where N is the number of the clause or letter of the annex.

Subclauses can be referenced in their entirety, including any subordinate subclauses, as "N.M" or "N.M.P" and so forth, depending on the level of the subclause, where N is the number of the subclause or letter of the annex, and M, P and so forth represent the successive levels of subclause up to and including the subclause of interest.

When a clause or subclause contains one or more subordinate subclauses, the text between the clause or subclause heading and its first subordinate subclause can be referenced in its entirety as "N.0" or "N.M.0" or "N.M.P.0" and so forth, where N, M and P are as above. Stated differently, a reference ending with ".0" designates the text and figures between a clause or subclause header and its first subordinate subclause.

NOTE This nomenclature provides a means of referencing text in hanging clauses. Such clauses existed in earlier editions of IEC 61784-3, Type 1 clauses. Those hanging clauses are maintained in this edition to minimize the disruption to existing national and multi-national standards and consortia documents which reference that prior subclause numbering.

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# INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

## Part 4-1: Data-link layer protocol specification – Type 1 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 the data-link service by making use of the services available from the physical layer. The relationship between the International Standards for fieldbus data-link service, fieldbus data-link protocol, fieldbus physical service and systems management is described in IEC/TR 61158-1.

This protocol provides communication opportunities to all participating data-link entities

a) in a cyclic asynchronous manner, sequentially to each of those data-link entities, and

b) in a synchronous manner, either cyclically or acyclically, according to a pre-established schedule.

The specified protocol also provides means of changing the set of participating data-link entities and of modifying the set of scheduled communications opportunities. When the set of scheduled communications opportunities is null, the distribution of communication opportunities to the participating data-link entities is completely asynchronous.

Thus this protocol can be characterized as one which provides access asynchronously but with a synchronous overlay.

IEC 61158-4-1:2007
https://standards.iteh.ai/catalog/standards/iec/a1b1384-cc31-4cb7-89e8-d1826b202650/iec-61158-4-1-2007

### 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.

NOTE In IEC 61158-4-1, gray boxes have been used in the tables to indicate that the specified field is not a conceptual part of the specific DLPDU.

### 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.

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