

# INTERNATIONAL STANDARD

**Industrial communication networks – Fieldbus specifications –  
Part 4-19: Data-link layer protocol specification – Type 19 elements**

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IEC 61158-4-19:2007

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# INTERNATIONAL ELECTROTECHNICAL COMMISSION

## INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

### Part 4-19: Data-link layer protocol specification – Type 19 elements

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DE 102 37 097	[RI]	Korrektur von Signallaufzeiten in verteilten Kommunikationssystemen
DE 102 00 405 0416.4-42	[RI]	Verfahren zur Synchronisation in einem redundanten Kommunikationssystem
DE 102 00 502 4759.8-32	[RI]	Verfahren zur Laufzeitkorrektur in einer Kommunikationsstruktur
DE 102 00 4056364.0-31	[RI]	Verfahren zum Betreiben eines Netzwerks mit Ringtopologie
DE 103 12 907.3-31	[RI]	Kommunikationssystem mit redundanter Kommunikation

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International Standard IEC 61158-4-19 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 a technical addition. This part and its companion Type 19 parts also cancel and replace IEC PAS 62410, published in 2005.

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.

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- withdrawn;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.

## 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.

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# INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

## Part 4-19: Data-link layer protocol specification – Type 19 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

- a) in a synchronously-starting cyclic manner, according to a pre-established schedule, and
- b) in a cyclic or acyclic asynchronous manner, as requested each cycle 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.

#### 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.

#### 1.5 Conformance

This standard also specifies conformance requirements for systems implementing these procedures. This part of 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 standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61158-4-16, *Industrial communications networks – Fieldbus specifications – Part 4-16: Data-link layer protocol specification – Type 16 elements*

IEC 61800-7-20x (all subparts), *Adjustable speed electrical power drive systems – Part 7-20x: Generic interface and use of profiles for power drive systems – Profile type x specification*<sup>1</sup>

ISO/IEC 7498-1, *Information technology – Open Systems Interconnection – Part 1: Basic Reference Model: The Basic Model*

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

ISO/IEC 8802-3, *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*

## 3 Terms, definitions, symbols, abbreviations and conventions

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

### 3.2 Additional Type 19 terms and definitions

#### 3.2.1 broadcast

transmission to all devices in a network without any acknowledgment by the receivers

#### 3.2.2 communication cycle

fixed time period between two master synchronization telegrams in which real-time telegrams are transmitted in the RT channel and non real-time telegrams are transmitted in the IP channel

#### 3.2.3 control unit

control device (e.g., a PLC as specified in the IEC 61131 standard family)

#### 3.2.4 control word

two adjacent OCTETs inside the master data telegram containing commands for the addressed device

<sup>1</sup> At present, these subparts are IEC 61800-7-201, 7-202, 7-203 and 7-204.

**3.2.5****cross communication**

direct data transfer between slave devices (without active involvement of master)

**3.2.6****cycle time**

duration of a communication cycle

**3.2.7****cyclic communication**

periodic exchange of telegrams

**3.2.8****cyclic data**

part of a telegram, which does not change its meaning during cyclic operation of the network

**3.2.9****cyclic operation**

operation in which devices in the communication network are addressed and queried one after the other at fixed, constant time intervals

**3.2.10****device**

a slave in the communication network, (e.g., a power drive system as defined in the IEC 61800 standard family, I/O stations as defined in the IEC 61131 standard family)

**3.2.11****device address field**

address field (eight bits) containing the address of the device

**3.2.12****device control**

four adjacent OCTETS inside the master data telegram containing commands for each device

**3.2.13****device status**

four adjacent OCTETS inside the acknowledge telegram containing status information for each device

**3.2.14****DLE station identifier**

network address assigned to a DLE

**3.2.15****DLE station slot**

unit (granularity of one) of position dependent mapping (for cyclic data field) of which a DLE may occupy one or more, delineated by the range beginning at the DLE station identifier with a length equal to the configured number of occupied slots

**3.2.16****element**

part of IDNs – each IDN has 7 elements, whereas each one has a specific meaning (e.g., number, name, data)

**3.2.17****EtherType**

part of the Type 19 specific telegram header

**3.2.18  
forwarding**

mode by which a device passes on a received telegram to the other port, either changed or unchanged

**3.2.19  
identification number (IDN)**

designation of operating data under which a data block is preserved with its attribute, name, unit, minimum and maximum input values, and the data

**3.2.20  
line, line structure**

network topology, in which the transmission medium is routed from station to station in the form of a line; the information is transmitted in one direction from the master down to the last slave in the line, and then flows back to the master via all the slaves in the reverse order (CP16/3)

**3.2.21  
loopback**

mode by which a device passes on a received telegram to the same port and to the other port, either changed or unchanged

**3.2.22  
master**

node, which assigns the other nodes (i.e., slaves) the right to transmit

**3.2.23  
master data telegram (MDT)**

telegram, in which the master inserts its data

**3.2.24  
master DLE**

DLE that performs the functions of network master

**3.2.25  
master synchronization telegram (MST)**

telegram, or part of a telegram, in which the master inserts a time synchronization signal

**3.2.26  
MDT0 telegram**

telegram, in which the master transmits its synchronization data, as well as parts or all of its real-time data, to the slaves

**3.2.27  
participant  
node**

**3.2.28  
physical layer**

first layer of the ISO-OSI reference model

**3.2.29  
protocol**

convention about the data formats, time sequences, and error correction in the data exchange of communication systems