IEC 61158-4-17

Edition 1.0 2007-12

INTERNATIONAL STANDARD

Industrial communication networks – Fieldbus specifications –
Part 4-17: Data-link layer protocol specification – Type 17 elements

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Part 4-17: Data-link layer protocol specification – Type 17 elements

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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 the IEC 61784 series. Use of the various protocol types in other combinations may require permission from their respective intellectual-property-right holders.

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 17 and possibly other Types:

PCT Application No. PCT/JP2004/011537	[YEC]	Communication control method
PCT Application No. PCT/JP2004/011538	[YEC]	Communication control method

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

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[YEC]: Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, 180-8750 Tokyo,
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Attention: Intellectual Property & Standardization Center

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International Standard IEC 61158-4-17 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 Type 17 companion parts also cancel and replace IEC/PAS 62405, 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.

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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.

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-17: Data-link layer protocol specification – Type 17 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 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.

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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 standard does not contain tests to demonstrate compliance with such requirements.

2 Normative reference

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For all other undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61158-3-17, *Industrial communication networks – Fieldbus specifications – Part 3-17: Data-link layer service definition – Type 17 elements*

ISO/IEC 7498 (all parts), *Information technology – Open Systems Interconnection – Basic Reference Model*

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*

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

IEEE Std 802.3ab, *Information technology – Telecommunications and information exchange between systems - Local and metropolitan area networks – Specific requirements – Supplement to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and physical layer specifications – Physical layer parameters and specifications for 1000 Mb/s operation over 4-pair of category 5 balanced copper cabling, type 1000BASE-T*

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Internet Engineering Task Force (IETF), *Request for Comments (RFC):*

RFC 768	*User Datagram Protocol* (available at <http://www.ietf.org/rfc/rfc0768.txt>)
RFC 791	*Internet Protocol* (available at <http://www.ietf.org/rfc/rfc0791.txt>)
RFC 792	*Internet Control Message Protocol* (available at <http://www.ietf.org/rfc/rfc0792.txt>)
RFC 826	*Ethernet Address Resolution Protocol* (available at <http://www.ietf.org/rfc/rfc0826.txt>)
RFC 894	A standard for the Transmission of IP Datagrams over Ethernet Networks (available at <http://www.ietf.org/rfc/rfc0894.txt>)
RFC 1112	*Host Extensions for IP Multicasting* (available at <http://www.ietf.org/rfc/rfc1112.txt>)
RFC 2236	*Internet Group Management Protocol Version 2* (available at <http://www.ietf.org/rfc/rfc2236.txt>)

3 Definitions

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

3.1 Terms and definitions

3.1.1 ISO/IEC 10731 terms

a) (N)-connection

b) (N)-entity

c) (N)-layer

d) (N)-service

e) (N)-service-access-point

f) confirm (primitive)

g) deliver (primitive)

h) indication (primitive)

i) request (primitive)

j) response (primitive)

3.1.2 Other terms and definitions

3.1.2.1
bridge
intermediate equipment that connects two or more segments using a Data Link layer relay function

3.1.2.2
domain
part of the RTE network consisting of one or two subnetwork(s)

NOTE Two subnetworks are required to compose a dual-redundant RTE network, and each end node in the domain is connected to both of the subnetworks.

3.1.2.3
domain master
station which performs diagnosis of routes to all other domains, distribution of network time to nodes inside the domain, acquisition of absolute time from the network time master and notification of status of the domain

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3.1.2.4
domain number
numeric identifier which indicates a domain

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3.1.2.5
external bridge
bridge to which neither internal bridges nor RTE stations are connected directly

3.1.2.6
interface port
physical connection point of an end node, which has an independent DL-address

3.1.2.7
internal bridge
bridge to which no routers, external bridges or nodes non-compliant with this specification are connected directly

3.1.2.8
junction bridge
bridge to which at least one router, external bridge or node non-compliant with this specification, and to which at least one internal bridge or RTE station is connected

3.1.2.9
link
physical communication channel between two nodes

3.1.2.10
network time master
station which distributes network time to domain masters