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Industrial communication networks – Fieldbus specifications – Part 4-21: Data-link layer protocol specification – Type 21 elements

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

International Standard IEC 61158-4-21:2010 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This standard cancels and replaces IEC/PAS 62573 published in 2008. This first edition constitutes a technical revision.

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

FDIS	Report on voting
65C/605/FDIS	65C/619/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.

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.

NOTE The revision of this standard will be synchronized with the other parts of the IEC 61158 series.

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.

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 profile parts. Use of the various protocol types in other combinations may require permission of their respective intellectual-property-right holders.

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning Type 21 elements and possibly other types given in subclause 4.1, 4.2 and 7.3 as follows:

KR 0789444	[LS]	A communication packet processing apparatus and method for ring topology ethernet network capable of preventing permanent packet looping
KR 0732510	[LS]	Network system
KR 0870670	[LS]	Method for determining a Ring Manager Node

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

The holder of these patent rights has assured the IEC that he/she is willing to negotiate licences either free of charge or under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of these patent rights is registered with IEC. Information may be obtained from:

[LS]: LS Industrial Systems Co., Ltd.
LS Tower 1026-6
Hogye-dong, Dongan-gu,
Anyang-si, Gyeonggi-do 431-848
Republic of Korea

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. IEC shall not be held responsible for identifying any or all such patent rights.

ISO (www.iso.org/patents) and IEC (http://www.iec.ch/tctools/patent_decl.htm) maintain on-line data bases of patents relevant to their standards. Users are encouraged to consult the data bases for the most up to date information concerning patents.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-21: Data-link layer protocol specification – Type 21 elements

1 Scope

1.1 General

The DLL provides basic time-critical data communications between devices in an automated environment. Type 21 provides priority-based cyclic and acyclic data communication using an internal collision-free, full-duplex dual-port Ethernet switch technology. For wide application in various automation applications, Type 21 does not restrict the cyclic/acyclic scheduling policy in the DLL.

1.2 Specifications

This standard describes:

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) procedures for giving communication opportunities based on standard ISO/IEC 8802-3 MAC, with provisions for nodes to be added or removed during normal operation;

c) structure of the fieldbus data link protocol data units (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 data link entities (DLEs) through the exchange of fieldbus DLPDUs;

b) the interactions between a data link 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 physical layer 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 that support time-critical communications services in the data link layer of the OSI or fieldbus reference models, and that 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-deterministic 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 references

The following referenced documents are indispensable for the application 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.

IEC 61158-3-21:2010 [1], *Industrial Communication Networks – Fieldbus specifications – Part 3-21: Data-link layer service definition – Type 21 elements*

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 8802-3:2000, *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 10731:1994, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*

3 Terms, definitions, symbols and abbreviations

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 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 7498-1]

3.1.4 correspondent (N)-entities [ISO/IEC 7498-1]
correspondent DL-entities (N=2)
correspondent Ph-entities (N=1)

3.1.5 demultiplexing [ISO/IEC 7498-1]

3.1.6 DL-address [ISO/IEC 7498-3]

3.1.7 DL-address-mapping [ISO/IEC 7498-1]

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[1] To be published.

3.1.8 DL-connection [ISO/IEC 7498-1]

3.1.9 DL-connection-end-point [ISO/IEC 7498-1]

3.1.10 DL-connection-end-point-identifier [ISO/IEC 7498-1]

3.1.11 DL-connection-mode transmission [ISO/IEC 7498-1]

3.1.12 DL-connectionless-mode transmission [ISO/IEC 7498-1]

3.1.13 DL-data-sink [ISO/IEC 7498-1]

3.1.14 DL-data-source [ISO/IEC 7498-1]

3.1.15 DL-duplex-transmission [ISO/IEC 7498-1]

3.1.16 DL-facility [ISO/IEC 7498-1]

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 7498-1]

3.1.20 DL-protocol-connection-identifier [ISO/IEC 7498-1]

3.1.21 DL-protocol-control-information [ISO/IEC 7498-1]

3.1.22 DL-protocol-data-unit [ISO/IEC 7498-1]

3.1.23 DL-protocol-version-identifier [ISO/IEC 7498-1]

3.1.24 DL-relay [ISO/IEC 7498-1]

3.1.25 DL-service-connection-identifier [ISO/IEC 7498-1]

3.1.26 DL-service-data-unit [ISO/IEC 7498-1]

3.1.27 DL-simplex-transmission [ISO/IEC 7498-1]

3.1.28 DL-subsystem [ISO/IEC 7498-1]

3.1.29 DL-user-data [ISO/IEC 7498-1]

3.1.30 flow control [ISO/IEC 7498-1]

3.1.31 layer-management [ISO/IEC 7498-1]

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 7498-1]
DL-entity
Ph-entity

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