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CONTENTS

FOREWORD 5
INTRODUCTION 7
1 Scope 8
1.1 General 8
1.2 Specifications 8
1.3 Procedures 8
1.4 Applicability 9
1.5 Conformance 9
2 Normative references 9
3 Terms, definitions, symbols and abbreviations 9
3.1 Reference model terms and definitions 9
3.2 Service convention terms and definitions 11
3.3 Terms and definitions 12
3.4 Symbols and abbreviations 16
4 Overview of the DL-protocol 17
4.1 General 17
4.2 Overview of the medium access control 17
4.3 Service assumed from the PhL 18
4.4 DLL architecture 19
4.5 Access control machine and schedule support functions 21
4.6 Local parameters, variable, counters, timers 22
5 General structure and encoding of PhIDUs and DLPDU and related elements of procedure 32
5.1 Overview 32
5.2 PhIDU structure and encoding 32
5.3 Common MAC frame structure, encoding and elements of procedure 33
5.4 Elements of the MAC frame 34
5.5 Order of bit transmission 38
5.6 Invalid DLPDU 38
6 DLPDU-specific structure, encoding and elements of procedure 39
6.1 General 39
6.2 Synchronization DLPDU (SYN) 39
6.3 Transmission complete DLPDU (CMP) 44
6.4 In-ring request DLPDU (REQ) 45
6.5 Claim DLPDU (CLM) 46
6.6 Command (COM) DLPDU 47
6.7 Cyclic data and cyclic data with transmission complete DLPDU (DT) and (DT-CMP) 48
6.8 RAS DLPDU (RAS) 49
7 DLE elements of procedure 50
7.1 Overall structure 50
7.2 Initialization 51
7.3 Cyclic transmission TX/RX control (CTRC) 52
7.4 Sporadic TX/RX control (STRC) 56
7.5 Access control machine (ACM) 59
7.6 Redundancy medium control (RMC) 67
7.7 Serializer and deserializer 74

7.8 DLL management protocol 74
Bibliography 80

Figure 1 – Relationships of DLSAPs, DLSAP-addresses and group DL-addresses 13
Figure 2 – Basic principle of medium access control 18
Figure 3 – Interaction of PhS primitives to DLE 19
Figure 4 – Data-link layer internal architecture 21
Figure 5 – Common MAC frame format for DLPDUs 33
Figure 6 – Sporadic DLPDU format 34
Figure 7 – Structure of FC field 35
Figure 8 – Structure of SYN DLPDU 39
Figure 9 – Structure of CMP DLPDU 44
Figure 10 – Structure of the REQ DLPDU 45
Figure 11 – Structure of CLM DLPDU 46
Figure 12 – Structure of COM DLPDU 47
Figure 13 – Structure of DT DLPDU 48
Figure 14 – Structure of RAS DLPDU 49
Table 18 – RAS parameter : 3rd and 4th octets 49
Figure 15 – Overall structure of DLL 51
Figure 16 – DLE state transition 52
Figure 17 – State transition diagram of CTRC 54
Figure 18 – State transition diagram of STRC 57
Table 29 – Primitives exchanged between ACM and RMC 60
Figure 19 – State transition diagram of ACM 62
Figure 20 – State transition diagram of RMC sending and send arbitration 69
Figure 21 – State transition diagram of RMC receiving 72
Figure 22 – State transition diagram of DLM 77

Table 1 – Data-link layer components 20
Table 2 – Mandatory DLE-variables and permissible values 22
Table 3 – Observable variables and their value ranges 23
Table 4 – F-type: DLPDU type 35
Table 5 – FCS length, polynomials and constants 36
Table 6 – PN -parameter: 3rd octet 40
Table 7 – CW -parameters: 4th octet 40
Table 8 – PM parameter 40
Table 9 – RMSEL parameter 41
Table 10 – ST-parameter: 5th octet 41
Table 11 – Th-parameter: 6th, 7th and 8th octets 41
Table 12 – Tm-parameter: 9th and 10th octets 42
Table 13 – Ts-parameter: 11th and 12th octets 42
Table 14 – Tl-parameter: 13th and 14th octets 42
Table 15 – LL parameters: 15th to 46th octets 43

Table 16 – CLM parameter: 4th octet 46
Table 17 – DT parameter: 3rd and 4th octets 48
Table 18 – RAS parameter : 3rd and 4th octets 49
Table 19 – Primitives exchanged between DLS-user and CTRC 53
Table 20 – Primitives exchanged between CTRC and ACM 53
Table 21 – Parameters used with primitives exchanged between DLS-user and CTRC 54
Table 22 – CTRC state table 55
Table 23 – CTRC functions table 56
Table 24 – Primitives exchanged between DLS-user and STRC 56
Table 25 – Primitives exchanged between STRC and ACM 57
Table 26 – Parameters used with primitives exchanged between DLS-user and STRC 57
Table 27 – STRC state table 58
Table 28 – STRC functions table 59
Table 29 – Primitives exchanged between ACM and RMC 60
Table 30 – Parameters used with primitives exchanged between ACM and RMC 60
Table 31 – Primitives exchanged between ACM and CTRC 60
Table 32 – Parameters used with primitives exchanged between ACM and CTRC 60
Table 33 – Primitives exchanged between ACM and STRC 61
Table 34 – Parameters used with primitives exchanged between ACM and STRC 61
Table 35 – ACM state table 63
Table 36 – ACM function table 67
Table 37 – Primitives exchanged between ACM and RMC 68
Table 38 – Primitives exchanged between RMC and derializer / deserializer 68
Table 39 – Primitives exchanged between RMC and Ph-layer 68
Table 40 – Parameters between RMC and ACM 69
Table 41 – Parameters between RMC and Ph-layer 69
Table 42 – State table of RMC sending 70
Table 43 – State table of RMC send arbitration 71
Table 44 – State table for RMC receiving 72
Table 45 – RMC function table 74
Table 46 – Primitives exchanged between DLMS-user and DLM 75
Table 47 – Parameters used with primitives exchanged between DL-user and DLM 75
Table 48 – Event-related state change variables 76
Table 49 – DLM state table 77
Table 50 – DLM function table 79

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-11: Data-link layer protocol specification – Type 11 elements

FOREWORD

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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 11 and possibly other Types:

US 4,930,121	[To]	Network system using token-passing bus with multiple priority levels
US 5,414,813	[To]	Direct transfer from a receive buffer to a host in a token-passing type network data transmission system
US 6,711,131	[To]	Data transmitting apparatus, network interface apparatus, and data transmitting system

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

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[To] Toshiba Corporation
1-1, Shibaura 1-Chome
Minato-ku Tokyo 105-8001, Japan
Attention: Intellectual Property Rights Section.

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International Standard IEC 61158-4-11 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 11 companion parts also cancel and replace IEC/PAS 62406, 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.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-11: Data-link layer protocol specification – Type 11 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) procedures for giving communications opportunities to all participating DL-entities, sequentially and in a cyclic manner for deterministic and synchronized transfer at cyclic intervals up to one millisecond;
c) 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;
d) procedures for giving cyclic and acyclic communication opportunities for time-critical data transmission with prioritized access;
e) procedures for giving communication opportunities based on standard ISO/ IEC 8802-3 medium access control, with provisions for nodes to be added or removed during normal operation;
f) 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 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 61158-3-11, *Industrial communication networks – Fieldbus specifications – Part 3-11: Data-link layer service definition – Type 11 elements*

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

ISO/IEC 7498-3, *Information technology – Open Systems Interconnection – Basic Reference Model – 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, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*