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INTERNATIONAL STANDARD



**Industrial communication networks – Fieldbus specifications –
Part 4-24: Data-link layer protocol specification – Type 24 elements**

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CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	10
1.1 General.....	10
1.2 Specifications	10
1.3 Procedures	10
1.4 Applicability	11
1.5 Conformance	11
2 Normative references	11
3 Terms, definitions, symbols, abbreviations and conventions	12
3.1 Reference model terms and definitions	12
3.2 Service convention terms and definitions	13
3.3 Common terms and definitions.....	13
3.4 Symbols and abbreviations	16
3.5 Additional Type 24 symbols and abbreviations.....	17
3.6 Common Conventions.....	17
3.7 Additional Type 24 conventions	18
3.7.1 Primitive conventions.....	18
3.7.2 State machine conventions.....	18
4 Overview of DL-protocol	19
4.1 Characteristic feature of the DL-protocol.....	19
4.2 DL layer component.....	20
4.2.1 Cyclic transmission control (CTC).....	21
4.2.2 Send Receive Control (SRC)	21
4.2.3 DL-management.....	21
4.3 Timing sequence.....	21
4.3.1 Overview	21
4.3.2 Cyclic transmission mode	21
4.3.3 Acyclic transmission mode.....	29
4.4 Service assumed from the PhL	30
4.4.1 General requirement.....	30
4.4.2 DL_Symbols	30
4.4.3 Assumed primitives of the PhS	30
4.5 Local parameters, variables, counters, timers	30
4.5.1 Overview	30
4.5.2 Variables, parameters, counters and timers to support DLE function	31
5 DLPDU structure	35
5.1 Overview	35
5.1.1 Transfer syntax for bit sequences	35
5.1.2 Data type encodings	36
5.1.3 Frame format.....	36
5.2 Basic format DLPDU structure	36
5.2.1 General	36
5.2.2 Synchronous frame.....	40
5.2.3 Output data or Input data frame.....	40
5.2.4 Delay measurement start frame	41

5.2.5	Delay measurement frame	41
5.2.6	Message token frame	42
5.2.7	Status frame	42
5.2.8	Cycle Information frame.....	43
5.2.9	Message frame	44
5.3	Short format DLPDU structure.....	45
5.3.1	General	45
5.3.2	Synchronous frame.....	47
5.3.3	Output data or Input data frame	48
5.3.4	Message frame	49
6	DLE element procedure	49
6.1	Overview	49
6.2	Cyclic transmission control sublayer	49
6.2.1	General	49
6.2.2	DLS-user interface.....	49
6.2.3	Protocol machines in CTC	50
6.2.4	CTC-DLM interface	101
6.3	Send Receive Control	102
6.3.1	General	102
6.3.2	SRC-CTC interface	103
6.3.3	Detailed specification of SRC	104
6.3.4	SRC-DLM interface.....	108
7	DL-management layer (DLM).....	109
7.1	Overview	109
7.2	Primitive definitions.....	109
7.2.1	Primitives exchanged between DLMS-user and DLM	109
7.2.2	Parameters used with DLM primitives	110
7.3	DLM protocol machine	110
7.3.1	C1 master.....	110
7.3.2	Slave and C2 master	115
7.4	Functions	119
	Bibliography.....	122
	Figure 1 – Data-link layer component.....	21
	Figure 2 – Timing chart of fixed-width time slot type cyclic communication.....	22
	Figure 3 – Timing chart of configurable time slot type cyclic communication	24
	Figure 4 – Schematic diagram of cyclic event occurrence	26
	Figure 5 – Timing relationship between cyclic transmission and data processing	29
	Figure 6 – Timing chart example of acyclic communication	29
	Figure 7 – Basic format DLPDU structure.....	37
	Figure 8 – Short format DLPDU structure.....	45
	Figure 9 – The state diagram of the C1 master for fixed-width time slot	51
	Figure 10 – The state diagram of the C2 master for fixed-width time slot	58
	Figure 11 – The state diagram of the slave for fixed-width time slot	62
	Figure 12 – The state diagram of the C1 master for configurable time slot	65
	Figure 13 – The state diagram of the C2 master for configurable time slot	74
	Figure 14 – The state diagram of slave for configurable time slot.....	77

Figure 15 – The state diagram of message initiator for basic format.....	82
Figure 16 – The state diagram of message responder for basic format	86
Figure 17 – The state diagram of message initiator for short format.....	90
Figure 18 – The state diagram of message responder for short format.....	94
Figure 19 – The state diagram of the acyclic transmission protocol machine.....	100
Figure 20 – Internal architecture of one-port SRC	104
Figure 21 – Internal architecture of multi-port SRC	104
Figure 22 – Internal architecture of serializer	105
Figure 23 – Internal architecture of deserializer	106
Figure 24 – State diagram of the C1 master DLM.....	111
Figure 25 – State diagram of the Slave and the C2 master DLM	116
Table 1 – State transition descriptions	18
Table 2 – Description of state machine elements	19
Table 3 – Conventions used in state machines	19
Table 4 – Characteristic features of the fieldbus data-link protocol.....	20
Table 5 – List of the values of the variable Cyc_sel	31
Table 6 – List of the values of the variable Tunit	32
Table 7 – List of the values of the variable PDUType	33
Table 8 – List of the values of the variable SlotType	34
Table 9 – Transfer syntax for bit sequences.....	36
Table 10 – Bit order	36
Table 11 – Destination and Source address format.....	37
Table 12 – Station address	37
Table 13 – Extended address	38
Table 14 – Message control field format (Information transfer format).....	38
Table 15 – Message control field format (Supervisory format).....	38
Table 16 – The list of Supervisory function bits.....	39
Table 17 – Frame type and data length format.....	39
Table 18 – The list of Frame type.....	39
Table 19 – Data format of the Synchronous frame	40
Table 20 – The field list of the Synchronous frame.....	40
Table 21 – Data format of the Output data or the Input data frame.....	40
Table 22 – The field list of the Output data or the Input data frame	41
Table 23 – Data format of Delay measurement start frame.....	41
Table 24 – The field list of Delay measurement start frame.....	41
Table 25 – Data format of Delay measurement frame.....	42
Table 26 – The field list of Delay measurement frame.....	42
Table 27 – Data format of Status frame.....	42
Table 28 – The field list of Status frame.....	43
Table 29 – The list of the DLE status	43
Table 30 – The list of Repeater status	43
Table 31 – Data format of Delay measurement frame.....	44

Table 32 – The field list of Cycle Information frame.....	44
Table 33 – Data format of Message frame	44
Table 34 – The field list of Message frame.....	45
Table 35 – Range of Station address field.....	46
Table 36 – Control field format (I/O data exchange format)	46
Table 37 – Control field format (Message format)	46
Table 38 – The field list of Message format.....	47
Table 39 – Data format of the Synchronous frame	47
Table 40 – The field list of the Synchronous frame.....	48
Table 41 – Data format of the Output data frame	48
Table 42 – The field list of the Output data frame.....	48
Table 43 – Data format of the Input data frame	48
Table 44 – The field list of the Input data frame	48
Table 45 – Primitives and parameters for the DLS-user interface issued by the DLS-user	49
Table 46 – Primitives and parameters for the DLS-user interface issued by the CTC	50
Table 47 – The state table of the C1 master for fixed-width time slot	52
Table 48 – The state table of the C2 master for fixed-width time slot	59
Table 49 – The state table of the slave for fixed-width time slot	63
Table 50 – The state table of the C1 master for configurable time slot	66
Table 51 – The state table of the C2 master for configurable time slot	75
Table 52 – The state table of slave for configurable time slot	78
Table 53 – The list of functions used by cyclic transmission machine.....	79
Table 54 – The state table of message initiator for basic format.....	82
Table 55 – The state table of message responder for basic format.....	86
Table 56 – The state table of message initiator for short format	90
Table 57 – The state table of message responder for short format	95
Table 58 – List of functions used by the message segmentation machine	99
Table 59 – The state table of the acyclic transmission protocol machine.....	101
Table 60 – The list of functions used acyclic transmission protocol machine	101
Table 61 – Primitives and parameters exchanged between CTC and DLM	102
Table 62 – Error event primitive and parameters.....	102
Table 63 – primitives and parameters for SRC-CTC interface	103
Table 64 – Send frame primitive and parameters	103
Table 65 – Receive frame primitives and parameters	104
Table 66 – Primitives and parameters exchanged between SRC and DLM.....	108
Table 67 – Get value primitive and parameters	109
Table 68 – Error event primitive and parameters.....	109
Table 69 – The list of primitives and parameters (DLMS-user source).....	110
Table 70 – The list of primitives and parameters (DLM source).....	110
Table 71 – State table of the C1 Master DLM.....	112
Table 72 – State table of the Slave and the C2 master DLM	117
Table 73 – The list of the functions used by DLM protocol machine	120

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-24: Data-link layer protocol specification – Type 24 elements

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NOTE Combinations of protocol types are specified in IEC 61784-1 and IEC 61784-2.

International Standard IEC 61158-4-24 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- patent declaration in the Introduction;
- corrections on transmission sequence of fixed-width time slot type in 4.3.2;
- technical extension for band sharing between I/O data exchange and message communication; and
- spelling and grammar.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
65C/946/FDIS	65C/955/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the 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.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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

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US 8223804 JP 4760978 CN 200880002225.3 DE 602008046644.2	[YE]	COMMUNICATION DEVICE, SYNCHRONIZED SYSTEM, AND SYNCHRONIZED COMMUNICATION METHOD
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US 7769935 JP 4683346 US 8046512 DE 602007041530.6	[YE]	MASTER SLAVE COMMUNICATION SYSTEM AND MASTER SLAVE COMMUNICATION METHOD
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JP 4356698	[YE]	COMMUNICATION DEVICE, SYNCHRONIZED COMMUNICATION SYSTEM, AND SYNCHRONIZED COMMUNICATION METHOD
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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-24: Data-link layer protocol specification – Type 24 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, or
- b) in an acyclic manner, as requested 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 document 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 datalink service provider;
- b) procedures for giving communications opportunities to all participating DL-entities (DLEs), sequentially and in a cyclic manner for deterministic and synchronized transfer at cyclic intervals up to 64 ms;
- 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 ISO/IEC/IEEE 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 document, 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 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 document also specifies conformance requirements for systems implementing these procedures. This document does not contain tests to demonstrate compliance with such requirements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE All parts of the IEC 61158 series, as well as IEC 61784-1 and IEC 61784-2 are maintained simultaneously. Cross-references to these documents within the text therefore refer to the editions as dated in this list of normative references.

IEC 61158-2, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-3-24:2014, *Industrial communication networks – Fieldbus specifications – Part 3-24: Data-link layer service definition – Type 24 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/IEEE 8802-3:2017, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Standard for Ethernet*

ISO/IEC 9899, *Information technology – Programming languages – C*

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

ISO/IEC 13239:2002, *Information technology – Telecommunications and information exchange between systems – High-level data link control (HDLC) procedures*

ISO/IEC 19501:2005, *Information technology – Open Distributed Processing – Unified Modelling Language (UML) Version 1.4.2*