

STN	Priemyselné komunikačné siete Špecifikácie prevádzkových zberníc Časť 4-2: Špecifikácia protokolu údajovej vrstvy Prvky typu 2	STN EN IEC 61158-4-2 18 4020
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Industrial communication networks - Fieldbus specifications - Part 4-2: Data-link layer protocol specification - Type 2 elements

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 06/23

Obsahuje: EN IEC 61158-4-2:2023, IEC 61158-4-2:2023

Oznámením tejto normy sa od 13.04.2026 ruší
STN EN IEC 61158-4-2 (18 4020) z októbra 2019

136951



EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN IEC 61158-4-2

April 2023

ICS 25.040.40; 35.100.20; 35.110

Supersedes EN IEC 61158-4-2:2019

English Version

**Industrial communication networks - Fieldbus specifications -
Part 4-2: Data-link layer protocol specification - Type 2 elements
(IEC 61158-4-2:2023)**

Réseaux de communication industriels - Spécifications des
bus de terrain - Partie 4-2: Spécification du protocole de la
couche liaison de données - Éléments de type 2
(IEC 61158-4-2:2023)

Industrielle Kommunikationsnetze - Feldbusse – Teil 4-2:
Protokollspezifikation des Data Link Layer
(Sicherheitsschicht) - Typ 2-Elemente
(IEC 61158-4-2:2023)

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EN IEC 61158-4-2:2023 (E)

European foreword

The text of document 65C/1202/FDIS, future edition 5 of IEC 61158-4-2, prepared by SC 65C "Industrial networks" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61158-4-2:2023.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2024-01-13
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2026-04-13

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In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 61131-9 NOTE Approved as EN IEC 61131-9

IEC 61158-1 NOTE Approved as EN IEC 61158-1

IEC 61158-2 NOTE Approved as EN 61158-2

IEC 61784-1 (series) NOTE Approved as EN IEC 61784-1 (series)¹

IEC 61784-2 (series) NOTE Approved as EN IEC 61784-2 (series)²

¹ To be published. Stage at the time of publication: FprEN IEC 61784-1-X:2023.

² To be published. Stage at the time of publication: FprEN IEC 61784-2-X:2023.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61131-3	-	Programmable controllers - Part 3: Programming languages	EN 61131-3	-
IEC 61158-3-2	2023	Industrial communication networks - Fieldbus specifications - Part 3-2: Data-link layer service definition - Type 2 elements	EN IEC 61158-3-2	2023
IEC 61158-5-2	2023	Industrial communication networks - Fieldbus specifications - Part 5-2: Application layer service definition - Type 2 elements	EN IEC 61158-5-2	— ³
IEC 61158-6-2	2023	Industrial communication networks - Fieldbus specifications - Part 6-2: Application layer protocol specification - Type 2 elements	EN IEC 61158-6-2	— ⁴
IEC 61588	-	Precision clock synchronization protocol for-networked measurement and control systems		-
IEC 61784-3-2	-	Industrial communication networks - Profiles - Part 3-2: Functional safety fieldbuses - Additional specifications for CPF 2	EN IEC 61784-3-2	-
IEC 62026-3	2014	Low-voltage switchgear and controlgear - Controller-device interfaces (CDIs) - Part 3: DeviceNet	EN 62026-3	2015
IEC 62439-3	2016	Industrial communication networks - High availability automation networks - Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)	EN IEC 62439-3	2018

³ Under preparation. Stage at time of publication: prEN IEC 61158-5-2:2023.

⁴ Under preparation. Stage at time of publication: prEN IEC 61158-6-2:2023.

EN IEC 61158-4-2:2023 (E)

ISO/IEC 13239	-	Information technology - Telecommunications and information exchange between systems - High-level data link control (HDLC) procedures	-	-
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	-	Telecommunications and exchange between information technology systems - Requirements for local and metropolitan area networks - Part 3: Standard for Ethernet	-	-
ISO 11898-1	2015	Road vehicles - Controller area network (CAN) - Part 1: Data link layer and physical signalling	-	-
IEEE Std 802.1AB	2016	IEEE Standard for Local and metropolitan area networks: Station and Media Access Control Connectivity Discovery	-	-
IEEE Std 802.1ABcu	2021	Standard for Local and metropolitan area networks - Station and Media Access Control Connectivity Discovery Amendment: YANG Data Model	-	-
IEEE Std 802.1Q	2018	IEEE Standard for local and metropolitan area networks - Bridges and bridged networks	-	-
IEEE Std 802.3	2018	IEEE Standard for Ethernet	-	-
IETF RFC 951	1985	Bootstrap Protocol (BOOTP)	-	-
IETF RFC 1213	1991	Management Information Base for Network-Management of TCP/IP-based Internets: MIB-II	-	-
IETF RFC 1542	1993	Clarifications and Extensions for the Bootstrap Protocol	-	-
IETF RFC 1643	1994	Definitions of Managed Objects for the Ethernet-like interface types	-	-
IETF RFC 2131	1997	Dynamic Host Configuration Protocol	-	-
IETF RFC 2132	1997	DHCP Options and BOOTP Vendor Extensions	-	-
IETF RFC 2863	2000	The Interfaces Group MIB	-	-
IETF RFC 3418	2002	Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)	-	-
IETF RFC 3635	2003	Definitions of Managed Objects for the Ethernet-like Interface Types	-	-
IETF RFC 4541	2006	Considerations for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping Switches	-	-

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IETF RFC 5227	2008	IPv4 Address Conflict Detection	-	-
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IEC 61158-4-2

Edition 5.0 2023-03

INTERNATIONAL STANDARD



**Industrial communication networks – Fieldbus specifications –
Part 4-2: Data-link layer protocol specification – Type 2 elements**



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IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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IEC 61158-4-2

Edition 5.0 2023-03

INTERNATIONAL STANDARD



**Industrial communication networks – Fieldbus specifications –
Part 4-2: Data-link layer protocol specification – Type 2 elements**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 35.100.20; 35.110

ISBN 978-2-8322-6554-3

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CONTENTS

FOREWORD.....	16
INTRODUCTION.....	18
1 Scope.....	19
1.1 General.....	19
1.2 Specifications	19
1.3 Procedures	19
1.4 Applicability	20
1.5 Conformance	20
2 Normative references	20
3 Terms, definitions, symbols, abbreviated terms and conventions	22
3.1 Reference model terms and definitions	22
3.2 Service convention terms and definitions	24
3.3 Common terms and definitions.....	24
3.4 Additional Type 2 definitions	25
3.5 Type 2 symbols and abbreviated terms	33
3.6 Conventions for station management objects	34
4 Overview of the data-link protocol.....	35
4.1 General.....	35
4.1.1 DLL architecture	35
4.1.2 Access control machine (ACM) and scheduling support functions	37
4.1.3 Connection-mode, connectionless-mode data transfer and DL service.....	37
4.2 Services provided by the DL	37
4.2.1 Overview	37
4.2.2 QoS.....	38
4.3 Structure and definition of DL-addresses	38
4.3.1 General	38
4.3.2 MAC ID address	39
4.3.3 Generic tag address	40
4.3.4 Fixed tag address	40
4.4 Services assumed from the PhL.....	41
4.4.1 General requirements	41
4.4.2 Data encoding rules.....	41
4.4.3 DLL to PhL interface	42
4.5 Functional classes	44
5 General structure and encoding of PhIDUs and DLPDUs and related elements of procedure.....	44
5.1 Overview.....	44
5.2 Media access procedure	44
5.3 DLPDU structure and encoding	48
5.3.1 General	48
5.3.2 DLPDU components	48
5.3.3 Preamble	48
5.3.4 Start and end delimiters.....	48
5.3.5 DLPDU octets and ordering	48
5.3.6 Source MAC ID.....	49
5.3.7 Lpackets field	49
5.3.8 Frame check sequence (FCS).....	49

5.3.9	Null DLPDU	52
5.3.10	Abort DLPDU	52
5.4	Lpacket components	52
5.4.1	General Lpacket structure	52
5.4.2	Size	53
5.4.3	Control	53
5.4.4	Generic tag Lpackets	53
5.4.5	Fixed tag Lpackets	54
5.5	DLPDU procedures	54
5.5.1	General	54
5.5.2	Sending scheduled DLPDUs	55
5.5.3	Sending unscheduled DLPDUs	55
5.5.4	Receiving DLPDUs	55
5.6	Summary of DLL support services and objects	56
6	Specific DLPDU structure, encoding and procedures	57
6.1	Modeling language	57
6.1.1	State machine description	57
6.1.2	Use of DLL- prefix	58
6.1.3	Data types	58
6.2	DLS user services	59
6.2.1	General	59
6.2.2	Connected mode and connectionless mode transfer service	60
6.2.3	Queue maintenance service	61
6.2.4	Tag filter service	61
6.2.5	Link synchronization service	62
6.2.6	Synchronized parameter change service	62
6.2.7	Event reports service	63
6.2.8	Bad FCS service	64
6.2.9	Current moderator service	64
6.2.10	Power up and online services	64
6.2.11	Enable moderator service	65
6.2.12	Listen only service	65
6.3	Generic tag Lpacket	65
6.3.1	General	65
6.3.2	Structure of the generic-tag Lpacket	65
6.3.3	Sending and receiving the generic-tag Lpacket	66
6.4	Moderator Lpacket	66
6.4.1	General	66
6.4.2	Structure of the moderator Lpacket	66
6.4.3	Sending and receiving the moderator Lpacket	66
6.5	Time distribution Lpacket	67
6.5.1	General	67
6.5.2	Structure of the time distribution Lpacket	67
6.5.3	Sending and receiving the time distribution Lpacket	69
6.6	UCMM Lpacket	70
6.6.1	General	70
6.6.2	Structure of the UCMM Lpacket	70
6.6.3	Sending and receiving the UCMM Lpacket	70
6.7	Keeper UCMM Lpacket	70

6.7.1	General	70
6.7.2	Structure of the Keeper UCMM Lpacket	70
6.7.3	Sending and receiving the Keeper UCMM Lpacket	70
6.8	TUI Lpacket	71
6.8.1	General	71
6.8.2	Structure of the TUI Lpacket	71
6.8.3	Sending and receiving the TUI Lpacket	72
6.9	Link parameters Lpacket and tMinus Lpacket	72
6.9.1	General	72
6.9.2	Structure of link parameters and tMinus Lpackets	72
6.9.3	Sending and receiving the tMinus and Link parameters Lpackets	73
6.10	I'm-alive Lpacket	73
6.10.1	General	73
6.10.2	Structure or the I'm-alive Lpacket	73
6.10.3	Sending and receiving I'm Alive	74
6.10.4	I'm alive state processing	74
6.11	Ping Lpackets	75
6.11.1	General	75
6.11.2	Structure of the ping Lpackets	76
6.11.3	Sending and receiving the ping Lpackets	76
6.12	WAMI Lpacket	76
6.12.1	General	76
6.12.2	Structure of the WAMI Lpacket	77
6.12.3	Sending and receiving the WAMI Lpacket	77
6.13	Debug Lpacket	77
6.14	IP Lpacket	78
6.15	Ethernet Lpacket	78
7	Objects for station management	78
7.1	General	78
7.2	ControlNet™ object	80
7.2.1	Overview	80
7.2.2	Class attributes	80
7.2.3	Instance attributes	80
7.2.4	Common services	89
7.2.5	Class specific services	90
7.2.6	Behavior	91
7.2.7	Module status indicator	91
7.3	Keeper object	92
7.3.1	Overview	92
7.3.2	Revision history	92
7.3.3	Class attributes	92
7.3.4	Instance attributes	92
7.3.5	Common services	101
7.3.6	Class specific services	102
7.3.7	Service error codes	108
7.3.8	Behavior	108
7.3.9	Miscellaneous notes	109
7.3.10	Keeper power up sequence	110
7.4	Scheduling object	115

7.4.1	Overview	115
7.4.2	Class attributes	116
7.4.3	Instance attributes	116
7.4.4	Common services	117
7.4.5	Class specific services	119
7.4.6	Typical scheduling session	125
7.5	TCP/IP Interface object	126
7.5.1	Overview	126
7.5.2	Revision history	126
7.5.3	Class attributes	126
7.5.4	Instance attributes	127
7.5.5	Diagnostic connection points	142
7.5.6	Common services	142
7.5.7	Class specific services	145
7.5.8	Behavior	147
7.5.9	Address Conflict Detection (ACD)	148
7.6	Ethernet Link object	154
7.6.1	Overview	154
7.6.2	Revision history	154
7.6.3	Class attributes	154
7.6.4	Instance attributes	155
7.6.5	Diagnostic connection points	165
7.6.6	Common services	166
7.6.7	Class specific services	167
7.6.8	Behavior	168
7.7	DeviceNet™ object	169
7.7.1	Overview	169
7.7.2	Revision history	170
7.7.3	Class attributes	170
7.7.4	Instance attributes	170
7.7.5	Common services	177
7.7.6	Class specific services	178
7.8	Connection Configuration object (CCO)	179
7.8.1	Overview	179
7.8.2	Revision history	179
7.8.3	Class attributes	179
7.8.4	Instance attributes	181
7.8.5	Connection Configuration object change control	190
7.8.6	Common services	190
7.8.7	Class specific services	196
7.8.8	Behavior	200
7.9	DLR object	200
7.9.1	Overview	200
7.9.2	Revision history	201
7.9.3	Class attributes	201
7.9.4	Instance attributes	201
7.9.5	Diagnostic connection points	213
7.9.6	Common services	213
7.9.7	Class specific services	217

7.10	QoS object.....	218
7.10.1	Overview	218
7.10.2	Revision History	218
7.10.3	Class attributes	218
7.10.4	Instance Attributes.....	219
7.10.5	Common services	220
7.11	Port object	221
7.11.1	Overview	221
7.11.2	Revision History	221
7.11.3	Class attributes	222
7.11.4	Instance attributes	222
7.11.5	Common services	229
7.12	PRP/HSR Protocol object.....	231
7.12.1	Overview	231
7.12.2	Revision history.....	231
7.12.3	Class attributes	231
7.12.4	Instance attributes	231
7.12.5	Diagnostic connection points	239
7.12.6	Common Services.....	239
7.13	PRP/HSR Nodes Table object.....	241
7.13.1	Overview	241
7.13.2	Revision history	241
7.13.3	Class attributes	242
7.13.4	Instance attributes	242
7.13.5	Common services	244
7.14	LLDP Management object	245
7.14.1	Overview	245
7.14.2	Revision history	245
7.14.3	Class attributes	246
7.14.4	Instance attributes	246
7.14.5	Common services	247
7.15	LLDP Data Table object	248
7.15.1	Overview	248
7.15.2	Revision history	249
7.15.3	Class attributes	249
7.15.4	Instance attributes	249
7.15.5	Common services	253
8	Other DLE elements of procedure.....	254
8.1	Network attachment monitor (NAM).....	254
8.1.1	General	254
8.1.2	Default parameters	256
8.1.3	Auto-addressing	256
8.1.4	Valid MAC IDs	257
8.1.5	State machine description.....	257
8.2	Calculating link parameters.....	263
8.2.1	Link parameters.....	263
8.2.2	Conditions affecting link parameters	263
8.2.3	Moderator change.....	263
8.2.4	NUT timing	264

8.2.5	Slot timing	265
8.2.6	Blanking	266
8.2.7	Example implementation.....	266
9	Detailed specification of DL components	271
9.1	General.....	271
9.2	Access control machine (ACM)	271
9.3	TxLLC	290
9.4	RxLLC	295
9.5	Transmit machine (TxM)	298
9.6	Receive machine (RxM)	302
9.7	Serializer	308
9.8	Deserializer	310
9.8.1	Octet construction	310
9.8.2	FCS checking	311
9.8.3	End of DLPDU processing	311
9.9	DLL management.....	311
10	Device Level Ring (DLR) protocol.....	313
10.1	General.....	313
10.2	Support for Multiple DLR Ring Pairs.....	314
10.3	Supported topologies	315
10.4	Overview of DLR operation	316
10.4.1	Normal operation	316
10.4.2	Link failures	317
10.5	Classes of DLR implementation	318
10.6	DLR behavior.....	319
10.6.1	DLR variables.....	319
10.6.2	Ring supervisor	319
10.6.3	Ring node.....	322
10.6.4	Sign on process.....	323
10.6.5	Neighbor check process	324
10.7	Implementation requirements.....	324
10.7.1	Embedded switch requirements and recommendations	324
10.7.2	DLR implementation requirements	325
10.7.3	IEC 61588 and Type 2 Ethernet considerations	326
10.7.4	IEEE Std 802.1Q-2018 STP/RSTP/MSTP considerations.....	326
10.8	Using non-DLR nodes in the ring network	326
10.8.1	General considerations	326
10.8.2	Non-DLR end devices.....	327
10.8.3	Non-DLR switches	327
10.9	Redundant gateway devices on DLR network.....	329
10.9.1	General	329
10.9.2	Supported topologies.....	330
10.9.3	Redundant gateway capable device.....	330
10.9.4	Redundant gateway device behavior.....	331
10.10	DLR messages	334
10.10.1	General	334
10.10.2	Common frame header	335
10.10.3	Beacon frame	336
10.10.4	Neighbor_Check request	336

10.10.5	Neighbor_Check_response.....	337
10.10.6	Link_Status/Neighbor_Status.....	337
10.10.7	Locate_Fault.....	338
10.10.8	Announce	338
10.10.9	Sign_On	338
10.10.10	Advertise	339
10.10.11	Flush_Tables.....	339
10.10.12	Learning_Update	340
10.11	State diagrams and state-event-action matrices.....	340
10.11.1	Beacon-based ring node.....	340
10.11.2	Announce-based ring node.....	347
10.11.3	Ring supervisor	351
10.11.4	Redundant gateway.....	366
10.12	Performance analysis.....	369
10.12.1	General	369
10.12.2	Redundant gateway switchover performance	373
11	PRP and HSR redundancy protocols	375
11.1	General.....	375
11.2	PRP overview	375
11.2.1	General	375
11.2.2	Address Conflict Detection (ACD).....	376
11.3	HSR overview	377
12	LLDP protocol.....	378
12.1	General.....	378
12.2	LLDP overview.....	379
12.3	Type 2 LLDP Transmission Requirements.....	379
12.3.1	General	379
12.3.2	Chassis ID TLV (TLV Type = 1)	380
12.3.3	Port ID TLV (TLV Type = 2)	380
12.3.4	System Capabilities TLV (TLV Type = 7)	381
12.3.5	Management Address (TLV Type = 8).....	381
12.3.6	Type 2 Identification TLV (TLV Type = 127).....	381
12.3.7	Type 2 MAC Address TLV (TLV Type = 127)	381
12.3.8	Type 2 Interface Label TLV (TLV Type = 127).....	381
12.3.9	Additional Ethernet Capabilities TLV (TLV Type = 127).....	382
12.4	Type 2 LLDP Reception Requirements.....	382
12.5	Type 2 LLDP Reporting Requirements	382
12.6	EtherNet/IP LLDP Link State Transition Requirements	382
Annex A (normative)	Indicators and switches.....	383
A.1	Purpose	383
A.2	Indicators.....	383
A.2.1	General indicator requirements.....	383
A.2.2	Common indicator requirements	383
A.2.3	Fieldbus specific indicator requirements – option 1	385
A.2.4	Fieldbus specific indicator requirements – option 2.....	389
A.2.5	Fieldbus specific indicator requirements – option 3.....	393
A.3	Switches	398
A.3.1	Common switch requirements.....	398
A.3.2	Fieldbus specific switch requirements – option 1	398

A.3.3	Fieldbus specific switch requirements – option 2	398
A.3.4	Fieldbus specific switch requirements – option 3	399
Bibliography.....		400
Figure 1 – Data-link layer internal architecture.....		36
Figure 2 – Relationships of DLSAPs, DLSAP-addresses, and group DL-addresses.....		39
Figure 3 – Basic structure of a MAC ID address.....		39
Figure 4 – Basic structure of a generic tag address		40
Figure 5 – Basic structure of a fixed tag address		40
Figure 6 – M_symbols and Manchester encoding at 5 MHz.....		42
Figure 7 – NUT structure		45
Figure 8 – Media access during scheduled time.....		46
Figure 9 – Media access during unscheduled time		47
Figure 10 – DLPDU format.....		48
Figure 11 – Aborting a DLPDU during transmission.....		52
Figure 12 – Lpacket format		53
Figure 13 – Generic tag Lpacket format		54
Figure 14 – Fixed tag Lpacket format.....		54
Figure 15 – Goodness parameter of TimeDist_Lpacket.....		68
Figure 16 – Example I'm alive processing algorithm.....		75
Figure 17 – Keeper CRC algorithm		99
Figure 18 – Keeper object power-up state diagram		111
Figure 19 – Keeper object operating state diagram		112
Figure 20 – Synchronized network change processing		115
Figure 21 – State transition diagram for TCP/IP Interface object.....		147
Figure 22 – State transition diagram for TCP/IP Interface object.....		148
Figure 23 – ACD Behavior		150
Figure 24 – State transition diagram for Ethernet Link object		169
Figure 25 – Connection Configuration object edit flowchart.....		200
Figure 26 – Communication objects diagram for example device		229
Figure 27 – NAM state machine		256
Figure 28 – Devices with Multiple DLR Ring Pairs.....		314
Figure 29 – DLR rings connected to switches.....		315
Figure 30 – Normal operation of a DLR network.....		316
Figure 31 – Beacon and Announce frames.....		316
Figure 32 – Link failure		317
Figure 33 – Network reconfiguration after link failure		318
Figure 34 – Neighbor Check process		324
Figure 35 – Unsupported topology – example 1		328
Figure 36 – Unsupported topology – example 2		328
Figure 37 – DLR ring connected to switches through redundant gateways		330
Figure 38 – DLR redundant gateway capable device.....		331
Figure 39 – Advertise frame.....		333

Figure 40 – State transition diagram for Beacon frame based non-supervisor ring node.....	341
Figure 41 – State transition diagram for Announce frame based non-supervisor ring node	347
Figure 42 – State transition diagram for ring supervisor	351
Figure 43 – State transition diagram for redundant gateway.....	366
Figure 44 – PRP network	376
Figure 45 – Directly Attached SANs	377
Figure 46 – Virtual DANs	377
Figure 47 – HSR network	378
Figure 48 – IEEE LLDP PDU Format (source IEEE Std 802.1AB-2016).....	379
Figure 49 – Type 2 LLDP PDU Format	380
Figure 50 – Type 2 Identification TLV Format.....	381
Figure 51 – Type 2 MAC Address TLV Format	381
Figure 52 – Type 2 Interface Label TLV Format	382
Figure A.1 – Non redundant network status indicator labeling	389
Figure A.2 – Redundant network status indicator labeling	389
Figure A.3 – Network status indicator state diagram	392
Figure A.4 – Examples of multiple network status indicators	392
Table 1 – Format of attribute tables	34
Table 2 – Data-link layer components	36
Table 3 – MAC ID addresses allocation	40
Table 4 – Fixed tag service definitions	40
Table 5 – Data encoding rules	42
Table 6 – M Data symbols.....	43
Table 7 – Truth table for ph_status_indication.....	43
Table 8 – FCS length, polynomials and constants	49
Table 9 – DLL support services and objects.....	56
Table 10 – Elementary data types.....	59
Table 11 – DLL events	63
Table 12 – Time distribution priority	69
Table 13 – Format of the TUI Lpacket.....	71
Table 14 – ControlNet object class attributes	80
Table 15 – ControlNet object instance attributes	81
Table 16 – TUI status flag bits	86
Table 17 – Mac_ver bits.....	87
Table 18 – Channel state bits	87
Table 19 – ControlNet object common services.....	89
Table 20 – ControlNet object class specific services	90
Table 21 – Keeper object revision history	92
Table 22 – Keeper object class attributes	92
Table 23 – Keeper object instance attributes	93
Table 24 – Keeper operating state definitions	97

Table 25 – Port status flag bit definitions	97
Table 26 – TUI status flag bits	98
Table 27 – Keeper attributes	101
Table 28 – Memory requirements (in octets) for the Keeper attributes.....	101
Table 29 – Keeper object common services	102
Table 30 – Keeper object class specific services	102
Table 31 – Service error codes	103
Table 32 – Wire order format of the TUI Lpacket.....	107
Table 33 – Service error codes	108
Table 34 – Keeper object operating states	109
Table 35 – Keeper object state event matrix	113
Table 36 – Scheduling object class attributes	116
Table 37 – Scheduling object instance attributes	117
Table 38 – Scheduling object common services	117
Table 39 – Status error descriptions for Create	118
Table 40 – Status error descriptions for Delete and Kick_Timer	119
Table 41 – Scheduling object class specific services	119
Table 42 – Status error descriptions for Read	121
Table 43 – Status error descriptions for Conditional_Write	122
Table 44 – Status error descriptions for Forced_Write.....	122
Table 45 – Status error descriptions for Change_Start	123
Table 46 – Status error descriptions for Break_Connections	124
Table 47 – Status error descriptions for Change_Complete.....	124
Table 48 – Status error descriptions for Restart_Connections	125
Table 49 – Revision history.....	126
Table 50 – TCP/IP Interface object class attributes	127
Table 51 – TCP/IP Interface object instance attributes	127
Table 52 – Status bits	132
Table 53 – Configuration capability bits	133
Table 54 – Configuration control bits.....	134
Table 55 – Example path	135
Table 56 – Interface configuration components	136
Table 57 – Alloc control values	138
Table 58 – AcdActivity values	139
Table 59 – ArpPdu – ARP Response PDU in binary format	139
Table 60 – Admin Capability member bit definitions	140
Table 61 – Admin Capability member bit definitions	141
Table 62 – TCP/IP Interface connection point 1, Standard Network Diagnostics.....	142
Table 63 – TCP/IP Interface object common services	143
Table 64 – Get_Attributes_All response format	144
Table 65 – Set_Attributes_All request format	145
Table 66 – TCP/IP Interface object class specific services.....	145
Table 67 – Set_Port_Admin_State service request parameters	146

Table 68 – Set_Protocol_Admin_State service request parameters.....	146
Table 69 – Class specific error codes	147
Table 70 – Ethernet link object revision history	154
Table 71 – Ethernet link object class attributes	155
Table 72 – Ethernet link object instance attributes	155
Table 73 – Interface flags bits.....	160
Table 74 – Control bits.....	162
Table 75 – Interface type	163
Table 76 – Interface state	163
Table 77 – Admin state	163
Table 78 – Capability Bits	164
Table 79 – Ethernet Link connection point 1, Standard Network Diagnostics.....	165
Table 80 – Ethernet Link object common services.....	166
Table 81 – Get_Attributes_All response format	167
Table 82 – Ethernet Link object class specific services	168
Table 83 – DeviceNet object revision history.....	170
Table 84 – DeviceNet object class attributes.....	170
Table 85 – DeviceNet object instance attributes.....	170
Table 86 – Bit rate attribute values	173
Table 87 – BOI attribute values.....	173
Table 88 – Diagnostic counters bit description	176
Table 89 – DeviceNet object common services	177
Table 90 – Reset service parameter.....	177
Table 91 – Reset service parameter values	177
Table 92 – DeviceNet object class specific services.....	178
Table 93 – Connection Configuration object revision history	179
Table 94 – Connection Configuration object class attributes	179
Table 95 – Format number values.....	181
Table 96 – Connection Configuration object instance attributes	181
Table 97 – Originator connection status values.....	185
Table 98 – Target connection status values	185
Table 99 – Connection flags	186
Table 100 – I/O mapping formats	188
Table 101 – Services valid during a change operation	190
Table 102 – Connection Configuration object common services	190
Table 103 – Get_Attributes_All Response – class level.....	191
Table 104 – Get_Attributes_All response – instance level.....	191
Table 105 – Set_Attributes_All error codes	193
Table 106 – Set_Attributes_All request	193
Table 107 – Create request parameters	195
Table 108 – Create error codes	195
Table 109 – Delete error codes.....	195
Table 110 – Restore error codes.....	196

Table 111 – Connection Configuration object class specific services	196
Table 112 – Change_Start error codes.....	197
Table 113 – Get_Status service parameter	198
Table 114 – Get_Status service response	198
Table 115 – Get_Status service error codes	198
Table 116 – Change_Complete service parameter	199
Table 117 – Change_Complete service error codes	199
Table 118 – Audit_Changes service parameter	199
Table 119 – Audit_Changes service error codes	199
Table 120 – Revision history.....	201
Table 121 – DLR object class attributes	201
Table 122 – DLR object instance attributes	202
Table 123 – Network Status values	206
Table 124 – Ring Supervisor Status values.....	206
Table 125 – Capability flags.....	210
Table 126 – Redundant Gateway Status values	212
Table 127 – DLR connection point 1, Standard Network Diagnostics.....	213
Table 128 – DLR connection point 2, Standard Network Diagnostics.....	213
Table 129 – DLR object common services	214
Table 130 – Get_Attributes_All Response – Object Revision 1, non supervisor device.....	214
Table 131 – Get_Attributes_All Response – Object Revision 1, supervisor-capable device.....	215
Table 132 – Get_Attributes_All Response – Object Revision 2, non supervisor device.....	215
Table 133 – Get_Attributes_All Response – All other cases	216
Table 134 – DLR object class specific services	217
Table 135 – QoS object revision history	218
Table 136 – QoS object class attributes	219
Table 137 – QoS object instance attributes	219
Table 138 – Default DCSP values and usages	220
Table 139 – QoS object common services	221
Table 140 – Port object revision history	222
Table 141 – Port object class attributes	222
Table 142 – Port object instance attributes	223
Table 143 – Port Type and associated Logical Link Object classes and Port Type Name values.....	225
Table 144 – Port Routing Capabilities attribute bit definitions.....	228
Table 145 – Contents of Associated Communication objects attribute 11 for the two Port object instances of the example device	229
Table 146 – Port object common services	230
Table 147 – Get_Attributes_All response– class level	230
Table 148 – Get_Attributes_All response– instance level	230
Table 149 – Revision history.....	231
Table 150 – Class attributes	231
Table 151 – Instance attributes	232

Table 152 – Node Type.....	235
Table 153 – Switching Node	236
Table 154 – HSR Mode.....	237
Table 155 – RedBox ID.....	238
Table 156 – PRP/HSR Protocol connection point 1, Standard Network Diagnostics	239
Table 157 – PRP/HSR Protocol object common services	240
Table 158 – Get_Attributes_All response	240
Table 159 – Revision history.....	242
Table 160 – Class attributes	242
Table 161 – Instance attributes.....	242
Table 162 – Remote Node Type.....	244
Table 163 – PRP/HSR Nodes Tables object common services.....	245
Table 164 – Get_Attributes_All response	245
Table 165 – Revision history.....	245
Table 166 – Class attributes	246
Table 167 – Instance attributes.....	246
Table 168 – Bit Definitions of the LLDP Enable Array	247
Table 169 – LLDP Management object common services.....	248
Table 170 – Get_Attributes_All response	248
Table 171 – Revision history.....	249
Table 172 – Class attributes	249
Table 173 – Instance attributes.....	249
Table 174 – Bitmaps of supported capabilities & enabled capabilities	253
Table 175 – LLDP Management object common services.....	253
Table 176 – Get_Attributes_All response	254
Table 177 – NAM states.....	255
Table 178 – Default link parameters.....	256
Table 179 – PhL timing characteristics.....	264
Table 180 – DLR variables.....	319
Table 181 – DLR Link speed and duplex requirements.....	325
Table 182 – Redundant gateway variables.....	332
Table 183 – MAC addresses for DLR messages	335
Table 184 – IEEE Std 802.1Q-2018 common frame header format.....	335
Table 185 –DLR message payload fields	335
Table 186 – DLR frame types.....	336
Table 187 – Format of the Beacon frame	336
Table 188 – Ring State values	336
Table 189 – Format of the Neighbor_Check request	337
Table 190 – Format of the Neighbor_Check response.....	337
Table 191 – Format of the Link_Status/Neighbor_Status frame	337
Table 192 – Link/Neighbor status values.....	338
Table 193 – Format of the Locate_Fault frame.....	338
Table 194 – Format of the Announce frame	338

Table 195 – Format of the Sign_On frame	339
Table 196 – Format of the Advertise frame	339
Table 197 – Gateway state values	339
Table 198 – Format of the Flush_ Tables frame	340
Table 199 – Format of the Learning_Update frame	340
Table 200 – Parameter values for Beacon frame based non-supervisor ring node	341
Table 201 – LastBcnRcvPort bit definitions	342
Table 202 – State-event-action matrix for Beacon frame based non-supervisor ring node	342
Table 203 – Parameter values for Announce frame based non-supervisor ring node	348
Table 204 – State-event-action matrix for Announce frame based non-supervisor ring node	348
Table 205 – Parameter values for ring supervisor node	352
Table 206 – LastBcnRcvPort bit definitions	353
Table 207 – State-event-action matrix for ring supervisor node	353
Table 208 – Parameter values for redundant gateway node	366
Table 209 – State-event-action matrix for redundant gateway node	367
Table 210 – Parameters/assumptions for example performance calculations	370
Table 211 – Example ring configuration parameters and performance	373
Table 212 – Variables for performance analysis	374
Table 213 – LLDP support requirements	379
Table 214 – LLDP TLV Type Values	380
Table A.1 – Module status indicator	384
Table A.2 – Time Sync status indication	385
Table A.3 – Network status indicators	387
Table A.4 – Network status indicator	391
Table A.5 – Combined Module/Network status indicator	393
Table A.6 – Network status indicator	395
Table A.7 – Combined module/network status indicator	396
Table A.8 – I/O status indicator	397
Table A.9 – Bit rate switch encoding	399

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 4-2: Data-link layer protocol specification –
Type 2 elements**

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

IEC 61158-4-2 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2019. This edition constitutes a technical revision.

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

- a) update of normative and bibliographic references;
- b) use of more inclusive terminology ("master" and "slave" replaced, mainly in 7.3 and 7.7;
- c) new STIME, UTIME, NTIME, STRINGI and EPATH data types in 6.1.3;
- d) updates, addition of diagnostics connection points and new service for TCP/IP interface object in 7.5;
- e) addition of diagnostics connection points and new service for Ethernet Link object in 7.6;
- f) update of Get/Set_Attributes_All parameters for the Connection Configuration object in 7.8;
- g) addition of diagnostics connection points and new service for DLR object in 7.9;
- h) extensions and clarifications of Port object in 7.11;
- i) addition of diagnostics connection points and new service for PRP/HSR Protocol object in 7.12;
- j) addition of LLDP Management and LLDP Data Table objects in 7.1, 7.14 and 7.15;
- k) addition of LLDP protocol support in Clause 12;
- l) addition of a combined module/network indicator in A.2.4.5;
- m) removal of all references to CPF and CPs (material moved to profile documents);
- n) miscellaneous editorial corrections.

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

Draft	Report on voting
65C/1202/FDIS	65C/1243/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document 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 document 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 could work together in any combination.

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 4-2: Data-link layer protocol specification – Type 2 elements

1 Scope

1.1 General

The data-link layer provides basic time-critical messaging communications between devices in an automation environment.

This part of IEC 61158 specifies a main protocol with the following characteristics.

- This protocol provides communication opportunities to all participating data-link entities, sequentially and in a cyclic synchronous manner. Foreground scheduled access is available for time-critical activities together with background unscheduled access for less critical activities.
- Deterministic and synchronized transfers can be provided at cyclic intervals up to 1 ms and device separations of 25 km. This performance is adjustable dynamically and on-line by re-configuring the parameters of the local link whilst normal operation continues. By similar means, DL connections and new devices can be added or removed during normal operation.
- This protocol provides means to maintain clock synchronization across an extended link with a precision better than 10 μ s.
- This protocol optimizes each access opportunity by concatenating multiple DLSDUs and associated DLPCI into a single DLPDU, thereby improving data transfer efficiency for data-link entities that actively source multiple streams of data.
- The maximum system size is an unlimited number of links of 99 nodes, each with 255 DLSAP-addresses. Each link has a maximum of 2^{24} related peer and publisher DLCEPs.

This document specifies additional lower layers protocols or implementations of additional lower layers protocols for use in combination with ISO/IEC/IEEE 8802-3.

This document specifies a set of corresponding objects providing a consistent management interface to the lower layers.

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 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 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 (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 capabilities of an implementation, 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 the IEC 61784-1 series and the IEC 61784-2 series 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 61131-3, *Programmable controllers – Part 3: Programming languages*

IEC 61158-3-2:2023, *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*

IEC 61158-5-2:2023, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61158-6-2:2023, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*

IEC 61588, *Precision clock synchronization protocol for networked measurement and control systems*

IEC 61784-3-2, *Industrial communication networks – Profiles – Part 3-2: Functional safety fieldbuses – Additional specifications for CPF 2*

IEC 62026-3:2014, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) – Part 3: DeviceNet*

IEC 62439-3:2016¹, *Industrial communication networks – High availability automation networks – Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)*

¹ A newer edition of this standard has been published, but only the cited edition applies.

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

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, *Telecommunications and exchange between information technology systems – Requirements for local and metropolitan area networks – Part 3: Standard for Ethernet*

ISO 11898-1:2015, *Road vehicles – Controller area network (CAN) – Part 1: Data link layer and physical signalling*

IEEE Std 802.1AB-2016, *IEEE Standard for local and metropolitan area networks – Station and Media Access Control Connectivity Discovery*

IEEE Std 802.1ABcu-2021, *Standard for local and metropolitan area networks – Station and Media Access Control Connectivity Discovery Amendment: YANG Data Model*

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