

BS EN 61158-4-20:2014



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Industrial communication networks — Fieldbus specifications

Part 4-20: Data-link layer protocol specification — Type 20 elements

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National foreword

This British Standard is the UK implementation of EN 61158-4-20:2014. It is identical to IEC 61158-4-20:2014.

The UK participation in its preparation was entrusted to Technical Committee AMT/7, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2014

ISBN 978 0 580 79448 3

ICS 25.040.40; 35.100.20; 35.110

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2014.

Amendments/corrigenda issued since publication

Date	Text affected
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English Version

**Industrial communication networks - Fieldbus specifications -
Part 4-20: Data-link layer protocol specification - Type 20
elements
(IEC 61158-4-20:2014)**

Réseaux de communication industriels - Spécifications des
bus de terrain - Partie 4-20: Spécification du protocole de la
couche liaison de données - Éléments de type 20
(CEI 61158-4-20:2014)

Industrielle Kommunikationsnetze - Feldbusse - Teil 4-20:
Protokollspezifikation des Data Link Layer
(Sicherheitsschicht) - Typ 20-Elemente
(IEC 61158-4-20:2014)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of document 65C/762/FDIS, future edition 1 of IEC 61158-4-20, 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 61158-4-20:2014.

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) 2015-06-19
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-09-19

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This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

Endorsement notice

The text of the International Standard IEC 61158-4-20:2014 was approved by CENELEC as a European Standard without any modification.

In the official version, for bibliography, the following notes have to be added for the standards indicated:

IEC 61158-1:2014	NOTE	Harmonised as EN 61158-1:2014
IEC 61158-3-20:2014	NOTE	Harmonised as EN 61158-3-20:2014
IEC 61158-5-20:2014	NOTE	Harmonised as EN 61158-5-20:2014
IEC 61784-1	NOTE	Harmonised as EN 61784-1
IEC 61784-2	NOTE	Harmonised as EN 61784-2
IEC 62591:2010	NOTE	Harmonised as EN 62591:2010

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When 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.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-2	2014	Industrial communication networks - Fieldbus specifications Part 2: Physical layer specification and service definition	EN 61158-2	2014
IEC 61158-6-20	2014	Industrial communication networks - Fieldbus specifications Part 6-20: Application layer protocol specification - Type 20 elements	EN 61158-6-20	2014
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 10731	-	Information technology - Open Systems Interconnection - Basic Reference Model - Conventions for the definition of OSI services	-	-

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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 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 4-20: Data-link layer protocol specification – Type 20 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 a means of connecting devices through a partial mesh network, such that most failures of an interconnection between two devices can be circumvented. In common practice the devices are interconnected in a non-redundant hierarchical manner reflecting application needs

1.2 Specifications

This International 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 International 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 61158-2:2014, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-6-20:2014, *Industrial communication networks – Fieldbus specifications – Part 6-20: Application layer protocol specification – Type 20 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 10731, *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	[7498-3]
3.1.2	calling-DL-address	[7498-3]
3.1.3	centralized multi-end-point-connection	[7498-1]
3.1.4	correspondent (N)-entities	[7498-1]
	correspondent DL-entities (N=2)	
	correspondent Ph-entities (N=1)	
3.1.5	demultiplexing	[7498-1]
3.1.6	DL-address	[7498-3]
3.1.7	DL-address-mapping	[7498-1]
3.1.8	DL-connection	[7498-1]
3.1.9	DL-connection-end-point	[7498-1]
3.1.10	DL-connection-end-point-identifier	[7498-1]
3.1.11	DL-connection-mode transmission	[7498-1]
3.1.12	DL-connectionless-mode transmission	[7498-1]
3.1.13	DL-data-sink	[7498-1]
3.1.14	DL-data-source	[7498-1]
3.1.15	DL-duplex-transmission	[7498-1]
3.1.16	DL-facility	[7498-1]
3.1.17	DL-local-view	[7498-3]
3.1.18	DL-name	[7498-3]
3.1.19	DL-protocol	[7498-1]
3.1.20	DL-protocol-connection-identifier	[7498-1]
3.1.21	DL-protocol-control-information	[7498-1]

3.1.22	DL-protocol-data-unit	[7498-1]
3.1.23	DL-protocol-version-identifier	[7498-1]
3.1.24	DL-relay	[7498-1]
3.1.25	DL-service-connection-identifier	[7498-1]
3.1.26	DL-service-data-unit	[7498-1]
3.1.27	DL-simplex-transmission	[7498-1]
3.1.28	DL-subsystem	[7498-1]
3.1.29	DL-user-data	[7498-1]
3.1.30	flow control	[7498-1]
3.1.31	layer-management	[7498-1]
3.1.32	multiplexing	[7498-3]
3.1.33	naming-(addressing)-authority	[7498-3]
3.1.34	naming-(addressing)-domain	[7498-3]
3.1.35	naming-(addressing)-subdomain	[7498-3]
3.1.36	(N)-entity	[7498-1]
	DL-entity	
	Ph-entity	
3.1.37	(N)-interface-data-unit	[7498-1]
	DL-service-data-unit	(N=2)
	Ph-interface-data-unit	(N=1)
3.1.38	(N)-layer	[7498-1]
	DL-layer	(N=2)
	Ph-layer	(N=1)
3.1.39	(N)-service	[7498-1]
	DL-service	(N=2)
	Ph-service	(N=1)
3.1.40	(N)-service-access-point	[7498-1]
	DL-service-access-point	(N=2)
	Ph-service-access-point	(N=1)
3.1.41	(N)-service-access-point-address	[7498-1]
	DL-service-access-point-address	(N=2)
	Ph-service-access-point-address	(N=1)
3.1.42	peer-entities	[7498-1]
3.1.43	Ph-interface-control-information	[7498-1]
3.1.44	Ph-interface-data	[7498-1]
3.1.45	primitive name	[7498-3]
3.1.46	reassembling	[7498-1]
3.1.47	recombining	[7498-1]
3.1.48	reset	[7498-1]
3.1.49	responding-DL-address	[7498-3]
3.1.50	routing	[7498-1]
3.1.51	segmenting	[7498-1]
3.1.52	sequencing	[7498-1]
3.1.53	splitting	[7498-1]
3.1.54	synonymous name	[7498-3]
3.1.55	systems-management	[7498-1]

3.2 Service convention terms and definitions

This standard also makes use of the following terms defined in ISO/IEC 10731 as they apply to the data-link layer:

3.2.1	acceptor
3.2.2	asymmetrical service
3.2.3	confirm (primitive); requestor.deliver (primitive)
3.2.4	deliver (primitive)
3.2.5	DL-confirmed-facility
3.2.6	DL-facility
3.2.7	DL-local-view
3.2.8	DL-mandatory-facility

3.2.9	DL-non-confirmed-facility
3.2.10	DL-provider-initiated-facility
3.2.11	DL-provider-optional-facility
3.2.12	DL-service-primitive; primitive
3.2.13	DL-service-provider
3.2.14	DL-service-user
3.2.15	DLS-user-optional-facility
3.2.16	indication (primitive); acceptor.deliver (primitive)
3.2.17	multi-peer
3.2.18	request (primitive); requestor.submit (primitive)
3.2.19	requestor
3.2.20	response (primitive); acceptor.submit (primitive)
3.2.21	submit (primitive)
3.2.22	symmetrical service

3.3 Common terms and definitions

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

NOTE Many definitions are common to more than one protocol Type; they are not necessarily used by all protocol Types.

3.3.1

DL-segment, link, local link

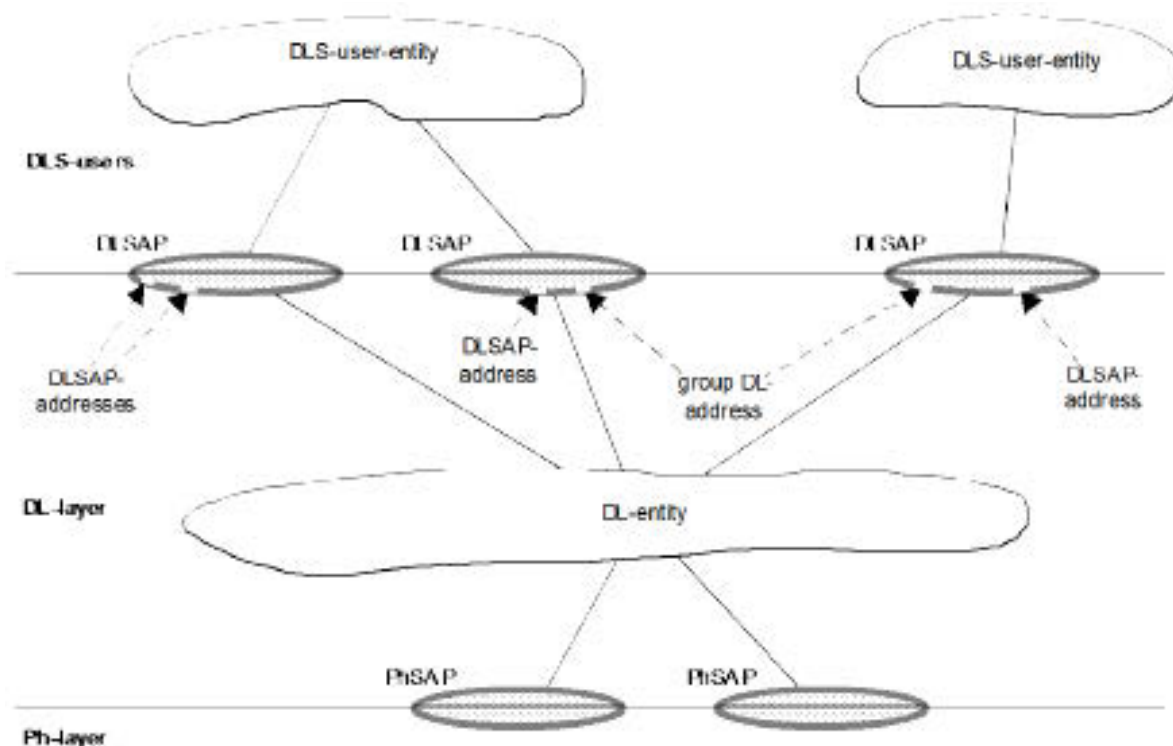
single DL-subnetwork in which any of the connected DLEs may communicate directly, without any intervening DL-relaying, whenever all of those DLEs that are participating in an instance of communication are simultaneously attentive to the DL-subnetwork during the period(s) of attempted communication

3.3.2

DLSAP

distinctive point at which DL-services are provided by a single DL-entity to a single higher-layer entity

Note 1 to entry: This definition, derived from ISO/IEC 7498-1, is repeated here to facilitate understanding of the critical distinction between DLSAPs and their DL-addresses, see Figure 1.



NOTE 1 DLSAPs and PhSAPs are depicted as ovals spanning the boundary between two adjacent layers.

NOTE 2 DL-addresses are depicted as designating small gaps (points of access) in the DLL portion of a DLSAP.

NOTE 3 A single DL-entity may have multiple DLSAP-addresses and group DL-addresses associated with a single DLSAP.

Figure 1 – Relationships of DLSAPs, DLSAP-addresses and group DL-addresses

3.3.3

DL(SAP)-address

either an individual DLSAP-address, designating a single DLSAP of a single DLS-user, or a group DL-address potentially designating multiple DLSAPs, each of a single DLS-user

Note 1 to entry: This terminology is chosen because ISO/IEC 7498-3 does not permit the use of the term DLSAP-address to designate more than a single DLSAP at a single DLS-user.

3.3.4

(individual) DLSAP-address

DL-address that designates only one DLSAP within the extended link

Note 1 to entry: A single DL-entity may have multiple DLSAP-addresses associated with a single DLSAP.

3.3.5

extended link

DL-subnetwork, consisting of the maximal set of links interconnected by DL-relays, sharing a single DL-name (DL-address) space, in which any of the connected DL-entities may communicate, one with another, either directly or with the assistance of one or more of those intervening DL-relay entities

Note 1 to entry: An extended link may be composed of just a single link.

3.3.6

frame

designated synonym for DLPDU

3.3.7**group DL-address**

DL-address that potentially designates more than one DLSAP within the extended link

Note 1 to entry: A single DL-entity may have multiple group DL-addresses associated with a single DLSAP. A single DL-entity also may have a single group DL-address associated with more than one DLSAP.

3.3.8**node**

single DL-entity as it appears on one local link

3.3.9**receiving DLS-user**

DL-service user that acts as a recipient of DLS-user-data

Note 1 to entry: A DL-service user can be concurrently both a sending and receiving DLS-user.

3.3.10**sending DLS-user**

DL-service user that acts as a source of DLS-user-data

3.4 Additional Type 20 definitions**3.4.1****analog controller**

controller designed for use with only 4 mA to 20 mA current signaling that meets all requirements of a current input device or current output device

3.4.2**analog signal**

low frequency current, predominantly 4 mA to 20 mA signal sent to or originating from a field device

3.4.3**analog signal spectrum**

frequencies from zero to 25 Hz at unit amplitude and decreasing at 40 dB per decade above 25 Hz

3.4.4**analog test filter**

two-pole low-pass Butterworth filter with the cutoff frequency of 25 Hz

3.4.5**application**

function or data structure for which data is consumed or produced

3.4.6**application object**

object class that manages and provides the run time exchange of messages across the network and within the network device

Note 1 to entry: Multiple types of application object classes may be defined.

3.4.7**application relationship**

cooperative association between two or more application-entity-invocations for the purpose of exchange of information and coordination of their joint operation

Note 1 to entry: This relationship is activated either by the exchange of application-protocol-data-units or as a result of pre-configuration activities.