

© Copyright SEK. Reproduction in any form without permission is prohibited.

Industriell processtyrning – Fältbuss – Del 4-17: Specifikation av protokoll i datalänksskiktet – Delar i fältbuss, Typ 17

*Industrial communication networks –
Fieldbus specifications –
Part 4-17: Data-link layer protocol specification –
Type 17 elements*

Som svensk standard gäller europastandarden EN 61158-4-17:2008. Den svenska standarden innehåller den officiella engelska språkversionen av EN 61158-4-17:2008.

Nationellt förord

Europastandarden EN 61158-4-17:2008

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 61158-4-17, First edition, 2007 - Industrial communication networks - Fieldbus specifications - Part 4-17: Data-link layer protocol specification - Type 17 elements**

utarbetad inom International Electrotechnical Commission, IEC.

Denna standard, och de andra delarna i serien SS-EN 61158-4, ersätter SS-EN 61158-4, utgåva 1, 2004.

Tidigare fastställd svensk standard SS-EN 61158-4, utgåva 1, 2004, gäller ej fr o m 2011-02-01.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a säkerhet, prestanda, dokumentation, utförande och skötsel av elprodukter, elanläggningar och metoder. Genom att utforma sådana standarder blir säkerhetskraven tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

English version

**Industrial communication networks -
Fieldbus specifications -
Part 4-17: Data-link layer protocol specification -
Type 17 elements
(IEC 61158-4-17:2007)**

Réseaux de communication industriels -
Spécifications des bus de terrain -
Partie 4-17: Spécification des protocoles
des couches de liaison de données -
Eléments de type 17
(CEI 61158-4-17:2007)

Industrielle Kommunikationsnetze -
Feldbusse -
Teil 4-17: Protokollspezifikation
des Data Link Layer (Sicherheitsschicht) -
Typ 17-Elemente
(IEC 61158-4-17:2007)

This European Standard was approved by CENELEC on 2008-02-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 65C/474/FDIS, future edition 1 of IEC 61158-4-17, 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 was approved by CENELEC as EN 61158-4-17 on 2008-02-01.

This and the other parts of the EN 61158-4 series supersede EN 61158-4:2004.

With respect to EN 61158-4:2004 the following changes were made:

- deletion of Type 6 fieldbus, and the placeholder for a Type 5 fieldbus data-link layer, for lack of market relevance;
- addition of new fieldbus types;
- partition into multiple parts numbered 4-1, 4-2, ..., 4-19.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2008-11-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2011-02-01

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 EN 61784 series. Use of the various protocol types in other combinations may require permission from their respective intellectual-property-right holders.

IEC and CENELEC draw 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 17 and possibly other types:

PCT Application No. PCT/JP2004/011537 [YEC] Communication control method

PCT Application No. PCT/JP2004/011538 [YEC] Communication control method

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

The holders of these patent rights have assured IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holders of these patent rights are registered with IEC. Information may be obtained from:

[YEC]: Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, 180-8750 Tokyo,
Japan
Attention: Intellectual Property & Standardization Center

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

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61158-4-17:2007 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 61158-5-17	NOTE	Harmonized as EN 61158-5-17:2008 (not modified).
IEC 61158-6-17	NOTE	Harmonized as EN 61158-6-17:2008 (not modified).
IEC 61784-2	NOTE	Harmonized as EN 61784-2:2008 (not modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-3-17	- ¹⁾	Industrial communication networks - Fieldbus specifications - Part 3-17: Data-link layer service definition - Type 17 elements	EN 61158-3-17	2008 ²⁾
ISO/IEC 7498	Series	Information technology - Open Systems Interconnection - Basic Reference Model	EN ISO/IEC 7498	Series
ISO/IEC 8802-3	- ¹⁾	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	- ¹⁾	Information technology - Open Systems Interconnection - Basic reference model - Conventions for the definition of OSI services	-	-
IEEE 802.3ab	- ¹⁾	Information technology - Telecommunications - and information exchange between systems - Local and metropolitan area networks - Specific requirements - Supplement to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and physical layer specifications - Physical layer parameters and specifications for 1000 Mb/s operation over 4-pair of category 5 balanced copper cabling, type 1000BASE-T		-
IETF RFC 768	- ¹⁾	User Datagram Protocol	-	-
IETF RFC 791	- ¹⁾	Internet Protocol	-	-
IETF RFC 792	- ¹⁾	Internet Control Message Protocol	-	-
IETF RFC 826	- ¹⁾	Ethernet Address Resolution Protocol	-	-
IETF RFC 894	- ¹⁾	Standard for the Transmission of IP Datagrams over Ethernet Networks	-	-
IETF RFC 1112	- ¹⁾	Host Extensions for IP Multicasting	-	-

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IETF RFC 2236	- ¹⁾	Internet Group Management Protocol	-	-

CONTENTS

INTRODUCTION.....	6
1 Scope.....	7
1.1 General.....	7
1.2 Specifications.....	7
1.3 Procedures.....	7
1.4 Applicability.....	7
1.5 Conformance.....	8
2 Normative reference	8
3 Definitions	8
3.1 Terms and definitions	8
3.2 Abbreviations and symbols	11
3.3 Conventions	11
4 Overview of the DL-protocol	12
4.1 General.....	12
4.2 Characteristics of the protocol.....	12
4.3 Data-link layer architecture.....	12
4.4 Services provided by the DLL.....	14
4.5 Network sharing with other protocols.....	15
5 DLPDU-parameter structure and encoding.....	15
5.1 Overview	15
5.2 DLPDU common header format	16
5.3 DLPDU body format	17
6 Local parameters and resources.....	21
6.1 General.....	21
6.2 Parameters and resources related to network structure	22
6.3 Parameters and resources to support real-time data transfer.....	23
6.4 Parameters and resources to support the scheduling function	24
6.5 Parameters and resources to support the security function.....	25
7 DL-service elements of procedure	26
7.1 Unacknowledged unitdata transfer service (UUS).....	26
7.2 Acknowledged unitdata transfer service (AUS).....	26
7.3 Acknowledged sequence of unitdata transfer service (ASS)	26
7.4 Multipoint unitdata transfer service (MUS).....	27
7.5 Multipoint sequence of unitdata transfer service (MSS)	27
8 DL-support protocol	28
8.1 Transmission scheduling	28
8.2 Redundancy	29
8.3 DLPDU authentication	31
Bibliography.....	32
Table 1 – Conventions used for protocol procedure definitions	12
Table 2 – Referenced standards for the layers.....	13
Table 3 – Bit positions	16
Table 4 – Common header format.....	17

Table 5 – DLPDU types	17
Table 6 – Service subtype and PDU type of DLPDUs	18
Table 7 – UUS_DT_PDU	18
Table 8 – AUS_DT_PDU	19
Table 9 – AUS_RSP_PDU	19
Table 10 – ASS_DT_PDU	20
Table 11 – ASS_ENQ_PDU	20
Table 12 – ASS_RSP_PDU	20
Table 13 – MUS_DT_PDU	21
Table 14 – MSS_DT_PDU	21
Table 15 – Parameters and resources for the network structure	22
Table 16 – Ranges of parameters for the network structure	23
Table 17 – Parameters and resources real-time data transfer	23
Table 18 – Ranges of parameters for real-time data transfer	23
Table 19 – Parameters and resources for scheduling function	24
Table 20 – Ranges of parameters for scheduling	25
Table 21 – Parameters and resources for security function	25
Table 22 – Ranges of parameters for security function	25
Table 23 – UUS procedure	26
Table 24 – AUS procedure	26
Table 25 – ASS procedure	27
Table 26 – MUS procedure	27
Table 27 – MSS procedure	28

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 4-17: Data-link layer protocol specification – Type 17 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 cyclic asynchronous manner, sequentially to each of those data-link entities, and
- b) in a synchronous manner, either cyclically or acyclically, according to a pre-established schedule.

The specified protocol also provides means of changing the set of participating data-link entities and of modifying the set of scheduled communications opportunities. When the set of scheduled communications opportunities is null, the distribution of communication opportunities to the participating data-link entities is completely asynchronous.

Thus this protocol can be characterized as one which provides access asynchronously but with a synchronous overlay.

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) 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 reference

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For all other undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61158-3-17, *Industrial communication networks – Fieldbus specifications – Part 3-17: Data-link layer service definition – Type 17 elements*

ISO/IEC 7498 (all parts), *Information technology – Open Systems Interconnection – Basic Reference Model*

ISO/IEC 8802-3, *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*

IEEE Std 802.3ab, *Information technology – Telecommunications and information exchange between systems - Local and metropolitan area networks – Specific requirements – Supplement to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and physical layer specifications – Physical layer parameters and specifications for 1000 Mb/s operation over 4-pair of category 5 balanced copper cabling, type 1000BASE-T*

Internet Engineering Task Force (IETF), *Request for Comments (RFC)*:

RFC 768	<i>User Datagram Protocol</i> (available at < http://www.ietf.org/rfc/rfc0768.txt >)
RFC 791	<i>Internet Protocol</i> (available at < http://www.ietf.org/rfc/rfc0791.txt >)
RFC 792	<i>Internet Control Message Protocol</i> (available at < http://www.ietf.org/rfc/rfc0792.txt >)
RFC 826	<i>Ethernet Address Resolution Protocol</i> (available at < http://www.ietf.org/rfc/rfc0826.txt >)
RFC 894	A standard for the Transmission of IP Datagrams over Ethernet Networks (available at < http://www.ietf.org/rfc/rfc0894.txt >)
RFC 1112	<i>Host Extensions for IP Multicasting</i> (available at < http://www.ietf.org/rfc/rfc1112.txt >)
RFC 2236	<i>Internet Group Management Protocol Version 2</i> (available at < http://www.ietf.org/rfc/rfc2236.txt >)

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]