

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

Industriell processtyrning – Fältbuss – Del 6-16: Specifikation av protokoll i applikationsskiktet – Delar i fältbuss, Typ 16

*Industrial communication networks –
Fieldbus specifications –
Part 6-16: Application layer protocol specification –
Type 16 elements*

Som svensk standard gäller europastandarden EN 61158-6-16:2008. Den svenska standarden innehåller den officiella engelska språkversionen av EN 61158-6-16:2008.

Nationellt förord

Europastandarden EN 61158-6-16:2008

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 61158-6-16, First edition, 2007 - Industrial communication networks - Fieldbus specifications - Part 6-16: Application layer protocol specification - Type 16 elements**

utarbetad inom International Electrotechnical Commission, IEC.

Denna standard, och de andra delarna i serien SS-EN 61158-6, ersätter SS-EN 61158-6, utgåva 1, 2004. Denna standard ersätter även delvis SS-EN 61491, utgåva 1, 1998.

Tidigare fastställd svensk standard SS-EN 61158-6, utgåva 1, 2004 och SS-EN 61491, utgåva 1, 1998, gäller ej fr o m 2011-02-01.

ICS 35.100.70; 25.040.40

Denna standard är fastställd av SEK Svensk Elstandard, som också kan lämna upplysningar om **sakinnehållet** i standarden.
Postadress: SEK, Box 1284, 164 29 KISTA
Telefon: 08 - 444 14 00. Telefax: 08 - 444 14 30
E-post: sek@elstandard.se. Internet: www.elstandard.se

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 6-16: Application layer protocol specification -
Type 16 elements
(IEC 61158-6-16:2007)**

Réseaux de communication industriels -
Spécifications des bus de terrain -
Partie 6-16: Spécification des services
des couches d'application -
Éléments de type 16
(CEI 61158-6-16:2007)

Industrielle Kommunikationsnetze -
Feldbusse -
Teil 6-16: Protokollspezifikation
des Application Layer
(Anwendungsschicht) -
Typ 16-Elemente
(IEC 61158-6-16:2007)

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/476/FDIS, future edition 1 of IEC 61158-6-16, 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 61158-6-16 on 2008-02-01.

This and the other parts of the EN 61158-6 series supersede EN 61158-6:2004. Together with EN 61158-2:2008 and its companion parts for Type 16, it also partially replaces EN 61491:1998 which is at present being revised (to be issued as a Technical Report).

With respect to EN 61158-6:2004 the following changes were made:

- deletion of Type 6 fieldbus for lack of market relevance;
- addition of new fieldbus types;
- partition into multiple parts numbered 6-2, 6-3, ...6-20.

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.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61158-6-16:2007 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 60559	NOTE Harmonized as HD 592 S1:1991 (not modified).
IEC 61158-3-16	NOTE Harmonized as EN 61158-3-16:2008 (not modified).
IEC 61784-1	NOTE Harmonized as EN 61784-1:2008 (not modified).
ISO/IEC 8877	NOTE Harmonized as EN 28877:1993 (not modified).
ISO 8601	NOTE Harmonized as EN 28601:1992 (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 61158-4-16	- ¹⁾	Industrial communication networks - Fieldbus specifications - Part 4-16 Application layer service definition - Type 16 elements	EN 61158-4-16	2008 ²⁾
IEC 61158-5-16	- ¹⁾	Industrial communication networks - Fieldbus specifications - Part 5-16 Application layer service definition - Type 16 elements	EN 61158-5-16	2008 ²⁾
ISO/IEC 7498-1	- ¹⁾	Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model	EN ISO/IEC 7498-1	1995 ²⁾
ISO/IEC 8822	1994	Information technology - Open Systems Interconnection - Presentation service definition	-	-
ISO/IEC 8824-2	- ¹⁾	Information technology - Abstract Syntax Notation One (ASN.1): Information object specification	-	-
ISO/IEC 9545	- ¹⁾	Information technology - Open Systems Interconnection - Application Layer structure	-	-
ISO/IEC 10731	- ¹⁾	Information technology - Open Systems Interconnection - Basic reference model - Conventions for the definition of OSI services	-	-

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

CONTENTS

INTRODUCTION	6
1 Scope	7
1.1 General	7
1.2 Specifications	8
1.3 Conformance	8
2 Normative references	8
3 Terms, definitions, abbreviations, symbols and conventions	8
3.1 Referenced terms and definitions	8
3.2 Additional terms and definitions for Type 16	10
3.3 Additional abbreviations and symbols for Type 16	11
3.4 Conventions	11
4 Abstract syntax	11
5 Transfer syntax	12
5.1 Introduction	12
5.2 RTC-MDT PDU merged abstract and transfer syntax	12
5.3 RTC-AT PDU merged abstract and transfer syntax	12
5.4 RTC-MDT PDU encoding	13
5.5 RTC-AT PDU encoding	13
6 Structure of FAL protocol state machines	13
7 AP-Context state machine	15
7.1 Overview	15
7.2 States	15
7.3 States, events and transitions	15
8 FAL service protocol machine (FSPM)	16
8.1 Overview	16
8.2 MGT services	16
8.3 IDN services	17
8.4 CYCIDN services	17
8.5 File transmission services	17
9 Application relationship protocol machine (ARPM)	18
9.1 Overview	18
9.2 Master ARPM	18
9.3 Slave ARPM	19
9.4 Primitives received from the FSPM	20
9.5 Indications received from the DMPM	22
10 DLL mapping protocol machine (DMPM)	23
10.1 Overview	23
10.2 Primitives received from the ARPM	23
10.3 Indications received from the DL	23
Bibliography	24
Figure 1 – Relationships among protocol machines and adjacent layers	14
Figure 2 – APCSM state diagram	15
Figure 3 – ARPM master AR state diagram	18

Figure 4 – ARPM slave AR state diagram	19
Table 1 – RTC-MDT PDU attribute format	12
Table 2 – RTC-AT PDU attribute format	12
Table 3 – RTC-MDT PDU attribute encoding	13
Table 4 – RTC-AT PDU attribute encoding	13
Table 5 – APCSM state-event table	16
Table 6 – ARPM master state-event table	19
Table 7 – ARPM slave state-event table	20
Table 8 – ARPM to DL mapping	23
Table 9 – DL to ARPM mapping	23

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 application protocol provides the application service by making use of the services available from the data-link or other immediately lower 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 application entities (AEs) 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:

- as a guide for implementors and designers;
- for use in the testing and procurement of equipment;
- as part of an agreement for the admittance of systems into the open systems environment;
- 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 6-16: Application layer protocol specification – Type 16 elements

1 Scope

1.1 General

The fieldbus Application Layer (FAL) provides user programs with a means to access the fieldbus communication environment. In this respect, the FAL can be viewed as a “window between corresponding application programs.”

This standard provides common elements for basic time-critical and non-time-critical messaging communications between application programs in an automation environment and material specific to Type 16 fieldbus. The term “time-critical” is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the time window risks failure of the applications requesting the actions, with attendant risk to equipment, plant and possibly human life.

This standard defines in an abstract way the externally visible service provided by the different Types of fieldbus Application Layer in terms of

- an abstract model for defining application resources (objects) capable of being manipulated by users via the use of the FAL service,
- the primitive actions and events of the service;
- the parameters associated with each primitive action and event, and the form which they take; and
- the interrelationship between these actions and events, and their valid sequences.

The purpose of this standard is to define the services provided to

- the FAL user at the boundary between the user and the Application Layer of the Fieldbus Reference Model, and
- Systems Management at the boundary between the Application Layer and Systems Management of the Fieldbus Reference Model.

This standard specifies the structure and services of the IEC fieldbus Application Layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498) and the OSI Application Layer Structure (ISO/IEC 9545).

FAL services and protocols are provided by FAL application-entities (AE) contained within the application processes. The FAL AE is composed of a set of object-oriented Application Service Elements (ASEs) and a Layer Management Entity (LME) that manages the AE. The ASEs provide communication services that operate on a set of related application process object (APO) classes. One of the FAL ASEs is a management ASE that provides a common set of services for the management of the instances of FAL classes.

Although these services specify, from the perspective of applications, how request and responses are issued and delivered, they do not include a specification of what the requesting and responding applications are to do with them. That is, the behavioral aspects of the applications are not specified; only a definition of what requests and responses they can send/receive is specified. This permits greater flexibility to the FAL users in standardizing

such object behavior. In addition to these services, some supporting services are also defined in this standard to provide access to the FAL to control certain aspects of its operation.

1.2 Specifications

The principal objective of this standard is to specify the syntax and behavior of the application layer protocol that conveys the application layer services defined in IEC 61158-5-16.

A secondary objective is to provide migration paths from previously-existing industrial communications protocols. It is this latter objective which gives rise to the diversity of protocols standardized in subparts of IEC 61158-6.

1.3 Conformance

This standard does not specify individual implementations or products, nor does it constrain the implementations of application layer entities within industrial automation systems.

There is no conformance of equipment to this application layer service definition standard. Instead, conformance is achieved through implementation of conforming application layer protocols that fulfill any given Type of application layer services as defined in this standard.

2 Normative references

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.

IEC 61158-4-16, *Industrial communication networks – Fieldbus specifications – Part 4-16: Data-link layer protocol specification – Type 16 elements*

IEC 61158-5-16, *Industrial communication networks – Fieldbus specifications – Part 5-16: Application layer service definition – Type 16 elements*

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

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

ISO/IEC 8822:1994, *Information technology – Open Systems Interconnection – Presentation service definition*

ISO/IEC 8824, *Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1)*

ISO/IEC 9545, *Information technology – Open Systems Interconnection – Application Layer structure*

■ [REDACTED]

■ [REDACTED]

■ [REDACTED]

[REDACTED]

[REDACTED]