



IEC 61158-5-17

Edition 1.0 2007-12

INTERNATIONAL STANDARD

**Industrial communication networks – Fieldbus specifications –
Part 5-17: Application layer service definition – Type 17 elements**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XA**

ICS 35.100.70; 25.040.40

ISBN 2-8318-9469-7

CONTENTS

| | |
|---|----|
| FOREWORD..... | 4 |
| INTRODUCTION..... | 6 |
| 1 Scope..... | 7 |
| 1.1 Overview..... | 7 |
| 1.2 Specifications..... | 8 |
| 1.3 Conformance..... | 8 |
| 2 Normative references | 8 |
| 3 Definitions | 8 |
| 3.1 Terms and definitions | 8 |
| 3.2 Abbreviations and symbols..... | 14 |
| 3.3 Conventions | 14 |
| 4 Concepts..... | 18 |
| 4.1 General..... | 18 |
| 4.2 Relationships between ASEs..... | 18 |
| 4.3 FAL ASEs..... | 18 |
| 4.4 Common FAL service parameters..... | 19 |
| 5 ASEs..... | 19 |
| 5.1 Variable ASE..... | 19 |
| 5.2 Event ASE..... | 23 |
| 5.3 Load region ASE | 25 |
| 5.4 Function invocation ASE | 28 |
| 5.5 Time ASE..... | 30 |
| 5.6 Network management ASE..... | 33 |
| 5.7 Application relationship ASE | 37 |
| 6 ARs..... | 46 |
| 6.1 General..... | 46 |
| 6.2 Point-to-point user-triggered confirmed client/server AREP (PTC-AR) | 46 |
| 6.3 Point-to-point user-triggered unconfirmed client/server AREP (PTU-AR) | 48 |
| 6.4 Point-to-point network-scheduled unconfirmed publisher/subscriber AREP (PSU-AR) | 49 |
| 6.5 Multipoint user-triggered unconfirmed publisher/subscriber AREP (MTU-AR) | 50 |
| 6.6 Multipoint network-scheduled unconfirmed publisher/subscriber AREP (MSU-AR)..... | 51 |
| 7 Summary of FAL classes | 53 |
| 8 Permitted FAL services by AREP role..... | 53 |
| Bibliography..... | 55 |
| Figure 1 – FAL ASEs | 18 |
| Figure 2 – The AR ASE conveys APDUs between APs | 37 |
| Table 1 – Read service parameters..... | 21 |
| Table 2 – Write service parameters..... | 22 |
| Table 3 – Information report service parameters | 22 |

| | |
|---|----|
| Table 4 – Event notification service parameters | 24 |
| Table 5 – Event notification recovery service parameters..... | 25 |
| Table 6 – Download service parameters | 27 |
| Table 7 – Upload service parameters | 27 |
| Table 8 – Start service parameters | 29 |
| Table 9 – Stop service parameters..... | 29 |
| Table 10 – Resume service parameters | 30 |
| Table 11 – Get network time service parameters | 31 |
| Table 12 – Set network time service parameters..... | 32 |
| Table 13 – Tick notification service parameters..... | 32 |
| Table 14 – Get network status service parameters..... | 34 |
| Table 15 – Get station status service parameters..... | 35 |
| Table 16 – Network status change report service parameters | 36 |
| Table 17 – Station status change report service parameters | 36 |
| Table 18 – Conveyance of service primitives by AREP role..... | 38 |
| Table 19 – Valid combinations of AREP roles involved in an AR | 38 |
| Table 20 – AR-Unconfirmed Send | 42 |
| Table 21 – AR-confirmed send..... | 43 |
| Table 22 – AR-establish service..... | 44 |
| Table 23 – AR-abort | 45 |
| Table 24 – FAL class summary | 53 |
| Table 25 – FAL services by AR type | 54 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –
FIELDBUS SPECIFICATIONS –****Part 5-17: Application layer service definition – Type 17 elements**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

International Standard IEC 61158-5-17 has been prepared by subcommittee 65C: Digital communications, of IEC technical committee 65: Industrial-process measurement and control.

This first edition and its companion parts of the IEC 61158-5 subseries cancel and replace IEC 61158-5:2003. This edition of this part constitutes a technical addition. This part and its Type 17 companion parts also cancel and replace IEC/PAS 62405.

This edition of IEC 61158-5 includes the following significant changes from the previous edition:

- a) deletion of the former Type 6 fieldbus for lack of market relevance;

- b) addition of new types of fieldbuses;
- c) partition of part 5 of the third edition into multiple parts numbered -5-2, -5-3, ...

The text of this standard is based on the following documents:

| | |
|--------------|------------------|
| FDIS | Report on voting |
| 65C/475/FDIS | 65C/486/RVD |

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

This publication has been drafted in accordance with ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under <http://webstore.iec.ch> in the data related to the specific publication. At this date, the publication will be:

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

NOTE The revision of this standard will be synchronized with the other parts of the IEC 61158 series.

The list of all the parts of the IEC 61158 series, under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC web site.

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 service is provided by the application protocol making use of the services available from the data-link or other immediately lower layer. This standard defines the application service characteristics that fieldbus applications and/or system management may exploit.

Throughout the set of fieldbus standards, the term “service” refers to the abstract capability provided by one layer of the OSI Basic Reference Model to the layer immediately above. Thus, the application layer service defined in this standard is a conceptual architectural service, independent of administrative and implementation divisions.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 5-17: Application layer service definition – Type 17 elements

1 Scope

1.1 Overview

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 17 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 the fieldbus Application Layer in terms of

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

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

- 1) the FAL user at the boundary between the user and the Application Layer of the Fieldbus Reference Model, and
- 2) 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 characteristics of conceptual application layer services suitable for time-critical communications, and thus supplement the OSI Basic Reference Model in guiding the development of application layer protocols for time-critical communications.

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 services standardized as the various types of IEC 61158.

This specification may be used as the basis for formal Application Programming-Interfaces. Nevertheless, it is not a formal programming interface, and any such interface will need to address implementation issues not covered by this specification, including

- a) the sizes and octet ordering of various multi-octet service parameters, and
- b) the correlation of paired request and confirm, or indication and response, primitives.

1.3 Conformance

This standard does not specify individual implementations or products, nor do they 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 the Type 17 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 all other undated references, the latest edition of the referenced document (including any amendments) applies.

IEC/TR 61158-1 (Ed.2.0), *Industrial communication networks – Fieldbus specifications – Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series*

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

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

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