

# INTERNATIONAL STANDARD

**Industrial communication networks – Fieldbus specifications –  
Part 5-23: Application layer service definition – 1 to 23 elements**





## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

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

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

### IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

### IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.



IEC 61158-5-23

Edition 3.0 2023-03

# INTERNATIONAL STANDARD

---

**Industrial communication networks – Fieldbus specifications –  
Part 5-23: Application layer service definition – Type 23 elements**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 25.040.40; 35.100.70; 35.110

ISBN 978-2-8322-6579-6

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
1.1 General.....	9
1.2 Specifications .....	10
1.3 Conformance .....	10
2 Normative references .....	10
3 Terms, definitions, symbols, abbreviated terms and conventions .....	11
3.1 Referenced terms and definitions.....	11
3.1.1 ISO/IEC 7498-1 terms.....	11
3.1.2 ISO/IEC 8822 terms.....	11
3.1.3 IEC 61158-1 terms.....	11
3.2 Additional Type 23 terms and definitions.....	12
3.3 Symbols and abbreviated terms .....	14
3.4 Conventions.....	15
3.4.1 General conventions.....	15
3.4.2 Conventions for class definitions .....	16
3.4.3 Conventions for service definitions .....	17
4 Concept.....	18
5 Data type ASE.....	18
5.1 Overview.....	18
5.2 Fixed length types.....	19
5.2.1 Bitstring types.....	19
5.2.2 Numeric types .....	20
6 Communication model specification.....	24
6.1 Communication model.....	24
6.1.1 General .....	24
6.1.2 Cyclic model n.....	24
6.1.3 Cyclic model 1.n.....	25
6.1.4 Transient model.....	25
6.2 ASE.....	26
6.2.1 Overview type C.....	26
6.2.2 Overview type F.....	26
6.2.3 Cyclic data ASE type C.....	26
6.2.4 Cyclic data ASE type F.....	33
6.2.5 Acyclic data ASE type C.....	38
6.2.6 Acyclic data ASE type F.....	44
6.2.7 Management ASE.....	57
6.2.8 Synchronization ASE .....	60
6.2.9 Measurement ASE.....	61
6.2.10 Overview type T.....	62
6.2.11 Cyclic data ASE type T.....	63
6.2.12 Acyclic data ASE type T .....	65
6.2.13 Management ASE type T .....	73
6.2.14 Time sync data ASE type T.....	75
6.2.15 SLMP data ASE type T .....	77

6.3	AR type C .....	78
6.3.1	Overview .....	78
6.3.2	Connection Control .....	79
6.3.3	Cyclic transmission type C .....	83
6.3.4	Acyclic transmission type C .....	84
6.3.5	Common parameter dist.....	87
6.4	AR type F .....	92
6.4.1	Overview .....	92
6.4.2	Channel control .....	93
6.4.3	Cyclic transmission type F .....	100
6.4.4	Acyclic transmission type F.....	102
6.4.5	Parameter dist.....	105
6.4.6	Synchronous trigger.....	108
6.4.7	Measurement transmission .....	109
6.5	AR type T .....	111
6.5.1	Overview .....	111
6.5.2	Cyclic transmission type T .....	112
6.5.3	Acyclic transmission type T.....	113
6.5.4	Channel control type T.....	114
6.5.5	Time sync control .....	117
6.5.6	IP trans control .....	118
6.5.7	Handler.....	119
	Bibliography.....	120
	Figure 1 – Cyclic model (n:n type distributed shared memory, unconfirmed push model) .....	25
	Figure 2 – Cyclic model (1:n type distributed shared memory, unconfirmed push model) .....	25
	Figure 3 – Transient model (Client server model).....	25
	Figure 4 – Transient model (Push model).....	26
	Figure 5 – Structure of ASE type C of FAL Type 23 .....	26
	Figure 6 – Structure of ASE type F of FAL Type 23.....	26
	Figure 7 – Structure of ASE type T of FAL Type 23.....	63
	Figure 8 – Structure of AR type C .....	78
	Figure 9 – Structure of AR type F.....	92
	Figure 10 – Structure of AR type T.....	111
	Table 1 – Ld service parameters .....	28
	Table 2 – Set service parameters.....	28
	Table 3 – Reset service parameters.....	28
	Table 4 – Read service parameters.....	29
	Table 5 – Write service parameters.....	29
	Table 6 – Ld service parameters .....	30
	Table 7 – Set service parameters.....	31
	Table 8 – Reset service parameters.....	31
	Table 9 – Read service parameters.....	32
	Table 10 – Write service parameters.....	32
	Table 11 – Ld service parameters .....	34

Table 12 – Set service parameters.....	35
Table 13 – Reset service parameters.....	35
Table 14 – Read service parameters.....	36
Table 15 – Write service parameters.....	36
Table 16 – Get memory access info service parameters .....	39
Table 17 – Run service parameters.....	40
Table 18 – Stop service parameters.....	41
Table 19 – Read memory service parameters .....	42
Table 20 – Write memory service parameters .....	43
Table 21 – Get memory access info service parameters .....	45
Table 22 – Run service parameters.....	46
Table 23 – Stop service parameters.....	47
Table 24 – Read memory service parameters .....	48
Table 25 – Write memory service parameters .....	49
Table 26 – Vendor command service parameters.....	50
Table 27 – Distribute node info service parameters.....	51
Table 28 – Get statistics service parameters.....	52
Table 29 – Get node info detail service parameters .....	54
Table 30 – AC data service parameters .....	56
Table 31 – AC data ND service parameters .....	57
Table 32 – Get attribute service parameters .....	58
Table 33 – Set attribute service parameters.....	59
Table 34 – Synchronization trigger service parameters .....	60
Table 35 – Start measurement service parameters .....	61
Table 36 – Get offset service parameters .....	62
Table 37 – Read service parameters.....	64
Table 38 – Write service parameters.....	64
Table 39 – Priority service parameters.....	66
Table 40 – Detection service parameters .....	67
Table 41 – Detection Ac service parameters .....	68
Table 42 – Test data service parameters .....	70
Table 43 – Test data ack service parameters.....	71
Table 44 – Acyclic data rsv service parameters .....	72
Table 45 – Acyclic data nrsv service parameters.....	73
Table 46 – Get attribute service parameters .....	74
Table 47 – Set attribute service parameters.....	75
Table 48 – TimeSyncMng service parameters.....	76
Table 49 – SLMP data service parameters.....	77
Table 50 – Control cyclic service parameters.....	82
Table 51 – CT Update service parameters .....	84
Table 52 – AC Send service parameters .....	85
Table 53 – AC Param send service parameters.....	87
Table 54 – CPD Set service parameters .....	92

Table 55 – Control cyclic service parameters .....	99
Table 56 – CT Update service parameters .....	101
Table 57 – AC Send service parameters .....	102
Table 58 – AC Send ND service parameters .....	104
Table 59 – Synchronous trigger internal service parameters .....	108
Table 60 – Measure send service parameters .....	109
Table 61 – MeasureAck send service parameters .....	110
Table 62 – Offset send service parameters .....	110
Table 63 – Update send service parameters .....	111
Table 64 – C Update service parameters .....	112
Table 65 – AC Update service parameters .....	114
Table 66 – Send cyclic service parameters .....	115
Table 67 – Send acyclic service parameters .....	116
Table 68 – TimeSync service parameters .....	117
Table 69 – SLMPSend service parameters .....	118

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –  
FIELDBUS SPECIFICATIONS –****Part 5-23: Application layer service definition –  
Type 23 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 in any 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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 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.

Attention is drawn to the fact that the use of the associated protocol type is restricted by its 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 layer protocol type to be used with other layer protocols of the same type, or in other type combinations explicitly authorized by its intellectual-property-right holders.

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

IEC 61158-5-23 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 third edition cancels and replaces the second 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) addition of Type T ASE (6.2.10 to 6.2.15).
- b) addition of Type T AR (6.5).

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

Draft	Report on voting
65C/1203/FDIS	65C/1244/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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under [wwwstore.iec.ch](http://wwwstore.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.

## INTRODUCTION

This document 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 application service is provided by the application protocol making use of the services available from the data-link or other immediately lower layer. This document defines the application service characteristics that fieldbus applications and/or system management can 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 document is a conceptual architectural service, independent of administrative and implementation divisions.

## **INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –**

### **Part 5-23: Application layer service definition – Type 23 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 part of IEC 61158 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 23 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 document 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 that they take; and
- d) the interrelationship between these actions and events, and their valid sequences.

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

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

This document specifies the structure and services of the IEC Fieldbus Application Layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498-1) 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.