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# INTERNATIONAL STANDARD

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**Industrial communication networks – Fieldbus specifications –  
Part 6-21: Application layer protocol specification – Type 21 elements**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INDUSTRIAL COMMUNICATION NETWORKS – FIELD BUS SPECIFICATIONS –

### Part 6-21: Application layer protocol specification – Type 21 elements

#### FOREWORD

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

International Standard IEC 61158-6-21 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- added WriteAndRead service;
- miscellaneous editorial corrections.

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

FDIS	Report on voting
65C/948/FDIS	65C/956/RVD

Full information on the voting for the approval of this International 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.

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

The committee has decided that the contents of this publication will remain unchanged until the stability 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- withdrawn;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.

A bilingual version of this publication may be issued at a later date.

## 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 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 document 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 implementers and designers;
- for use in the testing and procurement of equipment;
- as part of an agreement for the admission of systems into the open systems environment;
- as a refinement to the understanding of time-critical communications within OSI.

This document is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this document 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 6-21: Application layer protocol specification – Type 21 elements**

## **1 Scope**

### **1.1 General**

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.

This International Standard contains material specific to the Type 21 communication protocol.

### **1.2 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 document provides common elements for basic time-critical and non-time-critical messaging communications between application programs in an automation environment, as well as material specific to Type 21. The term “time-critical” is used to represent the presence of a time-window, within which one or more specified actions must be completed with some defined level of certainty. Failure to complete specified actions within the required time risks the failure of the applications requesting the actions, with attendant risk to equipment, plant, and possibly human life.

This document defines interactions between remote applications. It also defines the externally visible behavior provided by the Type 21 application layer in terms of:

- a) the formal abstract syntax defining the application layer protocol data units (APDUs) conveyed between communicating application entities;
- b) the transfer syntax defining encoding rules that are applied to the APDUs;
- c) the application context state machine defining the application service behavior visible between communicating application entities;
- d) the application relationship state machines defining the communication behavior visible between communicating application entities.

The purpose of this document is to:

- a) describe the wire-representation of the service primitives defined in IEC 61158-5-21;
- b) describe the externally visible behavior associated with their transfer.

This document defines the protocol of the Type 21 application layer in conformance with the OSI Basic Reference Model (ISO/IEC 7498) and the OSI application layer structure (ISO/IEC 9545).

### **1.3 Specifications**

The principal objective of this document is to specify the syntax and behavior of the application layer protocol that conveys the Type 21 application layer services.

A secondary objective is to provide migration paths from previously existing industrial communications protocols.

#### 1.4 Conformance

This document does not restrict individual implementations or products, nor does it constrain the implementations of application layer entities in industrial automation systems. Conformance is achieved through implementation of this application layer protocol specification.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 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 61158-3-21:2019, *Industrial communication networks – Fieldbus specifications – Part 3-21: Data-link layer service definition – Type 21 elements*

IEC 61158-4-21:2019, *Industrial communication networks – Fieldbus specifications – Part 4-21: Data-link layer protocol specification – Type 21 elements*

IEC 61158-5-21:2019, *Industrial communication networks – Fieldbus specifications – Part 5-21: Application layer service definition – Type 21 elements*

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

ISO/IEC/IEEE 8802-3, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Standard for Ethernet*

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

ISO/IEC 8824-1, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*

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*

ISO/IEC 9899, *Information technology – Programming Languages – C*

IEEE 754-2008, *IEEE Standard for Binary Floating-Point Arithmetic*