TECHNICAL SPECIFICATION

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Digital data communications for measurement and control — Fieldbus for use in industrial control systems

Part 6: Application Layer protocol specification

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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DIGITAL DATA COMMUNICATIONS FOR MEASUREMENT AND CONTROL – FIELDBUS FOR USE IN INDUSTRIAL CONTROL SYSTEMS –

Part 6: Application Layer protocol specification

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.

3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

6) Attention is drawn to the possibility that some of the elements of this technical specification may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 61158-6, which is a technical specification, has been prepared by subcommittee 65C: Digital communications, of IEC technical committee 65: Industrial-process measurement and control.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
65C/200/FDIS	65C/208+208A/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

IEC 61158 consists of the following parts, under the general title *Digital data communications for measurement and control — Fieldbus for use in industrial control systems*:

Part 1: Introductory guide (under preparation)
Part 2: Physical layer specification and service definition
Part 3: Data Link Service definition
Part 4: Data Link Protocol specification
Part 5: Application Layer service definition
Part 6: Application Layer protocol specification
Part 7: System management (under consideration)
Part 8: Conformance testing (under consideration)

Annexes A to O form an integral part of this technical specification.

Annexes P to R are for information only.

This publication will be reviewed by the committee responsible for its preparation before 2002. Information relating to confirmation, amendment or revision of the publication is available from the IEC web site (http:/www.iec.ch) or from IEC Central Office.

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

INTRODUCTION

This technical specification describes the Fieldbus Application Layer (FAL) protocol that defines the information interchange and the interactions between Application Entity invocations (AE-Is) to support the services defined in IEC 61158-5.

An Application Process uses the Fieldbus Application Layer services to exchange information with other Application Processes. The services define the abstract interface between the application process and the Application Layer.

The Application Layer protocol is the set of rules that governs the format and meaning of the information exchange between the Application Layers in various devices. The Application Layer uses the protocol to implement the Application Layer services definitions.

The protocol machine defines the various states of an Application Layer and the valid transitions between the states. It may be considered as a finite state machine. The protocol machine is described using state tables. The information is exchanged between the application process and the protocol machine through application service data units. The protocol machine exchanges information with other protocol machines through application protocol data units (APDU).

This set of Application Layer standards does not specify individual implementations or products, nor does it constrain the implementations of Application Entities (AEs) and interfaces within the industrial automation system.

This set of Application Layer standards does not contain test procedures to ensure compliance with such requirements.

DIGITAL DATA COMMUNICATIONS FOR MEASUREMENT AND CONTROL – FIELDBUS FOR USE IN INDUSTRIAL CONTROL SYSTEMS –

Part 6: Application Layer protocol specification

1 Scope

The Fieldbus Application Layer (FAL) is an Application Layer communication standard designed to support the conveyance of time-critical application requests and responses among devices in an automation environment. 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 technical specification specifies interactions between remote applications in terms of

- the encoding rules that are applied to all the Application Layer Protocol Data Units (APDUs);
- the formal Abstract Syntax definitions of such APDUs;
- the protocol state machine descriptions that handle the APDUs and the primitives in the correct sequences;
- the mappings of the APDUs to and from the Data Link Layer services defined in IEC 61158-3.

The FAL encoding rules are designed assuming that both the encoder (sender) and the decoder (receiver) have the common knowledge of the abstract syntax. Wherever possible, data types identifiers are not encoded and transferred over the network.

NOTE This is why the Abstract Syntax Notation One / Basic Encoding Rule is not practical for the FAL.

The purpose of this part of this technical specification is to define the protocol provided

a) to the Fieldbus Data Link Layer at the boundary between the Application and Data Link Layers of the Fieldbus Reference Model, and

b) to the System Management at the boundary between the System Management and Application Layers of the Fieldbus Reference Model.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61158. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61158 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards

IEC 61158-3:1999, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 3: Data Link service definitions*

IEC 61158-4:1999, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 4: Data Link protocol specifications*

IEC 61158-5:1999, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 5: Application Layer service definitions*

ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

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

ISO/IEC 8824:1990, *Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1)*

ISO/IEC 8825:1990, *Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)*

ISO/IEC 9545:1994, *Information technology – Open Systems Interconnection – Application Layer structure*

ISO/IEC 10646-1:1993, *Information technology – Universal Multiple-Octet Coded Character Set (UCS) – Part 1: Architecture and Basic Multilingual Plane*

ISO/IEC 10731:1994, *Information technology – Open Systems Interconnection – Basic Reference Model – Conventions for the definition of OSI services*