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PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

Industrial communication networks – Fieldbus specifications –
Part 5-22: Application layer service definition – Type SNpTYPE elements

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

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FOREWORD

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IEC-PAS 61158-5-22 has been processed by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
65C/530/PAS	65C/534/RVD

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of 3 years starting from the publication date. The validity may be extended for a single 3-year period, following which it shall be revised to become another type of normative document, or shall be withdrawn.

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 PAS contains an additional profile – SNpTYPE – which may be integrated into a future new edition of the IEC 61158-5 series.

INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 5-22: Application layer service definition – Type SNpTYPE 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 part of IEC 61158-5 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 SNpTYPE 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 part of IEC 61158-5 defines in an abstract way the externally visible service provided by 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 part of IEC 61158-5 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 part of IEC 61158-5 specifies the structure and services of the 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 part of IEC 61158-5 to provide access to the FAL to control certain aspects of its operation.

1.2 Specifications

The principal objective of this part of IEC 61158-5 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, and the corresponding protocols standardized in subparts of IEC 61158-6.

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 part of IEC 61158-5 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 the application layer services as defined in this part of IEC 61158-5.

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 60559, *Binary floating-point arithmetic for microprocessor systems*

IEC 61131-3, *Programmable controllers – Part 3: Programming languages*

IEC 61158-4-22, *Industrial communication networks – Fieldbus specifications – Part 4-SNpTYPE: Data-link layer protocol specification – Type SNpTYPE elements*

IEC 61158-6-22, *Industrial communication networks - Fieldbus specifications - Part 6-SNpTYPE: Application layer protocol specification - Type SNpTYPE elements*

ISO/IEC 646, *Information technology – ISO 7-bit coded character set for information interchange*

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

ISO/IEC 8802-3, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

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 10646, *Information technology – Universal Multiple-Octet Coded Character Set (UCS)*

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

IETF RFC 791, *Internet Protocol*

3 Terms, definitions, abbreviations, symbols and conventions

For the purposes of this document, the following terms as defined in these publications apply:

3.1 ISO/IEC 7498-1 terms

a) application entity
b) application process
c) application protocol data unit
d) application service element
e) application entity invocation
f) application process invocation
g) application transaction
h) real open system
i) transfer syntax

3.2 ISO/IEC 8822 terms

For the purposes of this document, the following terms as defined in ISO/IEC 8822 apply:

a) abstract syntax
b) presentation context

3.3 ISO/IEC 9545 terms

For the purposes of this document, the following terms as defined in ISO/IEC 9545 apply:

a) application-association
b) application-context
c) application context name
d) application-entity-invocation
e) application-entity-type

f) application-process-invocation

g) application-process-type

h) application-service-element

i) application control service element

3.4 ISO/IEC 8824 terms

For the purposes of this document, the following terms as defined in ISO/IEC 8824 apply:

a) object identifier

b) type

3.5 Fieldbus application-layer specific definitions

3.5.1
application
function for which data is exchanged

3.5.2
application object
representation of a particular component within a device

3.5.3
acyclic data
data which is transferred from time to time for dedicated purposes

3.5.4
bit
unit of information consisting of a 1 or a 0. This is the smallest data unit that can be transmitted

3.5.5
cell
synonym for a single DL-segment which uses RTFL communication model

3.5.6
channel
path provided for conveying data

3.5.7
client
object which uses the services of a server by initiating a message to perform a task

3.5.8
communication cycle
fixed time period between which the root device issues empty frames for cyclic communication initiation in which data is transmitted utilizing CDC and MSC

3.5.9
connection
logical binding between two application objects

3.5.10
cycle time
duration of a communication cycle

3.5.11
cyclic
events which repeat in a regular and repetitive manner

3.5.12
cyclic communication
periodic exchange of telegrams

3.5.13
cyclic data
data which is transferred in a regular and repetitive manner for dedicated purposes

3.5.14
cyclic data channel (CDC)
part of one or more frames, which is reserved for cyclic data

3.5.15
data
generic term used to refer to any information carried over a fieldbus

3.5.16
device
physical entity connected to the fieldbus

3.5.17
error
discrepancy between a computed, observed or measured value or condition and the specified or theoretically correct value or condition

3.5.18
error code
identification number of a specific type of error

3.5.19
gateway
device acting as a linking element between different protocols

3.5.20
index
position of an object within the object dictionary

3.5.21
inter-cell communication
communication between a RTFL device and a RTFN device or communication between a RTFL device and another RTFL device in different cells linked by RTFN

3.5.22
interface
shared boundary between two functional units, defined by functional characteristics, signal characteristic, or other characteristics as appropriate

3.5.23
intra-cell communication
communication between a RTFL device and another RTFL device in the same cell