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Function blocks (FB) for process control –

Part 2:
Specification of FB concept

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION
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FUNCTION BLOCKS (FB) FOR PROCESS CONTROL –

Part 2: Specification of FB concept

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.

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U.S. Patent No. 5,333,114

U.S. Patent No. 5,485,400

U.S. Patent No. 5,825,664

U.S. Patent No. 5,909,368

U.S. Patent Pending No. 08/916,178

Australian Patent No. 638507

Canadian Patent No. 2,066,743

European Patent No. 0495001

  Validated in:

  UK – Patent No. 0495001

  France – Patent No. 0495001

  Germany – Patent No. 69032954.7

  Netherlands – Patent No. 0495001

Japan Patent No. 3137643

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

This second edition, together with the first edition of IEC 61804-3, cancels and replaces the first edition of IEC 61804-2 published in 2004. This edition constitutes a technical revision.

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

a) transfer of the EDDL-specific clauses to IEC 61804-3;

b) the FB-specific subclauses 4.1 and 4.2 as well as Clauses 5, 6, 7 and 8 are unchanged.

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

CDV	Report on voting
65C/405/CDV	65C/420/RVC

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 list of all parts of the IEC 61804 series, under the general title *Function Blocks (FB) for process control*, can be found on the IEC website.

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.

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

INTRODUCTION

This part of IEC 61804 provides conceptual Function Block specifications, which can be mapped to specific communication systems, and their accompanying definitions by industrial groups.

The EDDL fills the gap between the conceptual FB specification of IEC 61804-2 and a product implementation. Figure 1 shows these aspects.
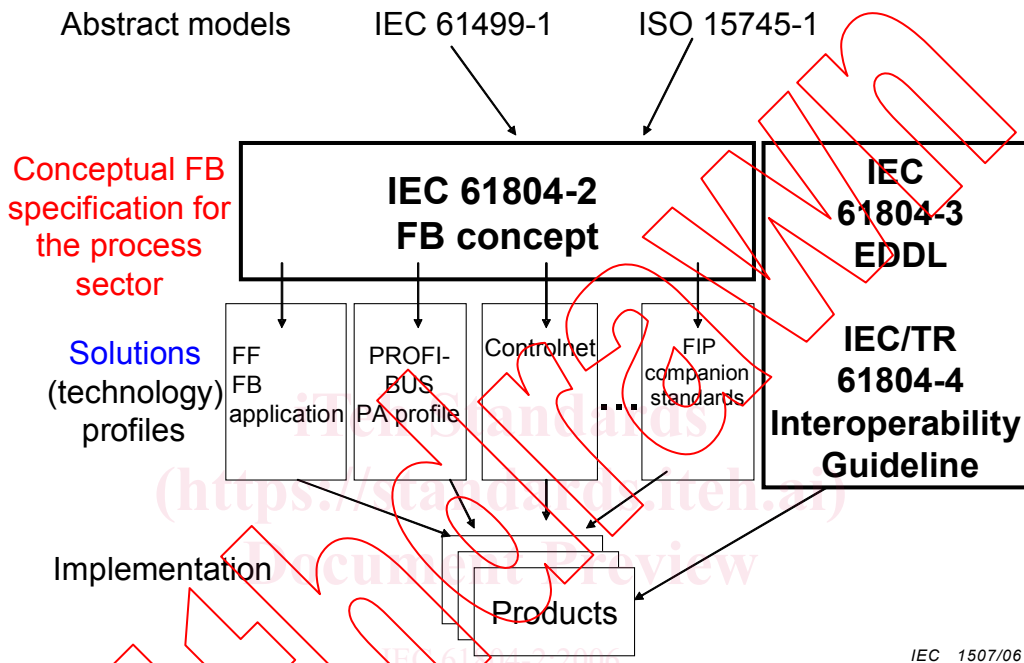
IEC   1507/06

Figure 1 – Position of the IEC 61804 series related to other standards and products

FUNCTION BLOCKS (FB) FOR PROCESS CONTROL –

Part 2: Specification of FB concept

1   Scope

This part of IEC 61804 is applicable to Function Blocks (FB) for process control.

This standard specifies FB by using the result of harmonization work as regards several elements:

c) the device model which defines the components of an IEC 61804-2 conformant device;

d) conceptual specifications of FBs for measurement, actuation and processing. This includes general rules for the essential features to support control, whilst avoiding details which stop innovation as well as specialization for different industrial sectors.

This standard defines a subset of the requirements of IEC 61804-1 (hereafter referred to as Part 1) only, while Part 1 describes requirements for a distributed system.

The conformance statement in Annex B, which covers the conformance declaration, is related to this standard only. Requirements of Part 1 are not part of these conformance declarations.

The standardization work for FB was carried out by harmonizing the description of concepts of existing technologies. It results in an abstract level that allowed the definition of the common features in a unique way. This abstract vision is called here the conceptual FB specification and mapped to specific communication systems and their accompanying definitions by the industrial groups. This standard is also based on the abstract definitions of IEC 61499-1.

NOTE   This standard can be mapped to ISO 15745-1.

There are solutions on the market today, which fulfil the requirements of this standard and show how the conceptual specification is implemented in a given technology. New technologies will need to find equivalent solutions (see Figure 4).

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 60050-351:1998, *International Electrotechnical Vocabulary (IEV) – Part 351: Automatic control*

IEC 60584-1, *Thermocouples – Part 1: Reference tables*

IEC 61131-3:2003, *Programmable controllers – Part 3: Programming languages*

IEC 61158 (all parts), *Digital data communications for measurement and control – Fieldbus for use in industrial control systems*

IEC 61499-1:2005, *Function blocks – Part 1: Architecture*

IEC 61499-2:2005, *Function blocks – Part 2: Software tools requirements*

IEC 61804-1:2003, *Function blocks (FB) for process control – Part 1: Overview of system aspects*

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

ISO/IEC 9899, *Programming languages – C*

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

3 Terms, definitions, and abbreviated terms and acronyms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions, some of which have been compiled from the referenced documents, apply.

3.1.1
algorithm
finite set of well-defined rules for the solution of a problem in a finite number of operations

3.1.2
application
software functional unit that is specific to the solution of a problem in industrial-process measurement and control

NOTE   An application may be distributed among resources and may communicate with other applications.

3.1.3
application function block
FB which has no input or output to the process

3.1.4
attribute
property or characteristic of an entity, for instance, the version identifier of an FB type specification

[IEC 61499-1]

NOTE   The formal description of attributes is part of the solution profiles to achieve domain-specific interoperability. IEC 61804 defines the general rules to define the attributes and specifies the EDDL to describe attributes, which may be described in solution profiles.

3.1.5
component function block
FB instance which is used in the specification of an algorithm of a composite FB type

NOTE   A component FB can be an FB or a composite FB type.

3.1.6
composite FB type
FB type whose algorithm is expressed entirely in terms of interconnected component FBs and variables

[IEC 61499-1]

3.1.7
configuration (of a system or device)
step in system design: selecting functional units, assigning their locations and defining their interconnections

[IEC 61499-1]

3.1.8
data
representation of facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing by human beings or by automatic means

[ISO/AFNOR Dictionary of Computer Science]

3.1.9
data connection
association established between functional units for conveyance of data

[IEC 61499-1]

3.1.10
data input
interface of an FB which receives data from a data connection

[IEC 61499-1]

3.1.11
data output
interface of an FB, which supplies data to a data connection

[IEC 61499-1]

3.1.12
data type
set of values together with a set of permitted operations

[ISO 2382 series]

3.1.13
device
independent physical entity capable of performing one or more specified functions in a particular context and delimited by its interfaces

[IEC 61499-1]

3.1.14
device block
FB which has no input and no output

3.1.15
device management application
application whose primary function is the management of a multiple resources within a device

[IEC 61499-1]

3.1.16
Electronic Device Description Language (EDDL)
methodology for describing parameter(s) of an automation system component

3.1.17
Electronic Device Description (EDD)
data collection containing the device parameter(s), their dependencies, their graphical representation and a description of the data sets which are transferred.

NOTE   The Electronic Device Description is created using the Electronic Device Description Language (EDDL).

3.1.18
entity
particular thing, such as a person, place, process, object, concept, association, or event

[IEC 61499-1]

3.1.19
event
instantaneous occurrence that is significant to scheduling the execution of an algorithm

[IEC 61499-1]

NOTE   The execution of an algorithm may make use of variables associated with an event.

3.1.20
exception
event that causes suspension of normal execution

[IEC 61499-1]

3.1.21
function
specific purpose of an entity or its characteristic action

[IEC 61499-1]

3.1.22
functional unit
entity of hardware or software, or both, capable of accomplishing a specified purpose

[ISO/AFNOR Dictionary of Computer Science]

3.1.23
function block (function block instance)
software functional unit comprising an individual, named copy of a data structure and associated operations specified by a corresponding FB type

[IEC 61499-1]

NOTE   Typical operations of an FB include modification of the values of the data in its associated data structure.

3.1.24
function block diagram
network in which the nodes are function block instances, variables, literals, and events

NOTE   This is not the same as the function block diagram defined in IEC 61131-3.

[IEC 61499-1]

3.1.25
hardware
physical equipment, as opposed to programs, procedures, rules and associated documentation

[ISO/AFNOR Dictionary of Computer Science]

3.1.26
implementation
development phase in which the hardware and software of a system become operational

[IEC 61499-1]

3.1.27
input variable
variable whose value is supplied by a data input, and which may be used in one or more operations of an FB

NOTE   An input parameter of an FB, as defined in IEC 61131-3, is an input variable.

[IEC 61499-1]

3.1.28
instance
functional unit comprising an individual, named entity with the attributes of a defined type

[IEC 61499-1]

3.1.29
instance name
identifier associated with, and designating, an instance

[IEC 61499-1]

3.1.30
instantiation
creation of an instance of a specified type

[IEC 61499-1]

3.1.31
interface
shared boundary between two functional units, defined by functional characteristics, signal characteristics, or other characteristics as appropriate

[IEV 351-11-19:1998]

3.1.32
internal variable
variable whose value is used or modified by one or more operations of an FB but is not supplied by a data input or to a data output

[IEC 61499-1]

3.1.33
invocation
process of initiating the execution of the sequence of operations specified in an algorithm

[IEC 61499-1]

3.1.34
management function block
FB whose primary function is the management of applications within a resource

[IEC 61499-1]

3.1.35
mapping
set of values having defined correspondence with the quantities or values of another set

[ISO/AFNOR Dictionary of Computer Science]

3.1.36
model
representation of a real world process, device, or concept

[IEC 61499-1]

3.1.37
operation
well-defined action that, when applied to any permissible combination of known entities, produces a new entity

[ISO/AFNOR Dictionary of Computer Science]

3.1.38
output variable
variable whose value is established by one or more operations of a FB and is supplied to a data output

NOTE   An output parameter of an FB, as defined in IEC 61131-3, is an output variable.

[IEC 61499-1]

3.1.39
parameter
variable that is given a constant value for a specified application and that may denote the application

[ISO/AFNOR Dictionary of Computer Science]

3.1.40
resource
functional unit contained within a device which has independent control of its operation and which provides various services to applications, including the scheduling and execution of algorithms

NOTE 1   The RESOURCE defined in IEC 61131-3 is a programming language element corresponding to the resource defined above.

NOTE 2   A device contains one or more resources.

3.1.41
resource management application
application whose primary function is the management of a single resource

[IEC 61499-1]

3.1.42
service
functional capability of a resource, which can be modelled by a sequence of service primitives

[IEC 61499-1]