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Function blocks – iTeh STANDARD PREVIEW
Part 1: Architecture (standards.iteh.ai)

Blocs fonctionnels –
Partie 1: Architecture <https://standards.iteh.ai/catalog/standards/sist/f5aa48c1-c9f0-4676-a2b5-a1cacac399f7/iec-61499-1-2012>
IEC 61499-1:2012



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FUNCTION BLOCKS –

Part 1: Architecture

FOREWORD

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International Standard IEC 61499-1 has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2005. This edition constitutes a technical revision.

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

- *Execution control* in basic function blocks (5.2) has been clarified and extended:
 - Dynamic and static parts of the EC transition condition are clearly delineated by using the `ec_transition_event[guard_condition]` syntax of the Unified Modeling Language (UML) (5.2.1.3, B.2.1).
 - The terminology "crossing of an EC transition" (3.10) is used preferentially to "clearing" to avoid the misinterpretation that the entire transition condition corresponds to a Boolean variable that can be "cleared."

- Operation of the ECC state machine in 5.2.2.2 has been clarified and made more rigorous.
- Event and data outputs of adapter instances (plugs and sockets) can be used in EC transition conditions, and event inputs of adapter instances can be used as EC action outputs.
- *Temporary variables* (3.97) can be declared (B.2.1) and used in algorithms of basic function blocks.
- *Service sequences* (6.1.3) can now be defined for basic and composite function block types and adapter types, as well as service interface types.
- The syntax for *mapping* of FB instances from applications to resources has been simplified (Clause B.3).
- Syntax for definition of *segment types* (7.2.3) for network segments of system configurations has been added (Clause B.3).
- Function block types for interoperation with programmable controllers are defined (Clause D.6).
- The READ/WRITE management commands (Table 8) now apply only to *parameters*.

The text of this part of IEC 61499 is based on the following documents:

FDIS	Report on voting
65B/845/FDIS	65B/855/RVD

iTeh STANDARD PREVIEW

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table (when voting is completed).

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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A list of all parts of the IEC 61499 series can be found, under the general title *Function blocks*, on the IEC website.

Terms used throughout this International Standard that have been defined in Clause 3 appear in *italics*.

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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC 61499 consists of the following parts, under the general title *Function blocks*:

- Part 1 (this document) contains:
 - general requirements, including scope, normative references, definitions, and reference models;
 - rules for the declaration of *function block types*, and rules for the behavior of *instances* of the types so declared;
 - rules for the use of function blocks in the *configuration* of distributed industrial-process measurement and control *systems* (IPMCSs);
 - rules for the use of function blocks in meeting the communication requirements of distributed IPMCSs;
 - rules for the use of function blocks in the management of *applications, resources and devices* in distributed IPMCSs.
- Part 2 defines requirements for *software tools* to support the following systems engineering tasks:
 - the specification of *function block types*;
 - the functional specification of *resource types* and *device types*;
 - the specification, analysis, and validation of distributed IPMCSs;
 - the *configuration, implementation, operation, and maintenance* of distributed IPMCSs;
 - the exchange of *information among software tools*.
- Part 3 (Tutorial information) has been withdrawn due to the widespread current availability of tutorial and educational materials regarding IEC 61499. However, an updated 2nd Edition of Part 3 may be developed in the future.
- Part 4 defines rules for the development of *compliance profiles* which specify the features of IEC 61499-1 and IEC 61499-2 to be implemented in order to promote the following attributes of IEC 61499-based systems, devices and software tools:
 - interoperability of devices from multiple suppliers;
 - portability of software between software tools of multiple suppliers; and
 - configurability of devices from multiple vendors by software tools of multiple suppliers.

FUNCTION BLOCKS –

Part 1: Architecture

1 Scope

This part of IEC 61499 defines a generic architecture and presents guidelines for the use of *function blocks* in distributed industrial-process measurement and control systems (IPMCSs). This architecture is presented in terms of implementable reference *models*, textual syntax and graphical representations. These models, representations and syntax **can be used for**:

- the specification and standardization of *function block types*;
- the functional specification and standardization of system elements;
- the implementation independent specification, analysis, and validation of distributed IPMCSs;
- the *configuration, implementation, operation, and maintenance* of distributed IPMCSs;
- the exchange of *information* among *software tools* for the performance of the above *functions*.

This part of IEC 61499 does not restrict or specify the functional capabilities of IPMCSs or their system elements, except as such capabilities are represented using the elements defined herein. IEC 61499-4 addresses the extent to which the elements defined in this standard may be restricted by the functional capabilities of compliant systems, subsystems, and devices.

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Part of the purpose of this standard is to provide reference models for the use of function blocks in other standards dealing with the support of the system life cycle, including system planning, design, implementation, validation, operation and maintenance. The models given in this standard are intended to be generic, domain independent and extensible to the definition and use of function blocks in other standards or for particular applications or application domains. It is intended that specifications written according to the rules given in this standard be concise, implementable, complete, unambiguous, and consistent.

NOTE 1 The provisions of this standard alone are not sufficient to ensure interoperability among devices of different vendors. Standards complying with this part of IEC 61499 can specify additional provisions to ensure such interoperability.

NOTE 2 Standards complying with this part of IEC 61499 can specify additional provisions to enable the performance of *system, device, resource* and *application* management *functions*.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61131-1, *Programmable controllers – Part 1: General*

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

IEC/ISO 7498-1:1994, *Information technology – Open systems interconnection – Basic reference model: The basic model*

ISO/IEC 8824-1:2008, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*

ISO/IEC 10646:2003, *Information technology – Universal Multiple-Octet Coded Character Set (UCS)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Terms defined in Clause 3 are *italicized* where they appear in definitions and Notes to entry of other terms as well as throughout the body of the document.

3.1

acceptor

function block instance which provides a *socket adapter* of a defined *adapter interface type*

3.2

adapter connection

connection from a *plug adapter* to a *socket adapter* of the same *adapter interface type*, which carries the flows of *data* and *events* defined by the *adapter interface type*

3.3

adapter interface type

type which consists of the definition of a set of *event inputs*, *event outputs*, *data inputs*, and *data outputs*, and whose *instances* are *plug adapters* and *socket adapters*

3.4

algorithm

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

3.5

application

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

Note 1 to entry: An application can be distributed among *resources*, and might communicate with other applications.

3.6

attribute

property or characteristic of an *entity*, for instance, the version identifier of a *function block type* specification

3.7

basic function block type

function block type that cannot be decomposed into other function blocks and that utilizes an *execution control chart (ECC)* to control the *execution* of its *algorithms*

3.8

bidirectional transaction

transaction in which a request and possibly *data* are conveyed from an *requester* to a *responder*, and in which a response and possibly *data* are conveyed from the responder back to the requester

**3.9
character**

member of a set of elements that is used for the representation, organization, or control of *data*

**3.10
crossing**

clearing

<of an EC transition> *operation* by means of which control is passed from the predecessor *EC state* of an *EC transition* to its successor EC state

Note 1 to entry: This operation consists of de-activation of the predecessor EC state, followed by activation of the successor EC state.

**3.11
communication connection**

connection that utilizes the communication mapping function of one or more *resources* for the conveyance of *information*

**3.12
communication function block**

service interface function block that represents the *interface* between an *application* and the communication mapping function of a *resource*

**3.13
communication function block type**

function block type whose *instances* are *communication function blocks*

**3.14
component function block**

function block instance which is used in the specification of an *algorithm* of a *composite function block type*

Note 1 to entry: A component function block can be of *basic*, *composite* or *service interface type*.

**3.15
component subapplication**

subapplication instance that is used in the specification of a *subapplication type*

**3.16
composite function block type**

function block type whose *algorithms* and the control of their *execution* are expressed entirely in terms of interconnected *component function blocks*, *events*, and *variables*

**3.17
concurrent**

pertaining to *algorithms* that are *executed* during a common period of time during which they may have to alternately share common *resources*

**3.18
configuration (of a system or device)**

selecting *functional units*, assigning their locations and defining their interconnections

**3.19
configuration parameter**

parameter related to the *configuration* of a *system*, *device* or *resource*

3.20**confirm primitive**

service primitive which represents an interaction in which a *resource* indicates completion of some *algorithm* previously *invoked* by an interaction represented by a *request primitive*

3.21**connection**

association established between *functional units* for conveying *information*

3.22**critical region**

operation or sequence of operations which is *executed* under the exclusive control of a locking object which is associated with the *data* on which the operations are performed

3.23**data**

reinterpretable representation of *information* in a formalized manner suitable for communication, interpretation or processing

3.24**data connection**

association between two *function blocks* for the conveyance of *data*

3.25**data input**

interface of a *function block* which receives *data* from a *data connection*

3.26**data output**

interface of a *function block* which supplies *data* to a *data connection*

3.27**data type**

set of values together with a set of permitted *operations*

3.28**declaration**

mechanism for establishing the definition of an *entity*

Note 1 to entry: A declaration can involve attaching an *identifier* to the entity, and allocating *attributes* such as *data types* and *algorithms* to it.

3.29**device**

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

Note 1 to entry: A *programmable controller system* as defined in IEC 61131-1 is a *device*.

3.30**device management application**

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

3.31**entity**

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

**3.32
event**

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

Note 1 to entry: The execution of an algorithm may make use of *variables* associated with an event.

**3.33
event connection**

association among *function blocks* for the conveyance of *events*

**3.34
event input**

interface of a *function block* which can receive *events* from an *event connection*

**3.35
event output**

interface of a *function block* which can issue *events* to an *event connection*

**3.36
exception**

event that causes suspension of normal *execution*

**3.37
execution**

process of carrying out a sequence of *operations* specified by an *algorithm*

Note 1 to entry: The sequence of operations to be executed may vary from one *invocation* of a *function block instance* to another, depending on the rules specified by the function block's *algorithm* and the current values of *variables* in the function block's data structure.

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**3.38
execution control action
EC action**

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element associated with an *execution control state*, which identifies an *algorithm* to be *executed*, an *event* to be issued, or both

Note 1 to entry: Timing of algorithm execution and event issuance are addressed in 5.2.2.

**3.39
execution control chart
ECC**

graphical or textual representation of the causal relationships among *events* at the *event inputs* and *event outputs* of a *function block* and the *execution* of the function block's *algorithms*, using *execution control states*, *execution control transitions*, and *execution control actions*

**3.40
execution control initial state
EC initial state**

execution control state that is active upon initialization of an *execution control chart*

**3.41
execution control state
EC state**

situation in which the behavior of a *basic function block* with respect to its *variables* is determined by the *algorithms* associated with a specified set of *execution control actions*

3.42
execution control transition
EC transition

means by which control passes from a predecessor *execution control state* to a successor *execution control state*

3.43
fault

abnormal condition that may cause a reduction in, or loss of, the capability of a *functional unit* to perform a required *function*

3.44
function

specific purpose of an *entity* or its characteristic action

3.45
function block
function block instance

software functional unit comprising an individual, named copy of a data structure upon which associated *operations* may be performed as specified by a corresponding *function block type*

Note 1 to entry: Typical operations of a function block include modification of the values of the data in its associated data structure.

Note 2 to entry: The *function block instance* and its corresponding *function block type* defined in IEC 61131-3 are programming language elements with a different set of features.

3.46
function block network

network whose nodes are *function blocks* or *subapplications* and their *parameters* and whose branches are *data connections* and *event connections*

Note 1 to entry: This is a generalization of the *function block diagram* defined in IEC 61131-3.

3.47
function block type

type whose *instances* are *function blocks*

Note 1 to entry: Function block types include basic function block types, composite function block types, and service interface function block types

3.48
functional unit

entity of *hardware* or *software*, or both, capable of accomplishing a specified purpose

3.49
hardware

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

3.50
identifier

one or more *characters* used to name an *entity*

3.51
implementation

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