

TECHNICAL REPORT

IEC TR 62390

First edition
2005-01

Common automation device – Profile guideline

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**COMMON AUTOMATION DEVICE –
PROFILE GUIDELINE**
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IEC 62390, which is a technical report, has been prepared by IEC technical committee 65: Industrial-process measurement and control, and ISO SC5 of ISO technical committee 184: Enterprise-control system integration.

It is published as a double logo standard.

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

Enquiry draft	Report on voting
65/334/DTR	65/340/RVC

Full information on the voting for the approval of this technical report 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 2.

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

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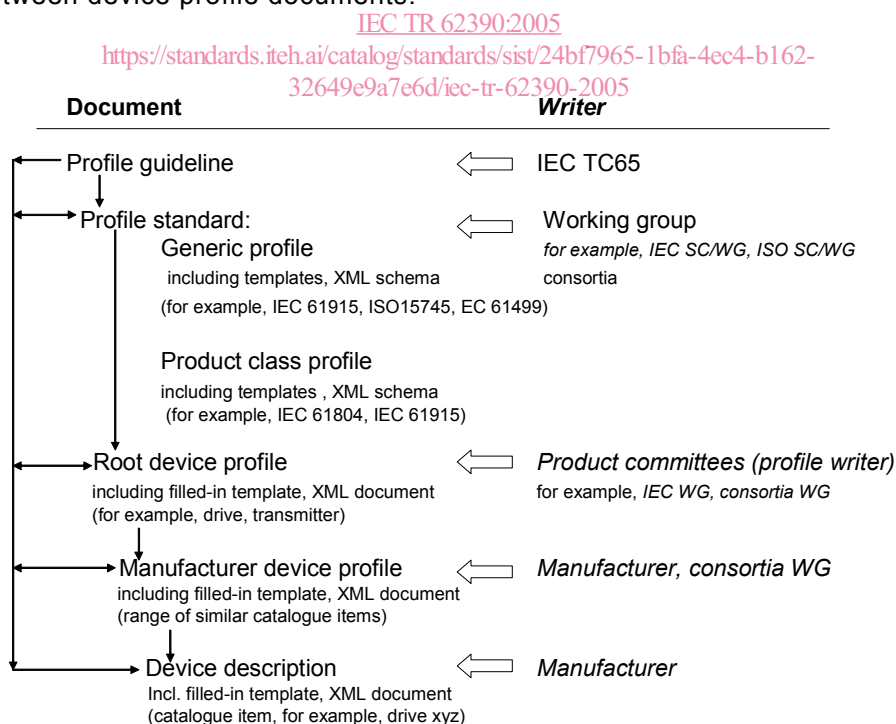
INTRODUCTION

This guideline is a recommended outline for use by standardization product committees, fieldbus consortia and product manufacturers to develop and provide profiles for networked devices. Some aspects of this guideline may also be applicable to stand-alone devices. The present wide variation in the form of concepts and methods used for disclosing device information and behaviour to users of devices leads to longer evaluations required to understand how to use and apply networked industrial devices. This variation makes determining device interoperability, interchangeability, comparisons and common device behaviour more difficult. Therefore, it is the intention of this guideline to provide a common and more generic way to publish device information and behaviour. This is a contribution to reduce the total cost of the industrial control system.

Profiles define a common set of functionality for a class of devices in a given industrial domain, thus allowing system designers, system integrators and maintenance staff to handle profile-based devices without special tool configuration. They also allow consistent structuring and semantics of device functionality.

NOTE Other technologies are available to support the integration of devices into control systems, in particular to handle manufacturer-specific extensions in commissioning and engineering tools. Examples of such technologies are device description languages, which detail the internal structure of the device, or standardized software interfaces, where each device is represented by a dedicated software component.

Figure 1 shows the various possible profile documents and the typical writer of each document. The figure also illustrates the developing sequence for the developing of the profile documents. It is proposed that this guideline be the base for other working groups to develop profile standards and product class profiles. The root device profiles and the manufacturer device profiles can be developed from these profile standards. Finally, the manufacturer can create the specific device descriptions for his products. Any shortcut is possible between device profile documents.



IEC 002/05

Figure 1 – Profile documents and their profile writer

This guideline provides the context, recommended minimum contents and construction rules for device profiles. Recommended generic device models, appropriate analysis and design diagrams using standards as UML (Unified Modeling Language) and methods to construct those models are provided.

This guideline provides recommendations for conveying the necessary device information to non-human users of the device profile such as software tools and application programs in an electronic file. These recommendations include the use of standards such as XML (eXtensible Markup Language).

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COMMON AUTOMATION DEVICE – PROFILE GUIDELINE

1 Scope

This Technical Report provides guidance for the development of device profiles for industrial field devices and control devices, independent of their complexity.

NOTE 1 Examples of devices covered are limit switches and contactors for simple device networks, medium complex devices, such as transmitters and actuators for process control, and complex devices for fieldbuses, such as power drive systems.

NOTE 2 This guideline is also recommended to be used for devices such as programmable controllers, network components and HMI. If a device is user programmable, its features, as introduced in this guideline (for example, parameters and behaviour), cannot be completely described in the profile. However, profile writers may agree on general common functions like Start, Stop and Reset as well as identification and process inputs/outputs.

A device profile may cover various aspects such as physical, functional, communication, electrical and functional safety as well as application system aspects, irrespective of whether these aspects are accessible over the network. This guideline focuses on the functional aspects of the device (see 3.1.9).

NOTE 3 Different users of a device profile such as device manufacturers, system integrators and maintenance operators may only use specific aspects of the profile.

The guideline is written in a network independent way. Therefore, it is applicable for various fieldbuses, including those based on Ethernet. The guideline is intended to be used by IEC product standards committees and industrial communications networks consortia when they develop their device profile organizations and structures. It is not intended to provide an outline for a specific device profile. Further, this guideline presents device models to better guide and delineate a device profile's content. The profile guideline allows the use of a parameter list, function block model and/or object model to convey the structure and behaviour of the device in a unique manner. It is up to the profile writers to decide which of the models they apply.

To be useful to users a common method for conveying the device profile information is required. This guideline recommends the use of device profile templates. This guideline gives an example of a template, which is intended to be the basis of the structure and content of further templates which may be developed by the relevant profile groups.

This will allow users of these profiles to make comparisons, determine interoperability and interchangeability, and recognize common device behaviour.

The development of industrial application and process profiles, as covered by ISO 15745-1, is not within the scope of this guideline.

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

IEC/PAS 61499-1:2000, *Function blocks for industrial-process measurement and control systems – Part 1: Architecture*

IEC/PAS 61499-2:2001, Function blocks for industrial-process measurement and control systems – Part 2: Software tools requirements

IEC/PAS 61804 (all parts), *Function blocks (FB) for process control*

IEC/PAS 61804-2:2004, *Function blocks (FB) for process control – Part 2: Specification of FB concept and Electronic Device Description Language (EDDL)*

ISO 15745 (all parts), *Industrial automation systems and integration – Open systems application integration framework*

ISO 15745-1:2003, *Part 1: Generic reference description*

3 Definitions and abbreviations

3.1 Definitions

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

3.1.1

algorithm

completely determined finite sequence of instructions by which the values of the output variables can be calculated from the values of the input variables

[IEV 351-11-21].

3.1.2

application program

software *functional element* 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

attribute

property or characteristic of an entity

3.1.4

class

description of a set of *objects* that share the same *attributes*, *operations*, methods, relationships, and semantics

[UML V1.5]

3.1.5

data

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

[ISO 2382, 01.01.02]

3.1.6

data type

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

[ISO 2382, 15.04.01]

3.1.7**device**

field device

1. networked independent physical *entity* of an industrial automation system capable of performing specified functions in a particular context and delimited by its *interfaces*

[IEC 61499-1]

2. entity that performs control, actuating and/or sensing functions and interfaces to other such entities within an automation system

[ISO 15745-1]

3.1.8**device class**

set of devices with a defined functional commonality in terms of their *parameters* or *functional elements*

3.1.9**device profile**

representation of a device in terms of its parameters, parameter assemblies and behaviour according to a device model that describes the data and behaviour of the device as viewed through a network, independent from any network technology;

NOTE 1 This is a definition from IEC 61915 which is extended by the addition of the device functional structure.

NOTE 2 The mapping onto a given network technology is the task of the communication profile.

3.1.10**entity**

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

[dpANS X3.172, 1989].

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3.1.11**execution**

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

3.1.12**functional element**

entity of software or software combined with hardware, capable of accomplishing a specified function of a *device*

NOTE 1 A functional element has an interface, associations to other *functional elements* and functions.

NOTE 2 A functional element can be made out of function block(s), object(s) or parameter list(s).

3.1.13**function block**

software functional element comprising an individual, named copy of a data structure and associated *operations* specified by a corresponding *function block type*

NOTE Adapted from IEC 61499.

3.1.14**input data**

data transferred from an external source into a *device*, *resource* or *functional element*

3.1.15**instance**

functional element comprising an individual, named copy of a data structure and associated *operations* specified by a corresponding *functional element type*

3.1.16 interface

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

[IEV 351-11-18].

NOTE The interface typically includes the device parameters.

3.1.17 method

implementation of an operation, which specifies the algorithm or procedure associated with an operation

3.1.18 model

mathematical or physical representation of a system or a process, based with sufficient precision upon known laws, identification or specified suppositions

[IEV 351-11-20].

3.1.19 object

entity with a well-defined boundary and identity that encapsulates state and behaviour

[UML V1.5]

NOTE State is represented by attributes and relationships, behaviour is represented by operations, methods, and state machines. An object is an instance of a class.

3.1.20 operation

service that can be requested from an object to effect behaviour

[UML V1.5]

3.1.21 output data

data originating in a device, resource or functional element and transferred from them to external systems

3.1.22 parameter

data element that represents device information that can be read from or written to a device, for example, through the network or a local HMI

NOTE 1 Adapted from IEC 61915.

NOTE 2 A parameter is typically characterized by a parameter name, data type and access direction.

3.1.23 resource

- logical device
- module
- group of functional elements which has independent control of its operation, and which provides various services to *application programs*, including the scheduling and execution of algorithms

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

3.1.24
service

specific work performed by a *device* or *object*

3.1.25
type

hardware or software element which specifies the common *attributes* shared by all *instances* of the type

3.1.26
use case

class specification of a sequence of actions, including variants, that a system (or other entity) can perform, interacting with actors of the system

[UML V1.5]

3.1.27
variable

software entity that may take different values, one at a time

[ISO 2382]

NOTE The values of a variable as well as of a parameter are usually restricted to a certain data type.

Abbreviations AIP Application Interoperability Profile

DCS Distributed Control System

ERP Enterprise Resource Planning

FBD Function block Diagram

HMI Human Machine Interface

H/W Hardware

I/O Input/Output

MES Manufacturing Execution System

OMG Object Management Group

S/W Software

UML Unified Modeling Language

URL Universal Resource Locator

XML Extensible Markup Language

4 Guideline overview

The device profile guideline

- presents a short introduction to the entire scope of profiles;
- specifies the subset which is the focus of this guideline;
- introduces a general structural view to a device.

A sequence of six profile definition steps is proposed to the profile writer groups to develop the necessary information for a device profile. This is recorded in a profile template, which is introduced in a corresponding clause. The profile template is to be collected in an electronically readable form and in a printed human readable document.