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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Field device tool (FDT) interface specification – Part 1: Overview and guidance

Spécification des interfaces des outils des dispositifs de terrain (FDT) – Partie 1: Vue générale et recommandations

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 1: Overview and guidance

FOREWORD

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International Standard IEC 62453-1 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

This part, in conjunction with the other parts of the first edition of the IEC 62453 series cancels and replaces IEC/PAS 62453-1, IEC/PAS 62453-2, IEC/PAS 62453-3, IEC/PAS 62453-4 and IEC/PAS 62453-5 published in 2006, and constitutes a technical revision.

This bilingual version (2012-12) corresponds to the monolingual English version, published in 2009-06.

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

FDIS	Report on voting
65E/123/FDIS	65E/136/RVD

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

The French version of this standard has not been voted upon.

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

A list of all parts of the IEC 62453 series, under the general title *Field Device Tool (FDT) interface specification,* 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- withdrawn,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.

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INTRODUCTION

Enterprise automation requires two main data flows: a “vertical” data flow from enterprise level down to the field devices including signals and configuration data, and a “horizontal” communication between field devices operating on the same or different communication technologies.

With the integration of fieldbusses into control systems, there are a few other tasks which need to be performed. In addition to fieldbus- and device-specific tools, there is a need to integrate these tools into higher-level system-wide planning- or engineering tools. In particular, for use in extensive and heterogeneous control systems, typically in the area of the process industry, the unambiguous definition of engineering interfaces that are easy to use for all those involved is of great importance.

Several different manufacturer specific tools have to be used. The data in these tools are often invisible data islands from the viewpoint of system life-cycle management and plant-wide automation.

To ensure the consistent management of a plant-wide control and automation technology, it is necessary to fully integrate fieldbusses, devices and sub-systems as a seamless part of a wide range of automation tasks covering the whole automation life-cycle.

IEC 62453 provides an interface specification for developers of FDT (Field Device Tool) components to support function control and data access within a client/server architecture. The availability of this standard interface facilitates development of servers and clients by multiple manufacturers and supports open interoperation.

A device or module-specific software component, called a DTM (Device Type Manager) is supplied by a manufacturer with the related device type or software entity type. Each DTM can be integrated into engineering tools via defined FDT interfaces. This approach to integration is in general open for all fieldbusses and thus supports integration of different devices and software modules into heterogeneous control systems.

The IEC 62453 common application interface supports the interests of application developers, system integrators, and manufacturers of field devices and network components. It also simplifies procurement, reduces system costs and helps manage the lifecycle. Significant savings are available in operating, engineering and maintaining the control systems.

The objectives of IEC 62453 series are to support:

- universal plant-wide tools for life-cycle management of heterogeneous fieldbus environments, multi-manufacturer devices, function blocks and modular sub-systems for all automation domains (e.g. process automation, factory automation and similar monitoring and control applications);
- integrated and consistent life-cycle data exchange within a control system including its fieldbuses, devices, function blocks and modular sub-systems;
- simple and powerful manufacturer-independent integration of different automation devices, function blocks and modular sub-systems into the life-cycle management tools of a control system.

The FDT concept supports planning and integration of monitoring and control applications, it does not provide a solution for other engineering tasks such as "electrical wiring planning”, “mechanical planning”. Plant management subjects such as "maintenance planning”, “control optimization”, “data archiving”, are not part of this FDT standard. Some of these aspects may be included in future editions of FDT publications.

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 1: Overview and guidance

1 Scope

This part of IEC 62453 presents an overview and guidance for the IEC 62453 series. It

- explains the structure and content of the IEC 62453 series (see Clause 5);
- provides explanations of some aspects of the IEC 62453 series that are common to many of the parts of the series;
- describes the relationship to some other standards.

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 61158 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 61784 (all parts), *Industrial communication networks – Profiles*

ISO/IEC 19501:2005, *Information technology – Open Distributed Processing – Unified Modeling Language (UML)* Version 1.4.2

3 Terms, definitions, symbols, abbreviations and conventions

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

3.1 Terms and definitions

3.1.1
actor
coherent set of roles that users of use cases play when interacting with these use cases

[ISO/IEC 19501]

NOTE An actor has one role for each use case with which it communicates.

3.1.2
address
communication protocol specific access identifier

3.1.3
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.

3.1.4
business object
object representing specific behavior (e.g. DTM, BTM and channel)

NOTE The term business object has been defined originally as part of the design pattern 3-tier architecture, where the business object is part of the business layer.

3.1.5
Block Type Manager (BTM)
specialized DTM to manage and handle a block

3.1.6
communication
fieldbus protocol specific data transfer

3.1.7
Communication Channel
access point for communication to field device

3.1.8
configuration
system created by configuring the plant components and the topology

3.1.9
configure
(see also parameterize)
setting parameters at the instance data as well as the logical association of plant components to build up the plant topology (off-line)

3.1.10
connection
established data path for communication with an selected device

3.1.11
data
set of parameter values

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

[ISO 2382 series]

3.1.13
DCS manufacturer / system manufacturer
manufacturer of the engineering system

3.1.14
device
(see also field device)

a) 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]

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

3.1.15
device manufacturer
manufacturer of fieldbus devices

3.1.16
device type
device characterization based on abstract properties such as manufacturer, fieldbus protocol, device type identifier, device classification, version information or other information

NOTE The scope of such characterizations can vary depending on the properties that are used in the definition of such a set and is manufacturer specific for each DTM.

3.1.17
distributed system
FDT objects that jointly are executed on different PCs in a network

NOTE The implementation of such a distributed system is vendor specific (for example: DTM and Presentation are executed on different PCs or DTMs are executed in multi-user system on different PCs)

3.1.18
documentation
human readable information about a device instance

NOTE This may be electronic information in a database.

3.1.19
Device Type Manager (DTM)
a) software component containing device specific application software

b) generic class and means "Type Manager"

NOTE The D is kept because the Acronym is well-known in the market.

3.1.20
DTM device type
software module for a particular device type within the DTM

NOTE A DTM may contain one or more DTM device types

3.1.21
entity
particular thing, such as a person, place, process, object, concept, association, or event

[IEC 61499-1]

3.1.22
field device
(see also device)

3.1.23
Frame Application
FDT runtime environment

3.1.24
FDT model
interface specification for objects and object behavior in a monitoring and control system

3.1.25
function
specific purpose of an entity or its characteristic action

[IEC 61499-1]

3.1.26
hardware
physical equipment, as opposed to programs, procedures, rules and associated documentation
[ISO/AFNOR Dictionary of computer science]

3.1.27
implementation
development phase in which the hardware and software of a system become operational

[IEC 61499-1]

3.1.28
instantiation
creation of an instance of a specified type

[IEC 61499-1]

3.1.29
interface
shared boundary between two *functional units,* defined by functional characteristics, signal characteristics, or other characteristics as appropriate

[IEC 60050-351]

3.1.30
mapping
set of values having defined correspondence with the quantities or values of another set
[ISO/AFNOR Dictionary of computer science]

3.1.31
multi-user environment
environment which allows operation by more than one user

3.1.32
network
all of the media, connectors, repeaters, routers, gateways and associated node communication elements by which a given set of communicating devices are interconnected

[IEC 61158-5-X]

NOTE In this document network is used to express that one or more interconnected fieldbus systems with different protocols can be applied.

3.1.33
nested communication
communication using a hierarchy of communication systems

3.1.34
operation
well-defined action that, when applied to any permissible combination of known entities, produces a new entity
[ISO/AFNOR Dictionary of computer science]

3.1.35
parameter
variable that is given a constant value for a specified application and that may denote the application
[ISO/AFNOR Dictionary of computer science]

3.1.36
parameterize
(see also configure)
setting parameters in a device or a block or an object

3.1.37
persistent data
stored data that is preserved through shut down/restart and maintenance activities

3.1.38
Process Channel
representation of process value and its properties

3.1.39
service
functional capability of a resource, which can be modeled by a sequence of service primitives

[IEC 61499-1]

3.1.40
session
instance of user interactions within the FDT model

3.1.41
synchronization
synchronization of data depending on the context where used

NOTE For example, synchronization can occur between the DTM and device or between several DTM instances having a reference to the same instance data.

3.1.42
system
set of interrelated elements considered in a defined context as a whole and separated from its environment

[IEC 60050-351]

NOTE 1 Such elements may be both material objects and concepts as well as the results thereof (e.g. forms of organization, mathematical methods, and programming languages).

NOTE 2 The system is considered to be separated from the environment and other external systems by an imaginary surface, which can cut the links between them and the considered system.

3.1.43
transient data
temporary data which have not been stored (while configuring or parameterizing)

3.1.44
type
software element, which specifies the common attributes shared by all instances of the type

[IEC 61499-1]

3.1.45
variable
software entity that may take different values, one at a time

[IEC 61499-1]

NOTE 1 The values of a variable are usually restricted to a certain data type.

NOTE 2 Variables are described as input variables, output variables, and internal variables.

3.1.46
use case
specification of a sequence of actions, including variants, that a system (or other entity) can perform, interacting with actors of the system

[ISO/IEC 19501]

3.2 Abbreviations

BTM	Block Type Manager
COM	Component Object Model
CP	Communication profile
CPF	Communication profile family
DCS	Distributed control system
DD	Device description
DTM	Device Type Manager
ERP	Enterprise resource planning
FA	Frame Application
FB	Function block
FDT	Field device tool
GUI	Graphical user interface
ID	Identifier
IDL	Interface definition language
I/O	Input/output
IT	Information technology
MES	Manufacturing execution systems
OEM	Original equipment manufacturer
OLE	Object Linking and Embedding
OPC	Open connectivity via open standards (originally: OLE for Process Control)
PC	Personal computer
PLC	Programmable logic controller
SCADA	Supervisory, control and data acquisition
UML	Unified modeling language
UUID	Universal unique identifier
XML	Extensible markup language

3.3 Conventions

The conventions for UML notation used in the IEC 62453 series is defined in Annex A.

4 FDT overview

4.1 State of the art

In industrial automation, a control system often comprises many binary and analog input/output signals transmitted via a communication network. Numerous field devices provided by different manufacturers have to be included in the network by direct connection or I/O multiplex units. Many applications use more than 100 different field device types from various device manufacturers.

Each device has specific configuration and parameterization functions to support its designed task. These device-specific properties and settings have to be taken into consideration when configuring a fieldbus coupler and bus communication for the device. The device presence and its capability have to be made known to the control system. Device input and output signals and function block services need to be effectively integrated into the planning of the control system.

In the absence of a common interface standard, the large number of different device types and suppliers within a control system project makes the configuration task difficult and time-consuming. Various different tools have to be used (see Figure 1). The user requirement for consistency of data, documentation and application configurations can only be guaranteed by intensive and costly system testing.

A common location for service and diagnostic tasks in the control system does not fully cover the functional capabilities of available fieldbus devices nor does it guarantee that different device or module-specific tools can be integrated into other system software tools. Typically, device-specific tools can only be connected directly to a specific fieldbus or directly to a specific field device type.

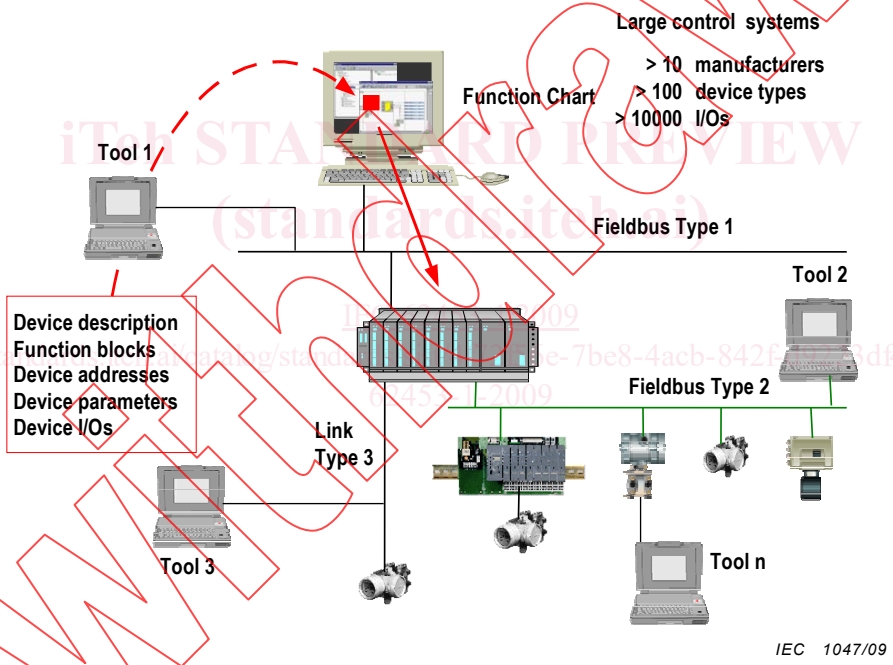

Figure 1 − Different tools and fieldbusses result in limited integration

4.2 Objectives of FDT

4.2.1 General features

Full integration of fieldbus devices or modules into automation systems requires a communication path from central engineering or operator terminals via the system and fieldbusses to the individual field devices.

FDT supports:

- central facilities for planning, diagnostics and service with direct access to all devices;
- integrated, consistent configuration and documentation of the automation system, its fieldbusses and devices;
- organization of common data for the automation system and the field devices;