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Specifikacija vmesnika orodja procesne naprave - 71. del: OPC UA informacijski model za orodje procesne naprave

Field device tool (FDT) interface specification - Part 71: OPC UA Information Model for FDT

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25.040.40	Merjenje in krmiljenje industrijskih postopkov	Industrial process measurement and control
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65E/806/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 62453-71 ED1**	
DATE OF CIRCULATION: **2021-11-19**	CLOSING DATE FOR VOTING: **2022-02-11**
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IEC SC 65E : DEVICES AND INTEGRATION IN ENTERPRISE SYSTEMS	
SECRETARIAT: United States of America	SECRETARY: Mr Donald (Bob) Lattimer
OF INTEREST TO THE FOLLOWING COMMITTEES: SC 65C	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT	☐ QUALITY ASSURANCE ☐ SAFETY
☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

Field device tool (FDT) interface specification – Part 71: OPC UA Information Model for FDT

PROPOSED STABILITY DATE: 2025

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 71: OPC UA Information Model for FDT

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IEC 62453-71 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

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

The language used for the development of this [...an International Standard, a Technical Specification: specify document type...] is English.

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This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

0.1 General

The new OPC Unified Architecture (OPC UA) unifies the existing standards and brings them to state-of-the-art technology using service-oriented architecture (SOA). Platform-independent technology allows the deployment of OPC UA beyond current OPC applications only running on Windows-based PC systems. OPC UA can also run on embedded systems as well as Linux / UNIX based enterprise systems. The provided information can be generically modelled and therefore arbitrary information models can be provided using OPC UA.

FDT standardizes the communication and configuration interface between all field devices and host systems. FDT provides a common environment for accessing the devices' most sophisticated features. Any device can be configured, operated, and maintained through the standardized user interface – regardless of supplier, type or communication protocol.

This international standard specifies a synergy of both approaches, thus allowing easy, standardized access via OPC UA interfaces to device know-how provided on base of FDT.

0.2 Introduction to FDT

FDT is a technology supporting the data exchange between field devices and automation systems. The technology is based on an interface specification standardized as IEC 62453. The specification defines two main concepts: Device Type Manager (DTM) and Frame Application. A DTM is a software component specific to a field device type. A Frame Application is a software environment (part of the automation system) for integration of DTMs. Within a Frame Application every DTM provides data and services specific to the respective field device. Since the technology is based on a standardized set of interfaces, every DTM may be integrated in every Frame Application. Based on FDT it is possible to integrate communication devices, communication infrastructure devices (e.g. gateways) and field devices, depending on their communication protocols. Support for different communication protocols is provided by means of supplemental communication protocol specifications (e.g. for PROFINET, PROFIBUS, Ethernet IP, TCP, HART and FF) or by means of manufacturer-specific protocol integration.

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0.3 Introduction to OPC Unified Architecture

The main use case for OPC standards is the online data exchange between devices and HMI or SCADA systems using Data Access functionality. In this use case the device data is provided by an OPC server and is consumed by an OPC client integrated into the HMI or SCADA system. OPC DA provides functionality to browse through a hierarchical namespace containing data items and to read, to write and to monitor these items for data changes. The OPC Classic specifications are based on Microsoft COM/DCOM technology for the communication between software components from different vendors. Therefore OPC Classic server and clients are restricted to Windows OS based automation systems.

OPC UA incorporates all features of OPC Class specifications like OPC DA, A&E and HDA, but defines platform independent communication mechanisms and generic, extensible and object-oriented modelling capabilities for the information a system wants to expose.

The OPC UA network communication part defines different mechanisms optimized for different use cases. The first version of OPC UA is defining an optimized binary TCP protocol for high performance intranet communication as well as a mapping to accepted internet standards like Web Services. The abstract communication model does not depend on a specific protocol mapping and allows adding new protocols in the future. Features like security, access control and reliability are directly built into the transport mechanisms. Based on the platform independence of the protocols, OPC UA servers and clients can be directly integrated into devices and controllers.

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The OPC UA Information Model provides a standard way for Servers to expose Objects to Clients. Objects in OPC UA terms are composed of other Objects, Variables and Methods. OPC UA also allows relationships to other Objects to be expressed.

The set of Objects and related information that an OPC UA Server makes available to Clients is referred to as its AddressSpace. The elements of the OPC UA Object Model are represented in the AddressSpace as a set of Nodes described by Attributes and interconnected by References. OPC UA defines eight classes of Nodes to represent AddressSpace components. The classes are Object, Variable, Method, ObjectType, DataType, ReferenceType and View. Each NodeClass has a defined set of Attributes.

This specification makes use of two essential OPC UA NodeClasses: Objects and Variables.

Objects are used to represent components of a system. An Object is associated with a corresponding ObjectType that provides definitions for that Object.

Variables are used to represent values. Two categories of Variables are defined, Properties and DataVariables.

Properties are Server-defined characteristics of Objects, DataVariables and other Nodes. Properties are not allowed to have Properties defined for them. An example for Properties of Objects is the Revision Property of a DeviceType.

DataVariables represent the contents of an Object. DataVariables may have component DataVariables. This is typically used by Servers to expose individual elements of arrays and structures. This specification uses DataVariables to represent data like the process variables provided by a device.

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0.4 Introduction to OPC UA Device Integration

The specification "OPC UA Device Integration" is an extension of the overall OPC Unified Architecture specification series and defines the information model associated with Devices. The model is intended to provide a unified view of Devices irrespective of the underlying Device protocols. FDT deals with physical or logical Devices and the information model of IEC 62541-100 therefore is used as base for the FDT information model.

The Devices information model specifies different ObjectTypes and procedures used to represent devices and related components like the communication infrastructure in an OPC UA Address Space. The main use cases are device configuration and diagnostic, but it allows a general and standardized way for any kind of application to access device related information. The following examples illustrate the concepts used in this specification. See UA Devices for the complete definition of the Devices information model.

Figure 1 shows an example for a temperature controller represented as Device Object. The component ParameterSet contains all Variables describing the Device. The component MethodSet contains all Methods provided by the Device. Both components are inherited from the TopologyElementType which is the root Object type of the Device Object type hierarchy. Objects of the type FunctionalGroupType are used to group the Parameters and Methods of the Device into logical groups. The FunctionalGroupType and the grouping concept are defined in UA Devices but the groups are device type specific i.e. the groups ProcessData and Configuration are defined by the TemperatureControllerType in this example.

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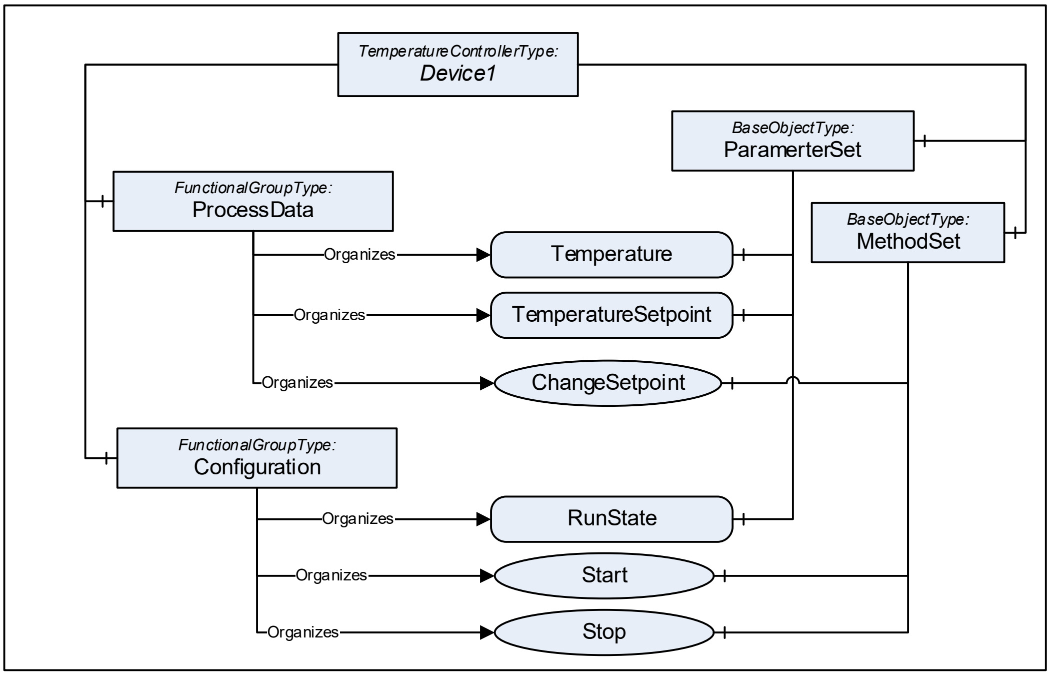

Figure 1 – OPC UA Devices Example

The use cases in Annex B illustrate the usage of the information model. Not all necessary Objects must be realized within a concrete OPC UA Server.

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 71: OPC UA Information Model for FDT

Scope

This part of IEC 62453 specifies an OPC UA Information Model to represent the device information based on FDT-defined device integration.

Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 62453-1:—[1], *Field Device Tool (FDT) interface specification – Part 1: Overview and guidance*

IEC 62453-2:—[1], *Field Device Tool (FDT) interface specification – Part 2: Concepts and detailed description*

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IEC 62541-3:2020, *OPC Unified Architecture - Part 3: Address Space Model*

IEC 62541-5:2020, *OPC Unified Architecture - Part 5: Information Model*

IEC 62541-6, *OPC Unified Architecture - Part 6: Mappings*

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IEC 62541-7, *OPC Unified Architecture - Part 7: Profiles*

IEC 62541-8, *OPC Unified Architecture - Part 8: Data Access*

IEC 62541-100:2015, *OPC Unified Architecture - Part 100: Device Interface*

Terms, definitions, and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62453-1, IEC 62453-2 as well as in IEC 62451-100 apply.

3.2 Abbreviations and symbols

For the purposes of this document, the abbreviations given in IEC 62453-1, IEC 62453-2 as well as the following apply.

———————

[1] To be published concurrently with this international standard.

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A&E	Alarms & Events
DA	Data Access
DTM	Device Type Manager
FDT	Field Device Technology
HDA	Historical Data Access
HMI	Human-Machine Interface
IEC	International Electrotechnical Commission
MES	Manufacturing Execution System
UA	Unified Architecture
XML	Extensible Markup Language

Conventions used in this document

4.1.1 Document conventions

Throughout this document certain document conventions are used.

Italics are used to denote a defined term or definition that appears in the “Terms and definition” clause in this document or in one of the referenced OPC UA documents.

Italics are also used to denote the name of a service input or output parameter or the name of a structure or element of a structure that are usually defined in tables.

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4.1.2 Conventions for FDT methods

FDT defines synchronous methods and asynchronous methods. Asynchronous methods are implemented with a set of methods. For example an asynchronous method <MethodName> is implemented with Begin<MethodName>(), Cancel<MethodName>(), and End<MethodName>().

In this document asynchronous methods are indicated by ‘<>’ in front of the name (e.g. <>MethodName).

4.1.3 Conventions for Node descriptions

Node definitions are specified using tables (seeTable 2)

Attributes are defined by providing the *Attribute* name and a value, or a description of the value.

References are defined by providing the *ReferenceType* name, the *BrowseName* of the *TargetNode* and its *NodeClass*.

- If the *TargetNode* is a component of the *Node* being defined in the table the *Attributes* of the composed *Node* are defined in the same row of the table.
- The *DataType* is only specified for *Variables*; “[<number>]” indicates a single-dimensional array, for multi-dimensional arrays the expression is repeated for each dimension (e.g. [2][3] for a two-dimensional array). For all arrays the *ArrayDimensions* is set as identified by <number> values. If no <number> is set, the corresponding dimension is set to 0, indicating an unknown size. If no number is provided at all the *ArrayDimensions* can be omitted. If no brackets are provided, it identifies a scalar *DataType* and the *ValueRank* is set to the corresponding value (see IEC 62541-3). In addition, *ArrayDimensions* is set to null or is omitted. If it can be Any or *ScalarOrOneDimension*, the value is put into “{<value>}”, so either “{Any}” or “{*ScalarOrOneDimension*}” and the *ValueRank* is set to the corresponding value (see