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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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65E/806/CDV

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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: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY	
<input checked="" type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING <input type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING	
<p>Attention IEC-CENELEC parallel voting</p> <p>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.</p> <p>The CENELEC members are invited to vote through the CENELEC online voting system.</p>	

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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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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

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Part 71: OPC UA Information Model for FDT

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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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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

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

247

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

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

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

- 258 • reconfirmed,
- 259 • withdrawn,
- 260 • replaced by a revised edition, or
- 261 • amended.

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INTRODUCTION

0.1 General

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

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

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

0.2 Introduction to FDT

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

0.3 Introduction to OPC Unified Architecture

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

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

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

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

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

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

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

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

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

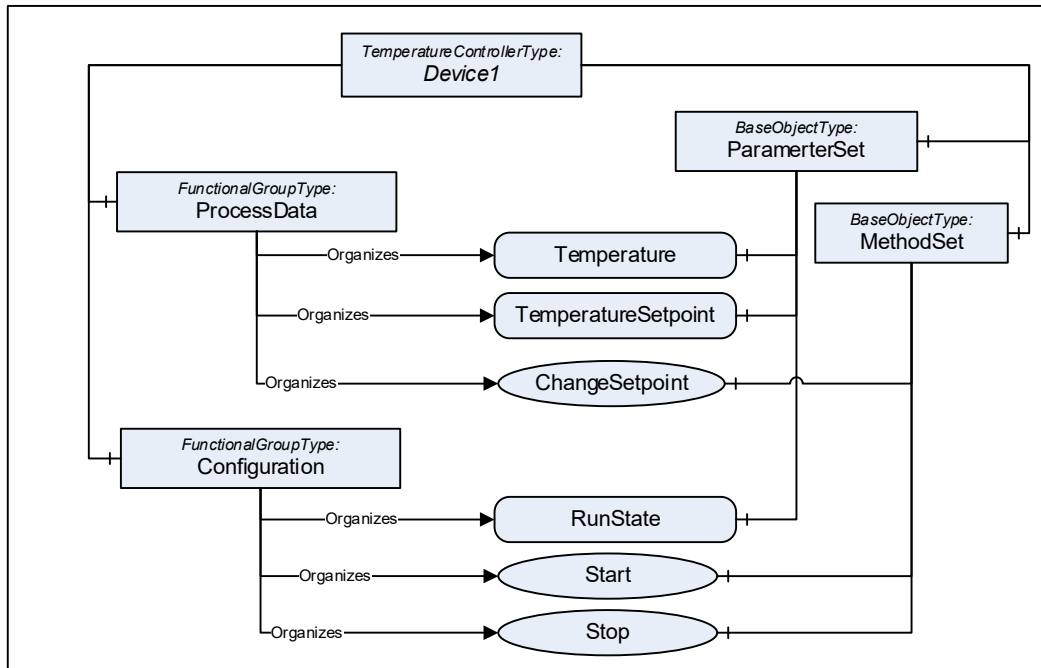
327 DataVariables represent the contents of an Object. DataVariables may have component
328 DataVariables. This is typically used by Servers to expose individual elements of arrays and
329 structures. This specification uses DataVariables to represent data like the process variables
330 provided by a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

331 **0.4 Introduction to OPC UA Device Integration**

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

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

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



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Figure 1 – OPC UA Devices Example

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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

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362 **Scope**

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

365 **Normative references**

366 The following documents are referred to in the text in such a way that some or all of their content
367 constitutes requirements of this document. For dated references, only the edition cited applies.
368 For undated references, the latest edition of the referenced document (including any
369 amendments) applies.

370 IEC 62453-1:—¹, *Field Device Tool (FDT) interface specification – Part 1: Overview and*
371 *guidance*

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

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

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

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

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

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

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

380

381 **Terms, definitions, and abbreviations**

382 **3.1 Terms and definitions**

383 For the purposes of this document, the terms and definitions given in IEC 62453-1, IEC 62453-
384 2 as well as in IEC 62451-100 apply.

385 **3.2 Abbreviations and symbols**

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

¹ To be published concurrently with this international standard.

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

388

389 **Conventions used in this document**390 **4.1.1 Document conventions**

391 Throughout this document certain document conventions are used.

392 Italics are used to denote a defined term or definition that appears in the “Terms and definition”
393 clause in this document or in one of the referenced OPC UA documents.394 Italics are also used to denote the name of a service input or output parameter or the name of
395 a structure or element of a structure that are usually defined in tables.396 **4.1.2 Conventions for FDT methods**397 FDT defines synchronous methods and asynchronous methods. Asynchronous methods are
398 implemented with a set of methods. For example an asynchronous method <MethodName> is
399 implemented with Begin<MethodName>(), Cancel<MethodName>(), and End<MethodName>().400 In this document asynchronous methods are indicated by '<>' in front of the name (e.g.
401 <>MethodName).402 **4.1.3 Conventions for Node descriptions**

403 Node definitions are specified using tables (see Table 2)

404 *Attributes* are defined by providing the *Attribute* name and a value, or a description of the value.405 *References* are defined by providing the *ReferenceType* name, the *BrowseName* of the
406 *TargetNode* and its *NodeClass*.

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