IEC TR 62453-51-20

Edition 1.0 2017-06

TECHNICAL REPORT

colour inside

Field device tool (FDT) interface specification – Part 51-20: Communication implementation for common object model – IEC 61784 CPF 2

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 51-20: Communication implementation for common object model – IEC 61784 CPF 2

FOREWORD

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IEC TR 62453-51-20, which is a technical report, has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process management, control and automation.

This document cancels and replaces IEC TR 62453-502 published in 2009. This edition constitutes a technical revision. The main change consists in improved support for Ethernet/IP.

Each part of the IEC 62453-51-xy series is intended to be read in conjunction with its corresponding part in the IEC 62453-3xy series. This document corresponds to IEC 62453-302.

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

Enquiry draft	Report on voting
65E/440/DTR	65E/514/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 document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The 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 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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

This part of IEC 62453 is an interface specification for developers of Field Device Tool (FDT) components for function control and data access within a client/server architecture. The specification is a result of an analysis and design process to develop standard interfaces to facilitate the development of servers and clients by multiple vendors that need to interoperate seamlessly.

With the integration of fieldbuses 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.

A device-specific software component, called Device Type Manager (DTM), is supplied by the field device manufacturer with its device. The DTM is integrated into engineering tools via the FDT interfaces defined in this specification. The approach to integration is in general open for all kind of fieldbuses and thus meets the requirements for integrating different kinds of devices into heterogeneous control systems.

Figure 1 shows how this part of the IEC 62453-51-xy series is aligned in the structure of the IEC 62453 series.

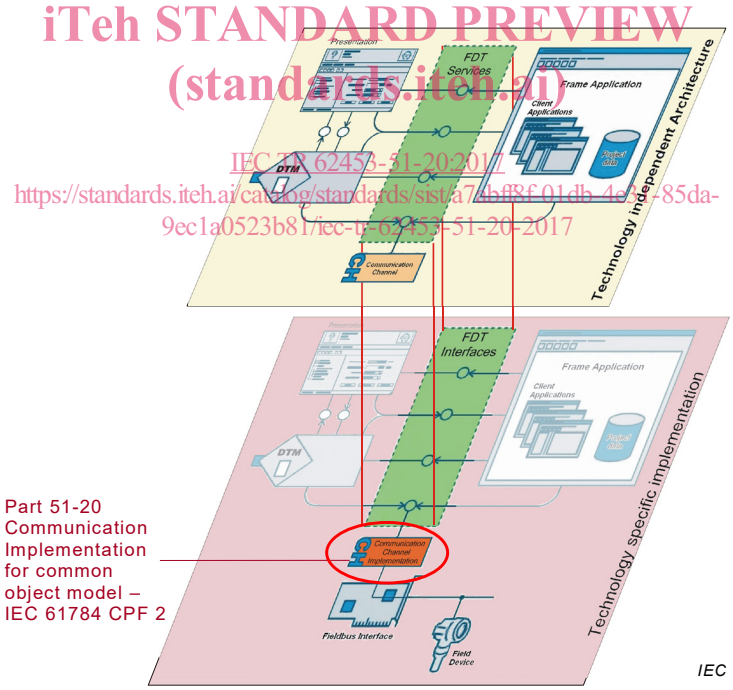

Figure 1 – Part 51-20 of the IEC 62453 series

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 51-20: Communication implementation for common object model – IEC 61784 CPF 2

1 Scope

This part of the IEC 62453-51-xy series, which is a Technical Report, provides information for integrating the CIP™ technology into the COM-based implementation of FDT interface specification (IEC TR 62453-41).

The Communication Profile Family 2 (commonly known as CIP™[1]) defines communication profiles based on IEC 61158-2 Type 2, IEC 61158-3-2, IEC 61158-4-2, IEC 61158-5-2, and IEC 61158-6-2, IEC 62026-3. The basic profiles CP 2/1 (ControlNet™[2]), CP 2/2 (EtherNet/IP™[3]), and CP 2/3 (DeviceNet™[1]) are defined in IEC 61784-1 and IEC 61784-2. An additional communication profile (CompoNet™),also based on CIP™, is defined in [15][4].

This document specifies implementation of communication and other services based on IEC 62453-302.

This document neither contains the FDT specification nor modifies it.

2 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 61158-2, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-3-2, *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*

IEC 61158-4-2, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*

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1 CIP™ (Common Industrial Protocol), DeviceNet™ and CompoNet™ are trade names of Open DeviceNet Vendor Association, Inc (ODVA). This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the trade name holder or any of its products. Compliance to this profile does not require use of the trade names CIP™, DeviceNet™ or CompoNet™. Use of the trade names CIP™, DeviceNet™ or CompoNet™ requires permission of Open DeviceNet Vendor Association,Inc.

2 ControlNet™ is a trade name of ControlNet International, Ltd. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name ControlNet™. Use of the trade name ControlNet™ requires permission of ControlNet International, Ltd.

3 EtherNet/IP™ is a trade name of ControlNet International, Ltd. and Open DeviceNet Vendor Association, Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name EtherNet/IP™. Use of the trade name EtherNet/IP™ requires permission of either ControlNet International, Ltd. or Open DeviceNet Vendor Association, Inc.

4 Figures in square brackets refer to the Bibliography.

IEC 61158-5-2, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61158-6-2, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*

IEC 61784-1:2014, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

IEC 61784-2, *Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3*

IEC 62026-3, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) – Part 3: DeviceNet*

IEC 62453-1:2016, *Field device tool (FDT) interface specification – Part 1: Overview and guidance*

IEC 62453-2:2016, *Field device tool (FDT) interface specification – Part 2: Concepts and detailed description*

IEC TR 62453-41:2016, *Field device tool (FDT) interface specification – Part 41: Object model integration profile – Common object model*

IEC 62453-302:2016, *Field device tool (FDT) interface specification – Part 302: Communication profile integration – IEC 61784 CPF 2*

3 Terms, definitions, symbols, abbreviated terms and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62453-1, IEC 62453-2, IEC TR 62453-41, and IEC 62453-301 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.2 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviations given in IEC 62453-1, IEC 62453-2, IEC 62453-302, and IEC TR 62453-41 apply.

3.3 Conventions

3.3.1 Data type names and references to data types

The conventions for naming and referencing of data types are explained in IEC 62453-2:2016, Clause A.1.

3.3.2 Vocabulary for requirements

The following expressions are used when specifying requirements.

Usage of “shall” or “mandatory”	No exceptions allowed.

Usage of “should” or “recommended”	Strong recommendation. It may make sense in special exceptional cases to differ from the described behaviour.
Usage of “can” or “optional”	Function or behaviour may be provided, depending on defined conditions.

4 Bus category

IEC 61784 CPF 2 protocol is identified in the attribute busCategory of the BusCategory element by the identifiers, as specified in IEC 62453-302.

5 Access to instance and device data

The elements and attributes specified in this clause are used at the following methods:

- IDtmParameter methods
- IDtmSingleDeviceDataAccess methods
- IDtmSingleInstanceDataAccess methods

All parameters defined in the Params section of the EDS shall be exposed. For IdtmParameter, the parameters are exposed in the ExportedVariables element of the DtmParameter schema.

6 Protocol specific behaviour

IEC 61784 CPF 2 protocol specific requirements are specified in IEC 62453-302.

7 Protocol specific usage of general data types

Table 1 shows how general attributes are used with IEC 61784 CPF 2 devices.

Table 1 – Protocol specific usage of general attributes

Attribute	Description for use
fdt:address	All these attributes of the FDTDatatype schema are used as defined in IEC 62453-302.
fdt:protocolId	
fdt:deviceTypeId	
fdt:deviceTypeInformation	
fdt:deviceTypeInformationPath	
fdt:manufacturerId	
fdt:semanticId	
fdt:applicationDomain	
fdt:tag	

8 Protocol specific common data types

8.1 Common data types – DTMCIPDataTypeSchema

This schema specifies the protocol specific common XML elements and attributes, which are used in other schemas. The definition of the elements and attributes follows the data type definitions in IEC 62453-302.

```
<?xml version="1.0"?>
<Schema name="DTMCIPDataTypeSchema" xmlns="urn:schemas-microsoft-com:xml-data" xmlns:dt="urn:schemas-microsoft-com:datatypes" xmlns:fdt="x-schema:FDTDataTypesSchema.xml" xmlns:dtminfo="x-schema:DTMInformationSchema.xml">
        <!-- Version of the Schema -->
        <AttributeType name="schemaVersion" dt:type="number" default="1.0"/>
        <!-- Definition of Attributes -->
        <AttributeType name="classId" dt:type="ui2"/>
        <AttributeType name="instanceId" dt:type="ui2"/>
        <AttributeType name="attributeId" dt:type="ui1"/>
        <AttributeType name="vendorID" dt:type="ui2"/>
        <AttributeType name="deviceType" dt:type="ui2"/>
        <AttributeType name="productCode" dt:type="ui2"/>
        <AttributeType name="majorRevision" dt:type="ui1"/>
        <AttributeType name="minorRevision" dt:type="ui1"/>
        <AttributeType name="serialNumber" dt:type="bin.hex"/>
        <AttributeType name="productName" dt:type="string"/>
        <AttributeType name="cipStatus" dt:type="ui2"/>
        <AttributeType name="portNumber" dt:type="ui2"/>
        <AttributeType name="extendedIdentifier" dt:type="string"/>
        <AttributeType name="shortIdentifier" dt:type="ui1"/>
        <AttributeType name="serviceCode" dt:type="ui1"/>
        <AttributeType name="serviceName" dt:type="string"/>
        <!-- refer to CIP Spec datatype definition Vol 1 C-2 through C-6 -->
        <AttributeType name="dataType" dt:type="enumeration" dt:values="byte float double int unsigned enumerator bitEnumerator index ascii password bitString hexString date time dateAndTime duration binary structured dtmSpecific"/>
  <AttributeType name="ePath" dt:type="bin.hex"/>
        <AttributeType name="bitOffset" dt:type="ui4"/>
        <AttributeType name="constValue" dt:type="ui4"/>
        <AttributeType name="symbolicAddress" dt:type="string"/>
        <!--Definition of Elements-->
        <ElementType name="Service" content="empty" model="closed">
          <attribute type="fdt:nodeId" required="no"/>
                <attribute type="serviceCode" required="yes"/>
                <attribute type="serviceName" required="no"/>
        </ElementType>

        <ElementType name="CIPObjectId" content="empty" model="closed">
                <attribute type="fdt:nodeId" required="no"/>
                <attribute type="classId" required="yes"/>
                <attribute type="instanceId" required="yes"/>
                <attribute type="attributeId" required="no"/>
        </ElementType>

        <ElementType name="CIPSymbolicAddress" content="empty" model="closed">
                <attribute type="fdt:nodeId" required="no"/>
                <attribute type="symbolicAddress" required="yes"/>
        </ElementType>

  <!-- See CIP Specification Appendix C-1 -->
        <ElementType name="HexAddress" content="empty" model="closed">
          <attribute type="fdt:nodeId" required="no"/>
                <attribute type="ePath" required="yes"/>
        </ElementType>

        <ElementType name="CIPObjectAddress" content="eltOnly" model="closed">
          <attribute type="fdt:nodeId" required="no"/>
                <group order="one" minOccurs="1" maxOccurs="1">
                        <element type="CIPObjectId"/>
                        <element type="CIPSymbolicAddress"/>
                        <element type="HexAddress"/>
                </group>
        </ElementType>

        <ElementType name="ParameterReference" content="empty"  model="closed">
                <attribute type="fdt:nodeId" required="no"/>
                <attribute type="fdt:idref" required="yes"/>
                <attribute type="bitOffset" required="no"/>
```

```
        </ElementType>

        <ElementType name="Constant">
          <attribute type="fdt:nodeId" required="no"/>
                <attribute type="constValue" required="yes"/>
        </ElementType>

        <ElementType name="ExtendedIdentifier" content="empty" model="closed">
          <attribute type="fdt:nodeId" required="no"/>
                <attribute type="extendedIdentifier" required="yes"/>
        </ElementType>

        <ElementType name="ShortIdentifier" content="empty" model="closed">
                <attribute type="fdt:nodeId" required="no"/>
                <attribute type="shortIdentifier" required="yes"/>
        </ElementType>

        <ElementType name="CIPNodeID" content="eltOnly" model="closed">
          <attribute type="fdt:nodeId" required="no"/>
                <group order="one" minOccurs="1" maxOccurs="1">
                        <element type="ExtendedIdentifier"/>
                        <element type="ShortIdentifier"/>
                </group>
</ElementType>

        <ElementType name="LinkAddress" content="eltOnly" model="closed">
          <attribute type="fdt:nodeId" required="no"/>
                <element type="CIPNodeID" minOccurs="1" maxOccurs="1"/>
        </ElementType>

        <ElementType name="Segment" content="eltOnly" model="closed">
                <attribute type="fdt:nodeId" required="no"/>
                <attribute type="portNumber" required="yes"/>
                <element   type="LinkAddress" minOccurs="1" maxOccurs="1"/>
                <element   type="Segment" minOccurs="0" maxOccurs="1"/>
        </ElementType>

        <ElementType name="RoutingPath" content="eltOnly" model="closed">
          <attribute type="fdt:nodeId" required="no"/>
                <element   type="Segment" minOccurs="1" maxOccurs="1"/>
        </ElementType>

        <ElementType name="CIPPath" content="eltOnly" model="closed">
                <attribute type="fdt:nodeId" required="no"/>
                <element   type="RoutingPath" minOccurs="0" maxOccurs="1"/>
                <element   type="CIPNodeID" minOccurs="1" maxOccurs="1"/>
        </ElementType>

        <ElementType name="CIPDeviceIdentity" content="empty" model="closed">
                <attribute type="fdt:nodeId" required="no"/>
                <attribute type="vendorID" required="yes"/> <!-- Identity Object Attribute 1 -->
                <attribute type="deviceType" required="yes"/> <!-- Identity Object Attribute 2 -->
                <attribute type="productCode" required="yes"/> <!-- Identity Object Attribute 3 -->
                <attribute type="majorRevision" required="yes"/> <!-- Identity Object Attribute 4.1 -->
                <attribute type="minorRevision" required="yes"/> <!-- Identity Object Attribute 4.2 -->
                <attribute type="serialNumber" required="yes"/> <!-- Identity Object Attribute 6 -->
                <attribute type="productName" required="yes"/> <!-- Identity Object Attribute 7 -->
        </ElementType>

        <ElementType name="CIPDevice" content="eltOnly" model="closed">
                <attribute type="fdt:nodeId" required="no"/>
                <attribute type="cipStatus" required="yes"/> <!-- Identity Object Attribute 5 -->
                <element type="CIPPath" minOccurs="1" maxOccurs="1"/>
                <element type="CIPDeviceIdentity" minOccurs="1" maxOccurs="1"/>
        </ElementType>

        <!-- used for reserved bits anywhere -->
        <ElementType name="ReservedBits" content="eltOnly" model="open">
        </ElementType>

</Schema>
```