TECHNICAL
REPORT

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Field device tool (FDT) interface specification –
Part 51-150: Communication implementation for common object model –
IEC 61784 CPF 15

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 51-150: Communication implementation for common object model – IEC 61784 CPF 15

FOREWORD

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IEC TR 62453-51-150, 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 62453-515 published in 2009. This edition constitutes a technical revision. The main changes consist in updates of the XML schemas.

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 62453-315.

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- withdrawn,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 IEC 62453-51-xy series is aligned in the structure of the IEC 62453 series.
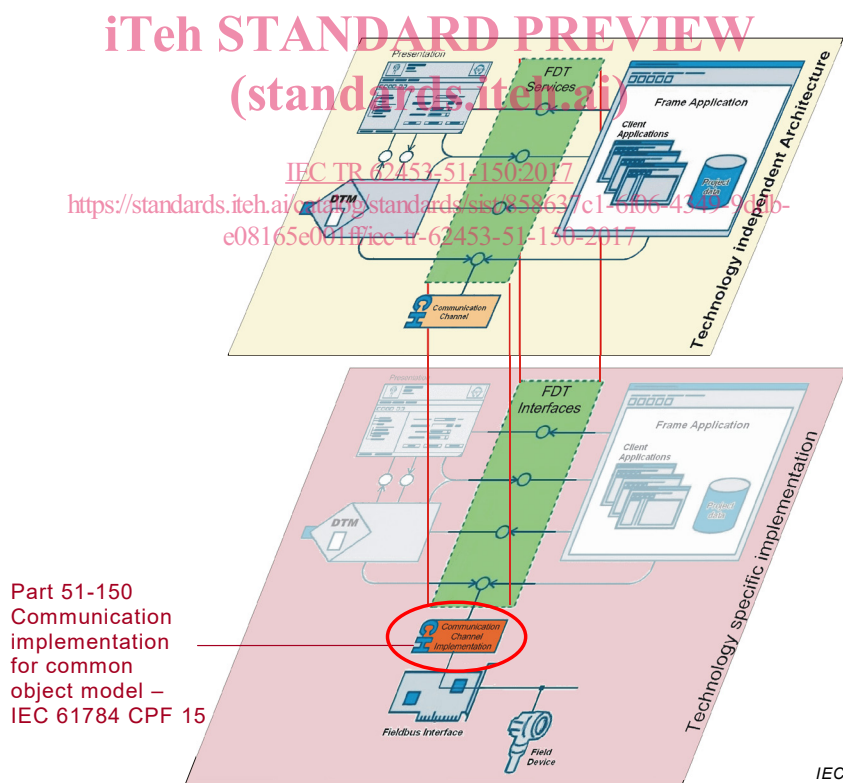

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Figure 1 – Part 51-150 of the IEC 62453 series

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

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1 Scope

This part of the IEC 62453-51-xy series, which is a Technical Report, provides information for integrating IEC 61784-2 CPF 15 (Modbus TCP®) and Modbus Serial Line®[1] protocol support into FDT systems based on COM implementation. This part is to be used in conjunction with IEC TR 62453-41.

NOTE   This part of IEC 62453 only specifies the mapping of Modbus parameters to FDT data types. For restrictions of protocol specific parameters concerning allowed values and concerning limitations of arrays used in the definition of FDT data types, refer to IEC 61158-5-15 and the MODBUS Application Protocol Specification.

This part of IEC 62453 specifies the implementation of communication and other services based on IEC 62453-315.

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

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 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 62453-315:2009, *Field device tool (FDT) interface specification – Part 315: Communication profile integration – IEC 61784 CPF 15*
IEC 62453-315:2009/AMD1:2016

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[1]   Modbus is the trademark of Schneider Automation Inc. It is registered in the United States of America. 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 trademark Modbus. Use of the trademark Modbus requires permission from Schneider Automation Inc.

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 62453-315 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 62453-315, 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 15 protocol is identified by the attribute definition busCategory as specified in IEC 62453-315 (protocol identifiers).

5   Access to instance and device data

Used at methods:

• IDtmParameter methods

• IDtmSingleDeviceDataAccess methods

• IDtmSingleInstanceDataAccess methods

These methods (if supported according IEC TR 62453-41) shall provide access to at least all parameters defined in IEC 62453-315.

6 Protocol specific usage of general data types

Table 1 shows how general data types are used with IEC 61784 CPF 15 devices.

Table 1 – Protocol specific usage of general data types

Attribute	Description for use
fdt:address	All these attributes of the FDTDatatype schema are used as defined in IEC 62453-315.
fdt:protocolId	
fdt:deviceTypeId	
fdt:deviceTypeInformation	
fdt:deviceTypeInformationPath	
fdt:manufacturerId	
fdt:semanticId	
fdt:applicationDomain	
fdt:tag	

7 Protocol specific common data types

This clause specifies the protocol specific common data types, which are used in the definition of other data types.

8 Network management data types

8.1 General

The data types specified in this clause are used at the following methods:

- IDtmParameter:GetParameters

- IDtmParameter:SetParameters

8.2 Modbus device address – FDTModbusAddressSchema

The address of a Modbus device is available at the element <BusInformation/UserdefinedBus>.

```xml
<?xml version="1.0"?>
<Schema name="FDTModbusAddressSchema" xmlns="urn:schemas-microsoft-com:xml-data" xmlns:dt="urn:schemas-
microsoft-com:datatypes" xmlns:fdt="x-schema:FDTDataTypesSchema.xml">

<!-- Address schema for Modbus protocol V1.0 -->
<!-- This additional schema describes the different methods of addressing for Modbus TCP and Modbus Serial Line Devices -->
        <AttributeType name = "schemaVersion" dt:type = "number" default = "1.0"/>

        <!--Definition of attributes for Modbus addressing-->
        <!-- Slave address for Modbus Serial Line -->
        <AttributeType name="slaveAddress" dt:type="ui1"/>
        <!-- IP address for Modbus TCP -->
        <AttributeType name="tcpAddress" dt:type="string"/>
        <!-- TCP Port for Modbus TCP (default 502) -->
        <AttributeType name="tcpPort" dt:type="ui2" default = "502"/>

        <ElementType name="ModbusTCP" content="mixed" model="closed">
                <attribute type="fdt:nodeId" required="no"/>
                <attribute type="tcpAddress" required="yes"/>
                <attribute type="tcpPort" required="no"/>
                <attribute type="slaveAddress" required="no"/>
        </ElementType>
```

```
                <ElementType name="ModbusSerial" content="mixed" model="closed">
                        <attribute type="fdt:nodeId" required="no"/>
                        <attribute type="slaveAddress" required="yes"/>
                </ElementType>
</Schema>
```

9   Communication data types – FDTModbusCommunicationSchema

The data types specified in this clause are used with the methods of IFdtCommunication.

```
<?xml version = "1.0" encoding = "UTF-8"?>

<!--FDT communication schema for Modbus protocol V1.0-->
<!--This schema describes all Modbus services which are defined in the Modbus Application Protocol Specification V1.1a from 4
June 2004 -->
<!--Due to the ongoing standardisation process in the CIA Group to specify the encapsulation of the CanOpen protocol in
Modbus -->
<!--it was abstained to describe the Modbus service 0x2B/0x0D  -->

<Schema name = "FDTModbusCommunicationSchema"
    xmlns = "urn:schemas-microsoft-com:xml-data"
    xmlns:dt = "urn:schemas-microsoft-com:datatypes"
    xmlns:fdt = "x-schema:FDTDataTypesSchema.xml"
    xmlns:mb = "x-schema:FDTModbusAddressSchema.xml">

    <AttributeType name = "schemaVersion" dt:type = "number" default = "1.0"/>
    <AttributeType name = "communicationReference" dt:type = "uuid"/>

<!--Modbus protocol parameters-->

<!--ModbusException response-->
    <AttributeType name = "modbusService" dt:type = "enumeration" dt:values = "ReadCoils ReadDiscreteInputs
ReadHoldingRegisters ReadInputRegisters WriteSingleCoil WriteSingleRegister ReadExceptionStatus Diagnostics
GetCommEventCounter GetCommEventLog WriteMultipleCoils WriteMultipleRegisters ReportSlaveID ReadFileRecord
WriteFileRecord MaskWriteRegister ReadWriteRegisters ReadFifoQueue EncapsulatedInterfaceTransport
ReadDeviceIdentification PrivateModbus"/>
    <AttributeType name = "modbusExceptionCode" dt:type = "bin.hex" dt:minLength = "1"/>

    <!--Read/Write Data attributes-->
    <AttributeType name = "outputAddress" dt:type = "ui2"/>
    <AttributeType name = "startAddress" dt:type = "ui2"/>
    <AttributeType name = "quantity" dt:type = "ui2"/>
    <AttributeType name = "multipleCoilValues" dt:type = "string" dt:minLength = "1" dt:maxLength = "2000"/>
    <AttributeType name = "discreteInputsStatus" dt:type = "string" dt:minLength = "1" dt:maxLength = "2000"/>
    <AttributeType name = "registerValues" dt:type = "bin.hex" dt:minLength = "2" dt:maxLength = "250"/>
    <AttributeType name = "singleCoilValue" dt:type = "boolean"/>
    <AttributeType name = "singleRegister" dt:type = "bin.hex" dt:maxLength = "2" dt:minLength = "2"/>
    <!-- Diagnostic services attributes-->
    <AttributeType name = "exceptionStatus" dt:type = "bin.hex" dt:maxLength = "1" dt:minLength = "1"/>
    <AttributeType name = "commStatus" dt:type = "bin.hex" dt:maxLength = "2" dt:minLength = "2"/>
    <AttributeType name = "diagnosticsSubFct" dt:type = "bin.hex" dt:maxLength = "2" dt:minLength = "2"/>
    <AttributeType name = "diagnosticsData" dt:type = "bin.hex" dt:maxLength = "250" dt:minLength = "2"/>
    <AttributeType name = "data" dt:type = "bin.hex"/>
    <AttributeType name = "eventCount" dt:type = "bin.hex" dt:maxLength = "2" dt:minLength = "2"/>
    <AttributeType name = "messageCount" dt:type = "bin.hex" dt:maxLength = "2" dt:minLength = "2"/>
    <AttributeType name = "events" dt:type = "bin.hex"/>
    <!-- Read/Write File Record attributes-->
    <AttributeType name = "referenceType" dt:type = "bin.hex" dt:maxLength = "1" dt:minLength = "1"/>
    <AttributeType name = "fileNumber" dt:type = "bin.hex" dt:maxLength = "2" dt:minLength = "2"/>
    <AttributeType name = "recordNumber" dt:type = "bin.hex" dt:maxLength = "2" dt:minLength = "2"/>
    <AttributeType name = "recordData" dt:type = "bin.hex" dt:minLength = "2"/>
    <!-- Mask Write Register attributes-->
    <AttributeType name = "referenceAddress" dt:type = "ui2"/>
    <AttributeType name = "andMask" dt:type = "bin.hex" dt:maxLength = "2" dt:minLength = "2"/>
    <AttributeType name = "orMask" dt:type = "bin.hex" dt:maxLength = "2" dt:minLength = "2"/>
    <!-- Read/Write Registers attributes-->
    <AttributeType name = "readStartAddress" dt:type = "ui2"/>
    <AttributeType name = "readRegisterValues" dt:type = "bin.hex" dt:minLength = "2" dt:maxLength = "250"/>
    <AttributeType name = "readQuantity" dt:type = "ui2"/>
    <AttributeType name = "writeStartAddress" dt:type = "ui2"/>
    <AttributeType name = "writeRegisterValues" dt:type = "bin.hex" dt:minLength = "2" dt:maxLength = "242"/>
    <!-- Read FIFO Queue attributes -->
    <AttributeType name = "fifoPointerAddress" dt:type = "ui2"/>
```

```xml
<AttributeType name = "fifoRegisterValues" dt:type = "bin.hex" dt:minLength = "2" dt:maxLength = "62"/>
<!--- Encapsulated Interface Transport attributes -->
<AttributeType name = "meiType" dt:type = "bin.hex" dt:maxLength = "1" dt:minLength = "1"/>
<AttributeType name = "meiData" dt:type = "bin.hex" dt:minLength = "1" dt:maxLength = "251"/>
<!-- Device identification attributes-->
<AttributeType name = "readDeviceIdCode" dt:type = "ui1"/>
<AttributeType name = "objectId" dt:type = "bin.hex" dt:minLength = "1" dt:maxLength = " 1"/>
<AttributeType name = "conformityLevel" dt:type = "bin.hex" dt:maxLength = "1" dt:minLength = "1"/>
<AttributeType name = "moreFollows" dt:type = "boolean"/>
<AttributeType name = "nextObjectId" dt:type = "bin.hex" dt:minLength = "1" dt:maxLength =" 1"/>
<AttributeType name = "numberOfObjects" dt:type = "ui1"/>
<AttributeType name = "objectValue" dt:type = "bin.hex" dt:minLength = "1" dt:maxLength = "244"/>
<!-- Private Request attributes-->
<AttributeType name = "privateRequest" dt:type = "bin.hex"/>
<AttributeType name = "privateResponse" dt:type = "bin.hex"/>


<ElementType name = "ConnectRequest" content = "eltOnly"  model = "closed">
    <attribute type="fdt:systemTag" required="yes"/>
    <group order = "one" maxOccurs="1" minOccurs="1">
        <element type = "mb:ModbusSerial"/>
        <element type = "mb:ModbusTCP"/>
    </group>
</ElementType>


<ElementType name = "ConnectResponse" content = "empty" model = "closed">
    <attribute type = "communicationReference" required = "yes"/>
</ElementType>


<ElementType name = "DisconnectRequest" content = "empty" model = "closed">
    <attribute type = "communicationReference" required = "yes"/>
</ElementType>


<ElementType name = "DisconnectResponse" content = "empty" model = "closed">
    <attribute type = "communicationReference" required = "yes"/>
</ElementType>


<ElementType name="Abort" content="empty" model="closed">
    <attribute type="communicationReference" required="no"/>
</ElementType>

<!--Modbus Exception response-->

<ElementType name = "ModbusExceptionRsp" content = "empty" model = "closed">
    <attribute type = "communicationReference" required = "yes"/>
    <!--Applied Modbus service, which failed-->
    <attribute type = "modbusService" required = "yes"/>
    <!-- Modbus Exception code-->
    <attribute type = "modbusExceptionCode" required = "yes"/>
</ElementType>


<!--Definition of Modbus services-->


<!-- 0x01 Read Coils -->

<ElementType name = "ReadCoilsReq" content = "empty" model = "closed">
    <attribute type = "communicationReference" required = "yes"/>
    <!-- Starting address: 0x0000 to 0xFFFF (2 bytes) -->
    <attribute type = "startAddress" required = "yes"/>
    <!--Quantity of coils: 0x0001 to 0x07D0 (2 bytes) -->
    <attribute type = "quantity" required = "yes"/>
</ElementType>

<ElementType name = "ReadCoilsRsp" content = "empty" model = "closed">
    <attribute type = "communicationReference" required = "yes"/>
    <!-- Coil status: ASCII string with each coil state coded in one character ("1"==TRUE; "0"==FALSE) -->
    <attribute type = "multipleCoilValues" required = "yes"/>
</ElementType>


<!-- 0x02 Read Discrete Inputs -->

<ElementType name = "ReadDiscreteInputsReq" content = "empty" model = "closed">
    <attribute type = "communicationReference" required = "yes"/>
    <!-- Starting address: 0x0000 to 0xFFFF (2 bytes) -->
```