PD CLC IEC/TR 62453-52-150:2019

BSI Standards Publication

Field device tool (FDT) interface specification

Part 52-150: Communication implementation for common language infrastructure - IEC 61784 CPF 15

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National foreword

This Published Document is the UK implementation of CLC IEC/TR 62453-52-150:2019. It is identical to IEC TR 62453-52-150:2017.

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Spécification des interfaces des outils des dispositifs de terrain (FDT) - Partie 52-150: Mise en œuvre d'un profil de communication pour l'infrastructure commune de langage - CPF 15 de l'IEC 61784 (IEC/TR 62453-52-150:2017)

Field Device Tool (FDT)-Schnittstellenspezifikation - Teil 52-150: Kommunikationsimplementierung mit der allgemeinen Sprachinfrastruktur - Kommunikationsprofilfamilie (CPF) 15 nach IEC 61784 (IEC/TR 62453-52-150:2017)

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European foreword

This document (CLC IEC/TR 62453-52-150:2019) consists of the text of IEC/TR 62453-52-150:2017 prepared by SC 65E "Devices and integration in enterprise systems" of IEC/TC 65 "Industrial-process measurement, control and automation".

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 61131-3	2013	Programmable controllers - Part 3: Programming languages	EN 61131-3	2013
IEC 61158-5-15	2010	Industrial communication networks - Fieldbus specifications - Part 5-15: Application layer service definition - Type 15 elements	EN 61158-5-15	2012
IEC 61784-1	2014	Industrial communication networks - Profiles - Part 1: Fieldbus profiles	EN 61784-1	2014
IEC 62453-1	2016	Field device tool (FDT) interface specification - Part 1: Overview and guidance	EN 62453-1	2017
IEC 62453-2	2016	Field device tool (FDT) interface specification - Part 2: Concepts and detailed description	EN 62453-2	2017
IEC TR 62453-42	2016	Field device tool (FDT) interface-specification - Part 42: Object model integration profile - Common language infrastructure	-	-
IEC 62453-315	2009	Field device tool (FDT) Interface specification - Part 315: Communication profile integration - IEC 61784 CPF 15	EN 62453-315	2009

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 52-150: Communication implementation for common language infrastructure – IEC 61784 CPF 15

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IEC TR 62453-52-150, which is a technical report, has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

Each part of the IEC 62453-52-xy series is intended to be read in conjunction with its corresponding part in the IEC 62453-3xy series. This document corresponds to IEC 63453-315.

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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.

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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 fieldbusses and thus meets the requirements for integrating different kinds of devices into heterogeneous control systems.

Figure 1 shows how this part of the IEC 62453-52-xy series is aligned in the structure of the IEC 62453 series.

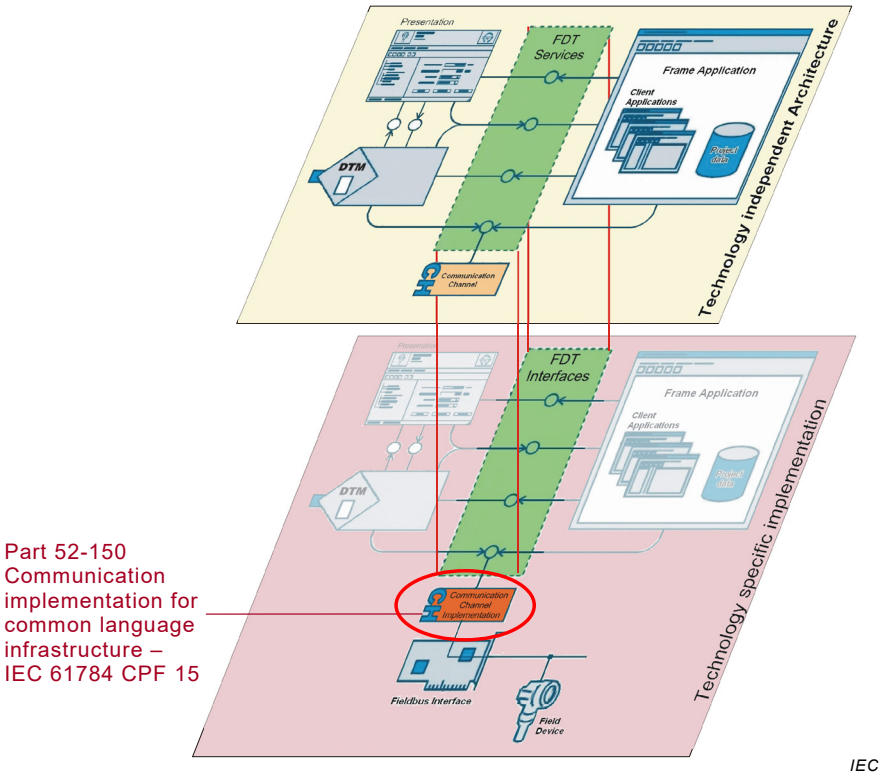

Figure 1 – Part 52-150 of the IEC 62453 series

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 52-150: Communication implementation for common language infrastructure – IEC 61784 CPF 15

1 Scope

This part of the IEC 62453-52-xy series, which is a Technical Report, provides information for integrating the Modbus®[1] technology into the CLI-based implementation of FDT interface specification (IEC TR 62453-42).

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 61131-3:2013, *Programmable controllers – Part 3: Programming languages*

IEC 61158-5-15:2010, *Industrial communication networks – Fieldbus specifications – Part 5-15: Application layer service definition – Type 15 elements*

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

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 62453-42:2016, *Field device tool (FDT) interface specification – Part 42: Object model integration profile – Common language infrastructure*

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.

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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 62453-42 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, IEC TR 62453-42 and the following apply.

IO Input/Output

3.3 Conventions

3.3.1 Datatype names and references to datatypes

The conventions for naming and referencing of datatypes 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.

3.3.3 Use of UML

Figures in this document are using UML notation as defined in Annex A of IEC 62453-1:2016.

4 Bus category

IEC 61784 CPF 15 protocol is identified in the attribute busCategory of the BusCategory element by the identifiers, as specified in IEC 62453-315.

5 Access to instance and device data

5.1 General

The minimum set of provided data shall be:

- All process values available for the device shall be modeled as ProcessData including the ranges and scaling if applicable;
- All network configuration related parameters shall be exposed in NetworkData (see Clause 9).

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5.2 IO signals provided by DTM

A DTM shall provide IO signal information for the device using the IProcessData interface. The IO signals describe datatype and address parameters of process data as detailed in 11.2.

5.3 Data interfaces

5.3.1 Common data set

For Modbus no minimum set of parameters or common data set is defined which shall be provided by a DTM. Exposure of device parameters is at the vendor's discretion. If a DTM provides process values, the process variables shall be modelled as process data objects.

5.3.2 Mapping of Modbus datatypes to FDT datatypes

Modbus uses datatypes as specified in [2][2] for the transmission on the fieldbus. The FDT interfaces IDeviceData and IInstanceData use .NET datatypes, while PLC applications use datatypes defined in IEC 61131-3. This subclause defines the mapping of parameter datatypes, whereas mapping of process datatypes is defined in 11.3.

The mapping of parameter datatypes is described in Table 1.

Table 1 – Mapping of datatypes

Modbus datatype	FDT datatype	IEC 61131 datatype
Discrete Inputs	BitArray	ARRAY [] OF BOOL
Coil	bool	BOOL
Coils	BitArray	ARRAY [] OF BOOL
Input Registers	ushort[]	ARRAY [] OF WORD
Holding Register	ushort	WORD
Holding Registers	ushort[]	ARRAY [] OF WORD

The FDT data types do not change any byte or bit order of the data. The data interpretation, e.g. if a float value is transferred in a holding register, is under the responsibility of the DTM respectively the user of the data. The user of the data shall know how the data is represented by the hardware device.

5.3.3 SemanticInfo

The usage of the SemanticInfo datatype is shown in Table 2. The identifier in SemanticId shall be unique and always reference the same element. This means the semantic information shall be the same whenever the same data is referenced. By using this attribute e.g. a Frame Application is able to get the information regarding the meaning and usage of a single data structure.

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2 Figures in square backets refer to the Bibliography.

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Table 2 – Usage of general datatypes

Attribute	Description for use in Modbus
SemanticInfo.ParameterReadAddress / SemanticInfo.ParameterWriteAddress	The value of ParameterReadAddress and ParameterWriteAdress is a string conforming to a pattern as follows: FunctionCode.StartAddress.BitOffset.BitLength where FunctionCode = Modbus function code to access the data StartAddress = starting address BitOffset = start bit within the starting address BitLength = length in bits All values are unsigned integers.
SemanticInfo.ApplicationDomain	The value of ApplicationDomain is as follows: MODBUS
SemanticInfo.SemanticId	The value of SemanticId is vendor specific.

6 Protocol specific behaviour

6.1 Modbus data and addressing model

The Modbus data model is very simple and described in [2]. Figure 2 shows an extract of the data model description.

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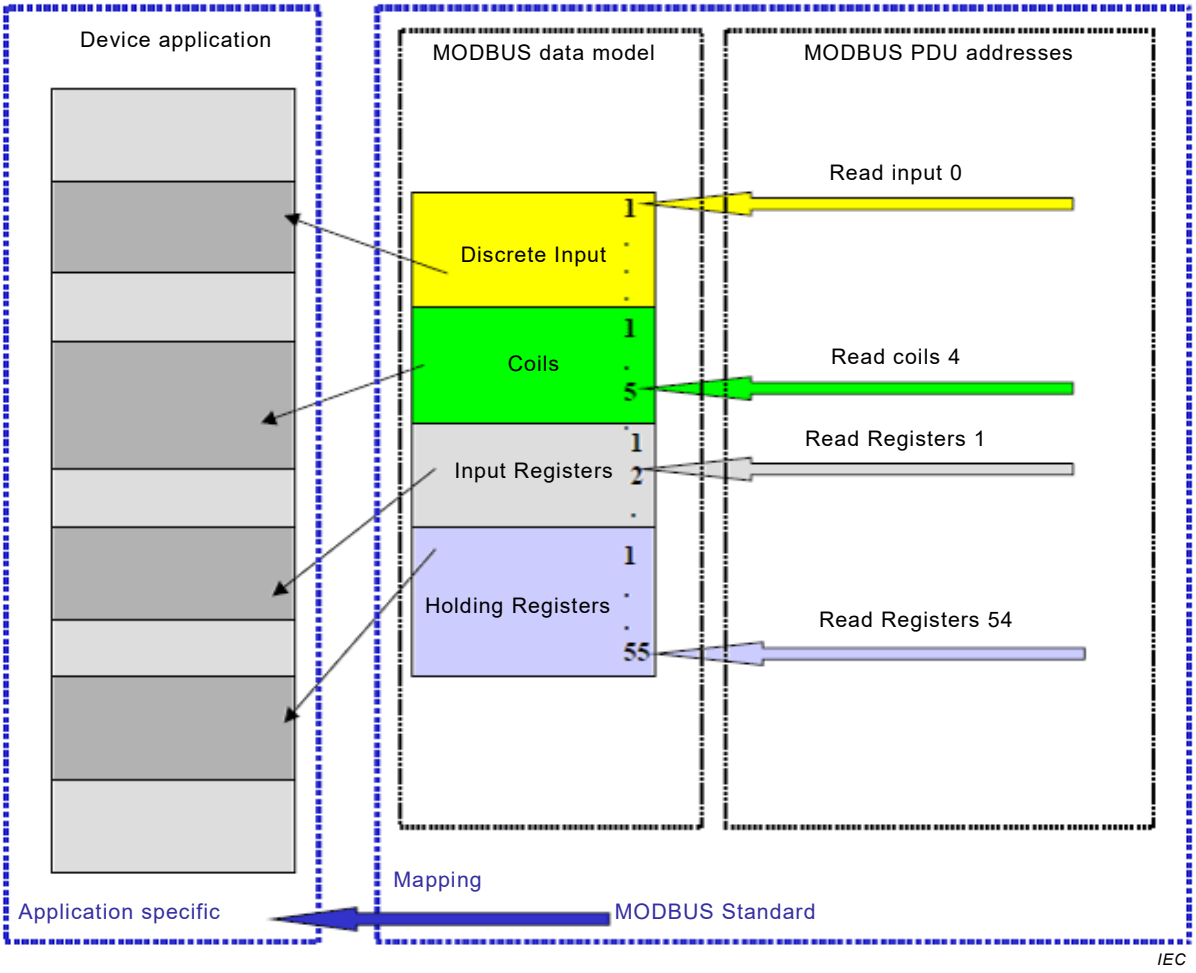

Figure 2 – Modbus data and addressing model

6.2 Modbus-related information of a Device DTM

The information used by a Modbus client (IO scanner) to set up the Modbus network properly and allow cyclic communication between control system and Modbus server devices is provided by a DTM in Process data items.

A DTM of a Modbus device shall deliver process data items related information to get integrated into an FDT-based engineering system.

This specification makes no assumptions whether a modular Modbus device is modeled in a Device DTM, Composite DTM or Gateway DTM. All types of DTMs shall provide all mandatory information defined in the following subclauses.

6.3 Broadcasting

In broadcast mode a DTM can send a Modbus request to all devices connected to the bus. This mode is only supported for devices which are connected via Modbus Serial Line. The connection can either be a direct connection or a connection via a gateway. The broadcast mode shall be initiated by a ConnectRequest with the slave address of the target device set to 0 (SlaveAddress=0).

Because in broadcast mode no response will be returned by the device, the broadcast mode shall be only used with the transaction requests listed in Table 3.

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Table 3 – Usage of broadcasts in transaction requests

Broadcast Transaction Request	Restrictions
ModbusWriteSingleRequest	None
ModbusWriteSingleRegisterRequest	None
ModbusDiagnosticsRequest	This transaction request shall be used in broadcast mode only with the following sub-functions: 0x01: Restart Communication Option 0x03: Change ASCII Input Delimiter 0x04: Force Listen Only Mode 0x0A: Clear Counters and Diagnostic Register 0x14: Clear Overrun Counter and Flag
ModbusWriteMultipleCoilsRequest	None
ModbusWriteMultipleRegisterRequest	None
ModbusWriteFileRecordRequest	None
ModbusMaskWriteRegisterRequest	None
ModbusPrivateRequest	Shall be only used with private services if no response is required from the device.

Although in broadcast mode no response will be returned by the target devices, a transaction response which corresponds to the transaction request, shall be generated. This transaction response shall be generated in order to inform the DTM that the broadcast request was sent on the bus. If a Modbus Communication DTM is used to establish the communication, it shall provide this generated transaction response. If no Modbus Communication DTM is used to establish the communication, the Modbus Gateway DTM, which provides the link to the higher communication level different from Modbus, shall provide this transaction response.

6.4 Unconfirmed private Modbus request

This transaction request can be used to send any unconfirmed private Modbus request. Although no response will be returned by the target device, a transaction response, which corresponds to the transaction request, shall be generated. This transaction response shall be generated in order to inform the DTM that the unconfirmed request was sent on the bus. If a Modbus Communication DTM is used to establish the communication, it shall provide this generated transaction response. If no Modbus Communication DTM is used to establish the communication, the Modbus Gateway DTM, which provides the link to the higher communication level different from Modbus, shall provide this transaction response.

7 Protocol specific usage of general datatypes

Table 4 shows how general datatypes are used with IEC 61784 CPF 15 devices.

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Table 4 – Protocol specific usage of general datatypes

Attribute	Description for use
ProtocolId	See Clause 4
PhysicalLayer	Not applicable
ApplicationDomain / SemanticId	See 5.3.3
Address	See Clause 8
ManufacturerId	Modbus Vendor Name
DeviceTypeId	Modbus Product Code
HardwareRevision	Not applicable
SoftwareRevision	Modbus MajorMinorRevision
ProtocolIdentificationProfile	Not applicable

8 Protocol specific common datatype: ModbusDeviceAddress

The only protocol-specific common datatype is ModbusDeviceAddress. The protocol specific device address relates to network management and communication.

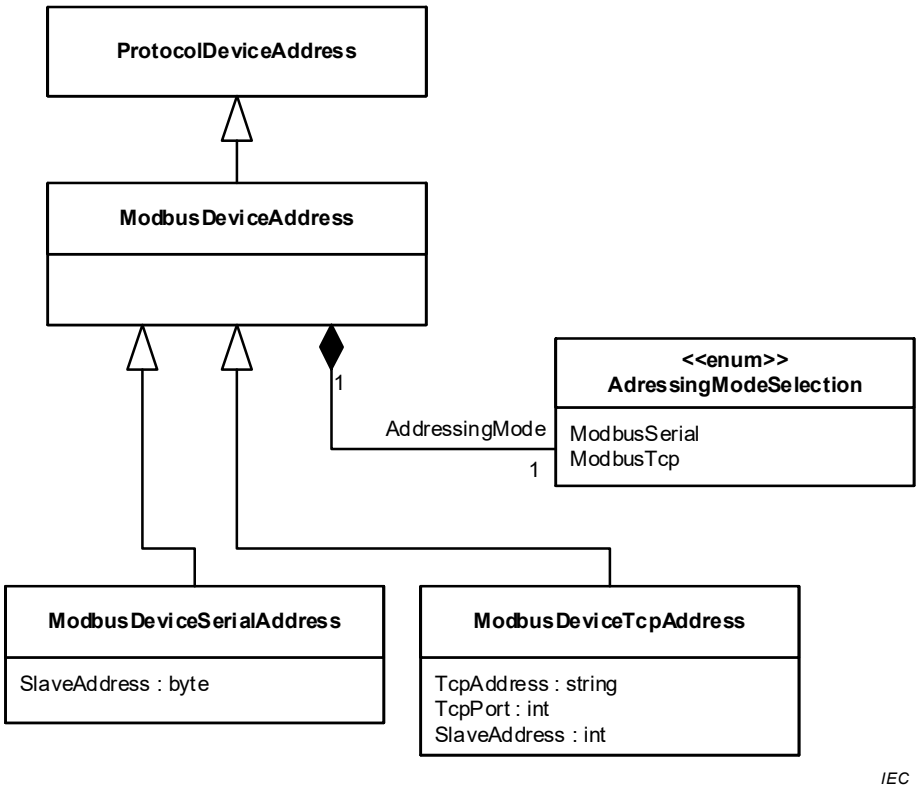

Figure 3 – ModbusDeviceAddress

Table 5, Table 6 and Table 7 show how address information is used with the different Modbus protocols.

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Table 5 – ModbusDeviceAddress

Member Name	Type	Description
AddressingModeSelection	enum	Specifies whether a Modbus Serial or a Modbus TCP address is used

Table 6 – ModbusDeviceSerialAddress

Member Name	Type	Description
SlaveAddress	byte	Address of the Modbus Serial device

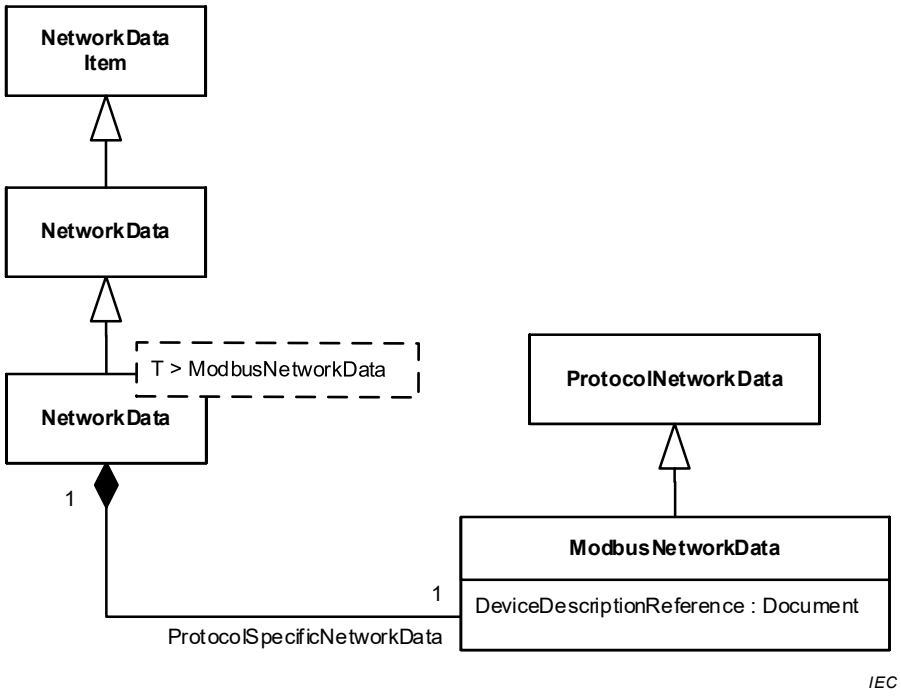
Table 7 – ModbusDeviceTcpAddress

Member Name	Type	Description
TcpAddress	string	String representation of the IP address of a Modbus TCP device
TcpPort	int	Port of the Modbus TCP connection
SlaveAddress	int	Slave address of a (virtual) Modbus device behind a Modbus TCP/ Modbus Serial Line gateway

9 Network management datatypes

9.1 General

The data needed for management of the network are exposed by the Device DTM in the INetworkData interface (see Figure 4).



Used in:
INetworkData.GetNetworkDataInfo()

Figure 4 – ModbusNetworkData

The properties of ModbusNetworkData are described in Table 8.

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