IEC/TR 62453-503-1

Edition 1.0 2009-08

# TECHNICAL REPORT



colour inside

## Field device tool (FDT) interface specification – Part 503-1: Communication implementation for common object model – IEC 61784 CP 3/1 and CP 3/2



IEC/TR 62453-503-1:2009(E)

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## Field device tool (FDT) interface specification – Part 503-1: Communication implementation for common object model – IEC 61784 CP 3/1 and CP 3/2



INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE X

ICS 25.040.40; 35.100.05; 35.110

ISBN 978-2-88910-728-5

# CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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# FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

## Part 503-1: Communication implementation for common object model – IEC 61784 CP 3/1 and CP 3/2

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IEC/TR 62453-503-1, 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:

This part, in conjunction with the other parts of the first edition of the IEC 62453 series cancels and replaces IEC/PAS 62453-1, IEC/PAS 62453-2, IEC/PAS 62453-3, IEC/PAS 62453-4 and IEC/PAS 62453-5 published in 2006, and constitutes a technical revision.

Each part of the IEC/TR 62453-5xy series is intended to be read in conjunction with its corresponding part in the IEC 62453-3xy series.

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

| Enquiry draft | Report on voting |
|---|---|
| 65E/67/DTR | 65E/116/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 publication 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 publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication 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- withdrawn,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 FDT (Field Device Tool) 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 fieldbusses 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 DTM (Device Type Manager), 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 IEC/TR 62453-503-1 is aligned in the structure of IEC 62453 series.



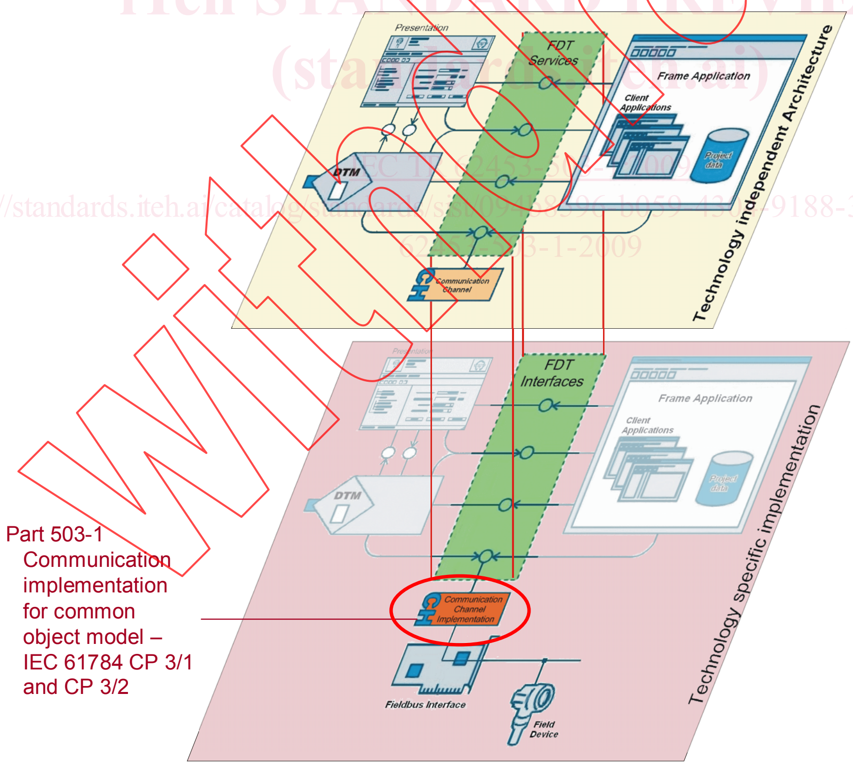


**Figure 1 – Part 503-1 of the IEC 62453 series**

# FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

# Part 503-1: Communication implementation for common object model – IEC 61784 CP 3/1 and CP 3/2

## 1 Scope

IEC 62435-503-1, which is a technical report, provides information for integrating the PROFIBUS protocol into the FDT interface specification (IEC 62453-2).

This part of IEC 62453 specifies communication and other services.

This specification neither contains the FDT specification nor modifies it.

## 2 Normative references

The following referenced documents are indispensable for the application of this specification. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.



IEC 61158 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 62453-1:2009, *Field Device Tool (FDT) interface specification – Part 1: Overview and guidance*



IEC 62453-2:2009, *Field Device Tool (FDT) interface specification – Part 2: Concepts and detailed description*

IEC/TR 62453-41:2009 *Field Device Tool (FDT) interface specification – Part 41: Object model integration profile – Common object model*

IEC 62453-303-1:2009 *Field Device Tool (FDT) interface specification – Part 303-1: Communication profile integration - IEC 61784 CP 3/1 and CP 3/2*

## 3 Terms, definitions, symbols, abbreviated terms and conventions

### 3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 62453-1 and IEC 62453-2 apply.

### 3.2 Symbols and abbreviated terms

For the purpose of this document, the symbols and abbreviations given in IEC 62453-1, IEC 62453-2 and the following apply.

| | | |
|---|---|---|
| **UML** | **Unified Modelling Language** | **[ISO/IEC 19501]** |

## 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 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 behavior. |
| Usage of “can’ or “Optional’ | Function or behavior may be provided, depending on defined conditions. |

# 4 Bus category

IEC 61784 CP 3/1 and CP3/2 protocols are identified in the attribute busCategory of BusCategory element by the identifiers, as specified in IEC 62453-303-1.

IEC 61784 CPF 3 protocols are using the identifiers in physicalLayer members within PhysicalLayer data type as specified in IEC 62453-303-1.



# 5 Access to instance and device data

Used at methods:

- IDtmParameter::GetParameters()
- IDtmParameter::SetParameters()

These methods shall provide access to at least to all parameters defined in IEC 62453-303-1.

# 6 Protocol specific behavior

## 6.1 General

A DTM shall deliver its GSD information via method IDtmInformation::GetInformation() and IDtmParameter::GetParameters(). GSD information is provided in the attribute <deviceTypeInformation>. Also it is required to provide a GSD file for each supported device type on the hard drive. The attribute <deviceTypeInformationPath> in the DTMParameter document specifies the location of the GSD file.

It is expected that a Profibus DTM in the attribute ‘deviceTypeInformation’ is exposing exactly the GSD file which is referenced by the attribute ‘deviceTypeInformationPath’.

If the GSD depends on bus settings, a DTM’s configuration or parameterization dialog could be used to change bus settings. Based on these settings, updated GSD information can be inserted in the information document. Here too the DTM has to call IFdtContainer::SaveRequest() and IDtmEvents::OnParameterChanged().

Notice that the internal device structure (<InternalTopology>) with its modules and channels has to be updated as well.

An example for documents of a DTM representing a remote I/O can be found in Annex A.

## 6.2 Representing modularity

### 6.2.1 Monolithic DTMs

Monolithic DTM's should always provide at least one <Module> element.

A monolithic DTM that represents a modular device shall provide the structure information as part of the <InternalTopology> element. The IO values of the device are represented by Process Channels, which are referenced by child elements of the <Module> elements. If any of the modules provides communication, the respective <Module> element shall reference a Communication Channel.

Example 1:
A monolithic DTM for a PROFIBUS PA device will provide the information about instantiated modules in the <InternalTopology> element. – Each instantiated module will be represented as a <Module> element. (Be aware: it is necessary to define an <InternalChannel> element for each <Module> element.)
The IO values of the modules are represented as Process Channels, which are referenced by child elements of the <Module> elements. (see Figure 2)

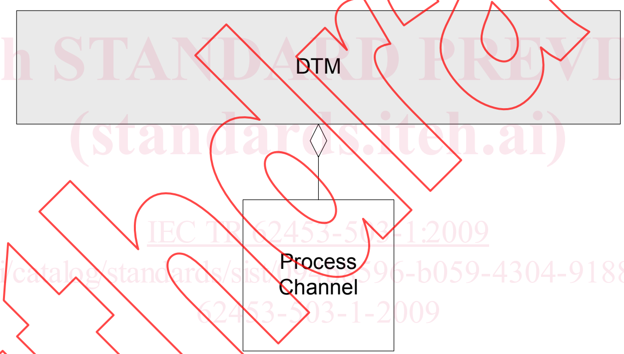




**Figure 2 – Example: Device DTM**

This means:

The DTM shall provide an internal topology in the parameter document to inform the frame about the internal structure of the device. The internal topology shall also include the module structure (element <Module>).

The DTM shall provide all channels in the channel collection based on the current configuration.

When the DTM changes the configuration of the process data or the module configuration the Process Channels shall be updated. This means Process Channels shall be removed/added and the parameter document shall be updated (e.g. by adding/removing <Module> elements) if necessary.

Each channel is represented by a channel reference that is child of a <Module> element in the parameter document.

Each channel object delivers a document based on the FDTProfibusChannelParameterSchema in IFdtChannel::GetChannelParameters() for the supported protocol.

Example 2:
A monolithic Gateway DTM for a remote I/O system, which requires PROFIBUS communication and has some

modules, which provide HART communication will provide Communication Channels for HART modules that are also Process Channels and “pure” Process Channels for non-HART modules. (see Figure 3)

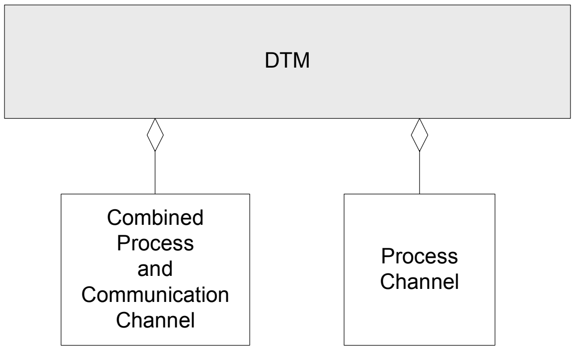


**Figure 3 – Example: Gateway DTM**

This means:

The DTM shall provide all channels in the channel collection based on the current configuration.

When the DTM changes the configuration of the process data or the module configuration the Process Channels shall be updated. This means Process Channels shall be removed/added and the parameter document shall be updated if necessary.



Communication Channel objects implements the interface IFdtCommunication.

Each channel is represented by a channel reference in the parameter document.

The DTM provides an internal topology in the parameter document to inform the frame about the internal structure of the device.



Each channel object delivers a document based on the FDTProfibusChannelParameterSchema in IFdtChannel::GetChannelParameters() for the supported protocol.

### 6.2.2 Modular DTMs

If a DTM is designed in a modular way, the BIM DTM provides Communication Channels for connecting the Module DTMs. These channels are not Process Channels.

Example 1:
A modular device will be represented by a Gateway DTM to represent the head station and a number of Module DTMs to represent the modules. The Module DTMs for the modules will provide Process Channels. (see Figure 4)

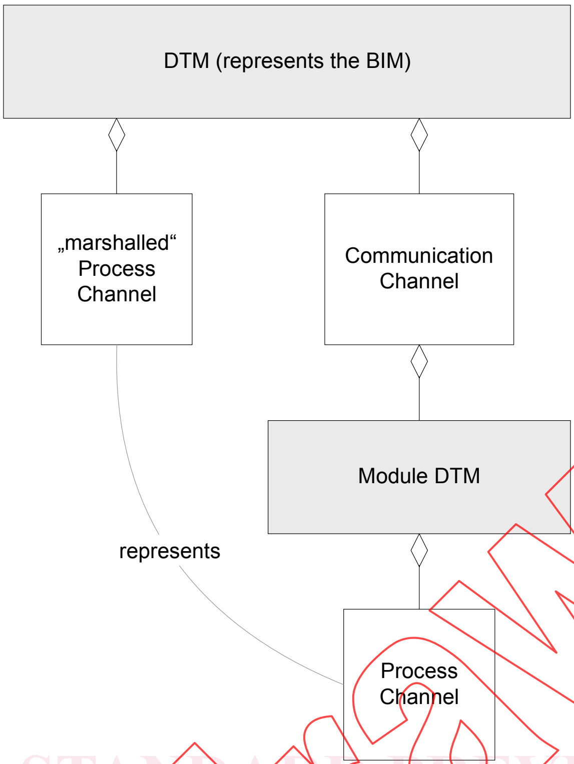




**Figure 4 – Example: Modular DTM**

Since the BIM DTM represents the PROFIBUS slave device from the communication point of view, it has to deliver the Process Channels of the complete device. This has the following consequences:



The BIM DTM shall provide the channel objects in the channel collection that represent its Communication Channels. These channel objects implement the interfaces IFdtCommunication.

The BIM DTM shall provide channel objects in the channel collection representing the Process Channels of the modules. The Process Channels are called “marshalled channel”. These channel objects do not implement the interfaces IFdtCommunication.

The BIM does not provide an internal topology because the project itself with the BIM and the Module DTMs represent the device structure.

The BIM DTM shall provide a channel reference in its parameter document for ALL the channels in the channel collection based on the current configuration.

Each Communication Channel of the BIM DTM delivers a document based on the BasicChannelParameterSchema when it receives IFdtChannel::GetChannelParameters() for any of its supported protocols.

Each marshalled channel of the BIM DTM delivers a document based on the FDTProfibusChannelParameterSchema when it receives IFdtChannel::GetChannelParameters() for any of its supported protocols.

A Module DTM has to deliver a channel reference in its parameter document for each channel.

Each channel of a Module DTM delivers a document based on the FDTProfibusChannelParameterSchema in IFdtChannel::GetChannelParameters() for the supported protocol.

Every time when a module changes the configuration so that the Process Channels (configuration or amount of Process Channels) changes the BIM shall update the Process Channels and the parameter document.

When a module is added or removed from the BIM the BIM has to add/remove the Process Channels of this module and update the parameter document.

Example 2:
When a modular I/O system as described by Example 1 also has some modules which provide HART communication, it will be represented by a Gateway DTM to represent the head station and a number of Module DTMs to represent the modules. The Module DTMs for the communication modules will provide Communication Channels. These channels represent also Process Channels.
Modules that are not used for communication will provide Process Channels only. (see Figure 5)

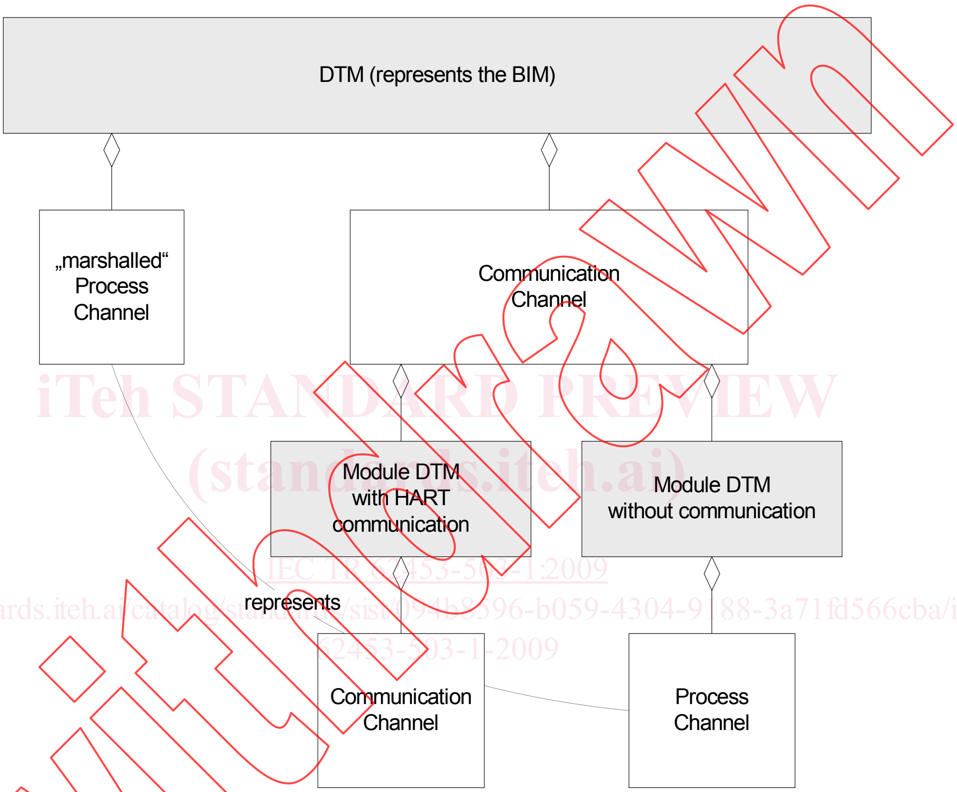




**Figure 5 – Example: Modular Gateway DTM**

Since the BIM represents the PROFIBUS slave device from the communication point of view, it has to deliver the Process Channels of the complete device. This has the following consequences:

The BIM DTM shall provide the channel objects in the channel collection that represent its Communication Channels. These channel objects implement the interfaces IFdtCommunication

The BIM DTM shall provide channel objects in the channel collection representing the Process Channels of the modules. The Process Channels are called “marshalled channel”. These channel objects do not implement the interfaces IFdtCommunication.

The BIM shall deliver a channel reference in its parameter document for ALL the channels in the channel collection based on the current configuration

The BIM does not provide an internal topology because the project itself with the BIM and the Module DTMs represent the device structure.

The BIM DTM shall provide a channel reference in its parameter document for ALL the channels in the channel collection based on the current configuration

Each Communication Channel of the BIM DTM delivers a document based on the BasicChannelParameterSchema when it receives IFdtChannel::GetChannelParameters() for any of its supported protocols.

Each marshalled channel of the BIM DTM delivers a document based on the FDTProfibusChannelParameterSchema when it receives IFdtChannel::GetChannelParameters()for any of its supported protocols.

A Module DTM has to provide a channel reference in its parameter document for each channel (if applicable).

Each channel of a Module DTM delivers a document based on the Basic Channel Schema when it receives IFdtChannel::GetChannelParameters() for any of its supported or required protocols.

Every time when a module changes the configuration so that the Process Channels (configuration or amount of Process Channels) changes the BIM shall update the Process Channels and the parameter document.

When a module is added or removed from the BIM the BIM has to add/remove the process channels of this module and update the parameter document.

## 6.3 Interfaces and Information related to Bus Master Configuration

The following graphic (Figure 6) shows the interfaces and methods related to establishing DPV0 functionality in DCS environments. The interface IFdtTopology is required only for a modular DTM.



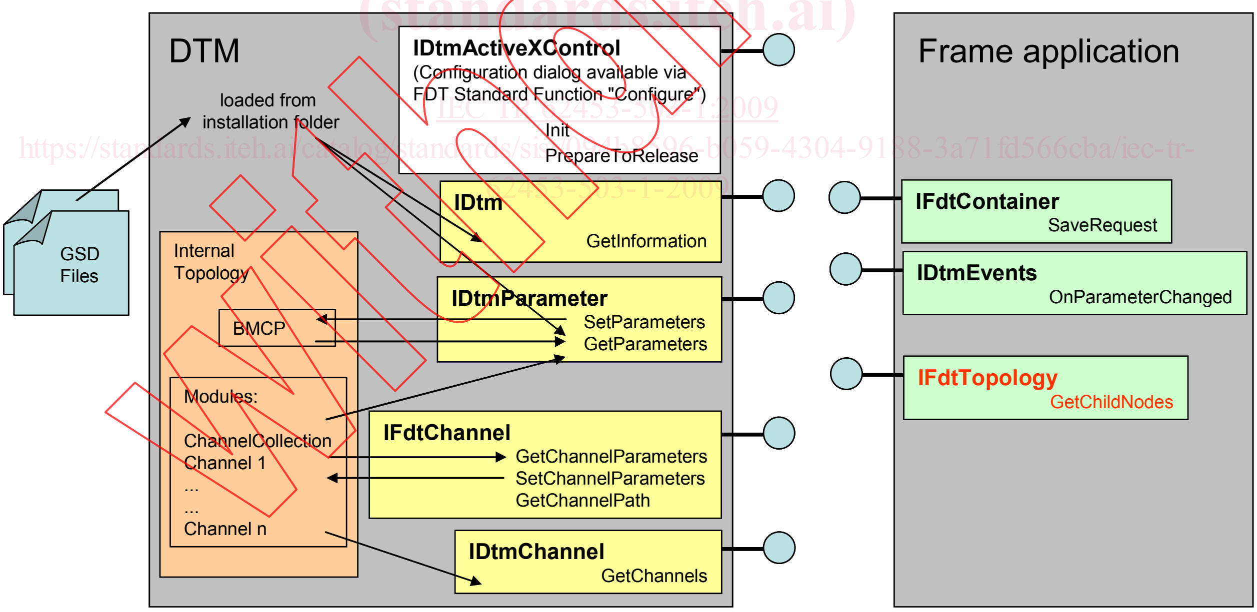


**Figure 6 – Interfaces and information related to bus master configuration**

NOTE The BMCP contains (besides other parts) two important parts called Prm_Data and Cfg_Data. Often these two parts are called Parameter-String and Config-String.

## 6.4 Configuration changes in a device

The sequence related to configuration changes is shown in Figure 7.