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BSI Standards Publication

Field device tool (FDT) interface specification

Part 303-1: Communication profile integration — IEC 61784 CP 3/1 and CP 3/2

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The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment A1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee GEL/65/3, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its secretary.

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30 June 2020	Correction to image resolution

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English version

Field device tool (FDT) interface specification - Part 303-1: Communication profile integration - IEC 61784 CP 3/1 and CP 3/2

(IEC 62453-303-1:2009)

Spécification des interfaces des outils des dispositifs de terrain (FDT) - Partie 303-1: Intégration des profils de communication - CEI 61784 CP 3/1 et CP 3/2 (CEI 62453-303-1:2009)

Field Device Tool (FDT)-Schnittstellenspezifikation - Teil 303-1: Integration von Kommunikationsprofilen - Kommunikationsprofile (CP) 3/1 und 3/2 nach IEC 61784 (IEC 62453-303-1:2009)

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European foreword

The text of document 65E/127/FDIS, future edition 1 of IEC 62453-303-1, prepared by SC 65E, Devices and integration in enterprise systems, of IEC TC 65, Industrial-process measurement, control and automation, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62453-303-1 on 2009-08-01.

Each part of the EN 62453-3xy series is intended to be read in conjunction with EN 62453-2.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2010-05-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2012-08-01

Annex ZA has been added by CENELEC.

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The text of the International Standard IEC 62453-303-1:2009 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

[5] IEC 61158-6	NOTE Harmonized as EN 61158-6:2004 (not modified).
[7] IEC 61158-5	NOTE Harmonized as EN 61158-5:2004 (not modified).

Foreword to amendment A1

The text of document 65E/336/CDV, future edition IEC 62453-303-1:2009/A1, prepared subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62453-303-1:2009/A1:2018.

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• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2021-02-02

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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 When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 61131-3	2003	Programmable controllers - Part 3: Programming languages	EN 61131-3	2003
IEC 61158	Series	Industrial communication networks - Fieldbus specifications	EN 61158	Series
IEC 61158-2	2014	Industrial communication networks - Fieldbus specifications - Part 2: Physical layer specification and service definition	EN 61158-2	2014
IEC 61158-3-3	–[1)]	Industrial communication networks - Fieldbus specifications - Part 3-3: Data-link layer service definition - Type 3 elements	EN 61158-3-3	2008[2)]
IEC 61158-4-3	–[1)]	Industrial communication networks - Fieldbus specifications - Part 4-3: Data-link layer protocol specification - Type 3 elements	EN 61158-4-3	2008[2)]
IEC 61158-5-3	–[1)]	Industrial communication networks - Fieldbus specifications - Part 5-3: Application layer service definition - Type 3 elements	EN 61158-5-3	2008[2)]
IEC 61158-6-3	–[1)]	Industrial communication networks - Fieldbus specifications - Part 6-3: Application layer protocol specification - Type 3 elements	EN 61158-6-3	2008[2)]
IEC 61784-1	–[1)]	Industrial communication networks - Profiles - Part 1: Fieldbus profiles	EN 61784-1	2008[2)]
IEC 62453-1	2009	Field device tool (FDT) interface specification - Part 1: Overview and guidance	EN 62453-1	2009
IEC 62453-2	2009	Field device tool (FDT) interface specification - Part 2: Concepts and detailed description	EN 62453-2	2009

[1)] Undated reference.

[2)] Valid edition at date of issue.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 303-1: Communication profile integration – IEC 61784 CP 3/1 and CP 3/2

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International Standard IEC 62453-303-1 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 62453-3xy series is intended to be read in conjunction with IEC 62453-2.

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The text of this standard is based on the following documents:

FDIS	Report on voting
65E/127/FDIS	65E/140/RVD

Full information on the voting for the approval of this standard 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.

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

Figure 1 shows how IEC 62453–303-1 is aligned in the structure of the IEC 62453 series.

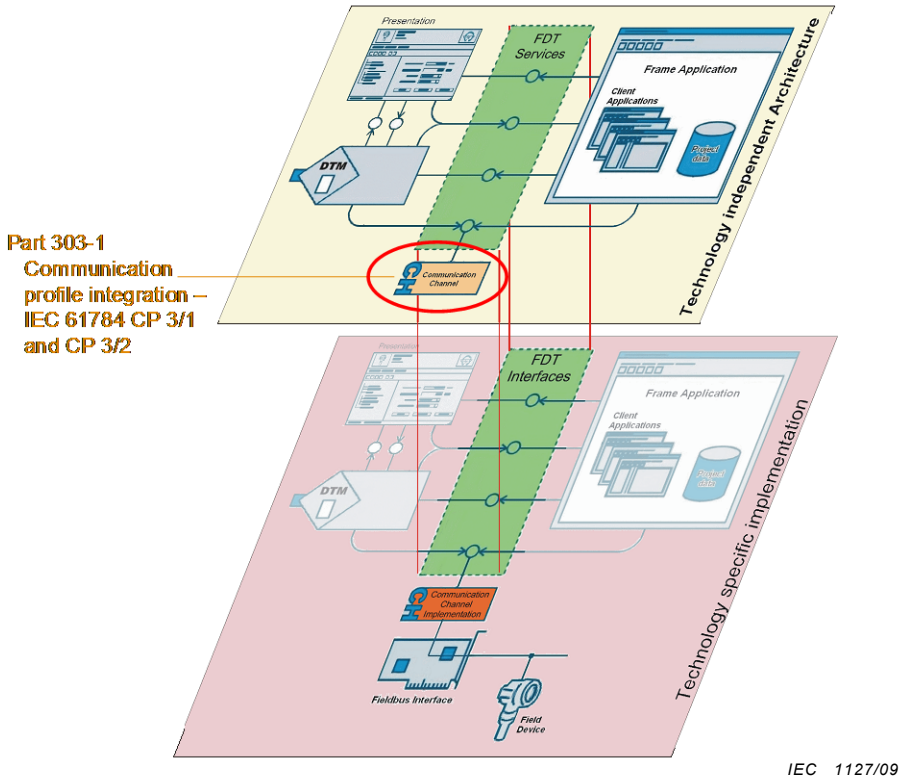


Figure 1 – Part 303-1 of the IEC 62453 series

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 303-1: Communication profile integration – IEC 61784 CP 3/1 and CP 3/2

1 Scope

Communication Profile 3/1 and Communication Profile 3/2 (commonly known as PROFIBUS™ [1]) defines communication profiles based on IEC 61158-2 Type 3, IEC 61158-3-3, IEC 61158-4-3, IEC 61158-5-3, and IEC 61158-6-3. The basic profiles CP 3/1 (PROFIBUS DP) and CP 3/2 (PROFIBUS PA) are defined in IEC 61784-1.

This part of IEC 62453 provides information for integrating the PROFIBUS protocol into the FDT interface specification (IEC 62453–2).

This part of the 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 61131-3:2003, *Programmable controllers – Part 3: Programming languages*

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

〈A1〉 IEC 61158-2:2014, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition* 〈A1〉

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

IEC 61158-4-3 *Industrial communication networks – Fieldbus specifications – Part 4-3: Data-link layer protocol specification – Type 3 elements*

IEC 61158-5-3: *Industrial communication networks – Fieldbus specifications – Part 5-3: Application layer service definition – Type 3 elements*

IEC 61158-6-3, *Industrial communication networks – Fieldbus specifications – Part 6-3: Application layer protocol specification – Type 3 elements*

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

[1] PROFIBUS™ is a trade names of the non-profit organization PROFIBUS Nutzerorganisation e.V. (PNO). This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade name holder or any of its products. Compliance to this standard does not require use of the registered logos for PROFIBUS™. Use of the registered logos for PROFIBUS™ requires permission of PNO.

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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*

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 and IEC 62453–2 apply.

3.1.1
bus interface module
module of a field device that provides the connection to the fieldbus

3.1.2

CP 3/1
Communication profile of CPF3, featuring asynchronous transmission; RS 485 (ANSI TIA/EIA RS-485-A); optional RS 485-IS; plastic fiber; glass multi mode fiber or glass single mode fiber; PCF fiber

3.1.3
CP 3/2
Communication profile of CPF3, featuring synchronous transmission; manchester coded and bus powered (MBP); optional intrinsically safe (MBP-IS) and lower power (MBP-LP)

3.2 Symbols and abbreviated terms

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

ANSI	American National Standards Institute (http://www.ansi.org)
BIM	Bus Interface Module
BMCP	Bus Master Configuration Part
CFG	Configuration data used during initialization of PROFIBUS slave device
DCS	Distributed Control System
DP	Decentralized Peripherals
EIA	Electronic Industries Alliance
FDL	Fieldbus Data Link layer
FMA	Fieldbus Management layer
FMS	Fieldbus Message Specification
GSD	General Station Description
MBP	Manchester coded Bus Powered
I&M	Identification and maintenance functions
PA	Process Automation
PCF	Polymer Clad Fibre
PROFIBUS	Process Field Bus
RS	Radio Sector / Recommended Standard
TIA	Telecommunications Industry Association

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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 behaviour.
Usage of “conditional”’	Function or behaviour shall be provided, depending on defined conditions.
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 the UML notation as defined in Annex A of IEC 62453–1.

4 Bus category

CP 3/1 and CP 3/2 protocols are identified in the protocolId element of the structured data type 'fdt:BusCategory' by the following unique identifiers (Table 1):

Table 1 – Protocol identifiers

Identifier value	ProtocolId name	Description
036D1497-387B-11D4-86E1-00E0987270B9	'Profibus DP/V0'	Support of Profibus DP V0 protocol
036D1499-387B-11D4-86E1-00E0987270B9	'Profibus DP/V1'	Support of Profibus DP V1 protocol

CP 3/1 AND CP 3/2 protocols are using the following unique identifiers in physicalLayer members within PhysicalLayer data type (Table 2):

Table 2 – Physical layer identifiers

Identifier value	Name	Description
036D1590-387B-11D4-86E1-00E0987270B9	MBP	IEC 61158-2 (MBP, Profibus PA)
036D1591-387B-11D4-86E1-00E0987270B9	RS485	IEC 61158-2:2014, Clause 22 (RS485, PROFIBUS DP)
036D1592-387B-11D4-86E1-00E0987270B9	Fiber Optic	IEC 61158-2:2014, Clause 23 (Fiber Optic cable, PROFIBUS DP)
036D1593-387B-11D4-86E1-00E0987270B9		Ethernet (depreciated, do not use)

Table 32 defines which DataLinkLayer shall be used in combination with the BusCategory values defined in Table 32.

Table 32 – DataLink Layer Identifiers

Identifier value	Name	Description
50A21B35-7EE7-4999-8174-70396929C0B4	PROFIBUS FDL	PROFIBUS FDL
CDF338DC-E9A3-4D13-91AC-60A43DCB2904	PROFIBUS FMA1/2	PROFIBUS FMA1/2

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5 Access to instance and device data

5.1 Process Channel objects provided by DTM

A1 The minimum set of provided data should be: Process values modeled as channel objects including the ranges and scaling. A1

5.2 DTM services to access instance and device data

The services InstanceDataInformation and DeviceDataInformation shall provide access to at least all parameters of the Physical Block and the status and Out value of the Function Blocks shall be exposed.

According to IEC 62453-2, at least one set of semantic information (one per supported fieldbus protocol) shall be provided for each accessible data object, using the 'SemanticInformation' general data type. The corresponding data type 'applicationDomain' shall have a value defined for Profibus and the data type 'semanticId' shall have an appropriate value, as specified in Table 9.

6 Protocol specific behavior

6.1 PROFIBUS device model

FDT extends the PROFIBUS device model by using Process Channels for description of I/O values (see Figure 2).

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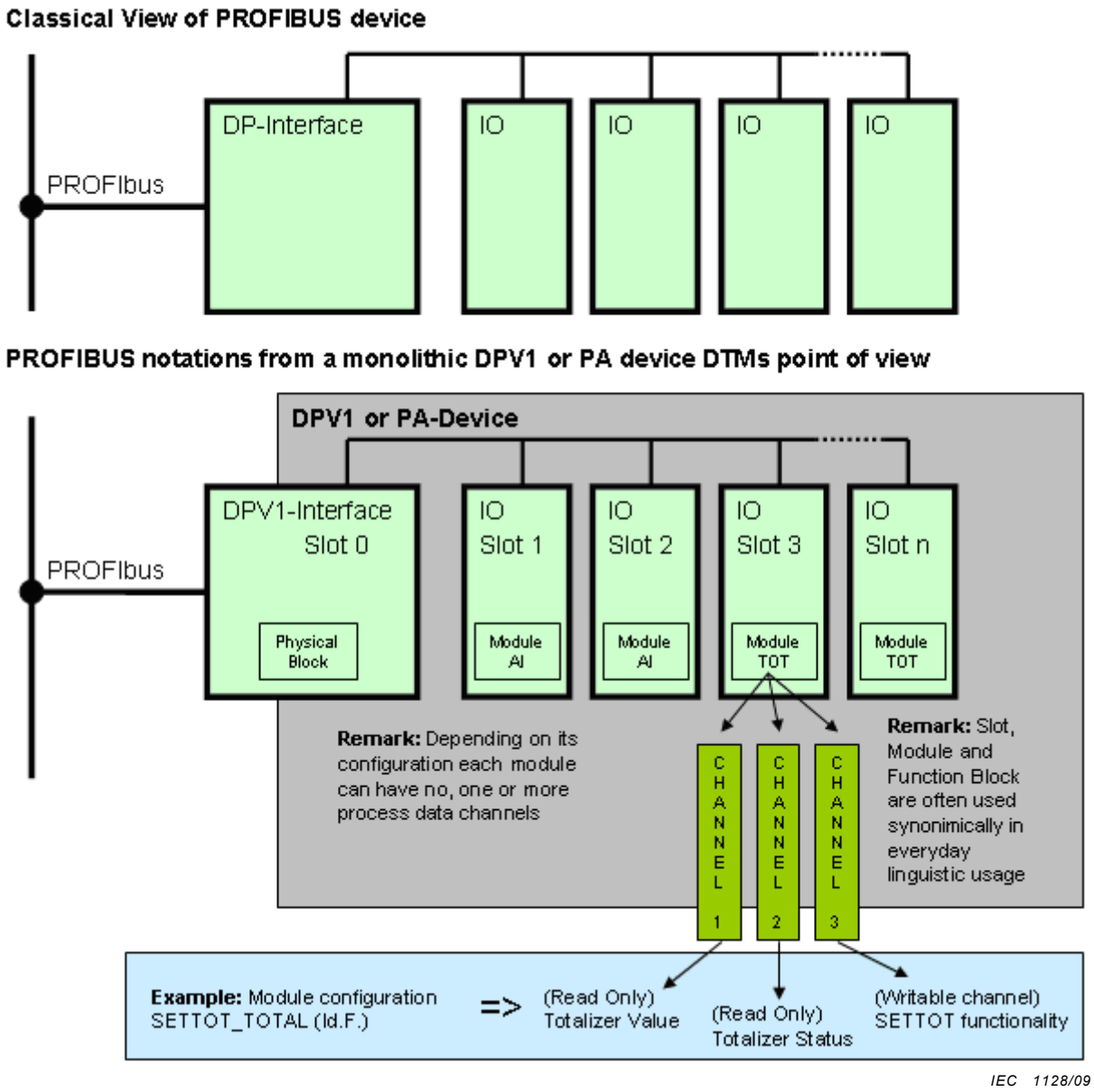


Figure 2 – FDT PROFIBUS device model

6.2 Configuration and parameterization of PROFIBUS devices

6.2.1 General

In a GSD-based configuration tool the user defines the configuration and sets the appropriate parameters for the modules. The configuration tool creates the configuration string and the parameter string that are used to set up the slave properly.

With FDT the configuration and parameterization of the devices is no longer executed only by a central component; it moved partly into the DTMs. A DTM is responsible for providing configuration and parameterization information for the cyclic master that puts the PROFIBUS slaves in operation.

A DTM is used to adjust a field device to its specific application. Within PROFIBUS, there are three different aspects of adjustment:

- parameterization: usr prm data (used in the PROFIBUS service SET_PRM for setting up the cyclic communication and the specific behavior of the device);

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- application parameterization: application specific parameters (transmitted via acyclic read/write PROFIBUS services);
- configuration: configuration data (used in the PROFIBUS service CHK_CFG for definition of the format and length of the input/output data that are transmitted within cyclic communication).

The application parameterization transmitted via acyclic communication is not in the scope of this document. Within this document the term parameterization represents communication parameterization (SET_PRM).

6.2.2 Monolithic DTM for a modular PROFIBUS device

A monolithic DTM is one single DTM that represents the complete device with its Bus Interface Module (BIM) and its I/O modules. In general, such a DTM offers a configuration dialog (presentation object) that allows definition of the used BIM and modules. The configuration dialog must be available via the FDT standard function “Configure” (see [1] 4.3 Operation Configuration).

Not all PROFIBUS devices require a configuration dialog. That is why not all DTMs provide the “Configure” function. This is valid only for non-modular PROFIBUS devices if the Usr_Prm-Data cannot be changed.

The configuration dialog allows changing the data only in offline mode if the data set can be locked.

6.2.3 Modular DTM for a modular PROFIBUS device

Separate DTMs represent the BIM (Device DTM) and the particular I/O modules (Module DTMs). The effort developing such a modular DTM is normally higher than in the case of a monolithic DTM, because:

- a private protocol has to be implemented between BIM and I/O modules to ensure that only a Module DTM can be added to the BIM DTM. This requires an own protocol ID and the adaptation / creation of communication;
- in some cases, additional private interfaces are necessary to exchange information between Device DTM for BIM and Module DTMs.

Implementing a Modular DTM results in the following advantages:

- the project represents the device structure;
- the user is able to access module-related information directly as a function of the Module DTM;
- the FDT specification defines a mechanism to identify DTMs. With these mechanisms it is possible to provide support for scanning the modules below the BIM and generate the topology automatically;
- supporting a new type of BIM or I/O module requires an additional DTM “only” and does not affect existing components. This may result in reduced test effort.

The configuration data to set up the PROFIBUS configuration must be provided by the Device DTM (representing the BIM). This configuration data may be generated from information of the instantiated Child DTMs and by using a configuration dialog.

Modular DTMs should be provided for modular devices (e.g. a plant operator may add/remove modules). Monolithic DTMs are used to represent devices that show no modularity (e.g. PA devices).

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6.3 Support for DPV0 configuration

A PROFIBUS slave is configured by a cyclic master and communicates via PROFIBUS DP. In addition to this the slave may support DPV1 communication.

A Gateway DTM for a PROFIBUS slave does not have to provide communication for the DPV0 communication schema. For example, there is a remote I/O system with HART modules. It may have a Gateway DTM that requires the DPV1 protocol and provides the HART protocol (defined in the information document and in the parameter document). This enables HART Device DTMs to communicate with their devices via the Gateway DTM and via Communication DTM for DPV1. Following the specification the Gateway DTM delivers channel parameter documents for both protocols DPV1 and HART. The protocolId is a member of NetworkManagementInfo data type.

A1 The Process Channels shall provide Channel Parameter documents for DPV1 including all information to allow integration into the control system (e.g. DPAddress of the IO value if available). A1

6.4 PROFIBUS slaves operating without a cyclic PROFIBUS master

In most cases, a PROFIBUS slave is configured and parameterized by a cyclic PROFIBUS master device. So a running master device in the network is required.

Some slaves are able to allow acyclic communication without a running cyclic master. Especially in the case of gateway functionality this is an eminent advantage because they allow the parameterization of field devices connected to them by using an acyclic bus master. So instrument specialists are able to work with field devices also in case the controller is not yet working.

If a master starts communication, these devices start to detect bus speed and settings to react properly. This may take some time.

In the following, two cases are described that a user may keep in mind when working with such devices.

Use case 1:

The user performs a network scan. The Communication DTM tries to read diagnostic data via a GetDiagnose Request but does not receive a response. The device is not detected by the Communication DTM. This occurs mostly when the device has a low PROFIBUS address. The reason is that the device has not completed bus speed / bus setting detection as it was asked for their diagnostic data. The workaround is to give these devices a higher PROFIBUS address.

Use Cases 2:

The user tries to connect a field device linked to the gateway that supports DPV1 without a running cyclic master. This can lead to an error message because the gateway device has not completed bus speed / bus setting detection as it was asked for a connection. So the user has to try to connect again. This happens only in very rare situations.

6.5 PROFIBUS-related information of a slave DTM

6.5.1 General

The information used by a cyclic master device to set up the PROFIBUS network properly and allow cyclic communication between control system and slave devices is provided by a DTM in

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- Bus Master Configuration Part (BMCP);
- GSD information;
- internal topology,
- pocess channels.

A DTM of a PROFIBUS slave must deliver these parts of PROFIBUS-related information to get integrated into a FDT-based Engineering System. In the next subclauses, a more detailed description is given on how to generate and how to provide this information. This depends on the kind of DTM (see 6.2 Configuration and parameterization of PROFIBUS devices).

6.5.2 Bus Master Configuration Part (BMCP)

6.5.2.1 BMCP introduction

The BMCP of one single DTM instance describes the actual parameter and configuration data of the corresponding PROFIBUS slave. Each DTM representing a PROFIBUS slave device must provide a Bus Master Configuration Part. The BMCP is provided in the busMasterConfigurationPart member of NetworkManagementInfo data type. This information is obtained by calling service NetworkManagementInfoRead.

The BMCP includes information about the configuration and the parameters for the slave. The BMCP is provided by the DTM and is required in order to generate the master configuration.

The BMCP contains data which might be changed during master configuration. That means that the BMCP may be changed and transferred back to the slave DTM by calling NetworkManagementInfoWrite. A Slave DTM must accept the new information and recompute the configuration / internal parameters to match the new BMCP.

DTM must check whether the new values are according to the capabilities of the device. The NetworkManagementInfoWrite call will be refused if the device can not handle the new values.

6.5.2.2 Creating the BMCP

This subclause explains the meaning of the individual elements of the BMCP in details.

The BCMP may be generated from the GSD information of a PROFIBUS device.

The BMCP is divided into four parts that are explained in the following subclauses.

The explanations use the GSD keywords and reference the PROFIBUS specification. See also the table with complete BMCP in 6.5.2.2.1 .

6.5.2.2.1 Part 1: From Slave_Para_Len to Octet 15

The first part consists of a fixed set of bytes described in the table below.

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Table 3 – BMCP Part1 – General configuration

Byte	Name	Defined in	Notice
0	Slave_Para_Len	[5] 6.2.12.1	Length of the BMCP including this value
1			
2	Sl_Flag	[5] 6.2.12.2	The following GSD values are used [6]: • Bit 0 : reserved, • Bit 1: Extra_Alarm_SAP, • Bit 2: DPV1_Data_Types, • Bit 3: DPV1_Supported, • Bit 4: Publisher_Enable, • Bit 5 : Fail_Safe, . The following bits are not based on GSD values: • Bit 6 : New_Prm, • Bit 7 : Active
3	Slave Type	[5] 6.2.12.3	Value is 0 (= DP-Slave)
4	Max_Diag_Data_Len	[5] 6.2.12.4	The following GSD value is used [6]: Max_Diag_Data_Len
5	Max_Alarm_Len	[5] 6.2.12.5	
6	Max_Channel_Data_Len	[5] 6.2.12.6	This field defines how much data can be transferred between slave and master. In this case, the maximum of these GSD values [6] must be calculated: • Max_Data_Len, • C1_Max_Data_Len plus 4 Bytes (Function Num, Slot_Number, Length)
7	Diag_Update_Delay	[5] 6.2.12.7	The following GSD value is used [6]:Diag_Update_Delay
8	Alarm_Mode	[5] 6.2.12.8	
9	Add_Sl_Flag	[5] 6.2.12.9	
10	C1_Timeout	[5] 6.2.12.10	The following GSD value is used [6]:C1_Response_Timeout
11			
12	Reserved		
13			
14			
15			

6.5.2.2.2 Part 2: Parameter data

Part 2 of the BMCP are the slave parameter data.

Table 4 – BMCP Part2 – Parameter data

Byte	Name	Defined in	Notice
16	Prm_Data_Len	[5] 6.2.12.11	Length of the Parameter Data including this value
17			
18	Station Status	[5] 6.2.4.1	The following GSD values are used [6]: • Bit 0-2: reserved, • Bit 3: WD_On, • Bit 4: Freeze_Req, • Bit 5: Sync_Req, • Bit 6,7(Lock/Unlock Request): [5] Table 402
19	WatchDog1	[5] 6.2.4.2	These values (WD_Fact_1 and WD_Fact_2) depend on the baud rate. A master should set these values and slaves should handle new values
20	WatchDog2	[5] 6.2.4.3	
21	Min Tsdr	[5] 6.2.4.4	Default value is 11 bit times [1]
22	Ident_Number	[5] 6.2.3.5	The following GSD value is used [6]: Ident_Number

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