

**AMERICAN NATIONAL STANDARD**

**ANSI/ISA-62453-303-1 (103.00.05)-2011**

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

**Approved 31 May 2011**

**ANSI/ISA-62453-303-1 (103.00.05)-2011, Field Device Tool (FDT) Interface Specification –  
Part 303-1: Communication profile integration –  
IEC 61784 CP 3/1 and CP 3/2**

ISBN: 978-0-876640-59-3

Copyright © 2011 IEC and ISA. These materials are subject to copyright claims of IEC and ISA. No part of this publication may be reproduced in any form, including an electronic retrieval system, without the prior written permission of ISA. All requests pertaining to the ANSI/ISA-62453-303-1 (103.00.05)-2011 Standard should be submitted to ISA.

ISA  
67 Alexander Drive  
P.O. Box 12277  
Research Triangle Park, North Carolina 27709

## Preface

This preface, as well as all footnotes and annexes, is included for information purposes and is not part of ANSI/ISA-62453-303-1 (103.00.05)-2011.

This document has been prepared as part of the service of ISA toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Secretary, Standards and Practices Board; ISA; 67 Alexander Drive; P. O. Box 12277; Research Triangle Park, NC 27709; Telephone (919) 549-8411; Fax (919) 549-8288; E-mail: [standards@isa.org](mailto:standards@isa.org).

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards. The Department is further aware of the benefits to USA users of ISA standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Toward this end, this Department will endeavor to introduce SI-acceptable metric units in all new and revised standards, recommended practices, and technical reports to the greatest extent possible. *Standard for Use of the International System of Units (SI): The Modern Metric System*, published by the American Society for Testing & Materials as IEEE/ASTM SI 10-97, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors.

It is the policy of ISA to encourage and welcome the participation of all concerned individuals and interests in the development of ISA standards, recommended practices, and technical reports. Participation in the ISA standards-making process by an individual in no way constitutes endorsement by the employer of that individual, of ISA, or of any of the standards, recommended practices, and technical reports that ISA develops.

**CAUTION — ISA ADHERES TO THE POLICY OF THE AMERICAN NATIONAL STANDARDS INSTITUTE WITH REGARD TO PATENTS. IF ISA IS INFORMED OF AN EXISTING PATENT THAT IS REQUIRED FOR USE OF THE DOCUMENT, IT WILL REQUIRE THE OWNER OF THE PATENT TO EITHER GRANT A ROYALTY-FREE LICENSE FOR USE OF THE PATENT BY USERS COMPLYING WITH THE DOCUMENT OR A LICENSE ON REASONABLE TERMS AND CONDITIONS THAT ARE FREE FROM UNFAIR DISCRIMINATION.**

**EVEN IF ISA IS UNAWARE OF ANY PATENT COVERING THIS DOCUMENT, THE USER IS CAUTIONED THAT IMPLEMENTATION OF THE DOCUMENT MAY REQUIRE USE OF TECHNIQUES, PROCESSES, OR MATERIALS COVERED BY PATENT RIGHTS. ISA TAKES NO POSITION ON THE EXISTENCE OR VALIDITY OF ANY PATENT RIGHTS THAT MAY BE INVOLVED IN IMPLEMENTING THE DOCUMENT. ISA IS NOT RESPONSIBLE FOR IDENTIFYING ALL PATENTS THAT MAY REQUIRE A LICENSE BEFORE IMPLEMENTATION OF THE DOCUMENT OR FOR INVESTIGATING THE VALIDITY OR SCOPE OF ANY PATENTS BROUGHT TO ITS ATTENTION. THE USER SHOULD CAREFULLY INVESTIGATE RELEVANT PATENTS BEFORE USING THE DOCUMENT FOR THE USER'S INTENDED APPLICATION. HOWEVER, ISA ASKS THAT ANYONE REVIEWING THIS DOCUMENT WHO IS AWARE OF ANY PATENTS THAT MAY IMPACT IMPLEMENTATION OF THE DOCUMENT NOTIFY THE ISA STANDARDS AND PRACTICES DEPARTMENT OF THE PATENT AND ITS OWNER.**

**ADDITIONALLY, THE USE OF THIS DOCUMENT MAY INVOLVE HAZARDOUS MATERIALS, OPERATIONS OR EQUIPMENT. THE DOCUMENT CANNOT ANTICIPATE ALL POSSIBLE APPLICATIONS OR ADDRESS ALL POSSIBLE SAFETY ISSUES ASSOCIATED WITH USE IN HAZARDOUS CONDITIONS. THE USER OF THIS DOCUMENT MUST EXERCISE SOUND PROFESSIONAL JUDGMENT CONCERNING ITS USE AND APPLICABILITY UNDER THE USER'S PARTICULAR CIRCUMSTANCES. THE USER MUST ALSO CONSIDER THE**

**APPLICABILITY OF ANY GOVERNMENTAL REGULATORY LIMITATIONS AND ESTABLISHED SAFETY AND HEALTH PRACTICES BEFORE IMPLEMENTING THIS DOCUMENT.**

**THE USER OF THIS DOCUMENT SHOULD BE AWARE THAT THIS DOCUMENT MAY BE IMPACTED BY ELECTRONIC SECURITY ISSUES. THE COMMITTEE HAS NOT YET ADDRESSED THE POTENTIAL ISSUES IN THIS VERSION.**

The following people served as members of ISA 103

| <b>NAME</b>                   | <b>COMPANY</b>                       |
|-------------------------------|--------------------------------------|
| I. Verhappen, Chair           | Industrial Automation Networks, Inc. |
| J. Jamison, Managing Director | Spectra Energy Ltd.                  |
| S. Foos                       | Rockwell Automation                  |
| K. Lindner                    | Endress+Hauser Process Solutions AG  |
| D. Smith                      | Wunderlich-Malec                     |
| J. Sprague                    | Saudi Aramco Oil Company             |
| J. Yap                        | Chevron Energy Technology Company    |

This standard was approved for publication by the ISA Standards and Practices Board on 18 March 2011.

| <b>NAME</b>                | <b>COMPANY</b>                               |
|----------------------------|----------------------------------------------|
| D. Dunn, S&P Department VP | Aramco Services Company                      |
| R. Bartusiak               | ExxonMobil Research & Engineering            |
| P. Brett                   | Honeywell Inc.                               |
| J. Campbell                | Consultant                                   |
| M. Coppler                 | Det Norske Veritas Certification Inc.        |
| E. Cosman                  | The Dow Chemical Company                     |
| B. Dumortier               | Schneider Electric                           |
| J. Federlein               | Federlein & Associates Inc.                  |
| J. Gilsinn                 | Kenexis Consulting                           |
| E. Icahan                  | Atkins                                       |
| J. Jamison                 | Spectra Energy Ltd.                          |
| K. P. Lindner              | Endress + Hauser Process Solutions AG        |
| V. Maggioli                | Feltronics Corp.                             |
| T. McAviney                | Instrumentation and Control Engineering, LLC |
| R. Reimer                  | Rockwell Automation                          |
| S. Russell                 | Valero Energy Corp.                          |
| N. Sands                   | DuPont                                       |
| H. Sasajima                | Azbil Corp.                                  |
| T. Schnaare                | Rosemount Inc.                               |
| J. Tatera                  | Tatera & Associates Inc.                     |
| I. Verhappen               | Industrial Automation Networks Inc.          |
| R. Webb                    | ICS Secure LLC                               |
| W. Weidman                 | WCW Consulting                               |
| J. Weiss                   | Applied Control Solutions LLC                |
| M. Widmeyer                | Kahler Engineering Inc.                      |
| M. Wilkins                 | Yokogawa IA Global Marketing                 |
| D. Zetterberg              | Chevron Energy Technology Company            |

NOTE All text of IEC 62453-303-1 is included. U.S. National Deviations are shown by ~~strikeout~~ through text deleted and underline under text added.

Copyright International Society of Automation  
Provided by IHS under license with ISA  
No reproduction or networking permitted without license from IHS

This page intentionally left blank.

## CONTENTS

|                                                                       |      |
|-----------------------------------------------------------------------|------|
| INTRODUCTION .....                                                    | 10 - |
| 1 Scope .....                                                         | 13 - |
| 2 Normative references .....                                          | 13 - |
| 3 Terms, definitions, symbols, abbreviated terms and conventions..... | 14 - |
| 3.1 Terms and definitions.....                                        | 14 - |
| 3.2 Symbols and abbreviated terms .....                               | 14 - |
| 3.3 Conventions.....                                                  | 14 - |
| 3.3.1 Data type names and references to data types .....              | 14 - |
| 3.3.2 Vocabulary for requirements .....                               | 15 - |
| 3.3.3 Use of UML .....                                                | 15 - |
| 4 Bus category.....                                                   | 15 - |
| 5 Access to instance and device data .....                            | 15 - |
| 5.1 Process Channel objects provided by DTM .....                     | 15 - |
| 5.2 DTM services to access instance and device data.....              | 16 - |
| 6 Protocol specific behavior .....                                    | 16 - |
| 6.1 PROFIBUS device model .....                                       | 16 - |
| 6.2 Configuration and parameterization of PROFIBUS devices .....      | 17 - |
| 6.2.1 General.....                                                    | 17 - |
| 6.2.2 Monolithic DTM for a modular PROFIBUS device .....              | 18 - |
| 6.2.3 Modular DTM for a modular PROFIBUS device .....                 | 18 - |
| 6.3 Support for DPV0 configuration.....                               | 19 - |
| 6.4 PROFIBUS slaves operating without a cyclic PROFIBUS master.....   | 19 - |
| 6.5 PROFIBUS-related information of a slave DTM .....                 | 20 - |
| 6.5.1 General.....                                                    | 20 - |
| 6.5.2 Bus Master Configuration Part (BMCP) .....                      | 20 - |
| 7 Protocol specific usage of general data types.....                  | 32 - |
| 8 Protocol specific common data types .....                           | 34 - |
| 9 Network management data types .....                                 | 35 - |
| 9.1 General.....                                                      | 35 - |
| 9.1.1 Configuration .....                                             | 35 - |
| 9.1.2 Process Channel .....                                           | 35 - |
| 9.1.3 Parameterization .....                                          | 36 - |
| 9.2 Master-bus parameter set .....                                    | 36 - |
| 9.3 Slave bus parameter set .....                                     | 37 - |
| 9.4 Module and channel data .....                                     | 38 - |
| 9.5 GSD information .....                                             | 41 - |
| 9.5.1 General.....                                                    | 41 - |
| 9.5.2 GSD for gateway devices .....                                   | 41 - |
| 10 Communication data types .....                                     | 42 - |
| 10.1 General.....                                                     | 42 - |

\*\*\*\*\*

|                                                                           |      |
|---------------------------------------------------------------------------|------|
| 10.2 Error information provided by Communication Channel .....            | 42 - |
| 10.3 DPV0 communication .....                                             | 42 - |
| 10.4 DPV1 communication .....                                             | 49 - |
| 11 Channel parameter data types .....                                     | 53 - |
| 12 Device identification .....                                            | 56 - |
| 12.1 General .....                                                        | 56 - |
| 12.2 Protocol specific handling of the data type STRING .....             | 56 - |
| 12.3 Common device type identification data types .....                   | 56 - |
| 12.4 Topology scan data types .....                                       | 61 - |
| 12.5 Scan identification data types .....                                 | 62 - |
| 12.6 Device type identification data types – provided by DTM .....        | 65 - |
| 12.7 Identification information in GUI .....                              | 68 - |
| 13 ProfiSafe .....                                                        | 68 - |
| 13.1 Motivation .....                                                     | 68 - |
| 13.2 General parameter handling .....                                     | 69 - |
| 13.3 ProfiSafe individual device parameter .....                          | 69 - |
| Bibliography .....                                                        | 71 - |
| Figure 1 – Part 303-1 of the IEC 62453 series .....                       | 11 - |
| Figure 2 – FDT PROFIBUS device model .....                                | 17 - |
| Figure 3 – Example for IO data within datagrams .....                     | 38 - |
| Figure 4 – F-Parameter and individual device parameter .....              | 69 - |
| Figure 5 – Data structure of ProfiSafe individual device parameters ..... | 70 - |
| Table 1 – Protocol identifiers .....                                      | 15 - |
| Table 2 – Physical layer identifiers .....                                | 15 - |
| Table 3 – BMPC Part1 – General configuration .....                        | 21 - |
| Table 4 – BMPC Part2 – Parameter data .....                               | 22 - |
| Table 5 – BMPC Part3 – Configuration data .....                           | 23 - |
| Table 6 – Part 4: Address table and slave user parameters .....           | 23 - |
| Table 7 – Part 4: Extended Prm data .....                                 | 24 - |
| Table 8 – Complete BMCP .....                                             | 25 - |
| Table 9 – Protocol specific usage of general data types .....             | 32 - |
| Table 10 – Bus parameter set for master device .....                      | 36 - |
| Table 11 – Bus parameter set for slave device .....                       | 37 - |
| Table 12 – Signal channels within the data frame .....                    | 40 - |
| Table 13 – Simple DPV0 communication data types .....                     | 43 - |
| Table 14 – Structured DPV0Communication data types .....                  | 44 - |
| Table 15 – Availability of services for Master Class1 (C1) .....          | 49 - |
| Table 16 – Availability of services for Master Class2 (C2) .....          | 49 - |
| Table 17 – Simple DPV1 communication data types .....                     | 50 - |

|                                                                                           |        |
|-------------------------------------------------------------------------------------------|--------|
| Table 18 – Structured DPV1 communication data types .....                                 | - 51 - |
| Table 19 – Mapping of DPV1 data types to FDT data types .....                             | - 53 - |
| Table 20 – Simple ChannelParameter data types .....                                       | - 54 - |
| Table 21 – Structured ChannelParameter data types .....                                   | - 54 - |
| Table 22 – Identification data types with Profibus DP specific mapping .....              | - 57 - |
| Table 23 – Identification data types with Profibus I&M specific mapping .....             | - 58 - |
| Table 24 – Identification data types with Profibus PA specific mapping .....              | - 60 - |
| Table 25 – Simple identification data types with protocol independent semantics .....     | - 61 - |
| Table 26 – Structured identification data types with protocol independent semantics ..... | - 61 - |
| Table 27 – Simple topology scan data types .....                                          | - 61 - |
| Table 28 – Structured topology scan data types .....                                      | - 62 - |
| Table 29 – Simple scan identification data types .....                                    | - 62 - |
| Table 30 – Structured scan identification data types .....                                | - 62 - |
| Table 31 – Structured device identification data types .....                              | - 65 - |

This page intentionally left blank.

Copyright International Society of Automation  
Provided by IHS under license with ISA  
No reproduction or networking permitted without license from IHS  
Full document details: ISA 62453-303-1 2011

## INTRODUCTION

This part of IEC ISA-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 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 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 fieldbuses and thus meets the requirements for integrating different kinds of devices into heterogeneous control systems.

Figure 1 shows how IEC ISA-62453-303-1 (103.00.05) is aligned in the structure of the IEC ISA 62453 series.

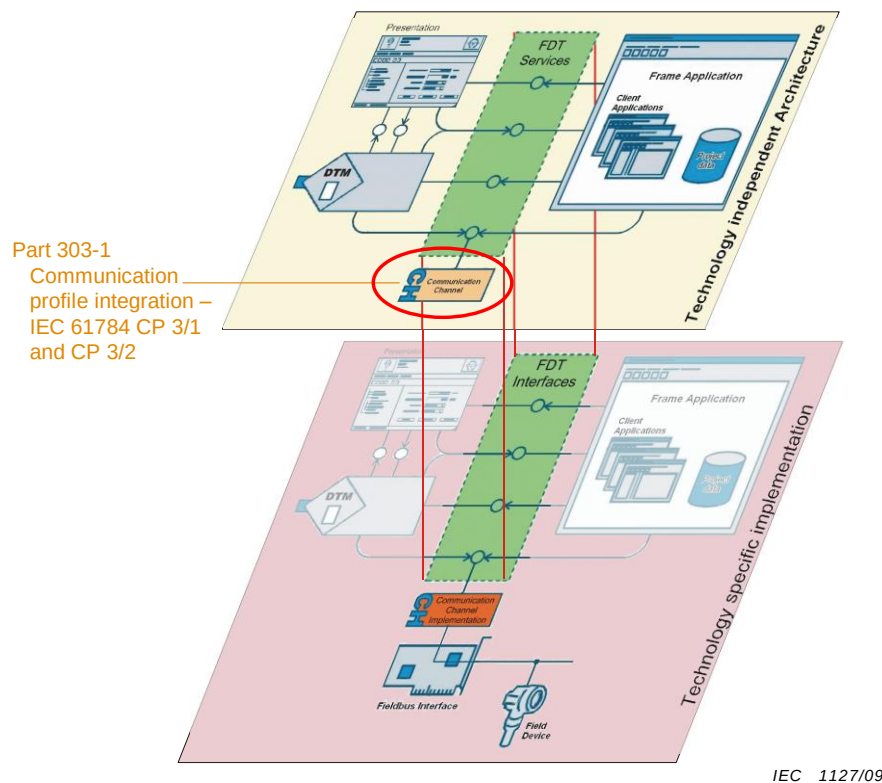


Figure 1 – Part 303-1 of the IEC ISA-62453 series

This page intentionally left blank.

.....

# 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™<sup>1</sup>) 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~~ ISA-62453 provides information for integrating the PROFIBUS protocol into the FDT interface specification (~~IEC~~ ISA-62453-2 [103.00.02]).

This part of the ~~IEC~~ ISA-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*

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

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*

<sup>1</sup> 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 or ISA 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.

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

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~~ ISA-62453-1 (103.00.01), ~~IEC~~ ISA-62453-2 (103.00.02) apply.

##### **bus interface module**

module of a field device that provides the connection to the fieldbus

##### 3.1.1

###### **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

##### 3.1.2

###### **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~~ ISA-62453-1 (103.00.01), ~~IEC~~ ISA-62453-2 (103.00.02) and the following apply.

|      |                               |
|------|-------------------------------|
| BIM  | Bus Interface Module          |
| BMCP | Bus Master Configuration Part |
| GSD  | General Station Description   |

#### 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~~ ISA-62453-2 (103.00.02), Clause A.1

Copyright International Society of Automation  
Provided by IHS under license with ISA  
No reproduction or networking permitted without license from IHS  
Full document details: ISA 62453-303-1 2011

### 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 the UML notation as defined in Annex A of ~~IEC~~ ISA-62453-1 (103.00.01).

## 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                     | Description               |
|--------------------------------------|---------------------------|
| 036D1590-387B-11D4-86E1-00E0987270B9 | IEC 61158-2 (Profibus PA) |
| 036D1591-387B-11D4-86E1-00E0987270B9 | RS485                     |
| 036D1592-387B-11D4-86E1-00E0987270B9 | Fiber                     |
| 036D1593-387B-11D4-86E1-00E0987270B9 | Ethernet                  |

## 5 Access to instance and device data

### 5.1 Process Channel objects provided by DTM

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

## 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.

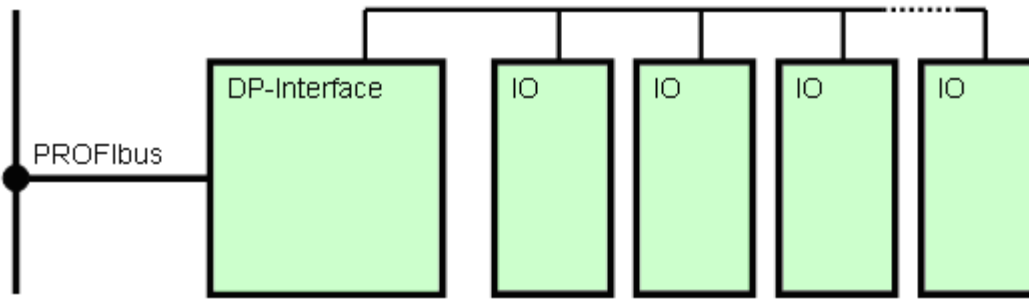
According to IEC ISA-62453-2 (103.00.02), at least one set of semantic information (one per supported fieldbus protocol) shall be provided for each accessible data object, using the 'SemanticInformation' general data type. The corresponding data type 'applicationDomain' shall have a value defined for Profibus and the data type 'semanticId' shall have an appropriate value, as specified in Table 9.

## 6 Protocol specific behavior

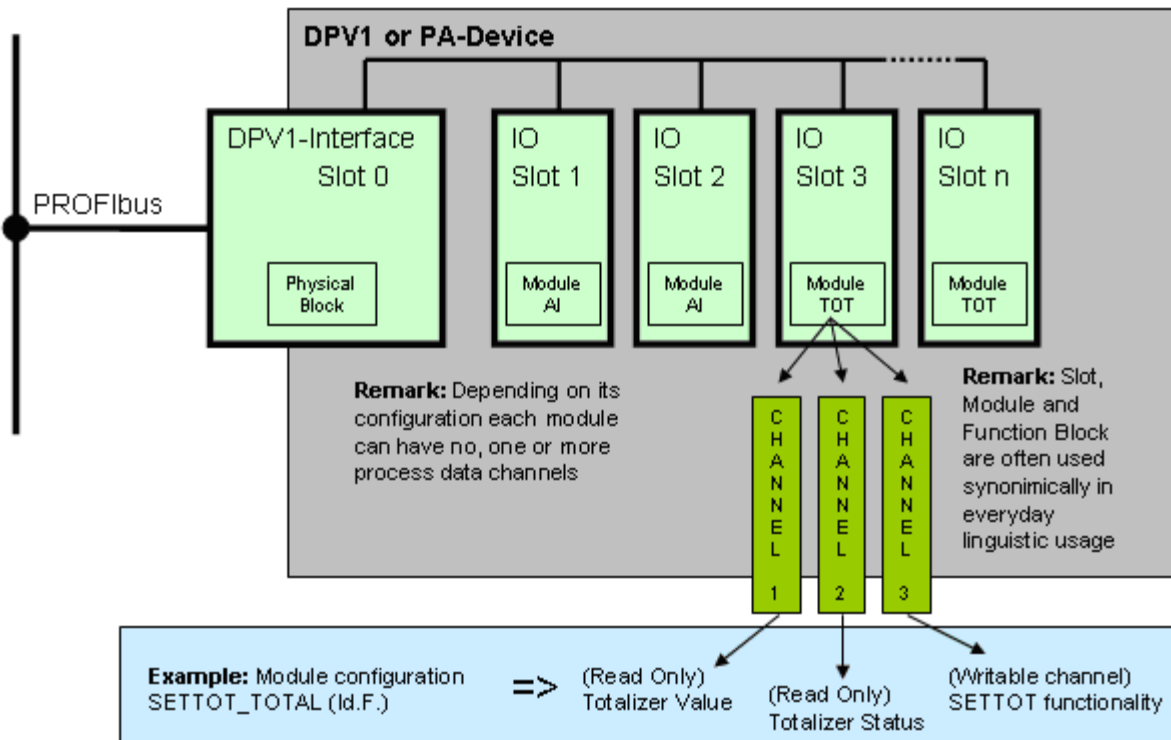
### 6.1 PROFIBUS device model

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

### Classical View of PROFIBUS device



### PROFIBUS notations from a monolithic DPV1 or PA device DTMs point of view



IEC 1128/09

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);
- 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).

### 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.

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

### 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

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

**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    | SI_Flag              | [5] 6.2.12.2  | <p>The following GSD values are used [6]:</p> <ul style="list-style-type: none"> <li>• Bit 0 : reserved,</li> <li>• Bit 1: Extra_Alarm_SAP,</li> <li>• Bit 2: DPV1_Data_Types,</li> <li>• Bit 3: DPV1_Supported,</li> <li>• Bit 4: Publisher_Enable,</li> <li>• Bit 5 : Fail_Safe, .</li> </ul> <p>The following bits are not based on GSD values:</p> <ul style="list-style-type: none"> <li>• Bit 6 : New_Prm,</li> <li>• Bit 7 : Active</li> </ul> |
| 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  | <p>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:</p> <ul style="list-style-type: none"> <li>• Max_Data_Len,</li> <li>• C1_Max_Data_Len plus 4 Bytes (Function Num, Slot_Number, Length)</li> </ul>                                                                                                                                              |
| 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_SI_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 – BMPC 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]: <ul style="list-style-type: none"> <li>• Bit 0-2: reserved,</li> <li>• Bit 3: WD_On,</li> <li>• Bit 4: Freeze_Req,</li> <li>• Bit 5: Sync_Req,</li> <li>• Bit 6,7(Lock/Unlock Request): [5] Table 402</li> </ul>                                                                                                                                                                                                                                                                            |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 23                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Group_Ident    | [5] 6.2.4.5   | Indicates the group assignment of the slave in a bitwise coded form                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DPV1_Status_1  | [5] 6.2.4.7   | The following GSD values are used [6]: <ul style="list-style-type: none"> <li>• Bit 0,1: reserved,</li> <li>• Bit 2: WD_Base_1ms,</li> <li>• Bit 3 – 5: reserved,</li> <li>• Bit 6: Fail_Safe,</li> <li>• Bit 7 : DPV1_Enable,</li> </ul> These bits report the slave capabilities to the master and are changed by the MS0 master following its capabilities                                                                                                                                                                      |
| 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DPV1_Status_2  | [5] 6.2.4.8   | The following GSD values are used [6]: <ul style="list-style-type: none"> <li>• Bit 0: Check_Cfg_Mode,</li> <li>• Bit 1: reserved,</li> <li>• Bit 2: Enable_Update_Alarm,</li> <li>• Bit 3: Enable_Status_Alarm,</li> <li>• Bit 4: Enable_Manufacturer_Specific_Alarm,</li> <li>• Bit 5: Enable_Diagnostic_Alarm,</li> <li>• Bit 6: Enable_Process_Alarm,</li> <li>• Bit 7: Enable_Pull_Plug_Alarm,</li> </ul> These bits report the slave capabilities to the master and are changed by the MS0 master following its capabilities |
| 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DPV1_Status_3  | [5] 6.2.4.9   | <ul style="list-style-type: none"> <li>• Bit 0-2: - ,</li> <li>• Bit 3: Prm Structure,</li> <li>• Bit 4: IsoM_Req,</li> <li>• Bit 5-6: reserved,</li> <li>• Bit 7: Prm_Cmd</li> </ul>                                                                                                                                                                                                                                                                                                                                              |
| 28                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | User_Prm_Data  |               | From Byte 28 of the BMCP, a DTM has to insert additional user parameter data. The information is given in the GSD file via value of User_Prm_Data                                                                                                                                                                                                                                                                                                                                                                                  |
| ...                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p>NOTE 1 It is possible that a module does not have user parameter data. In this case, no parameter string is inserted into the BMCP for this module.</p> <p>NOTE 2 Some slaves have some fixed modules besides the BIM. Even if these modules do not appear in the configuration dialog or are not represented as Module DTMs, they have to be considered in the BCMP if they have parameters.</p> <p>NOTE 3 The three DPV1 status bytes are defined by the MS0 master.</p> |                |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

### 6.5.2.2.3 Part 3: Configuration data

The configuration data are provided as part 3:

**Table 5 – BMPC Part3 – Configuration data**

| Byte                | Name         | Source        | Notice                            |
|---------------------|--------------|---------------|-----------------------------------|
| 16+Prm_Data_Len     | Cfg_Data_Len | [5] 6.2.12.13 | Length including this value       |
| 16+Prm_Data_Len + 1 |              |               |                                   |
| 16+Prm_Data_Len +2  | Cfg_Data     |               | Configuration data (if available) |
| ...                 |              |               |                                   |

From byte position (16+Prm\_Data\_Len +2), the configuration strings for the BIM and the modules are provided in ascending order. The information is given in the GSD file via value module.

NOTE 1 Some slaves have some fixed modules besides the BIM. Even if these modules do not appear in the configuration dialog or are not represented as Module DTMs, they have to be considered in the BCMP if they have parameters.

NOTE 2 Empty slots have to be considered in the configuration data. Refer to the GSD file as to which configuration string has to be used.

### 6.5.2.2.4 Part 4: Address table and slave user parameters

In Part 4 of the BMCP, the address table and the slave user parameter section is provided.

**Table 6 – Part 4: Address table and slave user parameters**

| Byte                                               | Name                | Source        | Hints                               |
|----------------------------------------------------|---------------------|---------------|-------------------------------------|
| 16 + Prm_Data_Len + Cfg_Data_Len                   | Add_Tab_Len         | [5] 6.2.12.15 | Length including this value         |
| 16 + Prm_Data_Len + Cfg_Data_Len + 1               |                     |               |                                     |
| 16 + Prm_Data_Len + Cfg_Data_Len + Add_Tab_Len     | Slave_User_Data_Len | [6] 6.2.12.21 | Length including this value         |
| 16 + Prm_Data_Len + Cfg_Data_Len + Add_Tab_Len + 1 |                     |               |                                     |
| 16 + Prm_Data_Len + Cfg_Data_Len + Add_Tab_Len + 2 | Slave_User_Data     |               | Slave user parameter (if available) |
| ...                                                |                     |               |                                     |

After Add\_Tab\_Len the address table data is inserted into the BMCP. If the master does not support this table the Add\_Tab\_Len is set to 2 and no data is inserted.

After Slave\_UserDataLen the slave user data is inserted into the BMCP. If the master does not support this data the Slave\_User\_Data\_Len is set to 2 and no data is inserted.