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SPECIFICATION

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PAS 62453-3

Pre-Standard

First edition
2006-05

Field Device Tool (FDT) interface specification –

Part 3:
PROFIBUS communication

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Field Device Tool (FDT) interface specification –

Part 3: PROFIBUS communication

FOREWORD

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IEC-PAS 62453-3 has been processed by subcommittee 65C: Digital communications, of IEC technical committee 65: Industrial-process measurement and control.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	Report on voting
65C/398A/NP	65C/411/RVN

Following publication of this PAS, which is a pre-standard, the technical committee or subcommittee concerned will transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of three years starting from 2006-05. The validity may be extended for a single three-year period, following which it shall be revised to become another type of normative document or shall be withdrawn.

IEC 62453 consists of the following parts under the general title *Field Device Tool (FDT) interface specification*:

Part 1: Concepts and detailed description

Part 2: INTERBUS communication

Part 3: PROFIBUS communication

Part 4: HART communication

Part 5: FOUNDATION FIELDBUS communication

INTRODUCTION

This PAS is an interface specification for developers of FDT components for Function Control and Data Access within a Client Server architecture. The specification is a result of an analysis and design process to develop standard interfaces to facilitate the development of servers and clients by multiple vendors that shall inter-operate seamlessly.

With the integration of fieldbusses into control systems, there are a few other tasks which must be performed. This applies to fieldbusses in general. Although there are fieldbus- and device-specific tools, there is no unified way to integrate those tools into higher level system-wide planning or engineering tools. In particular, for use in extensive and heterogeneous control systems, typically in the area of the process industry, the unambiguous definition of engineering interfaces that are easy to use for all those involved, is of great importance.

A device-specific software component, called DTM (Device Type Manager), is supplied by the field device manufacturer with its device. The DTM is integrated into engineering tools via the FDT interfaces defined in this specification. The approach to integration is in general open for all kind of fieldbusses and thus meets the requirements for integrating different kinds of devices into heterogeneous control systems.

Field Device Tool (FDT) interface specification –

Part 3: PROFIBUS communication

1 Scope

This part of IEC 62435 provides information for integrating the PROFIBUS protocol into the FDT interface specification (IEC 62453-1). This PAS neither contains the FDT specification nor modifies it.

2 Normative references

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

IEC 61158:2003 (all parts), *Digital data communications for measurement and control – Fieldbus for use in industrial control systems*

IEC 61158-2:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 2: Physical layer specification and service definition*

IEC 61158-5:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 5: Application layer service definition*

IEC 62453-1, *Field Device Tool (FDT) interface specification – Part 1: Concepts and detailed description*

3 General

3.1 PROFIBUS schema

PROFIBUS schemas are required to define the structure and semantics of the protocol-specific data transferred via XML documents on the FDT interfaces.

The schemas are based on definitions given in the PROFIBUS-Specification. Furthermore, they contain additional information about the device that is needed by systems to configure PROFIBUS links and to establish communication between the PROFIBUS master device and the PROFIBUS slave devices.

3.1.1 Configuration

The configuration of the device itself is done with the aid of the DTM's GUI. Downloading the configuration into the slave device is performed via the PROFIBUS master device. To do that and in order to set up the bus communication the master needs information from the DTM as there is:

- GSD file
The GSD information is type-specific information and not instance-specific. It is not stored with single slave instances or in a global accessible file. It is provided by the DTm at IDtmInformation. On method GetInformation(), a DTM of a PROFIBUS device provides the GSD information within its XML document.
The master device can use the general type-specific information from the slave's GSD information like bus timing parameters, supported baud rates etc.

- **CFG-String (Cfg_Data)**
The CFG-String provides the instance-specific information about the current configuration of the device. It defines the structure of the data frames that will be transmitted on the PROFIBUS. This structure depends on the modules that are actually configured.
The DTM provides the CFG-String within the attribute `busMasterConfigurationPart` that is part of the XML document available via `IDtmParameter::GetParameters()`. The structure of the `busMasterConfigurationPart` is defined according to the PROFIBUS-DP-Slave-Bus-Parameter-Set (see Bibliography and also IEC 61158 series).
The master device uses this information to set up communication with the slave device.

3.1.2 Channels

In case of PROFIBUS, an FDT channel is a representative for a single data or a process value that can be accessed from a Frame Application via the master device. The XML document available at `IFdtChannel` describes how to access a channel via a PROFIBUS DPV1 command or how to address a channel within a PROFIBUS DP frame for cyclic I/O. Besides all mandatory elements (which includes id and dp address) it is highly recommended that the XML document provides DPV1 address information. This information (DPV1 Slot) is used by some frames to manage the PROFIBUS device module information.

In a DPV0 environment, depending on the situation, the underlying master device may have either Master Class 1 functionality or Master Class 2 functionality. A Class 1 master can write output data to a device and control data exchange, where a Class 2 master can only read the output data. Generally it is assumed that parameterization as described here is performed as a master Class 2 station.

3.1.3 Parameterization

There are two options to write parameters set from the DTM's GUI to the PROFIBUS slave device in the field:

- **User Parameters**
User Parameters are part of the PROFIBUS-DP-Slave-Bus-Parameter-Set. They contain manufacturer-specific data to characterize the DP-Slave. The DTM writes the User Parameters to the `busMasterConfigurationPart`. The User Parameters are stored with the master device during PROFIBUS master configuration and are automatically sent to the slave during the setup of bus communication. (This is PROFIBUS-specific; for details, see IEC 61158 series.) When changing User Parameters on runtime, the DTM must use a DP-V0 connection and the appropriate DP-V0 commands for parameter exchange as described in the XML schemas.
- **Writing Parameters with DP-V1 services (MSAC2 services)**
The DTM may use DP-V1 transport services to send its parameters to the slave device. For that, it has to use a DP-V1 connection and the corresponding communication commands. During the setup of communication, DP-V1 services are not sent automatically. The Frame Application or a DTM must invoke a download of parameters via DP-V1.

For details on the different behavior of slaves depending on the kind of parameterization, refer to the IEC 61158 series.

DP-V1 connections and communication commands can also be used to execute commands at the slave. For details on the use of DP-V1, see also IEC 61158 series.

4 Provided data

4.1 Interface IDtmParameter

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

4.2 SingleDataAccess interfaces

Via the interfaces IDtmSingleDeviceDataAccess and IDtmSingleInstanceDataAccess at least all parameters of the Physical Block and the status and Out value of the Function Blocks must be exposed.

5 Protocol specific usage of XML attributes

Table 1 explains how attributes in documents of the SingleDataAccess interfaces are used with PROFIBUS protocols.

Table 1 – SingleDataAccessSchema attributes

Attribute	Description for use in Profibus
address	Profibus Slave Address: The attribute 'address' (defined in FDTDataTypesSchema.xml) follow the different device models that are defined for PROFIBUS devices. FDT currently supports following models: PROFIBUS DP / DPV1, PROFIBUS PA, PROFIdrive (greater or equal profile version 3) PROFIBUS DP / DPV1 The device model is based on devices that are composed of slots, whereas slots do not have to represent physical objects. The data that is contained in the slots, are addressable via Indexes. This data may be variables or composed blocks of data. The address attribute is APIxxSLOTyyINDEXzz xx API yy Slot zz Index xx, yy, zz are based on decimal format without leading '0' PROFIBUS PA The device is represented by a device management structure and a number of blocks that provide different functionality (physical block, function block, transducer block). The blocks are mapped to slot addresses, but this mapping may vary depending on the device type. The address attribute is APIxxSLOTyyINDEXzz xx API yy Slot zz Index xx, yy, zz are based on decimal format without leading '0' PROFIdrive According to the PROFIdrive profile, a device (drive unit) may be composed by a number (1-many) of drive objects (DOs). The DOs may have different type. Each DO is uniquely identifiable and manages its own parameters. Each parameter can be uniquely identified by its number (PNU). Each DO has its own number space. A parameter may contain simple data or composed data (e.g. arrays). The data of the device are accessible via a parameter channel (normally slot 0 index 47). The address attribute is APIxxSLOTyyINDEXzz.DODO-id.pnu

Attribute	Description for use in Profibus
	xx API yy Slot zz Index do-id Drive Object ID pnu ParameterNumber xx, yy, zz, do-id, pnu are based on decimal format without leading '0'
busCategory	See Clause 6
deviceTypeIeld	The attribute "fdt:DtmDeviceType/@deviceTypeIeld" must contain the IDENT_NUMBER of the supported physical device. The IDENT_NUMBER must be entered in decimal format, however, the value should be displayed as hex to the user
deviceTypeInformation	A PROFIBUS device has to provide its GSD information as human readable string at this attribute NOTE The GSD information is accessible via IDtmParameter::GetParameters() IDtmInformation::GetInformation()
deviceTypeInformationPath	Path to the file containing the information which is provided via the attribute 'deviceTypeInformation'. In case of PROFIBUS the attribute contains the full path to the GSD file including the file name. The file name depends on the current locale according to the usage of IDtm::SetLanguage(). For PROFIBUS devices it is mandatory to provide this attribute. Examples: English: 'C:\MyFolder\ABCD.GSE' German: 'C:\MyFolder\ABCD.GSG'
manufacturerId	Enter manufacturer according to Profile specification, for example in Profibus PA : Physical Block Index 10 : DEVICE_MAN_ID
semanticId applicationDomain	The SemanticIDs for PROFIBUS follow the different device models, that are defined for PROFIBUS devices. FDT currently supports the following models: PROFIBUS DP, PROFIBUS PA, PROFIdrive. PROFIBUS PA The applicationDomain is: FDT_PROFIBUS_PA The device is represented by a device management structure and a number of blocks that provide different functionality (physical block, function block, transducer block). The blocks are mapped to slot addresses, but this mapping may vary depending on the device type. Since the device model is based on blocks, the SemanticIDs also are based on the block model. Within each block, the data is identifiable by names of parameters. The semanticId for PROFIBUS profile-related parameter follows the following rules: The semanticId must be built based on the names defined in the profiles Structured parameters must be combined with a '.' Spaces within the profile definition must be exchanged with an underscore. Blocks must be counted according to the Object Dictionary

Attribute	Description for use in Profibus
	The block number must be part of the semanticID The semanticId is: BlockType.BlockIndex.NameOfParameter.AttributeOfParameter <i>Example:</i> AnalogInputFB.3.OUT.Unit PROFIdrive The applicationDomain is: FDT_PROFIBUS_PROFIDRIVE According to the PROFIdrive profile, a device (drive unit) may be composed by a number (1-many) of drive objects (DOs). The DOs may have different type. Each DO is uniquely identifiable and manages its own parameters. Each parameter can be uniquely identified by its number (PNU). Each DO has its own number space. A parameter may contain simple data or composed data (e.g. arrays). The data of the device are accessible via a parameter channel (normally slot 0 index 47). The semanticId is: DOdo-id.PNUpnu do-id Drive Object ID pnu ParameterNumber do-id, pnu are based on decimal format without leading '0' <i>Example:</i> DO3.PNU64 PROFIBUS DPV1, The applicationDomain is: FDT_PROFIBUS_DPV1 The device model is based on devices that are composed of slots, whereas slots do not have to represent physical objects. The data that is contained in the slots are addressable via Indexes. This data may be variables or composed blocks of data. The semanticID for devices not based on a profile is directly based on the PROFIBUS address information: The semanticId is: APIxx.SLOTyy.INDEXzz xx API yy Slot zz Index xx, yy, zz are based on decimal format without leading '0'
subDeviceType	Enter manufacturer-specific value here

6 Bus category

Profibus protocol is identified by the following unique identifier in busCategory attributes within XML BusCategory elements:

BusCategory Element	Description
036D1499-387B-11D4-86E1-00E0987270B9	Support of Profibus DP V0 protocol
036D1497-387B-11D4-86E1-00E0987270B9	Support of Profibus DP V1 protocol

Profibus uses the following unique identifier in physicalLayer attributes within XML PhysicalLayer elements:

PhysicalLayer Element	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

7 Communication schema

Used at: IFdtCommunication::ConnectRequest()

IFdtCommunicationEvents2::OnConnectResponse2()

IFdtCommunication::DisconnectRequest()

IFdtCommunicationEvents::OnDisconnectResponse ()

IFdtCommunication::TransactionRequest()

IFdtCommunicationEvents::OnTransactionResponse)

7.1 DPV0 communication

The XML document contains the address information and the communication data.

The supported services depend on the type of PROFIBUS master functionality that is provided by the communication infrastructure. Master Class 1 devices typically control the slaves and provide cyclic communication, Master Class 2 devices typically are used to configure the slaves and provide acyclic communication.

Not all defined services are supported if the Master is not in cyclic data exchange with the slaves. In such cases the following behavior is expected.

If a Communication Channel receives a request that can not be supported, it returns the TransactionRequest() with a result="false". (See Tables 2 and 3.)

Table 2 – DPV0CommunicationSchema attributes

Attribute	Description
busAddress	Address information according to the IEC 61158 series (see also DTMPParameterSchema, attribute busAddress)
connectStatus	Describes the connection status established by the communication component. The status "masterConnectedOnly" means that the communication component has established a connection to the Profibus master device and will accept an online access to the user parameters, independent whether the device is available or not. The Status "deviceAtLifeList" means that the communication component has established a connection to the Profibus master device and has checked that the device is in the life list of the master stack. In this state the master will accept an online access to the user parameters and will send the user parameter to the device, independent of whether the device is in data-exchange or not. The status "deviceInDataExchange" means that the communication component has established a connection to the Profibus master device and has checked that the device is in data-exchange. In this state the master will accept an online access to the user parameters and will send the user parameter to the device, so that the new data will directly influence the process

Attribute	Description
errorCode	Status information according to the IEC 61158 series. For description of error code see: DIN 19245 Part 3, PROFIBUS (P. 40ff., 83ff., 39)
communicationReference	Mandatory identifier for a communication link to a device This identifier is allocated by the communication component during the connect. The address information has to be used for all following communication calls
delayTime	Delay time in ms between two communication calls
sequenceTime	Period of time in ms for the whole sequence
schemaVersion	Defines the version of the schema

Table 3 – DPV0CommunicationSchema elements

Tag	Description	Master Class
Abort	Describes the abort	-
ConnectRequest	Describes the communication request to establish a connection to a Profibus master device. Depending on the network infrastructure used it is possible that this service is not mapped to a field bus request, but is used to manage the software. It is also possible that this service is used as a trigger to set the state of a device.	-
ConnectResponse	Describes the communication response to the connect request and provides the information on how the following WriteUserParameter commands will be sent to the device (see connectStatus). The resulting connection depends on the communication device used and on the configuration of the bus master. The DeviceDTM must expect that the resulting connection cannot be used to access all services. ConnectResponse may return true even if there is no communication with the device possible. For example, if ConnectRequest returns true with connectionStatus = "masterConnectedOnly" this means that there is a connection to the master device, but the device is not at the life list and can therefore not be accessed. Depending on the connectStatus some services may not be available (e.g. in status "masterConnectedOnly" only services provided by the master are accessible (ReadUserParameter, WriteUserParameter, ...)) whereas services provided by the device are not accessible. It should be noted that in this example the DTM is in state "online" but it cannot access the device. The provided services also depend on the type of master device. For an overview of availability of services depending on the type of connection, see the following tables	-
DisconnectRequest	Describes the communication request to release a connection to a Profibus master device	-
DisconnectResponse	Describes the communication response	-
FDT	Root tag	-
ReadUserParameterRequest	Describes the communication request according to the Profibus DPV0 specification. The request retrieves only the information that is available from the master device (local service). It may differ from the actual data of the device. The implementation on how to provide the data is proprietary. This is based on a local service or not available	1

Tag	Description	Master Class
ReadUserParameterResponse	Describes the communication response, read from the Profibus master device, according to the Profibus DPV0 specification. The returned data may reflect only the information that is available from the master device. It may differ from the actual data of the device	–
WriteUserParameterRequest	Describes the communication request according to the Profibus DPV0 specification. The user parameter will be send according to the established connection (see connectStatus). For Master Cl. 1 this is based on the service "DDLm_Set_Prm". For Master Cl. 2 this is based on the service "DDLm_Set_Prm" (an optional service)	1, 2
WriteUserParameterResponse	Describes the communication response according to the Profibus DPV0 specification	–
ReadOutputDataRequest	Describes the communication request according to the Profibus DPV0 specification Depending on whether the underlying FDTChannel is a Master Cl. 1 or a Master Cl. 2 this service will be local or result in a read access to the slave device. It is possible to specify which data will be read by providing an fdt:ChannelReference. For Master Cl. 1 this is a proprietary service (or un-available). For Master Cl. 2 refer to [1], section 8.2.2.3.6. "Read Output" (an optional service)	1, 2
ReadOutputDataResponse	Describes the communication response according to the Profibus DPV0 specification	–
SequenceBegin	Describes the sequence begin	–
SequenceEnd	Describes the sequence end	–
SequenceStart	Describes the sequence start	–
WriteOutputDataRequest	Describes the communication request according to the Profibus DPV0 specification. The output data will be sent according to the established connection. It is necessary to specify which data will be written by providing an fdt:ChannelReference. If the underlying FDTChannel is provided as Master Cl. 2, writing Output Data will be not possible. Refer to IEC 61158-5, 8.2.2.3.5: "Set Output" This functionality depends on the type of master used. In terms of PLC this functionality is named "forcing" of values	1
WriteOutputDataResponse	Describes the communication response according to the Profibus DPV0 specification	–
ReadInputDataRequest	Describes the communication request according to the Profibus DPV0 specification. Depending on whether the underlying FDTChannel is an Master Cl. 1 or a Master Cl. 2 this service will be local or result in a read access to the slave device. It is possible to specify which data is read by providing an fdt:ChannelReference. For Master Cl.1 refer to IEC 61158-5, 8.2.2.3.3: "Get Input". For Master Cl.2 refer to IEC 61158-5, 8.2.2.3.2: "Read Input"	1, 2
ReadInputDataResponse	Describes the communication response according to the Profibus DPV0 specification	–
ReadDiagnosisDataRequest	Describes the communication request according to the Profibus DPV0 specification. For Master Cl.1 refer to IEC 61158-5, 8.2.3.3.2: "Get slave diag". For Master Cl.2 refer to IEC 61158-5, 8.2.3.3.3: "Read slave diag"	1, 2

Tag	Description	Master Class
ReadDiagnosisDataResponse	Describes the communication response according to the Profibus DPV0 specification	–

Depending on the bus master type and on the returned connectStatus the following services are available, see Table 4.

Table 4 – Availability of services depending on master and connect status

For Master Class1 (C1)			
	connectStatus		
Slave DTM Service Request	masterConnectedOnly	DeviceAtLifeList	DeviceInDataExchange
Connect	✓	✓	✓
ReadUserParameter	✓	✓	✓
WriteUserParameter	✓	✓	✓
ReadOutputData			✓
WriteOutputData			O
ReadInputData			✓
ReadDiagnosisData		✓	✓
For Master Class2 (C2)			
	connectStatus		
Slave DTM Action	masterConnectedOnly	DeviceAtLifeList	DeviceInDataExchange
Connect	✓	✓	✓
ReadUserParameter	✓	✓	✓
WriteUserParameter	✓	✓	✓
ReadOutputData			✓
WriteOutputData			
ReadInputData			✓
ReadDiagnosisData		✓	✓
NOTE ✓ means that the service is available; O means that the service is optional and may be available, depending on the capabilities of the underlying master device.			

```

<Schema name="FDTPProfibusDPV0CommunicationSchema" xmlns="urn:schemas-microsoft-com:xml-data"
xmlns:dt="urn:schemas-microsoft-com:datatypes" xmlns:fdt="x-schema:FDTDataTypesSchema.xml">
  <!--Definition of Attributes-->
  <AttributeType name="schemaVersion" dt:type="number" default="1.21"/>
  <AttributeType name="busAddress" dt:type="ui1"/>
  <AttributeType name="errorCode" dt:type="bin.hex"/>
  <AttributeType name="communicationReference" dt:type="uuid"/>
  <AttributeType name="connectStatus" dt:type="enumeration" dt:values="masterConnectedOnly deviceAtLifeList
deviceInDataExchange"/>
  <AttributeType name="sequenceTime" dt:type="ui4"/>
  <AttributeType name="delayTime" dt:type="ui4"/>
  <!--Definition of Elements-->
  <ElementType name="ConnectRequest" content="empty" model="closed">
    <attribute type="fdt:nodet" required="no"/>
    <attribute type="busAddress" required="yes"/>
    <attribute type="fdt:systemTag" required="no"/>
  </ElementType>
  <ElementType name="ConnectResponse" content="empty" model="closed">
    <attribute type="fdt:nodet" required="no"/>
  </ElementType>

```

```

        <attribute type="busAddress" required="yes"/>
        <attribute type="communicationReference" required="yes"/>
        <attribute type="connectStatus" required="yes"/>
    </ElementType>
    <ElementType name="DisconnectRequest" content="empty" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="busAddress" required="yes"/>
        <attribute type="communicationReference" required="yes"/>
    </ElementType>
    <ElementType name="DisconnectResponse" content="empty" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="busAddress" required="yes"/>
        <attribute type="communicationReference" required="yes"/>
    </ElementType>
    <ElementType name="ReadUserParameterRequest" content="empty" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
    </ElementType>
    <ElementType name="ReadUserParameterResponse" content="eltOnly" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <attribute type="errorCode" required="yes"/>
        <element type="fdt:CommunicationData" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="WriteUserParameterRequest" content="eltOnly" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <element type="fdt:CommunicationData" minOccurs="1" maxOccurs="1"/>
    </ElementType>
    <ElementType name="WriteUserParameterResponse" content="empty" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <attribute type="errorCode" required="yes"/>
    </ElementType>
    <ElementType name="ReadOutputDataRequest" content="eltOnly" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <element type="fdt:ChannelReference" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="ReadOutputDataResponse" content="eltOnly" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <attribute type="errorCode" required="yes"/>
        <element type="fdt:CommunicationData" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="WriteOutputDataRequest" content="eltOnly" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <element type="fdt:ChannelReference" minOccurs="1" maxOccurs="1"/>
        <element type="fdt:CommunicationData" minOccurs="1" maxOccurs="1"/>
    </ElementType>
    <ElementType name="WriteOutputDataResponse" content="empty" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <attribute type="errorCode" required="yes"/>
    </ElementType>
    <ElementType name="ReadInputDataRequest" content="eltOnly" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <element type="fdt:ChannelReference" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="ReadInputDataResponse" content="eltOnly" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <attribute type="errorCode" required="yes"/>
        <element type="fdt:CommunicationData" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="ReadDiagnosisDataRequest" content="empty" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
    </ElementType>
    <ElementType name="ReadDiagnosisDataResponse" content="eltOnly" model="closed">
        <attribute type="fdt:nodell" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <attribute type="errorCode" required="yes"/>
        <element type="fdt:CommunicationData" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="SequenceBegin" content="empty" model="closed">

```

```

        <attribute type="sequenceTime" required="no"/>
        <attribute type="delayTime" required="no"/>
        <attribute type="communicationReference" required="yes"/>
    </ElementType>
    <ElementType name="SequenceEnd" content="empty" model="closed">
        <attribute type="communicationReference" required="yes"/>
    </ElementType>
    <ElementType name="SequenceStart" content="empty" model="closed">
        <attribute type="communicationReference" required="yes"/>
    </ElementType>
    <ElementType name="Abort" content="empty" model="closed">
    <attribute type="communicationReference" required="no"/>
    </ElementType>
    <ElementType name="FDT" content="eltOnly" model="closed">
        <attribute type="schemaVersion" required="no"/>
        <attribute type="fdt:nodeId" required="no"/>
        <group order="one">
            <element type="ConnectRequest"/>
            <element type="ConnectResponse"/>
            <element type="DisconnectRequest"/>
            <element type="DisconnectResponse"/>
            <element type="ReadUserParameterRequest"/>
            <element type="ReadUserParameterResponse"/>
            <element type="WriteUserParameterRequest"/>
            <element type="WriteUserParameterResponse"/>
            <element type="ReadOutputDataRequest"/>
            <element type="ReadOutputDataResponse"/>
            <element type="WriteOutputDataRequest"/>
            <element type="WriteOutputDataResponse"/>
            <element type="ReadInputDataRequest"/>
            <element type="ReadInputDataResponse"/>
            <element type="ReadDiagnosisDataRequest"/>
            <element type="ReadDiagnosisDataResponse"/>
            <element type="SequenceBegin"/>
            <element type="SequenceEnd"/>
            <element type="SequenceStart"/>
            <element type="Abort"/>
            <element type="fdt:CommunicationError"/>
        </group>
    </ElementType>
</Schema>

```

7.2 DPV1 communication

The XML document contains the address information and the communication data, see Table 5.

Table 5 – DPV1CommunicationSchema attributes and elements

Attribute	Description
api	Address information according to the IEC 61158 series. If the device needs special values for the DPV1-Initiate, the DeviceDTM is responsible for providing the values in the ConnectRequest. If the values are not provided, the communication component will use default values (0)
busAddress	Address information according to the IEC 61158 series (see also DTMPParameterSchema, attribute busAddress)
errorCode	Status information according to the IEC 61158 series. For description of error code see: PROFIBUS Nutzerorganisation e.V., PROFIBUS Guideline, Order-Nr. 2.0082, Technical Guideline, PROFIBUS – DP Extensions to EN 50170 (DPV1), Version 2.0, April 1998, (P. 120-121). For description of abort information see: DIN 19245 Part 3, PROFIBUS, (P. 54ff., 11)
index	Address information according to the IEC 61158 series
communicationReference	Mandatory identifier for a communication link to a device This identifier is allocated by the communication component during the connect. The address information has to be used for all following communication calls
delayTime	Minimum delay time in ms between two communication calls
MaxLenDataUnit	Optional attribute, to describe the amount of data, which can be transferred via the established connection If this attribute is not available, no special length restriction is announced Each communication component within the chain of interfaces concerning nested communication could introduce this attribute Each communication component should change the contents of the attribute based on the following rule: The new value is the minimum of the current value and the restriction of its own implementation If a communication component has no restriction, it should hand over the given value If a communication component is able to reuse an established connection concerning a new connect request, it should take into account the data length determined for the existing connection If the data length is not applicable, the DTM should send an error message via OnErrorMessage()
networkMACAddress	Network or MAC address as described in the IEC 61158 series. If there is a networkMACAddress, (i.e. networkMACAddress <> ""), the Profibus-DPV1-Master-DTM must set the corresponding "address type" in the Initiate request telegram "1", else "0". Example: Device with address 20 (14hex) addressed via a linking device: networkMACAddress="00000000000014"
scl	Access level as described in the IEC 61158 series. If the device needs special values for the DPV1-Initiate, the DeviceDTM is responsible for providing the values in the ConnectRequest. If the values are not provided, the communication component will use default values (0)
sequenceTime	Period of time in ms for the whole sequence
slot	Address information according to the IEC 61158 series
schemaVersion	Defines the version of the schema

Attribute	Description
systemTag	System Tag of a DTM. It is strongly recommended to provide the attribute in the Request document
Element	Description
Abort	Describes the abort
ConnectRequest	Describes the communication request
ConnectResponse	Describes the communication response
destNetworkAddress	Describes the extended address of the destination
DisconnectRequest	Describes the communication request
DisconnectResponse	Describes the communication response
FDT	Root tag
NetworkAddress	Describes the extended address format
ReadRequest	Describes the communication request
ReadResponse	Describes the communication response
redundantAddresses	Describes the redundant addresses
SequenceBegin	Describes the sequence begin
SequenceEnd	Describes the sequence end
SequenceStart	Describes the sequence start
srcNetworkAddress	Describes the extended address of the source
WriteRequest	Describes the communication request
WriteResponse	Describes the communication response

Within a connect request a DTM of a Profibus redundant slave can provide additional redundant slave addresses, set within its parameter document. The busAddress attribute is to be used as preferred address; the addresses in the redundantAddresses element should be used in this order if an alternative address must be used to connect to the redundant slave.

```
<Schema name="FDTProfibusDPV1CommunicationSchema" xmlns="urn:schemas-microsoft-com:xml-data"
xmlns:dt="urn:schemas-microsoft-com:datatypes" xmlns:fdt="x-schema:FDTDataTypesSchema.xml" xmlns:fdtparam="x-
schema:DTMParameterSchema.xml">
```

```
<!--Definition of Attributes-->
```

```
<AttributeType name="schemaVersion" dt:type="number" default="1.21"/>
```

```
<AttributeType name="api" dt:type="ui1"/>
```

```
<AttributeType name="busAddress" dt:type="ui1"/>
```

```
<AttributeType name="errorCode" dt:type="bin.hex"/>
```

```
<AttributeType name="index" dt:type="ui1"/>
```

```
<AttributeType name="communicationReference" dt:type="uuid"/>
```

```
<AttributeType name="slot" dt:type="ui1"/>
```

```
<AttributeType name="sequenceTime" dt:type="ui4"/>
```

```
<AttributeType name="delayTime" dt:type="ui4"/>
```

```
<AttributeType name="maxLenDataUnit" dt:type="ui1"/>
```

```
<AttributeType name="scl" dt:type="ui1"/>
```

```
<AttributeType name="networkMACAddress" dt:type="bin.hex"/>
```

```
<!--Definition of Elements-->
```

```
<ElementType name="redundantAddresses" content="eltOnly" model="closed">
```

```
<element type="fdtparam:SlaveAddress" maxOccurs="*" minOccurs="1"/>
```

```
</ElementType>
```

```
<ElementType name="NetworkAddress" content="empty" model="closed">
```

```
<attribute type="api" required="yes"/>
```

```
<attribute type="scl" required="yes"/>
```

```
<attribute type="networkMACAddress" required="yes"/>
```

```
</ElementType>
```

```
<ElementType name="srcNetworkAddress" content="eltOnly" model="closed">
```

```
<element type="NetworkAddress" minOccurs="1" maxOccurs="1"/>
```

```
</ElementType>
```

```
<ElementType name="destNetworkAddress" content="eltOnly" model="closed">
```

```
<element type="NetworkAddress" minOccurs="1" maxOccurs="1"/>
```

```
</ElementType>
```

```

<ElementType name="ConnectRequest" content="eltOnly" model="closed">
  <attribute type="fdt:nodId" required="no"/>
  <attribute type="api" required="yes"/>
  <attribute type="busAddress" required="yes"/>
  <attribute type="fdt:systemTag" required="no"/>
  <element type="redundantAddresses" maxOccurs="1" minOccurs="0"/>
  <element type="srcNetworkAddress" minOccurs="0" maxOccurs="1"/>
  <element type="destNetworkAddress" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="ConnectResponse" content="eltOnly" model="closed">
  <attribute type="fdt:nodId" required="no"/>
  <attribute type="api" required="yes"/>
  <attribute type="busAddress" required="yes"/>
  <attribute type="communicationReference" required="yes"/>
  <attribute type="errorCode" required="yes"/>
  <attribute type="maxLenDataUnit" required="no"/>
  <element type="redundantAddresses" maxOccurs="1" minOccurs="0"/>
  <element type="srcNetworkAddress" minOccurs="0" maxOccurs="1"/>
  <element type="destNetworkAddress" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="DisconnectRequest" content="empty" model="closed">
  <attribute type="fdt:nodId" required="no"/>
  <attribute type="api" required="yes"/>
  <attribute type="busAddress" required="yes"/>
  <attribute type="communicationReference" required="yes"/>
</ElementType>
<ElementType name="DisconnectResponse" content="empty" model="closed">
  <attribute type="fdt:nodId" required="no"/>
  <attribute type="api" required="yes"/>
  <attribute type="busAddress" required="yes"/>
  <attribute type="communicationReference" required="yes"/>
  <attribute type="errorCode" required="yes"/>
</ElementType>
<ElementType name="ReadRequest" content="empty" model="closed">
  <attribute type="fdt:nodId" required="no"/>
  <attribute type="slot" required="yes"/>
  <attribute type="index" required="yes"/>
  <attribute type="communicationReference" required="yes"/>
</ElementType>
<ElementType name="ReadResponse" content="eltOnly" model="closed">
  <attribute type="fdt:nodId" required="no"/>
  <attribute type="slot" required="yes"/>
  <attribute type="index" required="yes"/>
  <attribute type="communicationReference" required="yes"/>
  <attribute type="errorCode" required="yes"/>
  <element type="fdt:CommunicationData" minOccurs="1" maxOccurs="1"/>
</ElementType>
<ElementType name="WriteRequest" content="eltOnly" model="closed">
  <attribute type="fdt:nodId" required="no"/>
  <attribute type="slot" required="yes"/>
  <attribute type="index" required="yes"/>
  <attribute type="communicationReference" required="yes"/>
  <element type="fdt:CommunicationData" minOccurs="1" maxOccurs="1"/>
</ElementType>
<ElementType name="WriteResponse" content="empty" model="closed">
  <attribute type="fdt:nodId" required="no"/>
  <attribute type="slot" required="yes"/>
  <attribute type="index" required="yes"/>
  <attribute type="communicationReference" required="yes"/>
  <attribute type="errorCode" required="yes"/>
</ElementType>
<ElementType name="SequenceBegin" content="empty" model="closed">
  <attribute type="sequenceTime" required="no"/>
  <attribute type="delayTime" required="no"/>
  <attribute type="communicationReference" required="yes"/>
</ElementType>
<ElementType name="SequenceEnd" content="empty" model="closed">
  <attribute type="communicationReference" required="yes"/>
</ElementType>
<ElementType name="SequenceStart" content="empty" model="closed">
  <attribute type="communicationReference" required="yes"/>
</ElementType>
<ElementType name="Abort" content="empty" model="closed">
  <attribute type="communicationReference" required="no"/>
</ElementType>
<ElementType name="FDT" content="eltOnly" model="closed">
  <attribute type="schemaVersion" required="no"/>
  <attribute type="fdt:nodId" required="no"/>

```

```

    <group order="one">
      <element type="ConnectRequest"/>
      <element type="ConnectResponse"/>
      <element type="DisconnectRequest"/>
      <element type="DisconnectResponse"/>
      <element type="ReadRequest"/>
      <element type="ReadResponse"/>
      <element type="WriteRequest"/>
      <element type="WriteResponse"/>
      <element type="SequenceBegin"/>
      <element type="SequenceEnd"/>
      <element type="SequenceStart"/>
      <element type="Abort"/>
      <element type="fdt:CommunicationError"/>
    </group>
  </ElementType>
</Schema>

```

Example:

```

<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusDPV1CommunicationSchema.xml" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml">
  <ReadResponse slot="1" index="1" communicationReference="13966300-d860-4d18-8bc3-f11f8c9d7597"
  errorCode="0000000000">
    <fdt:CommunicationData byteArray="FF01"/>
  </ReadResponse>
</FDT>

```

```

<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusDPV1CommunicationSchema.xml" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml">
  <ReadResponse slot="1" index="1" communicationReference="6B29FC40-CA47-1067-B31D-00DD010662DA"
  errorCode="0">
    <fdt:CommunicationData byteArray="FF01"/>
  </ReadResponse>
</FDT>

```

Example for redundancy:

```

<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusDPV1CommunicationSchema.xml" xmlns:fdt="x-schema:FDTDataTypesSchema.xml"
xmlns:fdtparam="x-schema:DTMParameterSchema.xml">
  <ConnectRequest api="4" busAddress="1">
    <redundantAddresses>
      <fdtparam:SlaveAddress slaveAddress="2"/>
      <fdtparam:SlaveAddress slaveAddress="3"/>
    </redundantAddresses>
  </ConnectRequest>
</FDT>

```

8 ChannelParameterSchema

The following Table 6 describes the mapping of DPV1 Data types to FDT data types.

Table 6 – Mapping of DPV1 data types to FDT data types

PROFIBUS Data types	FDT datatype
Boolean	Binary (0 = FALSE, all other values are considered to be TRUE)
Integer8	int
Integer16	int
Integer32	int

PROFIBUS Data types	FDT datatype
Unsigned8	byte
Unsigned16	unsigned
Unsigned32	unsigned
Floating Point	float
Visible String	string
Octet String	hexString
Date	dateAndTime
Time of Day	time
Time Difference	duration
DS-32	structured
DS-33	structured
DS-34	structured
DS-35	structured
DS-36	structured
...	structured
DS-52	structured
..	structured

The format of all data types is defined in IEC 61158 series.

If only a part of the retrieved data is process data (e.g. for DS-33 the data consist of the float-value and a byte status), the access information (DPAAddress or DPV1Address) also contains information that is necessary to retrieve the information from the data structure.

Used at: IFdtChannel::GetChannelParameters()

The ChannelParameter XML document describes a how to access a channel via a Profibus DPV1 command or how to adress a channel within a Profibus DP frame for cyclic I/O. The following Table 7 provides a description of attributes and elements of the document.

Table 7 – ChannelParameter attributes and elements

Attribute	Description
api	Address information according to the IEC 61158 series for channels accessible via Profibus DPV1
bitLength	Additional data type information especially for fieldbus specific data types like 12 bit integer
bitPosition	Address information according to the IEC 61158 series for channels accessible via Profibus DP
frameApplicationTag	Frame Application specific tag used for identification and navigation. The DTM should display this tag at channel specific user interfaces
gatewayBusCategory	Unique identifier for a supported bus type like Profibus or HART according to the FDT specific CATID
invalidBit	Bit position of the invalid status channel accessible via Profibus DP
index	Address information according to the IEC 61158 series for channels accessible via Profibus DPV1
logic	Additional data type information: positive 0=FALSE 1=TRUE
number	Address information for diagnosis according to the IEC 61158 series for channels accessible via Profibus DP.

Attribute	Description
	Read DP – Slave Diagnostic Information
protectedByChannelAssignment	TRUE if the channel is set to read only by the Frame Application. Usually set to TRUE if a channel assignment exists
schemaVersion	Defines the version of the schema
simulationBit	Bit position of the simulation status channel accessible via Profibus DP
substituteValueBit	Bit position of the substitute status channel accessible via Profibus DP
statusChannel	TRUE if the channel is for status information only
slotNumber	Address information according to the IEC 61158 series for channels accessible via Profibus DPV1
Elements	Description
DpAddress	Address information according to the IEC 61158 series for channels accessible via Profibus DP
DpV1Address	Address information according to the IEC 61158 series for channels accessible via Profibus DPV1. It is highly recommended to provide this address information to enable assignment of logical addresses to a profibus module
FDT	Root tag
FDTChannel	Description of the channel
FDTChannelType	Description of the channel component in case of channels with gateway functionality
StatusInformation	Description of additional status information for channels accessible via Profibus DP

<Schema name="FDTProfibusChannelParameterSchema" xmlns="urn:schemas-microsoft-com:xml-data" xmlns:dt="urn:schemas-microsoft-com:datatypes" xmlns:fdt="x-schema:FDTDataTypesSchema.xml" xmlns:appld="x-schema:FDTApplicationIdSchema.xml">

<!--Definition of Attributes-->

<AttributeType name="schemaVersion" dt:type="number" default="1.21"/>

<AttributeType name="api" dt:type="ui1"/>

<AttributeType name="bitLength" dt:type="ui4"/>

<AttributeType name="bitPosition" dt:type="ui4"/>

<AttributeType name="frameApplicationTag" dt:type="string"/>

<AttributeType name="gatewayBusCategory" dt:type="uuid"/>

<AttributeType name="invalidBit" dt:type="ui4"/>

<AttributeType name="index" dt:type="ui1"/>

<AttributeType name="logic" dt:type="enumeration" dt:values="positive negative"/>

<AttributeType name="number" dt:type="ui4"/>

<AttributeType name="protectedByChannelAssignment" dt:type="boolean"/>

<AttributeType name="simulationBit" dt:type="ui4"/>

<AttributeType name="statusChannel" dt:type="boolean"/>

<AttributeType name="substituteValueBit" dt:type="ui4"/>

<AttributeType name="slotNumber" dt:type="ui1"/>

<!--Definition of Elements-->

<ElementType name="DpAddress" content="empty" model="closed">

<attribute type="fdt:nodeId" required="no"/>

<attribute type="bitPosition" required="yes"/>

<attribute type="bitLength" required="yes"/>

</ElementType>

<ElementType name="DpV1Address" content="empty" model="closed">

<attribute type="fdt:nodeId" required="no"/>

<attribute type="api" required="yes"/>

<attribute type="slotNumber" required="yes"/>

<attribute type="index" required="yes"/>

<attribute type="bitPosition" required="no"/>

<attribute type="bitLength" required="no"/>

</ElementType>

<ElementType name="StatusInformation" content="empty" model="closed">

<attribute type="fdt:nodeId" required="no"/>

<attribute type="logic" required="yes"/>

<attribute type="invalidBit" required="no"/>

<attribute type="simulationBit" required="no"/>

```

        <attribute type="substituteValueBit" required="no"/>
    </ElementType>
    <ElementType name="FDTChannel" content="eltOnly" model="closed" order="seq">
        <attribute type="fdt:nodeld" required="no"/>
        <attribute type="fdt:tag" required="yes"/>
        <attribute type="fdt:id" required="yes"/>
        <attribute type="fdt:descriptor" required="no"/>
        <attribute type="protectedByChannelAssignment" required="yes"/>
        <attribute type="number" required="yes"/>
        <attribute type="fdt:dataType" required="yes"/>
        <attribute type="fdt:signalType" required="yes"/>
        <attribute type="frameApplicationTag" required="no"/>
        <attribute type="appld:applicationId" required="no"/>
        <element type="fdt:SemanticInformation" minOccurs="0" maxOccurs="1"/>
        <element type="fdt:BitEnumeratorEntries" minOccurs="0" maxOccurs="1"/>
        <element type="fdt:EnumeratorEntries" minOccurs="0" maxOccurs="1"/>
        <element type="fdt:Unit" minOccurs="0" maxOccurs="1"/>
        <element type="DpAddress" minOccurs="0" maxOccurs="1"/>
        <element type="DpV1Address" minOccurs="0" maxOccurs="1"/>
        <element type="StatusInformation" minOccurs="0" maxOccurs="1"/>
        <element type="fdt:Alarms" minOccurs="0" maxOccurs="1"/>
        <element type="fdt:Ranges" minOccurs="0" maxOccurs="1"/>
        <element type="fdt:Deadband" minOccurs="0" maxOccurs="1"/>
        <element type="fdt:SubstituteValue" minOccurs="0" maxOccurs="1"/>
        <element type="fdt:StructuredElements" minOccurs="0" maxOccurs="1"/> <!--should be used if the data type is
structured-->
    </ElementType>
    <ElementType name="FDTChannelType" content="eltOnly" model="closed">
        <attribute type="fdt:nodeld" required="no"/>
        <element type="fdt:VersionInformation" minOccurs="1" maxOccurs="1"/>
        <attribute type="gatewayBusCategory" required="no"/>
        <attribute type="statusChannel" required="no"/>
    </ElementType>
    <ElementType name="FDT" content="eltOnly" model="closed">
        <attribute type="schemaVersion" required="no"/>
        <attribute type="fdt:nodeld" required="no"/>
        <element type="FDTChannelType" minOccurs="1" maxOccurs="1"/>
        <element type="FDTChannel" minOccurs="1" maxOccurs="1"/>
    </ElementType>
</Schema>

```

Example:

```

<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusChannelParameterSchema.xml" xmlns:fdt="x-schema:FDTDataTypesSchema.xml">
    <FDTChannelType>
        <fdt:VersionInformation name="myname" vendor="myVendor" version="1.0" date="2000-08-05"/>
    </FDTChannelType>
    <FDTChannel fdt:tag="myTag" fdt:id="PV" protectedByChannelAssignment="0" number="123" fdt:dataType="float"
fdt:signalType="output">
        <DpAddress bitPosition="17" bitLength="32"/>
        <DpV1Address api="1" slotNumber="1" index="1" bitPosition="0" bitLength="32"/>
        <StatusInformation logic="positive"/>
        <fdt:Alarms>
            <fdt:Alarm alarmType="lowAlarm">
                <fdt:StaticValue staticValue="25"/>
            </fdt:Alarm>
            <fdt:Alarm alarmType="highAlarm">
                <fdt:StaticValue staticValue="100"/>
            </fdt:Alarm>
        </fdt:Alarms>
        <fdt:Ranges>
            <fdt:Range>
                <fdt:LowerRange>
                    <fdt:ChannelReference idref="PV_LOWER_RANGE_VALUE"/>
                </fdt:LowerRange>
                <fdt:UpperRange>
                    <fdt:ChannelReference idref="PV_UPPER_RANGE_VALUE"/>
                </fdt:UpperRange>
                <fdt:Unit>
                    <fdt:ChannelReference idref="PV_RANGE_VALUES_UNITS_CODE"/>
                </fdt:Unit>
            </fdt:Range>
        </fdt:Ranges>
    </FDTChannel>
</FDT>

```

9 Topology scan schema

Used at: IDtmEvents::OnScanResponse()

The XML document describes one entry in the list of scanned PROFIBUS-Devices.

Tag	Description
ProfibusDevice	Specifies a Profibus device

```
<Schema name="DTMProfibusDeviceSchema" xmlns="urn:schemas-microsoft-com:xml-data" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml" xmlns:dt="urn:schemas-microsoft-com:datatypes">
  <!--Definition of Attributes-->
  <AttributeType name="schemaVersion" dt:type="number" default="1.21"/>
  <AttributeType name="busAddress" dt:type="ui1"/>
  <!--Definition of Elements-->
  <ElementType name="ProfibusDevice" content="empty" model="closed">
    <attribute type="fdt:nodet" required="no"/>
    <attribute type="schemaVersion" required="no"/>
    <attribute type="busAddress" required="yes"/>
    <attribute type="fdt:deviceTypeid" required="yes"/>
    <attribute type="fdt:subDeviceType" required="no"/>
  </ElementType>
</Schema>
```

10 Master-bus parameter set

The following parameter set represent the content of the attribute busMasterConfigurationPart within the DTMPParameterSchema for Profibus master device, see Table 8. This attribute has to be set for each Profibus master device according to the IEC 61158 series. For further details please refer to the sequence chart “Configuration of a Fieldbus Master” and the IEC 61158 series.

Table 8 – Bus parameter set for master device

Name	Type	Comment
Bus_Para_Len	Unsigned16	Length of the bus parameter set inclusive the length parameter (range 34 to 2 ¹⁶ -1)
FDL_Add	Unsigned8	Mandatory part of the Bus Parameter Set according to PROFIBUS-DP Specification; not used in this context as station address is transferred in a separate variable; FDL-Add may differ from real station address used by EE and DTMs
Baud_rate	Unsigned8	Code number for the baud rate
T _{SL}	Unsigned16	Slot Time
min T _{SDR}	Unsigned16	Min. station delay response
max T _{SDR}	Unsigned16	Max. station delay response
T _{QUI}	Unsigned8	Quit-time
T _{SET}	Unsigned8	Setup-time
T _{TR}	Unsigned32	Target rotation time
G	Unsigned8	GAP Update Factor
HSA	Unsigned8	Highest station address
max_retry_limit	Unsigned8	Max. retry limit
Bp_Flag	Unsigned8	Flags for the user interface, e.g. error action flag

Name	Type	Comment
Min_Slave_Interval	Unsigned16	Smallest allowed time period between two slave poll cycles
Poll_Timeout	Unsigned16	Master-master timeout
Data_Control_Time	Unsigned16	Guaranteed time period between two Data_transfer_list updates
Octet 1 (reserved)	Octet-String	
....		
Octet 6 (reserved)		
Master_User_Data_Len	Unsigned16	Length of Master_User_Data inclusive lengthparameter
Master_Class2_Name	Visible-String (32)	Name of DP class 2 master the parameter set was created with
Master_User_Data	Octet-String	Manufacturer-specific

11 Slave bus parameter set

The following parameter set represents the content of the attribute busMasterConfigurationPart within the DTMPParameterSchema for Profibus slave devices, see Table 9. This attribute has to be set for each Profibus slave device according to the IEC 61158 series. For further details, refer to the sequence chart “Configuration of a Fieldbus Master” and the IEC 61158 series.

Table 9 – Bus parameter set for slave device

Name	Type	Comment
Slave_Para_Len	Unsigned16	Length of the slave parameter set inclusive the length parameter
SI_Flag	Unsigned8	Slave specific flags like New_Prm, Active, Fail_Safe,
Slave_Type	Unsigned8	Manufacturer-specific slave type denotation (0 by default for DP-Slaves)
Octet 1 (reserved)	Octet-String	
....		
Octet 12 (reserved)		
Prm_Data_Len	Unsigned16	Length of Prm_Data inclusive the length parameter (range 9 to 246)
Prm_Data	Octet-String	
Cfg_Data_Len	Unsigned16	Length of Cfg_Data inclusive the length parameter (range 3 to 246)
Cfg_Data	Octet-String	
Add_Tab_Len	Unsigned16	Length of Add_Tab inclusive the length parameter (range 2 to 2 ¹⁶ -31)
Add_Tab	Octet-String	Address assignment table
Slave_User_Data_Len	Unsigned16	Length of Slave_User_Data inclusive the length parameter (range 2 to 2 ¹⁶ -31)
Slave_User_Data	Octet-String	Manufacturer-specific data to characterize the DP-Slave for the master

12 Module and channel data

A slave's current module configuration including the relevant channels has to be available by FdtChannel objects. That is required as within the environment process variables have to be assigned to single channels and the slave configuration has to be displayed in the environment's system overview without using the DTM's user interface.

The addressing of channels within the PROFIBUS data frame is bit-oriented and data-type independent. A bit position and a bit length determine each channel. The data type of a parameter determines how to convert the bitfield.

- Channels within PROFIBUS data frames, see Figure 1:

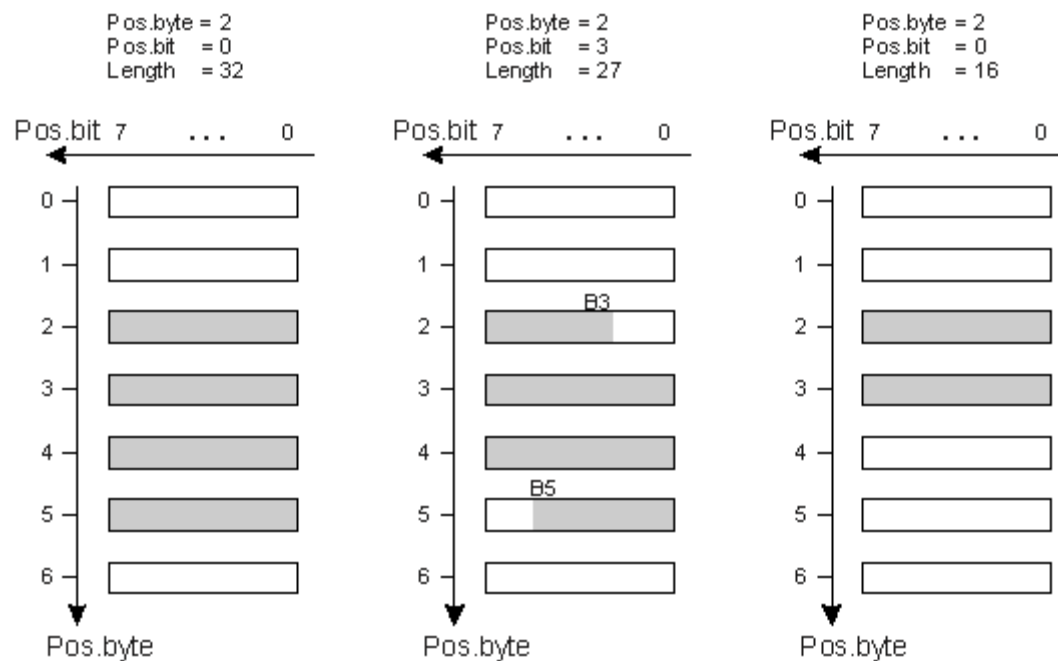


Figure 1 – Example for IO data within telegrams

- Representation in FDT Notation:

bitPosition="16"
bitLength="32"

bitPosition="19"
bitLength="27"

bitPosition="16"
bitLength="16"

The following example shows the expected structure description of a modular slave in a DTM parameter set using FDT-Parameters with the object types defined in the FDT-Specification.

- Representation of the data frame using GSD information:

```
BeginSlave;;
RIOLB8101.GSD;6;
BeginModules;;
  1X03 FrequencyCount;0x51;
  Empty ;0x00;
  Empty ;0x00;
  Empty;0x00;
  Empty;0x00;
```

Empty;0x00;
 Empty;0x00;
 2XXX ValveBlock.;0x30;
 EndModules;;
 EndSlave;;

Description of the position of signal channels within the data frame, see Table 10.

Table 10 – Signal channels within the data frame

# Frame description Remote I/O											
Vendor:	"RIO manufacturer"										
Devicetype :	"LB 8101"		Deviceid ent:			0x8101	# hex				
Frameident:	"B1t1"										
# Input data											
# Channel	# Channel l type	# Data	# Data	# Data	# Invalid Bit	# Invalid Bit	# Subst. Value Bit	# Subst. Value Bit	# Sim. Bit	# Sim. Bit	# Status- Channel
		# PoS. byte	# PoS. bit	# Length	# PoS. byte	# Pos. bit	# Pos. byte	# Pos. bit	# PoS. byte	# Pos. bit	
Module:	"EP01"	"Digital Input (Counter) LB/FB 1X03 (4 Byte)"									
"Count _1_0"	READ INT	0	0	32	-/-	-/-	-/-	-/-	-/-	-/-	0
Module:	"EP08"	"Valve block LB/FB 2XXX / 1 DO / 2 DI (1 Byte Input u. Output)"									
"DI_8_LFO UT0"	READ BOOL	4	1	1	-/-	-/-	-/-	-/-/-	-/-1		
"DI_8_LF1"	READ BOOL	4	3	1	-/-	-/-	-/-	-/-/-	-/-1		
"DI_8_LF2"	READ BOOL	4	5	1	-/-	-/-	-/-	-/-	-/-	-/-	1
# Output data											
# Channel	# Channel l type	# Data	# Data	# Data	# Invalid Bit	# Invalid Bit	# Subst. Value Bit	# Subst. Value Bit	# Sim. Bit	# Sim. Bit	# Status- Channel
		# PoS. byte	# PoS. bit	# Length	# PoS. byte"#"o". b"t"#"PoS. byte		# PoS. byte	# Pos. bit			
Modul:	"EP08"	"Valve block LB/FB 2XXX / 1 DO / 2 DI (1 Byte Input u. Output)"									
"DO_8_0"	WRITE BOOL	0	0	1	4	1	-/-	-/-	-/-	-/-	0

- Corresponding XML documents:
- DTM Parameters:

```
<?xml version="1.0"?>
<FDT xmlns="x-sch:ema:DTMParameterSchema.xml" xmlns:fdt="x-schema:FDTDataTypesSchema.xml"
fdt:storageState="persistant" fdt:dataSetState="default">
  <fdt:DtmDeviceType>
    <fdt:VersionInformation name="LB 8101" vendor="RIO Manufacturer" version="1.0" date="2000-08"05"/>
    <fdt:SupportedLanguages>
      <fdt:LanguageId languageid="1"/>
    </fdt:SupportedLanguages>
    <fdt:BusCategories>
      <fdt:BusCategory busCategory="036D1497-387B-11D4-86E1-00E098727"B9"/>
      <fdt:BusCategory busCategory="036D1499-387B-11D4-86E1-00E098727"B9"/>
    </fdt:BusCategories>
  </fdt:DtmDeviceType>
  <DtmDevice fdt:tag="00PGH10EC"01">
    <InternalTopology>
      <InternalChannel>
        <Module moduleid="1" slot="1">
          <fdt:VersionInformation name="LB/FB 1"03" vendor="RIO Manufacturer" versio="10" date="2000-
08"05" descriptor="Digital Input (Counter 4 Byte"/>
          <fdt:ChannelReferences>
            <fdt:ChannelReference idref="Count_ _0"/>
          </fdt:ChannelReferences>
        </Module>
      </InternalChannel>
      <InternalChannel>
        <Module moduleid="8" slot="8">
          <fdt:VersionInformation name="1DO / 2DI" vendor="Vendor name" version=""0" date="2000-08"05"
descriptor="Valve Block LB/FB 2XXX 1Byte Input Output"/>
          <fdt:ChannelReferences>
            <fdt:ChannelReference idref="DI_8LFO"0"/>
            <fdt:ChannelReference idref="DI_ _1"/>
            <fdt:ChannelReference idref="DI_8_ "F1"/>
            <fdt:ChannelReference idref="DI_ _2"/>
            <fdt:ChannelReference idref="DI_8_ "F2"/>
            <fdt:ChannelReference idref="DO_ _0"/>
          </fdt:ChannelReferences>
        </Module>
      </InternalChannel>
    </InternalTopology>
  </DtmDevice>
</FDT>
```

- FDT Channel "Count_1_0":

```
<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusChannelParameterSchema.xml" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml">
  <FDTChannelType>
    <fdt:VersionInformation name="Digital Input (Counter 4 Byte)" vendor="RIO Manufacturer" version="1.0"
date="2000-08"05"/>
  </FDTChannelType>
  <FDTChannel fdt:tag="00PGH10EB001" fdt:id="Count_0_1" protectedByChannelAssignment="0" number="0"
fdt:dataType="int" fdt:signalType="input">
    <DpAddress bitPosition="0" bitLength="32"/>
  </FDTChannel>
</FDT>
```

- FDT Channel "DI_8_LFOUT0":

```
<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusChannelParameterSchema.xml" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml">
  <FDTChannelType statusChannel="1">
    <fdt:VersionInformation name="Digital Input Valve Block" vendor="RIO Manufacturer" version="1.0" date="2000-
08-05"/>
  </FDTChannelType>
```

```
<FDTChannel fdt:tag="00PGH10FB001" fdt:id="DI_8LFOUT0" protectedByChannelAssignment="0" number="10"
fdt:dataType="binary" fdt:signalType="input">
  <DpAddress bitPosition="33" bitLength="1"/>
</FDTChannel>
</FDT>
```

- FDT Channel “DI_8_1”:

```
<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusChannelParameterSchema.xml" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml">
  <FDTChannelType>
    <fdt:VersionInformation name="Digital Input Valve Block" vendor="RIO Manufacturer" version="1.0" date="2000-
08-05"/>
  </FDTChannelType>
  <FDTChannel fdt:tag="00PGH10EB002" fdt:id="DI_8_1" protectedByChannelAssignment="0" number="1"
fdt:dataType="binary" fdt:signalType="input">
    <DpAddress bitPosition="34" bitLength="1"/>
    <StatusInformation logic="positive" invalidBit="35"/>
  </FDTChannel>
</FDT>
```

- FDT Channel “DI_8_LF1”:

```
<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusChannelParameterSchema.xml" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml">
  <FDTChannelType statusChannel="1">
    <fdt:VersionInformation name="Digital Input Valve Block" vendor="RIO Manufacturer" version="1.0" date="2000-
08-05"/>
  </FDTChannelType>
  <FDTChannel fdt:tag="00PGH10FB002" fdt:id="DI_8_LF1" protectedByChannelAssignment="0" number="11"
fdt:dataType="binary" fdt:signalType="input">
    <DpAddress bitPosition="35" bitLength="1"/>
  </FDTChannel>
</FDT>
```

- FDT Channel “DI_8_2”:

```
<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusChannelParameterSchema.xml" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml">
  <FDTChannelType>
    <fdt:VersionInformation name="Digital Input Valve Block" vendor="RIO Manufacturer" version="1.0" date="2000-
08-05"/>
  </FDTChannelType>
  <FDTChannel fdt:tag="00PGH10EB003" fdt:id="DI_8_2" protectedByChannelAssignment="0" number="2"
fdt:dataType="binary" fdt:signalType="input">
    <DpAddress bitPosition="36" bitLength="1"/>
    <StatusInformation logic="positive" invalidBit="37"/>
  </FDTChannel>
</FDT>
```

- FDT Channel “DI_8_LF2”:

```
<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusChannelParameterSchema.xml" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml">
  <FDTChannelType statusChannel="1">
    <fdt:VersionInformation name="Digital Input Valve Block" vendor="RIO Manufacturer" version="1.0" date="2000-
08-05"/>
  </FDTChannelType>
  <FDTChannel fdt:tag="00PGH10FB003" fdt:id="DI_8_LF2" protectedByChannelAssignment="0" number="12"
fdt:dataType="binary" fdt:signalType="input">
    <DpAddress bitPosition="37" bitLength="1"/>
  </FDTChannel>
</FDT>
```

- FDT Channel “DO_8_0”:

```
<?xml version="1.0"?>
<FDT xmlns="x-schema:FDTProfibusChannelParameterSchema.xml" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml">
  <FDTChannelType>
    <fdt:VersionInformation name="Digital Output Valve Block" vendor="RIO Manufacturer" version="1.0"
date="2000-08-05"/>
  </FDTChannelType>
  <FDTChannel fdt:tag="00PGH10EB004" fdt:id="DO_8_0" protectedByChannelAssignment="0" number="3"
fdt:dataType="binary" fdt:signalType="output">
    <DpAddress bitPosition="0" bitLength="1"/>
    <StatusInformation logic="positive" invalidBit="32"/>
  </FDTChannel>
</FDT>
```

13 ProfiSafe

13.1 Motivation

The purpose of the ProfiSafe-UseCase paper is to compile a collection of typical existing failsafe automation examples from the discrete and continuous manufacturing areas and to derive a common systematic approach. This proposed solution ought to be based on

- Profibus DPV1 and ProfiSafe communication principles,
- new possibilities of combined failsafe controllers (standard and failsafe programs within one PLC),
- and current activities of other Profibus working groups like FDT/DTM and Proxy FB.

Within the context of the ProfiSafe-UseCase paper this PAS covers the partial aspect "FDT programmers interface for individual device parameter verification".

13.2 General parameter handling

In order to communicate in a safe way, each ProfiSafe device (F-Slave) requires so-called F-Parameters for the adjustment of the operational mode of its ProfiSafe driver. Those parameters comprise watch dog time, safety integrity level, container size, etc. In case of simple F-slaves no further parameters are required. F-Parameters will therefore be defined within GSD Revision 4.0. See Figure 2.

In contrast, a complex F-slave requires additional individual and safety relevant parameters (individual device parameter) that, due to its size (>240 Bytes), often cannot be transported by the initial parameterization telegram (Prm-Telegram). As an amendment, ProfiSafe guidelines are suggesting an additional method via proxy function blocks in a safety PLC, thus providing additional functionality like program-controlled reparametrization, etc.

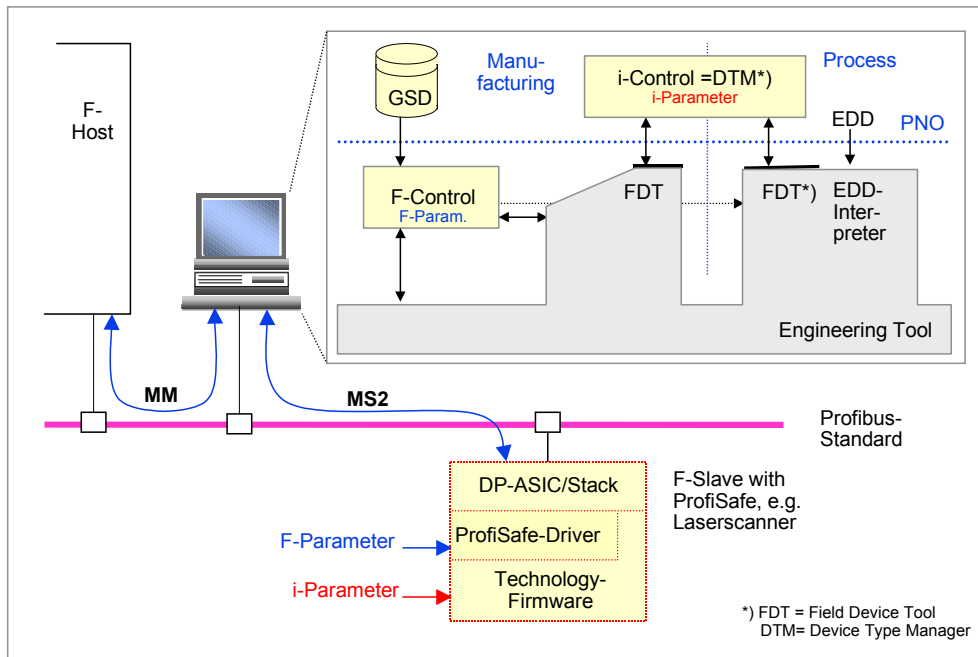


Figure 2 – F-Parameter and individual device parameter

Individual device parameters, being F-device specific by nature, ought to be handled by Device-Type-Manager programs (DTM) coming from the F-device manufacturers. The engineering tool operates as a Frame Application for such a DTM of a F-slave. It routes the communication requests of a DTM to its device (MS2) and provides data persistence. Otherwise it covers all traditional tasks like network configuration, parameterization, commissioning and diagnosis. It communicates with the PLC via the Master-Master-Protocol (MM). In this respect a PLC on the Profibus is a device of its own class (Master Class 1). The engineering tool itself is defined to be "a Master Class 2" device.

13.3 ProfiSafe individual device parameter

The structure of the ProfiSafe individual device parameter set is defined within the ProfiSafe guidelines. This set is wrapped up in XML-format for transportation across the FDT interface. See Figure 3.

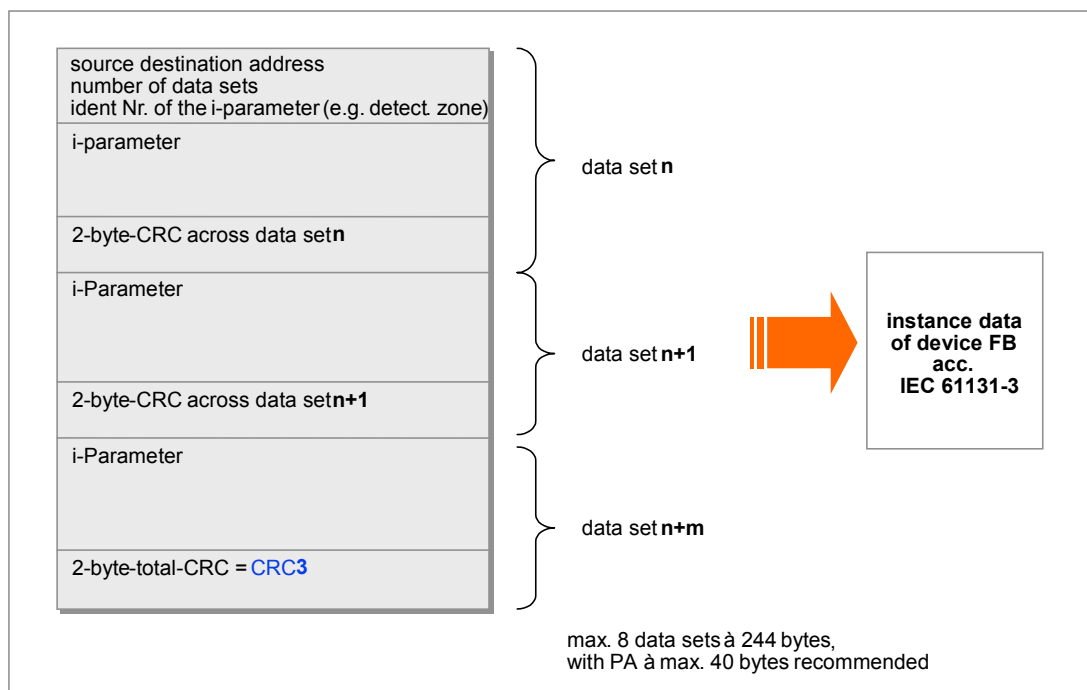


Figure 3 – Data structure of ProfiSafe individual device parameters

The data structures and the data formats of the inner individual device parameters are proprietary. The whole set is divided into parts that fit into a Profibus data set ready for transportation. Each data set comprises a 2-bytes CRC for data consistency check. The polynomial is fixed and defined within the ProfiSafe guidelines. The CRC of the last set checks the total block.

14 GSD information

The GSD information is not stored with single slave instances or in a global accessible file. It is provided by the DTM at IDtmInformation. On method GetInformation(), a DTM of a PROFIBUS device provides the GSD information within its XML document.

15 Profibus device identification

There are different Profibus specific identification elements.

A Profibus Scan may detect different device types: I&M devices, Profile devices or pure DP devices.

Following rule must be applied for Profibus communication channels:

- if I&M is available, create I&M identification,
- otherwise check Profile PA,
- otherwise create pure DP info = IDENT_NUMBER.

Profibus char array rules:

- in all strings based on char ranges defined in the fieldbus protocol specification, the leading spaces are left trimmed. The char array is to be filled with 0x20h (blank),
- in VisibleStrings, invisible characters provided by a device have to be replaced by '?'

15.1 FDTProfibusIdentSchema

The following Table 11 lists the identification relevant data, source and format for Profibus DP.

Table 11 – FDTProfibusIdentSchema – attributes with Profibus DP specific mapping

Profibus-Attribute name (semantic name)	Semantic Element	Data request in physical device	Protocol specific name	Profibus data format	XML-FDT format (display ormat)
busProtocol	IdBusProtocol	For all DP devices: "protocol_DP"	Protocol	-	Enum
slaveAddress	IdAddress	Bus address is provided as part of live list by a PROFIBUS master. Service: FMA1/2_LIVE_LIST	Slave Address	Unsigned8	string (dec)
identNumber	IdTypeID	IDENT_NUMBER can be requested by: DP Service DDLML_SLAVE_DIAG Allowed values are: Profile IDENT_NUMBER : 0x9700 (0x9700 to 0x9742) or Manufacturer specific IDENT_NUMBER	IDENT_NUMBER	Unsigned16	Bin.hex (hex)

Profibus-Attribute name (semantic name)	Semantic Element	Data request in physical device	Protocol specific name	Profibus data format	XML-FDT format (display ormat)
manufacturerSpecificExtension		Can be used by DTM for a vendor-specific device identification information, e.g. by combining a number of device parameter values into one string value. This can be used to identify a specific device variant			String

The following Table 12 shows the mapping for PROFIBUS I&M data.

Table 12 – FDTProfibusIdentSchema – attributes with Profibus I&M specific mapping

Profibus-Attribute name (semantic name)	Semantic Element	Data request in physical device	Protocol specific name	Profibus data format	XML-FDT format (display format)
identNumber, manufacturerSpecificExtension and slaveAddress as defined in DP table.					
busProtocol	IdBusProtocol	For all I&M devices : "protocol_IM"	Protocol	-	Enum
manufacturerId	IdManufacturer	I&M 0 Element 1 Mapped to PB.DEVICE_MAN_ID	MANUFACTURER_ID	Unsigned16	ui2
orderId	-	I&M 0 Element 2 Mapped to PB.DEVICE_ID	ORDER_ID	20 Octets Visible String	string [20]
serialNumber	IdSerialNumber	I&M 0 Element 3 unique serial number Mapped to PB.DEVICE_SER_NUM	SERIAL_NUMBER	16 Octets VisibleString	string [16]
hardwareRevision	IdHardwareRevision	I&M 0 Element 4 HARDWARE_REVISION <u>NOTE:</u> If the device is a PA device,(PROFILE_ID is set to 0x9700), HARDWARE_REVISION must be read from PA_I&M0 [6]	HARDWARE_REVISION	2 Octets - unsigned int 16 Converted to string to cover also : PA_I&M0 : VisibleString 16	String

Profibus-Attribute name (semantic name)	Semantic Element	Data request in physical device	Protocol specific name	Profibus data format	XML-FDT format (display format)
softwareRevision	IdSoftwareRevision	I&M 0 Element 5 SOFTWARE_REVISION <u>NOTE:</u> If the device is a PA device (PROFILE_ID is set to 0x9700), SOFTWARE_REVISION must be read from PA_I&M0 String format is used in FDT to harmonize version handling for all fieldbus protocols	SOFTWARE_REVISION	4 Octets – 1 char + 3 unsigned 8 , e.g.: V1.2.3 PA_I&M0 : VisibleString 16	String
profileID	-	I&M 0 Element 7	PROFILE_ID	2 Octets – unsigned 16	ui2
profileSpecificType	-	I&M 0 Element 8 MSB = BLOCK_OBJECT, LSB = PARENT_CLASS	PROFILE_SPECIFIC_TYPE	2 Octets – unsigned 16	ui2
imVersion	-	I&M 0 Element 9	IM_VERSION	2 Octets – unsigned 16; MSB major version xxx, LSB minor version yyy	Float xxx.yyy
imSupported	-	I&M 0 Element 10	IM_SUPPORTED	2 Octets -	ui2
tagFunction	IdTag	I&M 1 Element 1 TAG_FUNCTION	TAG_FUNCTION	32 Octets – visible string	String [32]
tagLocation	-	I&M 1 Element 2 TAG_LOCATION	TAG_LOCATION	22 Octets – visible string	String [22]
GenericSupport	IdDTMSupportLevel	Enumeration: GenericDTM, ProfileDTM, BlockSpecificProfileDTM	DTM Support Level	-	Enum

The following Table 13 lists the identification relevant data, source and format for Profibus PA.

Table 13 – FDTProfibusIdentSchema – attributes with Profibus PA specific mapping

Profibus-Attribute name (semantic name)	Semantic Element	Data request in physical device	Protocol specific name	Profibus data format	XML-FDT format (display format)
identNumber, manufacturerSpecificExtension and slaveAddress as defined in DP table.					
busProtocol	IdBusProtocol	For all PA devices : "protocol_PA"	Protocol	-	enum
manufacturerId	IdManufacturer	Physical Block - Index 10 (Unsigned16 – 2 decimal)	DEVICE_MAN_ID	Unsigned16	ui2
device_id	-	Physical Block - Index 11 - VisibleString 16	DEVICE_ID	VisibleString16	string [16]
profile	-	Block structure of physical block – element 7 : OctetString - (Index 10 – size 2)	Profile	OctetString2	ui2
profileRevision	IdBusProtocolVersion	Block structure of physical block – element 8 Unsigned 16 - (Index 6)	Profile Revision	Unsigned16	ui2
softwareRevision	IdSoftwareRevision	Physical Block - Index 8 (VisibleString 16)	SOFTWARE_REVISION	VisibleString16	string [16]
hardwareRevision	IdHardwareRevision	Physical Block - Index 9 (VisibleString 16)	HARDWARE_REVISION	VisibleString16	string [16]
serialNumber	IdSerialNumber	Physical Block - Index 12 (VisibleString 16)	DEVICE_SER_NUM	VisibleString16	string [16]
deviceTAG	IdTag	BO of PB - OctetString 32	TAG_DESC	OctetString32	String [16]
profileSpecificType	-	FDT attribute mapped to Block Object PARENT_CLASS sort of first TransducerBlock	BO PARENT_CLASS	Unsigned16	ui2
GenericSupport	IdDTMSupportLevel	Enumeration: GenericDTM, ProfileDTM, BlockSpecificProfileDTM	DTM Support Level		enum

The following Table 14 gives a description of the attributes with protocol independent semantics.

Table 14 – FDTProfibusIdentSchema – attributes with protocol independent semantics

Attribute	Description
schemaVersion	Identifies the schema version
idDTMSupportLevel	enumeration genericSupport profileSupport blockspecificProfileSupport specificSupport identSupport
match	Used by device DTM to define a regular expression which must match to scanned physical define identification information
nomatch	Used by device DTM to define a regular expression which must not match to scanned physical define identification information. Used by device DTM to indicate if identification information may not match
Tag	Description
RegExpr	Includes regular expression string – either for match or for nomatch

```
<Schema name="FDTProfibusIdentSchema" xmlns="urn:schemas-microsoft-com:xml-data" xmlns:dt="urn:schemas-microsoft-com:datatypes">
```

```
  <!--Definition of Attributes-->
  <AttributeType name="schemaVersion" dt:type="number" default="1.21"/>
  <AttributeType name="busProtocol" dt:type="enumeration" dt:values="protocol_DP protocol_IM protocol_PA"/>
  <!-- DP -->
  <!-- IM -->
  <AttributeType name="slaveAddress" dt:type="ui1"/>
  <!-- data source : live list provided by Profibus master - display decimal format -->
  <AttributeType name="identNumber" dt:type="bin.hex"/>
  <!-- Profile IDENT_NUMBER : 0x9700 ( 0x9700 to 0x9742) or Manufacturer specific IDENT_NUMBER -->
  <!-- Display format : 0xabcd -->
  <!-- IM -->
  <AttributeType name="manufacturer_id" dt:type="ui2"/>
  <!-- I&M 0 Element 1Mapped to PB.DEVICE_MAN_ID -->
  <AttributeType name="order_id" dt:type="string" dt:maxLength="20"/>
  <!-- I&M 0 Element 2 Mapped to PB.DEVICE_ID -->
  <AttributeType name="serialNumber" dt:type="string" dt:maxLength="16"/>
  <!-- I&M 0 Element 3 unique serial number - Mapped to PB.DEVICE_SER_NUM -->
  <AttributeType name="hardwareRevision" dt:type="string"/>
  <!-- I&M 0 Element 4 HARDWARE_REVISION - 2 Octets transformed to string (to be consistent to PA_I&M) -->
  <!-- if PROFILE_ID is 0x9700 = device is PA device, HARDWARE_REVISION must be read from PA_I&M0 element 2 -->
  <AttributeType name="softwareRevision" dt:type="string"/>
  <!-- I&M 0 Element 5 SOFTWARE_REVISION - 4 Octets : 4 Octets - 1 char + 3 unsigned 8 , e.g.: V1.2.3 -->
  <!-- if PROFILE_ID is 0x9700 = device is PA device, SOFTWARE_REVISION must be read from PA_I&M0 element 3 -->
  <AttributeType name="profileID" dt:type="ui2"/>
  <!--I&M 0 Element 7 PROFILE_ID -->
  <AttributeType name="profileSpecificType" dt:type="ui2"/>
  <!-- I&M 0 Element 8 PROFILE_SPECIFIC_TYPE - MSB = BLOCK_OBJECT, LSB = PARENT_CLASS -->
  <AttributeType name="imVersion" dt:type="float"/>
  <!-- I&M 0 Element 9 IM_VERSION - 2 Octets - unsigned 16; MSB major version xxx, LSB minor version yyy - convert to float xxx.yyy -->
  <!-- Frame Application and DTMs should split the float to major version and minor version for display -->
  <AttributeType name="imSupported" dt:type="ui2"/>
  <!-- I&M 0 Element 10 IM_SUPPORTED -->
  <AttributeType name="tagFunction" dt:type="string" dt:maxLength="32"/>
  <!-- I&M1 element 1 TAG_FUNCTION - mapped to semantic of IdTag -->
  <AttributeType name="tagLocation" dt:type="string" dt:maxLength="22"/>
  <!-- I&M1 element 2 TAG_LOCATION -->
```

```

<!--          PA          -->
<!--          PA          -->
<!--          PA          -->
<!-- AttributeType name="profile" dt:type="enumeration" dt:values="DP PA IM"/ -->
<AttributeType name="profilePA" dt:type="ui2"/>
<!-- Block structure of physical block - element 7 : OctetString - (Index 10 - size 2) -->
<AttributeType name="profileRevisionPA" dt:type="ui2"/>
<!-- Block structure of physical block - element 8 Unsigned 16 - (Index 6) -->
<AttributeType name="device_man_id" dt:type="ui2"/>
<!-- DEVICE_MAN_ID Physical Block - Index 10 - display format : decimal-->
<AttributeType name="device_id" dt:type="string" dt:maxLength="16"/>
<!-- DEVICE_ID Physical Block - Index 11 - VisibleString 16 -->
<AttributeType name="softwareRevisionPA" dt:type="string" dt:maxLength="16"/>
<!-- SOFTWARE_REVISION Physical Block - Index 8 (VisibleString 16) -->
<AttributeType name="hardwareRevisionPA" dt:type="string" dt:maxLength="16"/>
<!-- HARDWARE_REVISION Physical Block - Index 9 (VisibleString 16) -->
<!-- reused from I&M :
<AttributeType name="serialNumber" dt:type="string" dt:maxLength="16"/>
    DEVICE_SER_Num Physical Block - Index 12 (VisibleString 16)
-->
<AttributeType name="deviceTAG" dt:type="string" dt:maxLength="16"/>
<!-- TAG_DESC BO of PB - OctetString 32 -->
<AttributeType name="profileSpecificTypePA" dt:type="ui2"/>
<!-- block object PARENT_CLASS of first TransducerBlock -->
<!--          -->
<!--          general    -->
<!--          -->
<AttributeType name="idDTMSupportLevel" dt:type="enumeration" dt:values="genericSupport profileSupport
blockspecificProfileSupport specificSupport identSupport"/>
<AttributeType name="manufacturerSpecificExtension" dt:type="string"/>
<AttributeType name="match" dt:type="string"/>
<AttributeType name="nomatch" dt:type="string"/>
<ElementType name="RegExpr" content="empty" model="closed">
    <attribute type="match" required="no"/>
    <attribute type="nomatch" required="no"/>
</ElementType>
</Schema>

```

15.2 FDTProfibusScanIdentSchema

This schema defines the XML document provided by a scan response of a Profibus fieldbus.

Attribute	Description
schemaVersion	Identifies the schema version
resultState	Identifies if the result is one of the provisional results or the final result of the split scan results
configuredState	A communication master must indicate in this attribute, if the scan response is related to a detected physical device which is configured or unconfigured

Tag	Description
IdAddress	All elements contain exactly one attribute each including the value of the scanned physical device.
IdBusProtocol	
IdBusProtocolVersion	
IdManufacturer	
IdTypeID	
IdSoftwareRevision	
IdHardwareRevision	
IdSerialNumber	
Manufacturer_id	These elements contain corresponding attributes defined in FDTProfibusIdentSchema.xml. They are transformed to name value pairs without semantic meaning for Frame Application
Order_id	
ProfileID	
ProfileSpecificType	
ImVersion	
TagFunction	
TagLocation	
ImSupported	
IdSoftwareRevisionPA	
IdHardwareRevisionPA	
ProfileRevisionPA	
Device_man_id	
Device_id	
ProfileSpecificTypePA	
ManufacturerSpecificExtension	
ScanIdentification_IM	These elements contain all elements for the appropriate protocol variant
ScanIdentification_PA	
ScanIdentification_DP	
ScanIdentifications	Collection of ScanIdentification elements

<Schema name="FDTProfibusScanIdentSchema" xmlns="urn:schemas-microsoft-com:xml-data" xmlns:dt="urn:schemas-microsoft-com:datatypes" xmlns:profibusident="x-schema:FDTProfibusIdentSchema.xml" xmlns:fdt="x-schema:FDTDataTypesSchema.xml">

<!--Definition of Attributes-->
 <AttributeType name="schemaVersion" dt:type="number" default="1.21"/>
 <AttributeType name="resultState" dt:type="enumeration" dt:values="provisional final error"/>
 <AttributeType name="configuredState" dt:type="enumeration" dt:values="configuredAndPhysicallyAvailable configuredAndNotPhysicallyAvailable availableButNotConfigured notApplicable"/>

<!--Definition of elements-->
 <ElementType name="IdAddress" content="empty" model="closed">
 <attribute type="profibusident:slaveAddress" required="yes"/>
 </ElementType>
 <ElementType name="IdBusProtocol" content="empty" model="closed">
 <attribute type="profibusident:busProtocol" required="yes"/>
 </ElementType>
 <ElementType name="IdTypeID" content="empty" model="closed">
 <attribute type="profibusident:identNumber" required="yes"/>
 </ElementType>
 <!-- IM -->
 <!-- IM -->
 <!-- IM -->
 <ElementType name="Manufacturer_id" content="empty" model="closed">
 <attribute type="profibusident:manufacturer_id" required="yes"/>
 </ElementType>
 <ElementType name="Order_id" content="empty" model="closed">

```

    <attribute type="profibusident:order_id" required="yes"/>
  </ElementType>
  <ElementType name="IdSerialNumber" content="empty" model="closed">
    <attribute type="profibusident:serialNumber" required="yes"/>
  </ElementType>
  <ElementType name="IdHardwareRevision" content="empty" model="closed">
    <attribute type="profibusident:hardwareRevision" required="yes"/>
  </ElementType>
  <ElementType name="IdSoftwareRevision" content="empty" model="closed">
    <attribute type="profibusident:softwareRevision" required="yes"/>
  </ElementType>
  <ElementType name="IdTag" content="empty" model="closed">
    <attribute type="profibusident:deviceTAG" required="yes"/>
  </ElementType>
  <ElementType name="ProfileID" content="empty" model="closed">
    <attribute type="profibusident:profileID" required="yes"/>
  </ElementType>
  <ElementType name="ProfileSpecificType" content="empty" model="closed">
    <attribute type="profibusident:profileSpecificType" required="yes"/>
  </ElementType>
  <ElementType name="ImVersion" content="empty" model="closed">
    <attribute type="profibusident:imVersion" required="yes"/>
  </ElementType>
  <ElementType name="TagFunction" content="empty" model="closed">
    <attribute type="profibusident:tagFunction" required="yes"/>
  </ElementType>
  <ElementType name="TagLocation" content="empty" model="closed">
    <attribute type="profibusident:tagLocation" required="yes"/>
  </ElementType>
  <ElementType name="ImSupported" content="empty" model="closed">
    <attribute type="profibusident:imSupported" required="yes"/>
  </ElementType>
  <!-- -->
  <!-- PA -->
  <!-- -->
  <ElementType name="IdSoftwareRevisionPA" content="empty" model="closed">
    <attribute type="profibusident:softwareRevisionPA" required="yes"/>
  </ElementType>
  <ElementType name="IdHardwareRevisionPA" content="empty" model="closed">
    <attribute type="profibusident:hardwareRevisionPA" required="yes"/>
  </ElementType>
  <ElementType name="ProfileRevisionPA" content="empty" model="closed">
    <attribute type="profibusident:profileRevisionPA" required="yes"/>
  </ElementType>
  <ElementType name="Device_man_id" content="empty" model="closed">
    <attribute type="profibusident:device_man_id" required="yes"/>
  </ElementType>
  <ElementType name="Device_id" content="empty" model="closed">
    <attribute type="profibusident:device_id" required="yes"/>
  </ElementType>
  <ElementType name="ProfileSpecificTypePA" content="empty" model="closed">
    <attribute type="profibusident:profileSpecificTypePA" required="yes"/>
  </ElementType>
  <!-- reuse element from I&M -->
  <ElementType name="IdSerialNumber" content="empty" model="closed">
    <attribute type="profibusident:serialNumber" required="yes"/>
  </ElementType>
  <ElementType name="IdTag" content="empty" model="closed">
    <attribute type="profibusident:deviceTAG" required="yes"/>
  </ElementType>
  -->
  <!-- -->
  <!-- -->
  <!-- -->
  <ElementType name="ManufacturerSpecificExtension" content="empty" model="closed">
    <attribute type="profibusident:manufacturerSpecificExtension" required="yes"/>
  </ElementType>
  <ElementType name="ScanIdentification_DP" content="eltOnly" model="closed">
    <attribute type="configuredState" required="no"/>
    <!-- attributes with semantic meaning: -->
    <element type="fdt:CommunicationError" minOccurs="0" maxOccurs="1"/>
    <element type="IdAddress" minOccurs="1" maxOccurs="1"/>
    <element type="IdTypeID" minOccurs="1" maxOccurs="1"/>
    <element type="IdBusProtocol" minOccurs="1" maxOccurs="1"/>
    <!-- manufacturer specific extension, added in manufacturer specific identification -->
    <element type="ManufacturerSpecificExtension" minOccurs="0" maxOccurs="1"/>
  </ElementType>
  <ElementType name="ScanIdentification_IM" content="eltOnly" model="closed">

```

```

<attribute type="configuredState" required="no"/>
<!-- attributes with semantic meaning: -->
<element type="fdt:CommunicationError" minOccurs="0" maxOccurs="1"/>
<element type="IdAddress" minOccurs="1" maxOccurs="1"/>
<element type="IdTypeID" minOccurs="1" maxOccurs="1"/>
<element type="IdBusProtocol" minOccurs="1" maxOccurs="1"/>
<element type="Manufacturer_id" minOccurs="1" maxOccurs="1"/>
<element type="Order_id" minOccurs="1" maxOccurs="1"/>
<element type="IdHardwareRevision" minOccurs="1" maxOccurs="1"/>
<element type="IdSoftwareRevision" minOccurs="1" maxOccurs="1"/>
<element type="ProfileID" minOccurs="1" maxOccurs="1"/>
<element type="ProfileSpecificType" minOccurs="1" maxOccurs="1"/>
<element type="IdSerialNumber" minOccurs="1" maxOccurs="1"/>
<element type="ImVersion" minOccurs="1" maxOccurs="1"/>
<element type="TagFunction" minOccurs="1" maxOccurs="1"/>
<element type="TagLocation" minOccurs="1" maxOccurs="1"/>
<!-- TagFunction to be transformed to IdTag -->
<element type="ImSupported" minOccurs="1" maxOccurs="1"/>
<!-- manufacturer specific extension, added in manufacturer specific identification -->
<element type="ManufacturerSpecificExtension" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="ScanIdentification_PA" content="eltOnly" model="closed">
  <attribute type="configuredState" required="no"/>
  <!-- attributes with semantic meaning: -->
  <element type="fdt:CommunicationError" minOccurs="0" maxOccurs="1"/>
  <element type="IdAddress" minOccurs="1" maxOccurs="1"/>
  <element type="IdTypeID" minOccurs="1" maxOccurs="1"/>
  <element type="IdBusProtocol" minOccurs="1" maxOccurs="1"/>
  <element type="IdSoftwareRevisionPA" minOccurs="1" maxOccurs="1"/>
  <element type="IdHardwareRevisionPA" minOccurs="1" maxOccurs="1"/>
  <element type="ProfileRevisionPA" minOccurs="1" maxOccurs="1"/>
  <element type="Device_man_id" minOccurs="1" maxOccurs="1"/>
  <element type="Device_id" minOccurs="1" maxOccurs="1"/>
  <element type="ProfileSpecificTypePA" minOccurs="1" maxOccurs="1"/>
  <element type="IdSerialNumber" minOccurs="1" maxOccurs="1"/>
  <element type="IdTag" minOccurs="1" maxOccurs="1"/>
  <!-- manufacturer specific extension, added in manufacturer specific identification -->
  <element type="ManufacturerSpecificExtension" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="ScanIdentifications" content="eltOnly" model="closed">
  <attribute type="fdt:busCategory" required="yes"/>
  <attribute type="resultState" required="yes"/>
  <group order="one" minOccurs="1" maxOccurs="1">
    <element type="ScanIdentification_DP" minOccurs="0" maxOccurs="1"/>
    <element type="ScanIdentification_IM" minOccurs="0" maxOccurs="1"/>
    <element type="ScanIdentification_PA" minOccurs="0" maxOccurs="1"/>
  </group>
</ElementType>
<ElementType name="FDT" content="eltOnly" model="closed">
  <element type="ScanIdentifications" minOccurs="1" maxOccurs="1"/>
</ElementType>
</Schema>

```

15.3 FDTProfibusDeviceTypIdentSchema

The following Table 15 describes the schema for device type identification.

Table 15 – ProfibusDeviceTypIdentSchema – attributes and elements

Attribute	Description
schemaVersion	Identifies the schema version
Tag	Description
IdBusProtocol	All elements contain exactly one attribute each including the value of the scanned physical device. All elements with semantic meaning have a prefix "Id" for better identification
IdBusProtocolVersion	
IdManufacturer	
IdTypeID	
IdSoftwareRevision	
IdHardwareRevision	
Manufacturer_id	These elements contain corresponding attributes defined in FDTProfibusIdentSchema.xml. They are transformed to name value pairs without semantic meaning for Frame Application
Order_id	
ProfileID	
ProfileSpecificType	
ImVersion	
ImSupported	
IdSoftwareRevisionPA	
IdHardwareRevisionPA	
ProfileRevisionPA	
Device_man_id	
Device_id	
ProfileSpecificTypePA	
ManufacturerSpecificExtension	
DeviceIdentification _IM	These elements contain all elements for the appropriate protocol variant
DeviceIdentification _PA	
DeviceIdentification _DP	
DeviceIdentification s	Collection of DeviceIdentification elements

```

<Schema name="FDTProfibusDeviceIdentSchema" xmlns="urn:schemas-microsoft-com:xml-data" xmlns:dt="urn:schemas-microsoft-com:datatypes" xmlns:profibusident="x-schema:FDTProfibusIdentSchema.xml" xmlns:fdt="x-schema:FDTDataTypesSchema.xml">
  <!--Definition of Attributes-->
  <AttributeType name="schemaVersion" dt:type="number" default="1.21"/>
  <ElementType name="IdBusProtocol" content="eltOnly" model="closed">
    <attribute type="profibusident:busProtocol" required="no"/>
    <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="*" />
  </ElementType>
  <ElementType name="IdTypeID" content="eltOnly" model="closed">
    <attribute type="profibusident:identNumber" required="no"/>
    <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="*" />
  </ElementType>
  <!-- IM -->
  <!-- DP -->
  <ElementType name="Manufacturer_id" content="eltOnly" model="closed">

```

```

        <attribute type="profibusident:manufacturer_id" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="Order_id" content="eltOnly" model="closed">
        <attribute type="profibusident:order_id" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="IdHardwareRevision" content="eltOnly" model="closed">
        <attribute type="profibusident:hardwareRevision" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="IdSoftwareRevision" content="eltOnly" model="closed">
        <attribute type="profibusident:softwareRevision" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="ProfileID" content="eltOnly" model="closed">
        <attribute type="profibusident:profileID" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="ProfileSpecificType" content="eltOnly" model="closed">
        <attribute type="profibusident:profileSpecificType" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="ImVersion" content="eltOnly" model="closed">
        <attribute type="profibusident:imVersion" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="ImSupported" content="eltOnly" model="closed">
        <attribute type="profibusident:imSupported" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <!-- -->
    <!-- PA -->
    <!-- -->
    <ElementType name="IdSoftwareRevisionPA" content="eltOnly" model="closed">
        <attribute type="profibusident:softwareRevisionPA" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="IdHardwareRevisionPA" content="eltOnly" model="closed">
        <attribute type="profibusident:hardwareRevisionPA" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="ProfileRevisionPA" content="eltOnly" model="closed">
        <attribute type="profibusident:profileRevisionPA" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="Device_man_id" content="eltOnly" model="closed">
        <attribute type="profibusident:device_man_id" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="Device_id" content="eltOnly" model="closed">
        <attribute type="profibusident:device_id" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="ProfileSpecificTypePA" content="eltOnly" model="closed">
        <attribute type="profibusident:profileSpecificTypePA" required="no"/>
        <element type="profibusident:RegExpr" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <!-- -->
    <!-- -->
    <!-- -->
    <ElementType name="ManufacturerSpecificExtension" content="empty" model="closed">
        <attribute type="profibusident:manufacturerSpecificExtension" required="yes"/>
    </ElementType>
    <ElementType name="DeviceIdentification_DP" content="eltOnly" model="closed">
        <attribute type="profibusident:idDTMSupportLevel" required="yes"/>
        <element type="IdBusProtocol" minOccurs="1" maxOccurs="1"/>
        <element type="IdTypeID" minOccurs="1" maxOccurs="1"/>
        <!-- manufacturer specific extension, added in manufacturer specific identification -->
        <element type="ManufacturerSpecificExtension" minOccurs="0" maxOccurs="1"/>
    </ElementType>
    <ElementType name="DeviceIdentification_IM" content="eltOnly" model="closed">
        <attribute type="profibusident:idDTMSupportLevel" required="yes"/>
        <element type="IdTypeID" minOccurs="1" maxOccurs="1"/>
        <element type="IdBusProtocol" minOccurs="1" maxOccurs="1"/>
        <element type="Manufacturer_id" minOccurs="1" maxOccurs="1"/>
        <element type="Order_id" minOccurs="1" maxOccurs="1"/>
        <element type="IdHardwareRevision" minOccurs="1" maxOccurs="1"/>

```

```

    <element type="IdSoftwareRevision" minOccurs="1" maxOccurs="1"/>
    <element type="ProfileID" minOccurs="1" maxOccurs="1"/>
    <element type="ProfileSpecificType" minOccurs="1" maxOccurs="1"/>
    <element type="ImVersion" minOccurs="1" maxOccurs="1"/>
    <element type="ImSupported" minOccurs="1" maxOccurs="1"/>
    <!-- manufacturer specific extension, added in manufacturer specific identification -->
    <element type="ManufacturerSpecificExtension" minOccurs="0" maxOccurs="1"/>
  </ElementType>
  <ElementType name="DeviceIdentification_PA" content="eltOnly" model="closed">
    <attribute type="profilebusident:idDTMSupportLevel" required="yes"/>
    <element type="IdTypeID" minOccurs="1" maxOccurs="1"/>
    <element type="IdBusProtocol" minOccurs="1" maxOccurs="1"/>
    <element type="IdSoftwareRevisionPA" minOccurs="1" maxOccurs="1"/>
    <element type="IdHardwareRevisionPA" minOccurs="1" maxOccurs="1"/>
    <element type="ProfileRevisionPA" minOccurs="1" maxOccurs="1"/>
    <element type="Device_man_id" minOccurs="1" maxOccurs="1"/>
    <element type="Device_id" minOccurs="1" maxOccurs="1"/>
    <element type="ProfileSpecificTypePA" minOccurs="1" maxOccurs="1"/>
    <!-- manufacturer specific extension, added in manufacturer specific identification -->
    <element type="ManufacturerSpecificExtension" minOccurs="0" maxOccurs="1"/>
  </ElementType>
  <ElementType name="DeviceIdentifications" content="eltOnly" model="closed">
    <attribute type="fdt:busCategory" required="yes"/>
    <group order="one" minOccurs="1" maxOccurs="1">
      <element type="DeviceIdentification_DP" minOccurs="0" maxOccurs="1"/>
      <element type="DeviceIdentification_IM" minOccurs="0" maxOccurs="1"/>
      <element type="DeviceIdentification_PA" minOccurs="0" maxOccurs="1"/>
    </group>
  </ElementType>
  <ElementType name="FDT" content="eltOnly" model="closed">
    <element type="DeviceIdentifications" minOccurs="1" maxOccurs="1"/>
  </ElementType>
</Schema>

```

16 General recommendations

It is highly recommended to display I&M parameter labels in DTMs ActiveX or Frame Application user interface from IM-Runtime.xml, to achieve consistency and acceptance for the user.

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IEC 61158-3:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 3: Data link service definition*

IEC 61158-4:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 4: Data link protocol specification*

IEC 61158-6:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 6: Application layer protocol specification*

IEC 61784 (all parts), *Digital data communications for measurement and control*

CPF3/1: Type 3 of IEC 61158-3, IEC 61158-4, IEC 61158-5, IEC 61158-6; *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*

CPF3/2: Type 3 of IEC 61158-3, IEC 61158-4, IEC 61158-5, IEC 61158-6; *synchronous transmission; manchester coded and bus powered (MBP); optional intrinsically safe (MBP-IS) and lower power (MBP-LP)*

PROFIBUS-PA *Profile for Process Control Devices*, Version 3.0

PROFIBUS *Profile Guidelines, Part 1, Identification and Maintenance Functions*, Version 1.1 (May 2003)

PROFIBUS Guideline (Order No. 2.082): Chapter “*Services on communication relationships MSAC_C2*”: MSAC2_Initiate

PROFIBUS Profile Amendment 3 to the *Profibus Profile for Process Control Devices V 3.0*

PROFIBUS-DP Standard DIN 19245, Part 3

EN 50170 PROFIBUS

IEC 61158 series Normative Parts of PROFIBUS-FMS, -DP, -PA, according to the European Standard EN 50170, volume 2, Ed. 1.0, March 1998



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