PUBLICLY
AVAILABLE
SPECIFICATION

IEC PAS 62453-3

Pre-Standard

First edition
2006-05

Field Device Tool (FDT) interface specification –

Part 3:
PROFIBUS communication

Reference number
IEC/PAS 62453-3:2006(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site (www.iec.ch)**

- **Catalogue of IEC publications**

  The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

  This summary of recently issued publications (www.iec.ch/online_news/ justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

  If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

  Email: custserv@iec.ch
  Tel: +41 22 919 02 11
  Fax: +41 22 919 03 00

PUBLICLY
AVAILABLE
SPECIFICATION

IEC PAS 62453-3

Pre-Standard

First edition
2006-05

Field Device Tool (FDT) interface specification –

Part 3:
PROFIBUS communication

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE X

For price, see current catalogue

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

Field Device Tool (FDT) interface specification –

Part 3: PROFIBUS communication

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

A PAS is a technical specification not fulfilling the requirements for a standard but made available to the public.

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 date 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 (normaly 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
deviceTypeId	The attribute "fdt:DtmDeviceType/@deviceTypeId" 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 *Example:* 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' *Example:* 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: API*xx*.SLOT*yy*.INDEX*zz* 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 DTMParameterSchema, 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