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Field device tool (FDT) interface specification – Part 306: Communication profile integration – IEC 61784 CPF 6

Spécification des interfaces des outils des dispositifs de terrain (FDT) – Partie 306: Intégration des profils de communication – CEI 61784 CPF 6

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 306: Communication profile integration – IEC 61784 CPF 6

FOREWORD

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International Standard IEC 62453-306 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

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

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This bilingual version (2013-09) corresponds to the monolingual English version, published in 2009-06.

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

FDIS	Report on voting
65E/129/FDIS	65E/142/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 62453 series, under the general title *Field Device Tool (FDT) interface specification,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

This part of IEC 62453 is an interface specification for developers of FDT (Field Device Tool) components for function control and data access within a client/server architecture. The specification is a result of an analysis and design process to develop standard interfaces to facilitate the development of servers and clients by multiple vendors that need to interoperate seamlessly.

With the integration of fieldbusses into control systems, there are a few other tasks which need to be performed. In addition to fieldbus- and device-specific tools, there is a need to integrate these tools into higher-level system-wide planning- or engineering tools. In particular, for use in extensive and heterogeneous control systems, typically in the area of the process industry, the unambiguous definition of engineering interfaces that are easy to use for all those involved is of great importance.

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

Figure 1 shows how IEC 62453-306 is aligned in the structure of the IEC 62453 series.

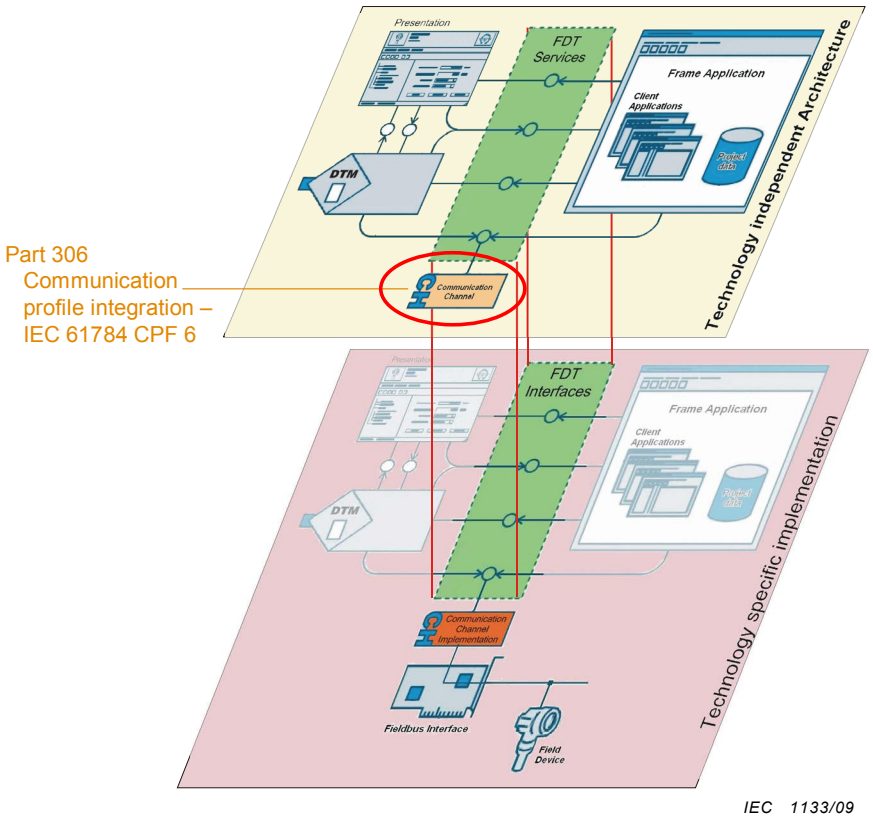

Figure 1 – Part 306 of the IEC 62453 series

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 306: Communication profile integration – IEC 61784 CPF 6

1 Scope

Communication Profile Family 6 (commonly known as INTERBUS®[1]) defines communication profiles based on IEC 61158-2 Type 8, IEC 61158-3-8, IEC 61158-4-8, IEC 61158-5-8, and IEC 61158-6-8. The basic profiles CP 6/1 (INTERBUS) and CP 6/3 (INTERBUS minimal subset) are defined in IEC 61784-1.

This part of IEC 62453 provides information for integrating the INTERBUS® technology into the FDT standard (IEC 62453-2).

This part of the IEC 62453 specifies communication and other services.

This standard neither contains the FDT specification nor modifies it.

2 Normative references

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

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

IEC 61158-3-8, *Industrial communication networks – Fieldbus specifications – Part 3-8: Data-link layer service definition – Type 8 elements*

IEC 61158-4-8, *Industrial communication networks – Fieldbus specifications – Part 4-8: Data-link layer protocol specification – Type 8 elements*

IEC 61158-5-8, *Industrial communication networks – Fieldbus specifications – Part 5-8: Application layer service definition – Type 8 elements*

IEC 61158-6-8, *Industrial communication networks – Fieldbus specifications – Part 6-8: Application layer protocol specification – Type 8 elements*

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

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

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

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[1] INTERBUS ® is the trade name of Phoenix Contact GmbH & Co. KG., control of trade name use is given to the non-profit organisation INTERBUS Club. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the trade name INTERBUS. Use of the trade name INTERBUS requires permission of the INTERBUS Club.

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3 Terms, definitions, symbols, abbreviated terms and conventions

3.1 Terms and definitions

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

3.2 Symbols and abbreviated terms

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

PCP	Peripherals Communication Protocol. Non-cyclic services of IEC 61784 CPF 6
FDCML	Field Device Configuration Markup Language
PMS	Peripherals Message Specification
UML	Unified Modelling Language

3.3 Conventions

3.3.1 Data type names and references to data types

The conventions for naming and referencing of data types are explained in IEC 62453-2, Clause A.1

3.3.2 Vocabulary for requirements

The following expressions are used when specifying requirements.

Usage of “shall” or “mandatory”	No exceptions allowed.
Usage of “should” or “recommended”	Strong recommendation. It may make sense in special exceptional cases to differ from the described behavior.
Usage of “can’ or “optional’	Function or behavior may be provided, depending on defined conditions.

3.3.3 Use of UML

Figures in this document are using UML notation as defined in Annex A of IEC 62453-1.

4 Bus category

IEC 61784 CPF 6 protocol is identified in the protocolId element of the structured data type 'fdt:BusCategory' by the following unique identifier (Table 1):

Table 1 – Protocol identifier

Identifier Value	ProtocolId name	Description
655D3F69-B757-4236-8E80-B0F78023B1DD	‘INTERBUS PCP’	Support of IEC 61784 CP 6/1
79079A7E-FF25-4709-ADB9-8AF16A4FFF82	‘INTERBUS’	Support of IEC 61784 CP 6/3

IEC 61784 CPF 6 uses the following unique identifier for its physical layers (Table 2).

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Table 2 – Physical layer identifier

PhysicalLayer Element	Description
D0D08238-B89C-11D9-AE7F-0000CB534BBC	LB ST
D0D08239-B89C-11D9-AE7F-0000CB534BBC	LB 2-wire
D0D0823A-B89C-11D9-AE7F-0000CB534BBC	LB Fiber Optics
D0D0823B-B89C-11D9-AE7F-0000CB534BBC	LB Inline
D0D0823C-B89C-11D9-AE7F-0000CB534BBC	LB Loop2
D0D0823D-B89C-11D9-AE7F-0000CB534BBC	LB Fieldline Modular
D0D0823E-B89C-11D9-AE7F-0000CB534BBC	LB Installations-Loop
D0D0823F-B89C-11D9-AE7F-0000CB534BBC	RB 2-wire
D0D08240-B89C-11D9-AE7F-0000CB534BBC	RB Fiber Optics
D0D08241-B89C-11D9-AE7F-0000CB534BBC	RB Fiber Optics HCS
D0D08242-B89C-11D9-AE7F-0000CB534BBC	RB Installation

5 Access to instance and device data

5.1 Process Channel objects provided by DTM

The minimum set of provided data should be:

- process values modeled as FDT-Channel objects including the ranges and scaling.

5.2 DTM services to access instance and device data

The services InstanceItemList and DeviceItemList shall provide access to at least to all mandatory parameters of the IEC 61784 CPF 6 Base Profile.

6 Protocol specific behavior

Not applicable.

7 Protocol specific usage of general data types

The following table (Table 3) shows how general data types, defined in IEC 62453-2 within namespace 'fdt', are used with IEC 61784 CPF 6 devices.

Table 3 – Protocol specific usage of general data types

Attribute	Description for use in IEC 61784 CPF 6
fdt:address	The address property is not mandatory for the exposed parameters in the DTMs. But if the address property is used the string shall be constructed according to the rules of the semanticId. That means the property ‘semanticId’ is always the same as the property ‘address’
fdt:protocolId	See 3.3
fdt:physicalLayer	See Clause 5
fdt:deviceTypeId	The property "fdt:DtmDeviceType/@deviceTypeId" shall contain the Identification Code (Ident Code) according to the IEC 61784 CPF 6 specification (1 Byte). The Ident Code shall be entered in decimal format
fdt:subDeviceType	Enter manufacturer specific value here
fdt:vendor	The attribute fdt:DtmDeviceType/VersionInformation/@vendor shall contain the Manufacturer’s_Name, which is returned in the PCF service

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Attribute	Description for use in IEC 61784 CPF 6
	"Identify Confirmation"
fdt:name	The attribute fdt:DtmDeviceType/VersionInformation/@name shall contain the Device_Name, which is returned in the PCP service "Identify Confirmation"
fdt:version	The attribute fdt:DtmDeviceType/VersionInformation/@version shall contain the Revision, which is returned in the PCP service "Identify Confirmation"
fdt:deviceTypeInformation	The deviceTypeInformation should not be used to provide the FDCML file information. The deviceTypeInformationPath attribute should be used instead
fdt:deviceTypeInformationPath	The attribute shall contain the full path to the FDCML file including the file name
fdt:semanticId fdt:applicationDomain	The semanticId's for IEC 61784 CPF 6 are defined for the cyclic and acyclic bus access. **Cyclic Bus Access** The applicationDomain is: FDT_INTERBUS. The semanticId follows the process access information of Process Channels. The semanticId is: BitPositionXX.BitLengthYY XX and YY are based on decimal format without leading '0'. **Acyclic Bus Access** The applicationDomain is: FDT_INTERBUS_PCP. The semanticId follows the PCP access information of Process Channels and of device parameters. The semanticId is: InvokeIDXX.IndexYY.SubIndexZZ XX, YY and ZZ are based on decimal format without leading '0'

8 Protocol specific common data types

Not applicable.

9 Network management data types

9.1 Parameter access data types

The data types specified in this subclause are used in the following services:

- NetworkManagementInfoRead service;
- NetworkManagementInfoWrite service.

The data types describe the address information of an IEC 61784 CPF 6 device (see Table 4 and Table 5)

Table 4 – Simple parameter access data types

Data type	Definition	Description
systemNumber	USINT	System number of the address information according to the IEC 61784 CPF 6 specification
segmentNumber	USINT	Segment number of the address information according to the IEC 61784 CPF 6 specification
positionNumber	USINT	Position number of the address information according to the IEC 61784 CPF 6 specification

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Table 5 – Structured parameter access data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
Address	STRUCT			The address information of an IEC 61784 CPF 6 device.
	systemNumber	M	[1..1]	
	segmentNumber	M	[1..1]	
	positionNumber	M	[1..1]	

9.2 Parameter for boot sequence

After the Offline-Parameterization the parameter should be exported via the IDtmParameter Interface. Then a Communication DTM can collect the data, configure the cyclic communication of the IEC 61784 CPF 6 network and generate a boot sequence, where the parameter will be written to the physical devices. All boot parameters shall be included in a DTMVariables list named “BOOT_PARAMS”. The boot parameter will be written subsequently to the devices.

10 Communication data types

The data types described in this clause are used in the following services:

- connect service;
- disconnect service;
- transaction service.

The service arguments contain the address information and the communication data (explained in Table 6 and Table 7).

The data types described in this clause are defined for the following namespace. Namespace: fdtinterbus

Table 6 – Simple communication data types

Data type	Definition	Description
systemNumber	USINT	System number of the address information according to the IEC 61784 CPF 6 specification
segmentNumber	USINT	Segment number of the address information according to the IEC 61784 CPF 6 specification
positionNumber	USINT	Position number of the address information according to the IEC 61784 CPF 6 specification
errorCode	ARRAY OF USINT	Contains information why a service could not be successfully executed
index	UINT	Address information according to the IEC 61784 CPF 6 specification
subIndex	USINT	Address information according to the IEC 61784 CPF 6 specification
communicationReference	UUID	Mandatory identifier for a communication link to a device This identifier is allocated by the communication component during the connect. The address information shall be used for all following communication calls NOTE This is not the communication reference of the PMS.
invokeId	USINT	Job number for parallel services according to the IEC 61784 CPF 6 specification
reasonCode	USINT	Cause for a connection abort

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Data type	Definition	Description
abortDetail	ARRAY OF USINT	Additional information for a connection abort
password	USINT	Password for the communication relationship to access device objects
accessGroup	USINT	Manufacturer specific assignment of the controller board to an access group for which an access authorization for device objects is specified
versionOD	UINT	Version number of the object directory
profile	UINT	Identification of the device profile
protection	USINT	Indicates whether the access rights are checked when accessing device objects
manufacturerName	STRING	Manufacturer name of the device
deviceName	STRING	The name of the device
revision	STRING	The revision number of the device
sequenceTime	UDINT	Period of time in [ms] for the whole sequence
delayTime	UDINT	Delay time in [ms] between two communication calls
schemaVersion	INT	Defines the version of the schema
systemTag	STRING	System Tag of a DTM. It is strongly recommended to provide the attribute in the Request document

Table 7 – Structured communication data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
Abort	STRUCT			Describes the abort
	communicationReference	M	[1..1]	
	reasonCode	M	[1..1]	
	...abortDetail	M	[1..1]	
ConnectRequest	STRUCT			Describes the communication request to establish a connection to an IEC 61784 CPF 6 PCP device
	fdt:nodeId	O	[0..1]	
	systemNumber	M	[1..1]	
	segmentNumber	M	[1..1]	
	postionNumber	M	[1..1]	
	password	M	[1..1]	
	accessGroup	M	[1..1]	
	fdt:systemTag	O	[0..1]	
ConnectResponse	STRUCT			Describes the communication response to the ConnectRequest
	fdt:nodeId	O	[0..1]	
	systemNumber	M	[1..1]	
	segmentNumber	M	[1..1]	
	postionNumber	M	[1..1]	
	versionOD	M	[1..1]	
	profile	M	[1..1]	

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Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
	protection	M	[1..1]	
	communicationReference	M	[1..1]	
	errorCode	M	[1..1]	
ReadRequest	STRUCT			Describes the communication request to read device objects
	fdt:nodeId	O	[0..1]	
	invokeId	M	[1..1]	
	index	M	[1..1]	
	subIndex	M	[1..1]	
	communicationReference	M	[1..1]	
ReadResponse	STRUCT			Describes the communication response to the ReadRequest
	fdt:nodeId	O	[0..1]	
	communicationReference	M	[1..1]	
	errorCode	M	[1..1]	
	fdt:CommunicationDate	M	[1..1]	
DisconnectRequest	STRUCT			Describes the communication request to release a connection to an IEC 61784 CPF 6 PCP device (Abort_Request)
	fdt:nodeId	O	[0..1]	
	reasonCode	M	[1..1]	
	abortDetail	M	[1..1]	
	communicationReference	M	[1..1]	
DisconnectResponse	STRUCT			Describes the corresponding response to a DisconnectRequest
	fdt:nodeId	O	[0..1]	
	communicationReference	M	[1..1]	
	errorCode	M	[1..1]	
WriteRequest	STRUCT			Describes the communication request to write device objects
	fdt:nodeId	O	[0..1]	
	invokeId	M	[1..1]	
	index	M	[1..1]	
	subIndex	M	[1..1]	
	communicationReference	M	[1..1]	
	fdt:CommunicationDate	M	[1..1]	
WriteResponse	STRUCT			Describes the communication response to the WriteRequest
	fdt:nodeId	O	[0..1]	
	communicationReference	M	[1..1]	
	errorCode	M	[1..1]	

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Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
IdentifyRequest	STRUCT			Describes the communication request to identify the device
	fdt:nodeId	O	[0..1]	
	invokeId	M	[1..1]	
	communicationReference	M	[1..1]	
IdentifyResponse	STRUCT			Describes the communication response to the IdentifyRequest
	fdt:nodeId	O	[0..1]	
	communicationReference	M	[1..1]	
	manufacturerName	M	[1..1]	
	deviceName	M	[1..1]	
	revision	M	[1..1]	
	errorCode	M	[1..1]	
SequenceBegin	STRUCT			Describes the sequence begin
	sequenceTime	O	[0..1]	
	delayTime	O	[0..1]	
	communicationReference	M	[1..1]	
SequenceEnd	STRUCT			Describes the sequence end
	communicationReference	M	[1..1]	
SequenceStart	STRUCT			Describes the sequence start
	communicationReference	M	[1..1]	

11 Channel parameter data types

It is up to a DTM whether it provides any channels. If a DTM allows a Frame Application, other DTMs, or a controller the direct access to its process values via IEC 61784 CPF 6 protocol, it should provide FDT-Channel objects as described in this clause. Only the complete description of all channels belonging to an IEC 61784 CPF 6 process value allows proper access for external applications.

The description of channels, especially of the process values, allows the Frame Application to support the device in a more efficient way.

The data types are used at GetChannelParameters service and SetChannelParameters services.

The information returned by the GetChannelParameters service describes how to access an I/O value via IEC 61784 CPF 6 protocol (see Table 8 and Table 9).

The data types described in this clause are defined for the following namespace. Namespace: ibschannel

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Table 8 – Simple channel parameter data types

Data type	Definition	Description
index	UINT	Address information according to the IEC 61784 CPF 6 specification for channels accessible via PCP
subIndex	USINT	Address information according to the IEC 61784 CPF 6 specification for channels accessible via PCP
invokeId	USINT	Job number for parallel services
bitLength	UDINT	Additional data type information especially for fieldbus specific data types like 12 bit integer
bitPosition	UDINT	Address information for channels accessible via IEC 61784 CPF 6
frameApplicationTag	STRING	Frame Application specific tag used for identification and navigation. The DTM should display this tag at channel specific user interfaces
gatewayBusCategory	UUID	Unique identifier for a supported bus type like IEC 61784 CPF 6 according to the FDT specific CATID
invalidBit	UDINT	Bit position of the invalid status channel accessible via IEC 61784 CPF 6
logic	enumeration (positive | negative)	Additional data type information: positive negative
simulationBit	UDINT	Bit position of the simulation status channel accessible via IEC 61784 CPF 6
protectedByChannelAssignment	BOOL	TRUE if the channel is set to read only by the Frame Application. Usually set to TRUE if a channel assignment exists
schemaVersion	INT	Defines the version of the schema
statusChannel	BOOL	TRUE if the channel is for status information only.
substituteValueBit	UDINT	Bit position of the substitute channel accessible via IEC 61784 CPF 6

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Table 9 – Structured channel parameter data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
ProcessAddress	STRUCT			Address information for channels accessible via IEC 61784 CPF 6
	fdt:nodeId	O	[0..1]	
	bitPosition	M	[1..1]	
	bitLenght	M	[1..1]	
PcpAddress	STRUCT			Address information for channels accessible via IEC 61784 CPF 6 PCP
	fdt:nodeId	O	[0..1]	
	invokeId	M	[1..1]	
	index	M	[1..1]	
	subIndex	M	[1..1]	
	bitPosition	O	[0..1]	
	bitLength	O	[0..1]	
StatusInformation	STRUCT			Description of additional status information for channels accessible via IEC 61784 CPF 6
	fdt:nodeId	O	[0..1]	
	logic	M	[1..1]	
	invalidBit	O	[0..1]	
	simulationBit	O	[0..1]	
	substituteBaluBit	O	[0..1]	
FDTChannel	STRUCT			Description of the channel
	fdt:nodeId	O	[0..1]	
	fdt:tag	M	[1..1]	
	fdt:id	M	[1..1]	
	fdt:descriptor	O	[0..1]	
	protectedByChannel-Assignment	M	[1..1]	
	fdt:dataType	M	[1..1]	
	fdt:signalType	M	[1..1]	
	frameApplicationTag	O	[0..1]	
	appId:applicationId	O	[0..1]	
	fdt:SemanticInformation	O	[0..*]	
	fdt:BitEnumeratorEntries	O	[0..1]	
	fdt:EnumeratorEntries	O	[0..1]	
	fdt:Unit	O	[0..1]	
	ProcessAddress	O	[0..1]	
	PcpAddress	O	[0..1]	
	StatusInformation	O	[0...1]	
	fdt:Alarms	O	[0..1]	
	fdt:Ranges	O	[0..1]	
	fdt:Deadband	O	[0..1]	
	fdt:SubstituteValue	O	[0..1]	

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Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
FDTChannelType	STRUCT			Description of the channel component in case of channels with gateway functionality
	fdt:nodeId	O	[0..1]	
	fdt:VersionInformation	M	[1..1]	
	gatewayBusCategory	O	[0..1]	
	statusChannel	O	[0..1]	

12 Device identification

There are different IEC 61784 CPF 6 specific identification elements.

An IEC 61784 CPF 6 scan may detect different device types: IEC 61784 CPF 6 devices following the base profile, IEC 61784 CPF 6 PCP devices and simple IEC 61784 CPF 6 devices.

The following rule shall be applied for IEC 61784 CPF 6 Communication Channels:

- if an IEC 61784 CPF 6 base profile is available, create an IEC 61784 CPF 6 base profile identification;
- otherwise check IEC 61784 CPF 6 PCP;
- otherwise create a simple IEC 61784 CPF 6 device identification.

12.1 Protocol specific handling of data type STRING

IEC 61784 CPF 6 char array rules

- In all strings based on char ranges defined in the field bus 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 '?'. Characters within VisibleStrings, which are not defined in the 7 bit ASCII/ANSI character set, are considered to be invisible.

12.2 Device type identification data types

The IEC 61784 CPF 6 device type identification data types provide general data types with a protocol specific semantic (see Table 10, Table 11 and Table 12) as well as data types without such a mapping (see Table 13).

The data types described in this clause are defined for the following namespace.
Namespace: ibsident

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Table 10 – Identification data types for simple IEC 61784 CPF 6 device

IEC 61784 CPF 6 Attribute	Semantic element name	Data request in physical device	Protocol specific name	IEC 61784 CPF 6 Data Format	FDT data type (display Format)	Specification reference
busProtocol	IdBusProtocol	For all non-IEC 61784 CPF 6 PCP device: “protocol_IBS”			enumeration(protocol_IBS | protocol_IBS_PCP | protocol_IBS_BASE_PROFILE)	
systemNumber	IdAddress	Logical addressing information in Nested IEC 61784 CPF 6 Systems	System Number	Unsigned8	STRING (systemNumber. segmentNumber. positionNumber)	
segmentNumber		Data from IEC 61784 CPF 6 Configuration Frame	Segment Number	Unsigned8		
positionNumber			Position Number	Unsigned8		
identCode	IdTypeId	Data from IEC 61784 CPF 6 Configuration Frame	Ident Code	Unsigned8	STRING (identCode/ PDLength/ PALength)	
PDLength			Process Data Length	Unsigned8		
PALength			Parameter Channel Length	Unsigned8		
manufacturer SpecificExtension		Can be used by DTM for a vendor specific device identification information				

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