IEC 62453-302

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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Field device tool (FDT) interface specification – Part 302: Communication profile integration – IEC 61784 CPF 2

Spécification des interfaces des outils des dispositifs de terrain (FDT) – Partie 302: Intégration des profils de communication – CPF 2 de l'IEC 61784

IEC 62453-302:2016-06(en-fr)

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CONTENTS

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 302: Communication profile integration – IEC 61784 CPF 2

FOREWORD

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International Standard IEC 62453-302 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2009. This edition constitutes a technical revision. The main changes are provided in order to provide improved support for Ethernet IP (see Clauses 9, 10, and 12), additional implementation hints (see Annex A) and to support introduction of the technology according to IEC TR 62453-42 [5][1] (see Clause 4).

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

1 Figures in square brackets refer to the Bibliography.

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

CDV	Report on voting
65E/336/CDV	65E/395A/RVC

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

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

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

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

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

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

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

Figure 1 shows how IEC 62453-302 is aligned in the structure of the IEC 62453 series.

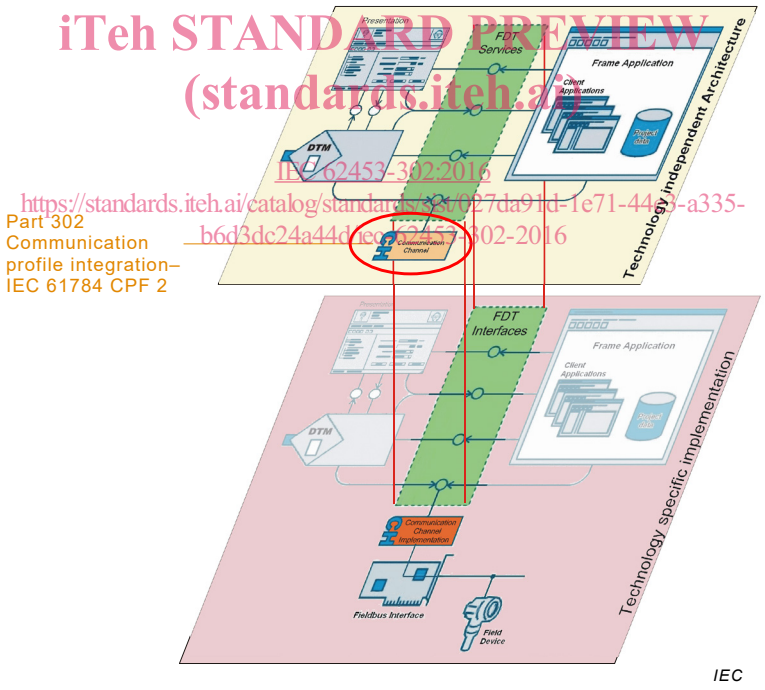

Figure 1 – Part 302 of the IEC 62453 series

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 302: Communication profile integration – IEC 61784 CPF 2

1 Scope

Communication Profile Family 2 (commonly known as CIP™[2]) defines communication profiles based on IEC 61158-2 Type 2, IEC 61158-3-2, IEC 61158-4-2, IEC 61158-5-2, IEC 61158-6-2, and IEC 62026-3. The basic profiles CP 2/1 (ControlNet™[3]), CP 2/2 (EtherNet/IP™[4]), and CP 2/3 (DeviceNet™[2]) are defined in IEC 61784-1 and IEC 61784-2. An additional communication profile (CompoNet™[2]), also based on CIP™, is defined in [15].

This part of IEC 62453 provides information for integrating the CIP™ technology into the FDT interface specification (IEC 62453-2).

This part of IEC 62453 specifies communication and other services.

This specification neither contains the FDT specification nor modifies it.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 61158-3-2, *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*

IEC 61158-4-2, *Industrial communication networks – Fieldbus specifications – Part 4-2: Data-link layer protocol specification – Type 2 elements*

IEC 61158-5-2:2014, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

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2 CIP™ (Common Industrial Protocol), DeviceNet™ and CompoNet™ are trade names of Open DeviceNet Vendor Association, Inc (ODVA). This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the trade name holder or any of its products. Compliance to this standard does not require use of the trade names CIP™, DeviceNet™ or CompoNet™. Use of the trade names CIP™, DeviceNet™ or CompoNet™ requires permission of Open DeviceNet Vendor Association, Inc.

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IEC 61158-6-2:2014, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*

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

IEC 61784-2, *Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3*

IEC 61784-3-2:2010, *Industrial communication networks – Profiles – Part 3-2: Functional safety fieldbuses – Additional specifications for CPF 2*

IEC 62026-3, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) – Part 3: DeviceNet*

IEC 62453-1:–[5], *Field device tool (FDT) interface specification – Part 1: Overview and guidance*

IEC 62453-2:–[5], *Field device tool (FDT) interface specification – Part 2: Concepts and detailed description*

ISO 15745-2:2003, *Industrial automation systems and integration – Open systems application integration framework – Part 2: Reference description for ISO 11898-based control systems*

ISO 15745-3:2003, *Industrial automation systems and integration – Open systems application integration framework – Part 3: Reference description for IEC 61158-based control systems*

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, as well as the following apply.

CIP™	Common Industrial Protocol	
EDS	Electronic Data Sheet	[ISO 15745-2]

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.

5 To be published concurrently with this standard.

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.

4 Bus category

IEC 61784 CPF 2 protocol is identified in the protocolId element of the structured data type 'fdt:BusCategory' by the following unique identifiers, as specified in Table 1.

Table 1 – Protocol identifiers

Identifier value	ProtocolId name	Description
19B91472-EDB9-4e8c-BB61-516EEC79C1C0	‘CIP DeviceNet’	Support for CP 2/3 (DeviceNet)
6CD80F51-019D-4e60-AEAC-B10144943B4B	‘CIP EthernetIP’	Support for CP 2/2 (EtherNet/IP)
C290CE23-62EA-478c-97F2-97EFEC602E05	‘CIP ControlNet’	Support for CP 2/1 (ControlNet)
089BB2BC-B75A-11DB-8314-0800200C9A66	‘CIP CompoNet’	Support for CompoNet

Table 2 shows the identifiers for physical layer that can be used for DeviceNet.

Table 2 – Physical layer identifiers for DeviceNet

Identifier value	Description
23E6EFA5-B1DA-11E2-9D9C-005056C00008	Standard DeviceNet

Table 3 shows the identifiers for physical layer that can be used for ControlNet.

Table 3 – Physical layer identifiers for ControlNet

Identifier value	Description
30F4EF13-B1DA-11E2-9D9C-005056C00008	ControlNet Coaxial Medium
30F4EF14-B1DA-11E2-9D9C-005056C00008	ControlNet Fiber Medium
30F4EF15-B1DA-11E2-9D9C-005056C00008	ControlNet Network Access Port (NAP)

Table 4 shows the identifiers for physical layer that can be used for Ethernet/IP.

Table 4 – Physical layer identifiers for Ethernet/IP

Identifier value	Description
307dd808-c010-11db-90e7-0002b3ecdcbe	10BASET
307dd809-c010-11db-90e7-0002b3ecdcbe	10BASETXHD
307dd80a-c010-11db-90e7-0002b3ecdcbe	10BASETXFD
307dd80b-c010-11db-90e7-0002b3ecdcbe	10BASEFLHD
307dd80c-c010-11db-90e7-0002b3ecdcbe	10BASEFLFD
307dd80d-c010-11db-90e7-0002b3ecdcbe	10BASEFXHD
307dd80e-c010-11db-90e7-0002b3ecdcbe	10BASEFXFD
307dd80f-c010-11db-90e7-0002b3ecdcbe	100BASETXHD
307dd810-c010-11db-90e7-0002b3ecdcbe	100BASETXFD

Identifier value	Description
307dd811-c010-11db-90e7-0002b3ecdcbe	100BASEFXHD
307dd812-c010-11db-90e7-0002b3ecdcbe	100BASEFXFD
307dd813-c010-11db-90e7-0002b3ecdcbe	100BASELX10
307dd814-c010-11db-90e7-0002b3ecdcbe	100BASEPX10
307dd815-c010-11db-90e7-0002b3ecdcbe	1000BASEXHD
307dd816-c010-11db-90e7-0002b3ecdcbe	1000BASEXFD
307dd817-c010-11db-90e7-0002b3ecdcbe	1000BASELXHD
307dd818-c010-11db-90e7-0002b3ecdcbe	1000BASELXFD
307dd819-c010-11db-90e7-0002b3ecdcbe	1000BASESXHD
307dd81a-c010-11db-90e7-0002b3ecdcbe	1000BASESXFD
307dd81b-c010-11db-90e7-0002b3ecdcbe	1000BASETHD
307dd81c-c010-11db-90e7-0002b3ecdcbe	1000BASETFD
307dd81d-c010-11db-90e7-0002b3ecdcbe	10GigBASEFX

Table 5 shows the identifiers for physical layer that can be used for CompoNet.

Table 5 – Physical layer identifiers for CompoNet

Identifier value	Description
475B2CB0-B1DA-11E2-9D9C-005056C00008	Standard CompoNet
475B2CAF-B1DA-11E2-9D9C-005056C00008	CompoNet IP67 Cable

Table 6 shows the identifiers for data link layer.

Table 6 – Data link layer identifiers

Identifier value	Description
5B1EDEF7-B1CC-11E2-9D9C-005056C00008	DeviceNet (CAN – CSMA/NBA)
5B1EDEF8-B1CC-11E2-9D9C-005056C00008	ControlNet (CTDMA)
5B1EDEF9-B1CC-11E2-9D9C-005056C00008	EtherNet/IP (CSMA/CD)
5B1EDEFA-B1CC-11E2-9D9C-005056C00008	CompoNet (TDMA)

5 Access to instance and device data

The services InstanceDataInformation and DeviceDataInformation shall provide access at least to all parameters defined in the Params section of the EDS.

6 Protocol specific behavior

IEC 61784 CPF 2 protocol has specific requirements related to configuration of fieldbus masters.

It is very important to keep both data provider and consumer synchronized. Therefore data provider shall be informed if the provided data has been modified. For instance, in case the provided data is modified by the scanner/master DTM, then the slave/adapter DTM shall be provided with the new data set.

NOTE For a description of data exchange between DTMs, see IEC 62453-2:–, 6.3 (Configuration of fieldbus master or communication scheduler).

7 Protocol specific usage of general data types

Table 7 shows how general data types, defined in IEC 62453-2 within the namespace ‘fdt’, are used with IEC 61784 CPF 2 devices.

According to IEC 62453-2, at least one set of semantic information (one per supported fieldbus protocol) shall be provided for each accessible data object, using the ‘SemanticInformation’ general data type. The corresponding data type ‘applicationDomain’ shall have the value “FDT_CIP” and the data type ‘semanticId’ shall have an appropriate value, as specified in Table 7).

Table 7 – Protocol specific usage of general data types

Data type	Description for use
fdt:address	The “address” data type is not mandatory for the exposed parameters in the DTMs. But if the address will be used, the string shall be constructed according to the rules of the semanticId. That means the data type “semanticId” is always the same as the data type “address”
fdt:protocolId	See Clause 4.
fdt:deviceTypeId	As defined in Identity object (see IEC 61158-5-2:2014, 6.2.1.2.2)
fdt:deviceTypeInformation	A CIP DTM shall provide the path to the device specific EDS file with this data type. For DTM certification, the path to the certified EDS file shall be provided here. NOTE The EDS information is accessible via • IDtmParameter::GetParameters() • IDtmInformation::GetInformation()
fdt:deviceTypeInformationPath	Path to the EDS file which is also provided via the attribute ‘deviceTypeInformation’ The attribute contains full path to the EDS file including the file name in URL notation. For CIP devices, it is mandatory to provide information for this data type. This attribute is specific to FDT 1.2.1 (see IEC 62453-2 and [9]), therefore it shall not be provided if DTM is running in FDT 1.2 (see [8]) based Frame Applications
fdt:manufacturerId	As defined in Identity object (see IEC 61158-5-2:2014, 6.2.1.2.2)
fdt:semanticId fdt:applicationDomain	The applicationDomain is: FDT_CIP. The data that is contained in the objects are addressable via classId, instanceId and attributeId. This data may be variables or composed blocks of data. The semanticID is directly based on the CIP address information: The semanticId is: CLASSxx.INSTANCEyy.ATTRIBUTEzz xx classId yy instanceId zz attributeId xx, yy, zz are based on decimal format without leading ‘0’. Since ‘ATTRIBUTE’ is conditional in CIP in certain cases, it can be left out. In this case, the semanticId is: CLASSxx.INSTANCEyy
fdt:tag	CIP assembly, parameter name or name of a I/O connection (in the context of channel data)

8 Protocol specific common data types

Table 8 and Table 9 specify the protocol specific common data types, which are used in the definition of other data types.

The data types described in Clause 8 are defined for following namespace:
Namespace: cip

Table 8 – Simple protocol specific common data types

Data type	Definition	Description
attributeId	USINT	CIP attribute identifier
bitOffset	UDINT	Bit offset of a parameter in an assembly
cipStatus	UINT	cipStatus represents the Status (attribute 5) of the Identity object. See IEC 61158-5-2:2014, 6.2.1.2.2
classId	UINT	CIP class identifier
constValue	UDINT	Represents the constant value used in the data type Constant
dataType	enumeration (byte | float | double | int | unsigned | enumerator | bitEnumerator | index | ascii | password | bitString | hexString | date | time | dateAndTime | duration | binary | structured | dtmSpecific)	Defines the different enumerations of the CIP data types
devicetype	UINT	Represents the DeviceType (attribute 2) of the Identity object. See IEC 61158-5-2:2014, 6.2.1.2.2
ePath	ARRAY OF USINT	CIP EPATH, see IEC 61158-6-2:2014, 4.1.9.
extendedIdentifier	STRING	Represents the address of the CIP device in the CIPNodeID if the address used on this CIP network is a name or IP-address. The extendedIdentifier shall be used for CompoNet networks to cover the CompoNet MAC ID. See also shortIdentifier
instanceId	UINT	CIP object instance identifier
majorRevision	USINT	Represents the Major Revision (attribute 4.1) of the Identity object. See IEC 61158-5-2:2014, 6.2.1.2.2
minorRevision	USINT	Represents the Minor Revision (attribute 4.2) of the Identity object. IEC 61158-5-2:2014, 6.2.1.2.2
portNumber	UINT	Represents the portnumber within a CIP bridging or routing device to route a message to another segment
productCode	UINT	Represents the Product code (attribute 3) of the Identity object. See IEC 61158-5-2:2014, 6.2.1.2.2
productName	STRING	Represents the Product name (attribute 7) of the Identity object. See IEC 61158-5-2:2014, 6.2.1.2.2
serialNumber	ARRAY OF USINT	Represents the Serialnumber (attribute 6) of the Identity object. See IEC 61158-5-2:2014, 6.2.1.2.2. If the serialNumber is not known because of offline configuration then a 0 should be returned
serviceCode	USINT	CIP service code. This is a function, or method, supported by a CIP object or attribute
serviceName	STRING	CIP service name. This is a function, or method, supported by a CIP object or attribute. This attribute provides additional human readable information about the related service code
shortIdentifier	USINT	Represents the address of the CIP device in the CIPNodeID if the address used on this CIP-network is a simple address. See also extendedIdentifier

Data type	Definition	Description
symbolicAddress	STRING	Represents a name of a component inside the device
vendorID	UINT	Represents the Vendor ID (attribute 1) of the Identity object. See IEC 61158-5-2:2014, 6.2.1.2.2

Table 9 – Structured protocol specific common data types

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
CIPDevice	STRUCT			Specifies a CIP device. CIPDevice contains manufacturer and device information (the Identity Object), which is present in every CIP node
	cipStatus	M	[1..1]	
	CIPPath	M	[1..1]	
	CIPDeviceIdentity	M	[1..1]	
CIPDeviceIdentity	STRUCT			Represents the static part of the Identity object of the CIP device. See IEC 61158-5-2:2014, 6.2.1.2.2
	vendorID	M	[1..1]	
	deviceType	M	[1..1]	
	productCode	M	[1..1]	
	majorRevision	M	[1..1]	
	minorRevision	M	[1..1]	
	serialNumber	M	[1..1]	
	productName	M	[1..1]	
CIPNodeID	STRUCT			Identifier used to identify a particular node (device) on a CIP network, e.g. CIP MAC (Media Access Control) ID (1 byte) for DeviceNet and ControlNet; IP address for EtherNet/IP. Since the size differs from protocol to protocol, structure is used which contains 2 attributes: extended identifier (n bytes string) and short identifier (1 byte unsigned integer) and only one of them shall be used
	choice of	M	[1..1]	
	ExtendedIdentifier	S	[1..1]	
	ShortIdentifier	S	[1..1]	
CIPObjectAddress	STRUCT			CIP object address as CIPObjectId, CIPSymbolicAddress or HexAddress
	choice of	M	[1..1]	
	CIPObjectId	S	[1..1]	
	CIPSymbolicAddress	S	[1..1]	
	HexAddress	S	[1..1]	