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

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

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 302: Communication profile integration – IEC 61784 CPF 2

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62453-302:2016. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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. It is an International Standard.

This third edition cancels and replaces the second edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) improved support for Ethernet IP (see 9.3, Clause 10, and 12.4).

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

The text of this International Standard is based on the following documents:

Draft	Report on voting
65E/1031/FDIS	65E/1032/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

IMPORTANT – The "colour inside" logo on the cover page of this document 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 [1].

Figure 1 – Part 302 of the IEC 62453 series

NOTE   For an example for the technology specific implementation of this document, see [2].

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 302: Communication profile integration –
IEC 61784 CPF 2

1 Scope

This part of IEC 62453 provides information for integrating the CIP™ technology into the FDT interface specification (IEC 62453-2). Communication Profile Family 2 (commonly known as CIP™[1]) 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™[2]), CP 2/2 (EtherNet/IP™[3]), and CP 2/3 (DeviceNet™[21]) are defined in IEC 61784-1 and IEC 61784-2. An additional communication profile (CompoNet™[21]), also based on CIP™, is defined in IEC 62026-7.

~~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 are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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[4], *Industrial communication networks – Fieldbus specifications – Part 3-2: Data-link layer service definition – Type 2 elements*

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[1] 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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[4] A consolidated version of this document exists, comprising the second edition (2014-08) [documents 65C/759/FDIS and 65C/769/RVD] and its amendment 1 (2019-04) [documents 65C/945/FDIS and 65C/954/RVD].

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~~2019, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61158-6-2:~~2014~~2019, *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/IEEE 8802-3*

IEC 61784-3-2:~~2010~~2021, *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 62026-7, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) – Part 7: CompoNet*

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

IEC 62453-2:~~–[5]~~2022, *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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http:www.iso.org/obp

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.

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[5] Under preparation. Stage at the time of publication: IEC/RPUB 62453-1:2022.

To be published concurrently with this document.

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:—,:2022, 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.

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
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, the 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: 2022, 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 2019, 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 52 and [3]), therefore it shall not be provided if DTM is running in FDT 1.2 (see [3]) based Frame Applications
fdt:manufacturerId	As defined in Identity object (see IEC 61158-5-2: 2014 2019, 6.2.1.2.2)

Data type	Description for use
fdt:semanticId	The applicationDomain is: FDT_CIP.
fdt:applicationDomain	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
arrayDimensions	STRING	Represents the dimension of an array, see [5], Appendix C
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~~2019, 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~~2019, 6.2.1.2.2
ePath	ARRAY OF USINT	CIP EPATH, see IEC 61158-6-2:~~2014~~2019, 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

Data type	Definition	Description
majorRevision	USINT	Represents the Major Revision (attribute 4.1) of the Identity object. See IEC 61158-5-2:~~2014~~2019, 6.2.1.2.2
minorRevision	USINT	Represents the Minor Revision (attribute 4.2) of the Identity object. IEC 61158-5-2:~~2014~~2019, 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~~2019, 6.2.1.2.2
productName	STRING	Represents the Product name (attribute 7) of the Identity object. See IEC 61158-5-2:~~2014~~2019, 6.2.1.2.2
serialNumber	ARRAY OF USINT	Represents the Serialnumber (attribute 6) of the Identity object. See IEC 61158-5-2:~~2014~~2019, 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
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~~2019, 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~~2019, 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]	
CIPObjectId	STRUCT			The CIP classId, instanceId and (conditional) attributeId 'address' information for a CIP object and attribute. If used in a Process Channel this is likely to be either an Assembly object or a Parameter object
	classId	M	[1..1]	
	instanceId	M	[1..1]	
	attributeId	O	[0..1]	

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
CIPPath	STRUCT			The full 'address' of the CIP node (device). In general, this consists of the Node ID stored in the CIPNodeID element. The RoutingPath element is used to transfer additional routing information that can be used by the CIP FDT communication component
	RoutingPath	O	[0..1]	
	CIPNodeID	M	[1..1]	
CIPSymbolicAddress	STRUCT			classId, instanceId and attributeId does not necessarily be known, a symbolic address could also be used. CIPSymbolicAddress, HexAddress or CIPObjectId could be used for DataExchangeRequest
	symbolicAddress	M	[1..1]	
Constant	STRUCT			A constant value
	constValue	M	[1..1]	
ExtendedIdentifier	STRUCT			See attribute extendedIdentifier
	extendedIdentifier	M	[1..1]	
HexAddress	STRUCT			CIP object address as ePath
	ePath	O	[0..1]	
LinkAddress	STRUCT			Represents the CIPNodeID within a Segment
	CIPNodeID	M	[1..1]	
ParameterReference	STRUCT			Reference to a description of a parameter
	fdt:idref	M	[1..1]	
	bitOffset	O	[0..1]	
ReservedBits	STRUCT			Used wherever reserved bits are needed
RoutingPath	STRUCT			Any additional CIP network routing information, which can be understood by the Communication Channel
	Segment	M	[1..1]	
Segment	STRUCT			Represents the path a message shall follow to reach the addressed CIP device
	portNumber	M	[1..1]	
	LinkAddress	M	[1..1]	
	Segment	O	[0..1]	
Service	STRUCT			CIP service identified by serviceCode and serviceName. CIP service code is a function, or method, supported by a CIP object or attribute
	serviceCode	M	[1..1]	
	serviceName	O	[0..1]	
ShortIdentifier	STRUCT			See attribute shortIdentifier
	shortIdentifier	M	[1..1]	

9 Network management data types

9.1 General

The data types specified in Clause 9 are used at following services:

- NetworkManagementInfoRead service;
- NetworkManagementInfoWrite service.

9.2 Node address

The CIPNodeID will be stored in the busAddress element of the fdt:DeviceAddress data type. This is not used for CompoNet because the master has a fixed address – since this is a mandatory element, the recommendation is to use the value "0".

NOTE   Additional implementation hints regarding addressing in CompoNet are provided in Annex Annex A.

9.3 Scanner/master – Bus parameter set (CIP)

Information is sent provided to the CIP scanner/master within the UserDefinedBus element of the NetworkInfo data type, using the data types specified in Table 10 and Table 11. This information shall be set to configure the scan list of scanner/master.

The data types described in this subclause are defined for following namespace:
Namespace: cippar

Table 10 – Simple fieldbus configuration data types

Data type	Definition	Description
async	USINT	See Table 7-2.35 of [9] Connection Manager Field Usage for Safety. This is a CIP Safety exclusive field. Only applies to producing connections. Field should be empty for consuming connections. Used to calculate Network Reaction Time
base	UINT	Scaling parameters according to ISO 15745-2:2003, A.4.1.4.6
class0	BOOL	Trigger and transport mask bit assignment. See ISO 15745-3:2003, Table A.25
class1	BOOL	
class2	BOOL	
class3	BOOL	
class4	BOOL	
class5	BOOL	
class6	BOOL	
compoNetDeviceCategory	USINT	Defines the different categories of CompoNet devices. See [10], Chapter 7-4
compoNetIOLength	UINT	See [10], Chapter 7-5
compoNetIOLengthUnit	USINT	
connectionId	STRING	Uniquely identifies the connection within the DTM.
connectionNameString	STRING	SeeConnection entry format according to ISO 15745-3:2003, Table A.24
connectionTypeMulticast	BOOL	See Connection parameters bit assignments. See ISO 15745-3:2003, Table A.26
connectionTypeNULL	BOOL	
connectionTypePoint2Point	BOOL	
consumedConnectionSize	UINT	Maximum number bytes received across this connection
defaultConnection	BOOL	Indicates whether the CIPConnection is default or not

Data type	Definition	Description
defaultSafetyConnections	USINT	See Table 7-2.~~2~~4 of [9] Connection Manager Section Keywords for Safety. Instance Number
defaultValue	STRING	Represents the value of the attribute when in offline state
div	UINT	Scaling parameters. See ISO 15745-2:2003, A.4.1.4.6
expectedPacketRate	UINT	Scanner determines this parameter. There might be some reason that the slave provides this parameter to the master
fixedSizeSupported	BOOL	Connection parameters bit assignments. See ISO 15745-3:2003, Table A.26
helpString	STRING	Connection entry format. See ISO 15745-3:2003, Table A.24
inhibitTime	UINT	Optional for COS, for other connection types it is not valid. Scanner determines this parameter. There might be some reason that the slave provides this parameter to the master
maxCIPConnections	UINT	Communication capacity, see Chapter 7-3.6.11.7 of [5]
maxConsumerNumber	USINT	See Table 7-2.~~3~~4 of [9] Connection Manager Section Keywords for Safety. This is a CIP Safety exclusive field. When safety devices wish to define multi-cast connections and need to restrict the maximum number of consumers to a value less than the default maximum of 15, this field can define the product limit. If this field is empty, the SNCT shall always use the default value of 15 for the maximum number of multi-cast connections. This field can be left empty for single-cast connections.
maxEMConnections	UINT	Communication capacity. See Chapter 7-3.6.11.7 of [5]
maxIOConnections	UINT	
maxRPI	UDINT	Maximum Packet Interval supported by the device. The RPI is delivered from the Device DTM to the Master DTM only with a default value. As the Master DTM only has the overview over all adjusted RPI, there is a possibility that the Master DTM will change/adapt this value therefore a minimum and a maximum value is necessary.
maxSafetyConnections	USINT	See Table 7-2.2 of [9] Connection Manager Section Keywords for Safety. Optional
maxSafetyInputCnxns	USINT	
maxSafetyOutputCnxns	USINT	
minRPI	UDINT	Minimum Packet interval required by the device. The RPI is delivered from the Device DTM to the Master DTM only with a default value. As the Master DTM only has the overview over all adjusted RPI, there is a possibility that the Master DTM will change/adapt this value therefore a minimum and a maximum value is necessary.
multiplier	UINT	Scaling parameters. See ISO 15745-2:2003, A.4.1.4.6
offset	INT	
precision	UINT	
priorityHigh	BOOL	Connection parameters bit assignments. See ISO 15745-3:2003, Table A.26.
priorityLow	BOOL	
priorityScheduled	BOOL	
priorityUrgent (ENIPV1.2)	BOOL	
producedConnectionSize	UINT	Maximum number of bytes transmitted across this connection
realTimeTransferFormat	USINT	Connection parameters bit assignments. See ISO 15745-3:2003, Table A.26.
~~rpi~~	~~UDINT~~	~~See ISO 15745-3:2003, Table A.24~~
~~minRpi (ENIP V1.2)~~	~~UDINT~~	~~Minimum Packet interval required by the device~~
~~maxRpi (ENIP V1.2)~~	~~UDINT~~	~~Maximum Packet Interval supported by the device~~

Data type	Definition	Description
rpi	UDINT	Requested packet interval in microseconds: the measure of how frequently the originating application requires the transmission of data from the target application. See ISO 15745-3:2003, Table A.24 Connection Manager Section
scId	ARRAY OF USINT	Safety Configuration Identifier. See IEC 61784-3-2:~~2010~~2021, 6.6.5.18
server	BOOL	Trigger and transport mask bit assignment. See ISO 15745-3:2003, Table A.25.
transportTypeExclusiveOwner	BOOL	
transportTypeInputOnly	BOOL	
transportTypeListenOnly	BOOL	
transportTypeRedundantOwner	BOOL	
triggerApplication	BOOL	
triggerChangeOfState	BOOL	
triggerCyclic	BOOL	
unId	ARRAY OF USINT	Target UNID. See IEC 61784-3-2:~~2010~~2021, 6.6.5.19
variableSizeSupported	BOOL	Connection parameters bit assignments. See ISO 15745-3:2003, Table A.26.

Table 11 – Structured fieldbus configuration data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
AssemblyMemberDefinition	STRUCT			Represents all members of an assembly
	fdt:id	O	[0..1]	
	fdt:tag	M	[1..1]	
	fdt:descriptor	O	[0..1]	
	cip:dataType	M	[1..1]	
	defaultValue	O	[0..1]	
	cip:arrayDimensions	O	[0..1]	
	Scaling	O	[0..1]	
	cip:CIPObjectAddress	O	[0..1]	
	fdt:BitEnumeratorEntries	O	[0..1]	
	fdt:EnumeratorEntries	O	[0..1]	
	fdt:Unit	O	[0..1]	
	fdt:Ranges	O	[0..1]	
	fdt:SubstituteValue	O	[0..1]	
	~~fdt:StructuredElements~~	~~O~~	~~[0..1]~~	
AssemblyMemberDefinitions	STRUCT			See AssemblyMember definition
	AssemblyMemberDefinition	O	[0..*]	
BitStrobeConnection	STRUCT			Represents the Bitstrobe IO connection
	MasterSlaveConnection	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
Capacity	STRUCT			Communication capacity, See Chapter 7-3.6.11.7 of [5]
	MaxCIPConnections	O	[0..1]	
	MaxIOConnections	O	[0..1]	
	MaxEMConnections	O	[0..1]	
CIPConnection	STRUCT			Defines one supported CIP connection Contains attributes, see ISO 15745-3:2003, Table A.24 For safety devices, see Chapter 7-2.2.4.3, Table 7-2-3 of [9]
	connectionId	M	[1..1]	
	connectionNameString	M	[1..1]	
	helpString	M	[1..1]	
	cip:ePath	M	[1..1]	
	defaultConnection	O	[0..1]	
	Config1	O	[0..1]	
	Config2	O	[0..1]	
	TriggerAndTransport	M	[1..1]	
	Originator2TargetParameters	M	[1..1]	
	Target2OriginatorParameters	M	[1..1]	
CIPNode	STRUCT			Represents all connection information of the device
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdtpar:configurationData	O	[0..1]	
	scId	O	[0..1]	
	unId	O	[0..1]	
	cip:CIPDeviceIdentity	M	[1..1]	
	cip:CIPNodeID	M	[1..1]	
	PossibleConnections	M	[1..1]	
	CurrentConnections	M	[1..1]	
	AssemblyMemberDefinitions	O	[0..1]	
CompoNetIO	STRUCT			Defines the IO of a CompoNet device. See [10], Chapter 7-2
	~~CompoNetInputInfo~~	~~O~~	~~[0..1]~~	
	~~CompoNetOutputInfo~~	~~O~~	~~[0..1]~~	
	~~compoNetDeviceCategory~~	~~M~~	~~[1..1]~~	
	compoNetDeviceCategory	M	[1..1]	
	CompoNetInputInfo	O	[0..1]	
	CompoNetOutputInfo	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
CompoNetInputInfo	STRUCT			Represents the Inputs of the CompoNet device
	CompoNetIOInfo	M	[1..1]	
CompoNetIOInfo	STRUCT			Represents the Inputs or Outputs of the CompoNet device
	compoNetIOLengthUnit	M	[1..1]	
	compoNetIOLength	M	[1..1]	
CompoNetOutputInfo	STRUCT			Represents the Outputs of the CompoNet device
	CompoNetIOInfo	M	[1..1]	
Config	STRUCT			Deprecated, see Clause A.3, Contains elements Size and Format
	Size	O	[0..1]	
	Format	O	[0..1]	
Config1	STRUCT[a]			Deprecated, see Clause A.3, See ISO 15745-3:2003, Table A.24
	Config	M	[1..1]	
Config2	STRUCT[b]			Deprecated, see Clause A.3, See ISO 15745-3:2003, Table A.24
	Config	M	[1..1]	
ConnectionParameters	STRUCT			Represents the Connection Parameters keyword of the Connection Manager Section of an EDS-file. See ISO 15745-3:2003, A.4.1.4.9
	fixedSizeSupported	O	[0..1]	
	variableSizeSupported	O	[0..1]	
	realTimeTransferFormat	O	[0..1]	
	connectionTypeNULL	O	[0..1]	
	connectionTypeMulticast	O	[0..1]	
	connectionTypePoint2Point	O	[0..1]	
	priorityLow	O	[0..1]	
	priorityHigh	O	[0..1]	
	priorityScheduled	O	[0..1]	
	priorityUrgent	O	[0..1]	
	cip:ReservedBits	O	[0..1]	
ConsumedAssemblyReference	STRUCT			Gives CIPObjectAddress of the data consumed on this IO connection. To reference what is the I/O assembly attached to this connection to allow the scanner to understand the members of the consumed assembly
	cip:CIPObjectAddress	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
COSConnection	STRUCT			Represents the COS IO connection. It is mutual exclusive with the Cyclic IO connection
	MasterSlaveConnection	M	[1..1]	
CurrentConnections	STRUCT			Represents all default connections of this device
	CIPConnection	O	[0..*]	
	MasterSlaveConnectionSet	O	[0..1]	
	CompoNetIO	O	[0..1]	
CyclicConnection	STRUCT			~~CyclicConnection~~ Represents the Cyclic IO connection. It is mutual exclusive with the COS IO connection
	MasterSlaveConnection	M	[1..1]	
Format	STRUCT			Config data format. See ISO 15745-3:2003, Table A.24
	choice of	M	[1..1]	
	cip:ParameterReference	S	[1..1]	
	fdt:ChannelReference	S	[1..1]	
MasterSlaveConnection	STRUCT			Defines one supported MasterSlave connection
	producedConnectionSize	M	[1..1]	
	consumedConnectionSize	M	[1..1]	
	expectedPacketRate	O	[0..1]	
	inhibitTime	O	[0..1]	
	ConsumedAssemblyReference	O	[0..1]	
	ProducedAssemblyReference	O	[0..1]	
MasterSlaveConnectionSet	STRUCT			Zero or more MasterSlaveConnections. MasterSlaveConnection elements can be combined according to the CIP specification (see IEC 62026-3). This element shall be provided for DeviceNet. If device does not support I/O connections through the MasterSlave connection set, this list shall be empty
	PolledIOConnection	O	[0..1]	
	BitStrobeConnection	O	[0..1]	
	choice of	O	[0..1]	
	COSConnection	S	[1..1]	
	CyclicConnection	S	[1..1]	
	MulticastPollingConnection	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
MulticastPollingConnection	STRUCT			Represents the Multicast Polled IO connection
	MasterSlaveConnection	M	[1..1]	
Originator2TargetParameters	STRUCT			Originator to target connection parameters. See ISO 15745-3:2003, Table A.24
	rpi	O	[0..1]	
	minRpi (ENIP V1.2)	O	[0..1]	
	maxRpi (ENIP V1.2)	O	[0..1]	
	ConnectionParameters	M	[1..1]	
	choice of	M	[1..*]	
	Size	S	[1..1]	
	Format	S	[1..1]	
PolledIOConnection	STRUCT			Represents the Polled IO connection
	MasterSlaveConnection	M	[1..1]	
PossibleConnections	STRUCT			Represents all possible connections that can be made to this device
	maxSafetyConnections	O	[0..1]	
	maxSafetyInputCnxns	O	[0..1]	
	maxSafetyOutputCnxns	O	[0..1]	
	defaultSafetyConnections	O	[0..1]	
	Capacity	O	[0..1]	
	CIPConnection	O	[0..*]	
	PolledIOConnection	O	[0..1]	
	BitStrobeConnection	O	[0..1]	
	COSConnection	O	[0..1]	
	CyclicConnection	O	[0..1]	
	MulticastPollingConnection	O	[0..1]	
	SafetyInputConnection	O	[0..*]	
	SafetyOutputConnection	O	[0..*]	
	CompoNetIO	O	[0..1]	
ProducedAssemblyReference	STRUCT			Provides CIPObjectAddress of the data produced on this IO connection,in order to reference what is the I/O assembly attached to this connection. This allows the scanner to understand the members of the produced assembly.
	cip:CIPObjectAddress	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
Target2OriginatorParameters	STRUCT			Target to originator connection parameters. See ISO 15745-3:2003, Table A.24
	rpi	O	[0..1]	
	minRpi (ENIP V1.2)	O	[0..1]	
	maxRpi (ENIP V1.2)	O	[0..1]	
	ConnectionParameters	M	[1..1]	
	choice of	M	[1..*]	
	Size	S	[1..1]	
	Format	S	[1..1]	
TransportTypeExclusiveOwner	STRUCT			See transportTypeExclusiveOwner
	transportTypeExclusiveOwner	M	[1..1]	
TransportTypeInputOnly	STRUCT			See transportTypeInputOnly
	transportTypeInputOnly	M	[1..1]	
TransportTypeListenOnly	STRUCT			See transportTypeListenOnly
	transportTypeListenOnly	M	[1..1]	
TransportTypeRedundantOwner	STRUCT			See transportTypeRedundantOwner
	transportTypeRedundantOwner	M	[1..1]	
TriggerAndTransport	STRUCT			Represents the Trigger and Transport keyword of the Connection Manager Section of an EDS-file. See ISO 15745-3:2003, A.4.1.4.9
	class0	O	[0..1]	
	class1	O	[0..1]	
	class2	O	[0..1]	
	class3	O	[0..1]	
	class4	O	[0..1]	
	class5	O	[0..1]	
	class6	O	[0..1]	
	triggerCyclic	O	[0..1]	
	triggerChangeOfState	O	[0..1]	
	triggerApplication	O	[0..1]	
	server	O	[0..1]	
	choice of	M	[1..1]	
	TransportTypeListenOnly	S	[1..1]	
	TransportTypeInputOnly	S	[1..1]	
	TransportTypeExclusiveOwner	S	[1..1]	
	TransportTypeRedundantOwner	S	[1..1]	
	cip:ReservedBits	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
SafetyInputConnection	STRUCT			Defines one supported CIP Safety Input connection
	async	M	[1..1]	
	maxConsumerNumber	O	[0..1]	
	CIPConnection	M	[1..1]	
SafetyOutputConnection	STRUCT			Defines one supported CIP Safety Output connection
	maxConsumerNumber	O	[0..1]	
	CIPConnection	M	[1..1]	
Scaling	STRUCT			Scaling of a parameter. See ISO 15745-2:2003, A.4.1.4.6
	offset	M	[1..1]	
	base	M	[1..1]	
	multiplier	M	[1..1]	
	div	M	[1..1]	
	precision	O	[0..1]	
Size	STRUCT			See ISO 15745-3:2003, Table A.24
	choice of	M	[1..1]	
	cip:Constant	S	[1..1]	
	cip:ParameterReference	S	[1..1]	
UserDefinedBus	STRUCT			Represents the CIP protocol specific part of NetworkInfo
	CIPNode	M	[1..1]	
a, b Additional implementation hints regarding Config1 and Config2 are provided in Annex A.				

10 Communication data types

The data types specified in Clause 10 are used with the following services:

- Connect service,
- Transaction service,
- Disconnect service,
- Abort service,
- Sequence service.

The service arguments contain the address information and the communication data (explained in Table 12 and Table 13).

The data types described in Clause 10 are defined for the following namespace.
Namespace: fdtcipcomm

Table 12 – Simple communication data types

Data type	Definition	Description
communicationReference	UUID	Mandatory internal FDT value which uniquely identifies a connection to a device. It is allocated by the Communication Channel during the ConnectRequest. The value is used by subsequent communication calls up to and including DisconnectRequest or Abort
delayTime	UDINT	Delay time in [ms] between two communication calls
extendedStatusCode	ARRAY OF USINT	CIP extended status code further elaborates upon the CIP status code and may be present in an Error Response message from a CIP object. (CIP range: 0-255 words) (DeviceNet: 1 byte) This information is formatted as a hex string to cover the CIP extended status codes. This information is protocol specific
sequenceTime	UDINT	Period of time in [ms] for the whole sequence
statusCode	USINT	CIP status code, which is present in the General Status Code field of a Response message from a CIP object. For DeviceNet, this is provided only in error cases

Table 13 – Structured communication data types

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
Abort	STRUCT			Describes the abort. An abort cancels all outstanding requests and closes the connection
	communicationReference	M	[1..1]	
ConnectRequest	STRUCT			Element used with ConnectRequest call to identify the CIP node (device) with which a communication connection should be established
	fdt:systemTag	O	[0..1]	
	cip:CIPPath	M	[1..1]	
ConnectResponse	STRUCT			Element used with the ConnectResponse call used to convey a unique value – the communicationReference – which should be used in subsequent calls on this communication connection. ConnectResponse contains the CIPDevice element as defined in DTMCIPDataTypeSchema.xml, which is used to acknowledge that the connection to the requested nodeID is actually established
	communicationReference	M	[1..1]	
	cip:CIPDevice	M	[1..1]	

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
DataExchangeRequest	STRUCT			Element used with the TransactionRequest call to describe the communication request to a particular object within the CIP node (the CIP node is associated with the connection identified by the connectionReference). The object address is specified using the CIPObjectAddress element. The service to perform is specified using the Service element. If data is required by the service it is stored in the fdt:CommunicationData element
	communicationReference	M	[1..1]	
	cip:serviceCode	M	[1..1]	
	cip:CIPObjectAddress	M	[1..1]	
	fdt:CommunicationData	O	[0..1]	
DataExchangeResponse	STRUCT			Element used with the TransactionResponse call to return the result of a TransactionRequest. Depending on the network, result codes are returned in the ServiceResponse
	communicationReference	M	[1..1]	
	ServiceResponse	M	[1..1]	
	fdt:CommunicationData	O	[0..1]	
DisconnectRequest	STRUCT			Element used with the DisconnectRequest call to identify the connection, which should be terminated
	communicationReference	M	[1..1]	
DisconnectResponse	STRUCT			Element used with DisconnectResponse to indicate that the connection identified by the communicationReference has been terminated
	communicationReference	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]	
ServiceResponse	STRUCT			CIP service response and status codes. All error codes are described in IEC 61158-6-2:20142019, 4.1.11
	cip:serviceCode	M	[1..1]	
	statusCode	M	[1..1]	
	extendedStatusCode	O	[0..1]	

11 Channel parameter data types

The data types specified in Clause 11 are used with the following services:

- ReadChannelData service,
- WriteChannelData service.

Channels in a DTM can be used to represent the "Process values" available on that device. These are sometimes called Process Channels. A process control system (i.e. some external system which monitors values on a device) can query each of the DTM's channels for its channel parameters. The channel parameter schema describes the process values so that an external system can use the information to access and interpret the values from the device during normal device runtime. The external system might not use FDT to access the values.

Information about the available channels (if there are any) is included in the information returned from the GetChannels service call.

Data types used by the services ReadChannelData and WriteChannelData are specified in Table 14 and Table 15.

These data types can be used by a DTM (e.g. slave/adapter device's DTM) to describe its I/O assemblies – data format and constituent Params (providing similar information to that found in the [IO_Info]/[Variant_IO_Info]/[Connection Manager], [Assembly] and [Params] sections of an EDS file) – and by a master/scanner device's DTM to describe the objects used to access a shadow of the slave device's I/O data. The Process Channel of the master DTM also refers to the child DTM and the Process Channel of the child DTM, which describes the assembly data layout within the master device.

The data types described in Clause 11 are defined for following namespace.
Namespace: cipchannel

Table 14 – Simple channel parameter data types

Data type	Definition	Description
assemblySize	USINT UDINT (ENIP V1.2 only)	Length of the assembly data in bytes
frameApplicationTag	STRING	Frame Application specific tag used for identification and navigation
gatewayBusCategory	UUID	Unique identifier for a supported bus type (DeviceNet, Ethernet/IP, ControlNet or CompoNet) according to the specific CATID
helpMessage	STRING	CIP assembly, parameter or I/O connection help string
memberPosition	UDINT	Zero based bit offset. Position of the member data in the assembly data. This has to be calculated from the Assembly structure information
memberSize	UDINT	Number of bits. Length of the member data in the assembly data
protectedByChannelAssignment	BOOL	This flag is set by the client. If the flag is set, DTM is not allowed to change the I/O connection definition

Table 15 – Structured channel parameter data types

Data type	Definition			Description
	Elementary data type	Usage	Multipli city	
AssemblyMember	STRUCT			Describes a member of an assembly. Provided is the bitPosition from the start of the assembly data block and the bitLength in bits, and the FDT channel reference of the channel which describes the member data. The reference to the data of the AssemblyMember can be a) a ParameterReference to the list of parameters derived from the deviceDTM by GETParametersList; b) an AssemblyMemberReference references another Assembly. So this is then a nested assembly; c) an FDT ChannelReference points to a channel provide by the Device DTM; d) a CIPObject Address points to the attribute holding the data in the CIP way of addressing. If the member is a constant, it is expressed in this way
	memberPosition	M	[1..1]	
	memberSize	M	[1..1]	
	choice of	M	[1..1]	
	AssemblyMemberReference	S	[0..1]	
	fdt:ChannelReference	S	[0..1]	
	cip:CIPObjectAddress	S	[1..1]	
	cip:Constant	S	[1..1]	
AssemblyMemberReferen ce	STRUCT			Reference to the description of an assembly member
	fdt:idref	M	[1..1]	
	cip:bitOffset	O	[0..1]	
AssemblyMembers	STRUCT			The collection of AssemblyMembers. This member is available only if the FDT channel object represents an assembly; otherwise channel represents a CIP object
	AssemblyMember	O	[0..*]	
ChannelReference	STRUCT			Refers to an FDT channel and an CIP object reference
	~~fdt:ChannelReference~~ cip:bitOffset	M	[1..1]	
	~~cip:CIPObjectAddress~~ fdt:ChannelReference	M	[1..1]	
	cip:~~bitOffset~~CIPObjectAddress	M	[1..1]	

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
FDTChannel	STRUCT			Describes the Process Channel in detail
	fdt:tag	M	[1..1]	
	fdt:id	M	[1..1]	
	protectedByChannelAssignment	M	[1..1]	
	fdt:dataType	M	[1..1]	
	assemblySize	M	[1..1]	
	fdt:signalType	M	[1..1]	
	frameApplicationTag	O	[0..1]	
	helpMessage	O	[0..1]	
	fdt:SemanticInformation	O	[0..1]	
	ServiceSet	M	[1..1]	
	cip:CIPObjectAddress	M	[1..1]	
	AssemblyMembers	O	[0..1]	
FDTChannelType	STRUCT			Description of the channel component in case of channels with gateway functionality. States the version number of the DTM and, optionally, the fieldbus category ID
	gatewayBusCategory	O	[0..1]	
	fdt:VersionInformation	M	[1..1]	
ServiceSet	STRUCT			The collection of supported CIP Service Codes
	cip:Service	M	[1..*]	

12 Device identification

12.1 Device type identification data types

The IEC 61784 CPF 2 device type identification data types provide general data types with a protocol specific semantic (see Table 16) as well as data types without such a mapping (see Table 17 and Table 18).

The data types described in this subclause are defined for following namespace:
Namespace: cipident

Table 16 – Identification data types with protocol specific mapping

IEC 61784 CPF 2 attribute name	Semantic element name	Data request in physical device	Protocol specific name	IEC 61784 CPF 2 data format	FDT data type (display format)	Specific reference
busProtocol	IdBusProtocol	For all DeviceNet Devices: protocol_CIP_DeviceNet For all Ethernet/IP Devices: protocol_CIP_EthernetIP For all ControlNet Devices: protocol_CIP_ControlNet For all CompoNet Devices: protocol_CIP_CompoNet	-	-	Enumeration (protocol_CIP_DeviceNet | protocol_CIP_EthernetIP | protocol_CIP_ControlNet | protocol_CIP_CompoNet)	-

Table 17 – Simple identification data types with protocol independent semantics

Data type	Definition	Description
idDTMSupportLevel	enumeration (genericSupport | profileSupport | blockspecificProfileSupport | specificSupport | identSupport)	Enumeration (see IEC 62453-2)
match	STRING	Used by a DTM to define a regular expression, which shall match the scanned physical identification information
nomatch	STRING	Used by a DTM to define a regular expression, which shall not match the scanned physical identification information. Used by Device DTM to indicate if identification information may not match

Table 18 – Structured identification data types with protocol independent semantics

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
RegExpr	STRUCT			Includes regular expression string – either for match or nomatch
	match	O	[0..1]	
	nomatch	O	[0..1]	

12.2 Topology scan data types

The data type CIPDevice (see Table 9), is used with the Scan service response.

This data type describes one entry in the list of scanned devices.

12.3 Scan identification data types

Subclause 12.3 defines data types that are used to provide the scan response of a CIP network (see Table 19 and Table 20).

The data types described in this subclause are defined for following namespace:
Namespace: cipdevscanid

Table 19 – Simple scan identification data types

Data type	Definition	Description
configuredState	enumeration (configuredAndPhysicallyAvailable | configuredAndNotPhysicallyAvailable | availableButNotConfigured | notApplicable)	A communication master shall indicate in this attribute, if the scan response is related to a detected physical device, which is configured or unconfigured
resultState	enumeration (provisional | final | error)	Identifies if the result is one of the provisional results or the final result of the split scan results

Table 20 – Structured scan identification data types

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
IdBusProtocol	STRUCT			This element contains exactly one attribute, which contains the value of the scanned physical device. This element has semantic meaning therefore has a prefix "Id" for better identification
	cipident:busProtocol	O	[0..1]	
	cipident:RegExpr	O	[0..*]	
ScanIdentification	STRUCT			These elements contain all elements for the appropriate protocol variant
	configuredState	O	[0..1]	
	fdt:CommunicationError	O	[0..1]	
	IdBusProtocol	M	[1..1]	
	cip:CIPDevice	M	[1..1]	
ScanIdentifications	STRUCT			Collection of ScanIdentification elements
	fdt:protocolId	M	[1..1]	
	resultState	M	[1..1]	
	ScanIdentification	O	[0..*]	

12.4 Device type identification data types

Subclause 12.4 defines data types that are used to provide protocol specific information for device types (see Table 21).

The data types described in this subclause are defined for following namespace:
Namespace: cipdevid

Table 21 – Structured device type identification data types

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
DeviceIdentification	STRUCT			This element contains all elements for the appropriate protocol variant
	cipident:idDTMSupportLevel	M	[1..1]	
	IdBusProtocol	M	[1..1]	
	cip:CIPDeviceIdentity	M	[1..1]	
	IdDeviceType	O	[0..*]	
	IdVendorID	O	[0..*]	
	IdRevision	O	[0..*]	
DeviceIdentifications	STRUCT			Collection of DeviceIdentification elements
	fdt:protocolId	M	[1..1]	
	DeviceIdentification	O	[0..*]	
~~CIPDeviceIdentity~~	~~STRUCT~~			~~Represents the static part of the Identity object of the CIP device with the possibility to express ranges of possible values. See IEC 61158-5-2:2014, 6.2.1.2.2~~
	~~IdvendorID~~	~~M~~	~~[1..1]~~	
	~~IddeviceType~~	~~M~~	~~[1..1]~~	
	~~IdproductCode~~	~~M~~	~~[1..1]~~	
	~~IdmajorRevision~~	~~M~~	~~[1..1]~~	
	~~IdminorRevision~~	~~M~~	~~[1..1]~~	
	~~IdserialNumber~~	~~M~~	~~[1..1]~~	
	~~IdproductName~~	~~M~~	~~[1..1]~~	
IdBusProtocol	STRUCT			This element contains exactly one attribute, which contains the value of the scanned physical device. This element has semantic meaning therefore has a prefix "Id" for better identification
	cipident:busProtocol	O	[0..1]	
	cipident:RegExpr	O	[0..*]	
IdVendorId	STRUCT			Represents the vendor id
	~~cip:vendorId~~	~~M~~	~~[1..1]~~	
	cipident:RegExpr	O	[0..*]	
IdDeviceType	STRUCT			Represents the device type
	~~cip:deviceType~~	~~M~~	~~[1..1]~~	
	cipident:RegExpr	O	[0..*]	
~~IdproductCode~~	~~STRUCT~~			~~Represents the product code~~
	~~cip:productCode~~	~~M~~	~~[1..1]~~	
	~~cipident:RegExpr~~	~~O~~	~~[0..*]~~	
~~IdmajorRevision~~ IdRevision	STRUCT			Represents the ~~major~~ revision
	~~cip:majorRevision~~	~~M~~	~~[1..1]~~	
	~~cipident:RegExpr~~	~~O~~	~~[0..*]~~	

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
IdminorRevision	STRUCT			Represents the minor revision
	cip:minorRevision	M	[1..1]	
	cipident:RegExpr	O	[0..*]	
IdserialNumber	STRUCT			Represents the serial number
	cip:serialNumber	M	[1..1]	
	cipident:RegExpr	O	[0..*]	
IdproductName	STRUCT			Represents the product name
	cip:productName	M	[1..1]	
	cipident:RegExpr	O	[0..*]	

Annex A
(informative)

Implementation hints

A.1 Addressing in CompoNet DTMs

In CompoNet the Node Address can be set on the device using switches (see [10], Chapter 9-3). This same address is used to set the Address on the DTM.

NOTE ~~As a consequence, the DTM always uses the address which is set on the device using the switches.~~

As for all other CIP protocols, the "UserDefinedBus" Addressing is used in the DTM's Parameter Document. Since the CompoNet Node Address range is limited to 127, the "ShortIdentifier" can be used to specify the address within the "UserDefinedBus" data type.

CompoNet defines different types of devices, with are specified in the EDS file by the Device Category keyword (see [10], Chapter 7 and Table A.1).

The Node Address range depends on the Device Category, as defined in Table A.1.

The address used for communication on Layer 2 (Media Access Control Address, MAC), i.e. the MAC ID, is calculated from the Device Type and the Node address, in accordance to Table A.1 (see also [10], Chapters 1-4).

Table A.1 – CompoNet relationship between Device Category, Node Address, MAC ID

Device Category	Value	Node Address	Node Address length	Prefix coding bit 9-7	MAC ID
Master	0		6-bit	0x111	0x1C0
Word IN	1	0x00-0x3F	6-bit	0x000	0x0-0x3F
Word OUT	2	0x00-0x3F	6-bit	0x001	0x40-0x7F
Word MIX	3	0x00-0x3F	6-bit	0x000	0x0-0x3F
Bit IN	4	0x00-0x7F	7-bit	0x01*	0x80-0xFF
Bit OUT	5	0x00-0x7F	7-bit	0x10*	0x100-0x17F
Bit MIX	6	0x00-0x7F	7-bit	0x01*	0x80-0xFF
Repeater	7	0x00-0x3F	6-bit	0x110	0x180-0x1BF

The MAC ID shall be used for direct communication, and not the Node Address. Since the length of the MAC ID is 9 bits, the short identifier that is used within the "UserDefinedBus" element of the DTM's Parameter Document cannot be used, as it is limited to one octet.

For addressing the DTM therefore uses the Node Address with a prefix. The Prefix depends on the Device Type as indicated in Table A.1. The prefix and the Node Address are combined to build the MAC ID, which is provided through the ExtendedIdentifier.

EXAMPLE

Word IN at Node Address 1   is MAC ID   0x0001
Word OUT at Node Address 5   is MAC ID   0x0045
Bit IN at Node Address 127   is MAC ID   0x00FF
Bit OUT at Node Address 127   is MAC ID   0x017F

When doing communication in FDT (slave request communication from master) this MAC ID is used in the ExtendedIdentifier. The notation is always in hexadecimal format.

A.2   Displaying addresses of CompoNet DTMs

As there are different types of devices according to the Device Category but they can have the same Node Address, there should be a way to distinguish devices of different Device Categories. The proposal is to add the Device Category in the name of the DTM, as shown for example in Figure A.1.
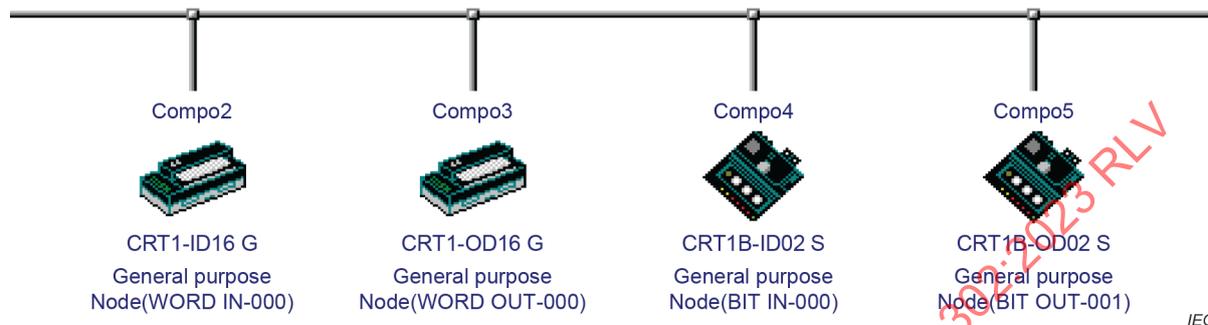

Figure A.1 – Examples of DTM naming for CompoNet

A.3   Handling of Config1 and Config2 elements in EtherNet/IP

During the CIP Forward_Open service an optional data segment can be appended to the path attribute of this service. The Config1 and Config2 elements are intended to be used to transfer this information from the Device DTM to the Parent DTM.

During the CIP Forward_Open service the data segments given in Config1 and Config2 are appended to the path attribute of this service. The path of the service is represented by the cip:ePath attribute in the CIPConnection element.

It is recommended to concatenate the configuration buffers Config1 and Config2 to the cip:ePath attribute in the element CIPConnection if required.

To be closer to the CIP forward_open request (See 3-5.5.1.11 Connection Path ~~in ODVA CIP specification v3.5~~ and example "Table 3-5.15" in [5]) the buffers shall be concatenated as follows.

The configuration buffers config1 and config2 are concatenated with a leading segment sub-type identifier (0x80), the configuration sizes in words (config1+config2) followed by a trailing pad byte if the size of the configuration buffer is not even number of bytes:

  cip:ePath

  + 1 byte segment Sub-Type: 0x80 (Simple Data Segment)

  + 1 byte size of the configuration buffers config1 and config2 (in words)

  + Configuration buffer Config1

  + Configuration buffer Config2

[+ 1 pad byte (0x00) if size of configuration buffers config1 and config2 modulo 2 is not 0].

The Format element of Config1 and Config2 shall not be used.

Bibliography

[1]   IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org/>)

[2]   IEC 61131-3:2013, *Programmable controllers – Part 3: Programming languages*

[1]   IEC 62453 (all parts), *Field device tool (FDT) interface specification*

[3]   IEC 62453-1:2009, *Field device tool (FDT) interface specification – Part 1: Overview and guidance*

[4]   IEC TR 62453-41:2009, *Field device tool (FDT) interface specification – Part 41: Object model integration profile – Common object model*

[5]   IEC TR 62453-42, *Field device tool (FDT) interface specification – Part 42: Object model integration profile – Common Language Infrastructure*

[2]   IEC TR 62453-502:2009, *Field device tool (FDT) interface specification – Part 502: Communication implementation for common object model – IEC 61784 CPF 2*

[7]   ISO/IEC 7498 (all parts), *Information technology – Open Systems Interconnection – Basic Reference Model*

[3]   FDT Interface Specification V1.2.1, Order No. of FDT Group: 0001-0001-002

[4]   FDT Interface Specification V1.2, Order No. of FDT Joint Interest Group: 0001-0001-001

[5]   ODVA: THE CIP NETWORKS LIBRARY – Volume 1: Common Industrial Protocol (CIP™) – Edition 3.5, available at <http://www.odva.org>

[6]   ODVA: THE CIP NETWORKS LIBRARY – Volume 2: EtherNet/IP™ Adaptation of CIP – Edition 1.5, available at <http://www.odva.org>

[7]   ODVA: THE CIP NETWORKS LIBRARY – Volume 3: DeviceNet™ Adaptation of CIP – Edition 1.5, available at <http://www.odva.org>

[8]   ControlNet International: THE CIP NETWORKS LIBRARY – Volume 4: ControlNet™ Adaptation of CIP – Edition 1.1, available at <http://www.controlnet.org>

[9]   ODVA: THE CIP NETWORKS LIBRARY – Volume 5, CIP Safety™, Edition 2.114, available at <http://www.odva.org>

[10] ODVA: THE CIP NETWORKS LIBRARY – Volume 6: CompoNet™ Adaptation of CIP – Edition 1.37, available at http://www.odva.org

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IEC 62453-302

INTERNATIONAL STANDARD

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colour inside

**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**

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 302: Communication profile integration –
IEC 61784 CPF 2

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This third edition cancels and replaces the second edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) improved support for Ethernet IP (see 9.3, Clause 10, and 12.4).

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

The text of this International Standard is based on the following documents:

Draft	Report on voting
65E/1031/FDIS	65E/1032/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

IMPORTANT – The "colour inside" logo on the cover page of this document 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 [1].
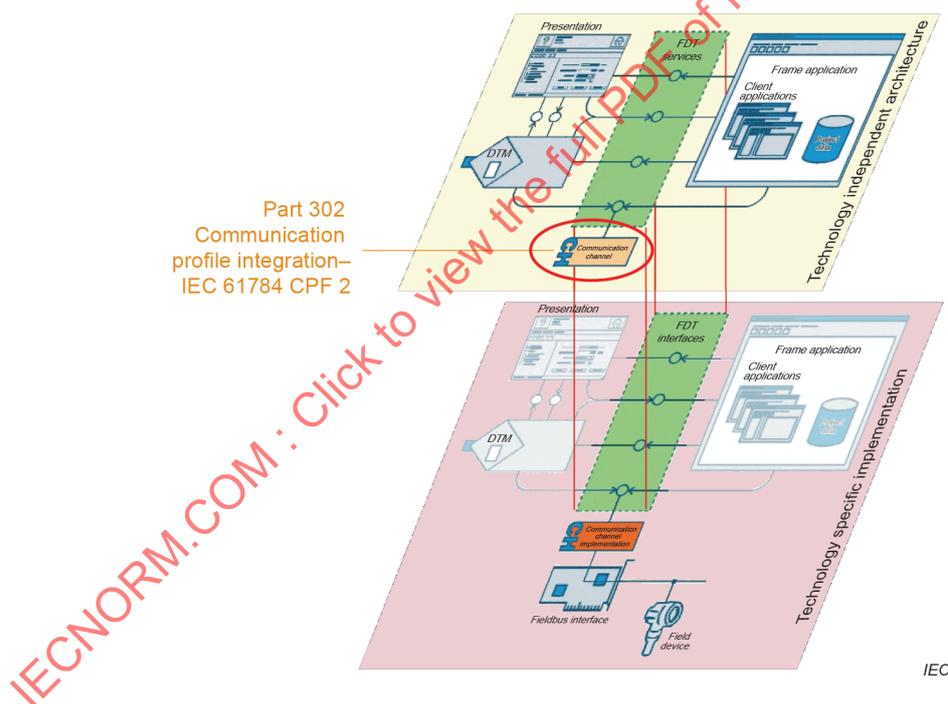

Figure 1 – Part 302 of the IEC 62453 series

NOTE   For an example for the technology specific implementation of this document, see [2].

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

**Part 302: Communication profile integration –
IEC 61784 CPF 2**

1 Scope

This part of IEC 62453 provides information for integrating the CIP™ technology into the FDT interface specification (IEC 62453-2). Communication Profile Family 2 (commonly known as CIP™[1]) 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™[2]), CP 2/2 (EtherNet/IP™[3]), and CP 2/3 (DeviceNet™[1]) are defined in IEC 61784-1 and IEC 61784-2. An additional communication profile (CompoNet™[1]), also based on CIP™, is defined in IEC 62026-7.

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 are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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[4], *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*

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[1] 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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[4] A consolidated version of this document exists, comprising the second edition (2014-08) [documents 65C/759/FDIS and 65C/769/RVD] and its amendment 1 (2019-04) [documents 65C/945/FDIS and 65C/954/RVD].

IEC 61158-5-2:2019, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61158-6-2:2019, *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/IEEE 8802-3*

IEC 61784-3-2:2021, *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 62026-7, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) – Part 7: CompoNet*

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

IEC 62453-2:2022, *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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http:www.iso.org/obp

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

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[5] Under preparation. Stage at the time of publication: IEC/RPUB 62453-1:2022.

   To be published concurrently with this document.

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 62453-2:2022, 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.

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
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, the 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 62453-2:2022, 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 61158-5-2:2019, 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. 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 62453-52 and [3]), therefore it shall not be provided if DTM is running in FDT 1.2 (see [3]) based Frame Applications
fdt:manufacturerId	As defined in Identity object (see IEC 61158-5-2:2019, 6.2.1.2.2)

Data type	Description for use
fdt:semanticId	The applicationDomain is: FDT_CIP.
fdt:applicationDomain	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
arrayDimensions	STRING	Represents the dimension of an array, see [5], Appendix C
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 61158-5-2:2019, 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 61158-5-2:2019, 6.2.1.2.2
ePath	ARRAY OF USINT	CIP EPATH, see IEC 61158-6-2:2019, 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

Data type	Definition	Description
majorRevision	USINT	Represents the Major Revision (attribute 4.1) of the Identity object. See IEC 61158-5-2:2019, 6.2.1.2.2
minorRevision	USINT	Represents the Minor Revision (attribute 4.2) of the Identity object. IEC 61158-5-2:2019, 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 61158-5-2:2019, 6.2.1.2.2
productName	STRING	Represents the Product name (attribute 7) of the Identity object. See IEC 61158-5-2:2019, 6.2.1.2.2
serialNumber	ARRAY OF USINT	Represents the Serialnumber (attribute 6) of the Identity object. See IEC 61158-5-2:2019, 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
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 61158-5-2:2019, 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 61158-5-2:2019, 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]	
CIPObjectId	STRUCT			The CIP classId, instanceId and (conditional) attributeId 'address' information for a CIP object and attribute. If used in a Process Channel this is likely to be either an Assembly object or a Parameter object
	classId	M	[1..1]	
	instanceId	M	[1..1]	
	attributeId	O	[0..1]	

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
CIPPath	STRUCT			The full 'address' of the CIP node (device). In general, this consists of the Node ID stored in the CIPNodeID element. The RoutingPath element is used to transfer additional routing information that can be used by the CIP FDT communication component
	RoutingPath	O	[0..1]	
	CIPNodeID	M	[1..1]	
CIPSymbolicAddress	STRUCT			classId, instanceId and attributeId does not necessarily be known, a symbolic address could also be used. CIPSymbolicAddress, HexAddress or CIPObjectId could be used for DataExchangeRequest
	symbolicAddress	M	[1..1]	
Constant	STRUCT			A constant value
	constValue	M	[1..1]	
ExtendedIdentifier	STRUCT			See attribute extendedIdentifier
	extendedIdentifier	M	[1..1]	
HexAddress	STRUCT			CIP object address as ePath
	ePath	O	[0..1]	
LinkAddress	STRUCT			Represents the CIPNodeID within a Segment
	CIPNodeID	M	[1..1]	
ParameterReference	STRUCT			Reference to a description of a parameter
	fdt:idref	M	[1..1]	
	bitOffset	O	[0..1]	
ReservedBits	STRUCT			Used wherever reserved bits are needed
RoutingPath	STRUCT			Any additional CIP network routing information, which can be understood by the Communication Channel
	Segment	M	[1..1]	
Segment	STRUCT			Represents the path a message shall follow to reach the addressed CIP device
	portNumber	M	[1..1]	
	LinkAddress	M	[1..1]	
	Segment	O	[0..1]	
Service	STRUCT			CIP service identified by serviceCode and serviceName. CIP service code is a function, or method, supported by a CIP object or attribute
	serviceCode	M	[1..1]	
	serviceName	O	[0..1]	
ShortIdentifier	STRUCT			See attribute shortIdentifier
	shortIdentifier	M	[1..1]	

9 Network management data types

9.1 General

The data types specified in Clause 9 are used at following services:

- NetworkManagementInfoRead service;
- NetworkManagementInfoWrite service.

9.2 Node address

The CIPNodeID will be stored in the busAddress element of the fdt:DeviceAddress data type. This is not used for CompoNet because the master has a fixed address – since this is a mandatory element, the recommendation is to use the value "0".

NOTE   Additional implementation hints regarding addressing in CompoNet are provided in Annex Annex A.

9.3 Scanner/master – Bus parameter set (CIP)

Information is provided to the CIP scanner/master within the UserDefinedBus element of the NetworkInfo data type, using the data types specified in Table 10 and Table 11. This information shall be set to configure the scan list of scanner/master.

The data types described in this subclause are defined for following namespace:
Namespace: cippar

Table 10 – Simple fieldbus configuration data types

Data type	Definition	Description
async	USINT	See Table 7-2.5 of [9] Connection Manager Field Usage for Safety. This is a CIP Safety exclusive field. Only applies to producing connections. Field should be empty for consuming connections. Used to calculate Network Reaction Time
base	UINT	Scaling parameters according to ISO 15745-2:2003, A.4.1.4.6
class0	BOOL	Trigger and transport mask bit assignment. See ISO 15745-3:2003, Table A.25
class1	BOOL	
class2	BOOL	
class3	BOOL	
class4	BOOL	
class5	BOOL	
class6	BOOL	
compoNetDeviceCategory	USINT	Defines the different categories of CompoNet devices. See [10], Chapter 7-4
compoNetIOLength	UINT	See [10], Chapter 7-5
compoNetIOLengthUnit	USINT	
connectionId	STRING	Uniquely identifies the connection within the DTM.
connectionNameString	STRING	Connection entry format according to ISO 15745-3:2003, Table A.24
connectionTypeMulticast	BOOL	See Connection parameters bit assignments. See ISO 15745-3:2003, Table A.26
connectionTypeNULL	BOOL	
connectionTypePoint2Point	BOOL	
consumedConnectionSize	UINT	Maximum number bytes received across this connection
defaultConnection	BOOL	Indicates whether the CIPConnection is default or not

Data type	Definition	Description
defaultSafetyConnections	USINT	See Table 7-2.4 of [9] Connection Manager Section Keywords for Safety. Instance Number
defaultValue	STRING	Represents the value of the attribute when in offline state
div	UINT	Scaling parameters. See ISO 15745-2:2003, A.4.1.4.6
expectedPacketRate	UINT	Scanner determines this parameter. There might be some reason that the slave provides this parameter to the master
fixedSizeSupported	BOOL	Connection parameters bit assignments. See ISO 15745-3:2003, Table A.26
helpString	STRING	Connection entry format. See ISO 15745-3:2003, Table A.24
inhibitTime	UINT	Optional for COS, for other connection types it is not valid. Scanner determines this parameter. There might be some reason that the slave provides this parameter to the master
maxCIPConnections	UINT	Communication capacity, see Chapter 7-3.6.11.7 of [5]
maxConsumerNumber	USINT	See Table 7-2.4 of [9] Connection Manager Section Keywords for Safety. This is a CIP Safety exclusive field. When safety devices wish to define multi-cast connections and need to restrict the maximum number of consumers to a value less than the default maximum of 15, this field can define the product limit. If this field is empty, the SNCT shall always use the default value of 15 for the maximum number of multi-cast connections. This field can be left empty for single-cast connections.
maxEMConnections	UINT	Communication capacity. See Chapter 7-3.6.11.7 of [5]
maxIOConnections	UINT	
maxRPI	UDINT	Maximum Packet Interval supported by the device. The RPI is delivered from the Device DTM to the Master DTM only with a default value. As the Master DTM only has the overview over all adjusted RPI, there is a possibility that the Master DTM will change/adapt this value therefore a minimum and a maximum value is necessary.
maxSafetyConnections	USINT	See Table 7-2.2 of [9] Connection Manager Section Keywords for Safety. Optional
maxSafetyInputCnxns	USINT	
maxSafetyOutputCnxns	USINT	
minRPI	UDINT	Minimum Packet interval required by the device. The RPI is delivered from the Device DTM to the Master DTM only with a default value. As the Master DTM only has the overview over all adjusted RPI, there is a possibility that the Master DTM will change/adapt this value therefore a minimum and a maximum value is necessary.
multiplier	UINT	Scaling parameters. See ISO 15745-2:2003, A.4.1.4.6
offset	INT	
precision	UINT	
priorityHigh	BOOL	Connection parameters bit assignments. See ISO 15745-3:2003, Table A.26.
priorityLow	BOOL	
priorityScheduled	BOOL	
priorityUrgent (ENIPV1.2)	BOOL	
producedConnectionSize	UINT	Maximum number of bytes transmitted across this connection
realTimeTransferFormat	USINT	Connection parameters bit assignments. See ISO 15745-3:2003, Table A.26.
rpi	UDINT	Requested packet interval in microseconds: the measure of how frequently the originating application requires the transmission of data from the target application. See ISO 15745-3:2003, Table A.24 Connection Manager Section
scId	ARRAY OF USINT	Safety Configuration Identifier. See IEC 61784-3-2:2021, 6.6.5.18

Data type	Definition	Description
server	BOOL	Trigger and transport mask bit assignment. See ISO 15745-3:2003, Table A.25.
transportTypeExclusiveOwner	BOOL	
transportTypeInputOnly	BOOL	
transportTypeListenOnly	BOOL	
transportTypeRedundantOwner	BOOL	
triggerApplication	BOOL	
triggerChangeOfState	BOOL	
triggerCyclic	BOOL	
unId	ARRAY OF USINT	Target UNID. See IEC 61784-3-2:2021, 6.6.5.19
variableSizeSupported	BOOL	Connection parameters bit assignments. See ISO 15745-3:2003, Table A.26.

Table 11 – Structured fieldbus configuration data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
AssemblyMemberDefinition	STRUCT			Represents all members of an assembly
	fdt:id	O	[0..1]	
	fdt:tag	M	[1..1]	
	fdt:descriptor	O	[0..1]	
	cip:dataType	M	[1..1]	
	defaultValue	O	[0..1]	
	cip:arrayDimensions	O	[0..1]	
	Scaling	O	[0..1]	
	cip:CIPObjectAddress	O	[0..1]	
	fdt:BitEnumeratorEntries	O	[0..1]	
	fdt:EnumeratorEntries	O	[0..1]	
	fdt:Unit	O	[0..1]	
	fdt:Ranges	O	[0..1]	
	fdt:SubstituteValue	O	[0..1]	
AssemblyMemberDefinitions	STRUCT			See AssemblyMember definition
	AssemblyMemberDefinition	O	[0..*]	
BitStrobeConnection	STRUCT			Represents the Bitstrobe IO connection
	MasterSlaveConnection	M	[1..1]	
Capacity	STRUCT			Communication capacity, See Chapter 7-3.6.11.7 of [5]
	MaxCIPConnections	O	[0..1]	
	MaxIOConnections	O	[0..1]	
	MaxEMConnections	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
CIPConnection	STRUCT			Defines one supported CIP connection Contains attributes, see ISO 15745-3:2003, Table A.24 For safety devices, see Chapter 7-2.2.4.3, Table 7-2-3 of [9]
	connectionId	M	[1..1]	
	connectionNameString	M	[1..1]	
	helpString	M	[1..1]	
	cip:ePath	M	[1..1]	
	defaultConnection	O	[0..1]	
	Config1	O	[0..1]	
	Config2	O	[0..1]	
	TriggerAndTransport	M	[1..1]	
	Originator2TargetParameters	M	[1..1]	
	Target2OriginatorParameters	M	[1..1]	
CIPNode	STRUCT			Represents all connection information of the device
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdtpar:configurationData	O	[0..1]	
	scId	O	[0..1]	
	unId	O	[0..1]	
	cip:CIPDeviceIdentity	M	[1..1]	
	cip:CIPNodeID	M	[1..1]	
	PossibleConnections	M	[1..1]	
	CurrentConnections	M	[1..1]	
	AssemblyMemberDefinitions	O	[0..1]	
CompoNetIO	STRUCT			Defines the IO of a CompoNet device. See [10], Chapter 7-2
	compoNetDeviceCategory	M	[1..1]	
	CompoNetInputInfo	O	[0..1]	
	CompoNetOutputInfo	O	[0..1]	
CompoNetInputInfo	STRUCT			Represents the Inputs of the CompoNet device
	CompoNetIOInfo	M	[1..1]	
CompoNetIOInfo	STRUCT			Represents the Inputs or Outputs of the CompoNet device
	compoNetIOLengthUnit	M	[1..1]	
	compoNetIOLength	M	[1..1]	
CompoNetOutputInfo	STRUCT			Represents the Outputs of the CompoNet device
	CompoNetIOInfo	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
Config	STRUCT			Deprecated, see Clause A.3, Contains elements Size and Format
	Size	O	[0..1]	
	Format	O	[0..1]	
Config1	STRUCT[a]			Deprecated, see Clause A.3, See ISO 15745-3:2003, Table A.24
	Config	M	[1..1]	
Config2	STRUCT[b]			Deprecated, see Clause A.3, See ISO 15745-3:2003, Table A.24
	Config	M	[1..1]	
ConnectionParameters	STRUCT			Represents the Connection Parameters keyword of the Connection Manager Section of an EDS-file. See ISO 15745-3:2003, A.4.1.4.9
	fixedSizeSupported	O	[0..1]	
	variableSizeSupported	O	[0..1]	
	realTimeTransferFormat	O	[0..1]	
	connectionTypeNULL	O	[0..1]	
	connectionTypeMulticast	O	[0..1]	
	connectionTypePoint2Point	O	[0..1]	
	priorityLow	O	[0..1]	
	priorityHigh	O	[0..1]	
	priorityScheduled	O	[0..1]	
	priorityUrgent	O	[0..1]	
	cip:ReservedBits	O	[0..1]	
ConsumedAssemblyReference	STRUCT			Gives CIPObjectAddress of the data consumed on this IO connection. To reference what is the I/O assembly attached to this connection to allow the scanner to understand the members of the consumed assembly
	cip:CIPObjectAddress	M	[1..1]	
COSConnection	STRUCT			Represents the COS IO connection. It is mutual exclusive with the Cyclic IO connection
	MasterSlaveConnection	M	[1..1]	
CurrentConnections	STRUCT			Represents all default connections of this device
	CIPConnection	O	[0..*]	
	MasterSlaveConnectionSet	O	[0..1]	
	CompoNetIO	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
CyclicConnection	STRUCT			Represents the Cyclic IO connection. It is mutual exclusive with the COS IO connection
	MasterSlaveConnection	M	[1..1]	
Format	STRUCT			Config data format. See ISO 15745-3:2003, Table A.24
	choice of	M	[1..1]	
	cip:ParameterReference	S	[1..1]	
	fdt:ChannelReference	S	[1..1]	
MasterSlaveConnection	STRUCT			Defines one supported MasterSlave connection
	producedConnectionSize	M	[1..1]	
	consumedConnectionSize	M	[1..1]	
	expectedPacketRate	O	[0..1]	
	inhibitTime	O	[0..1]	
	ConsumedAssemblyReference	O	[0..1]	
	ProducedAssemblyReference	O	[0..1]	
MasterSlaveConnectionSet	STRUCT			Zero or more MasterSlaveConnections. MasterSlaveConnection elements can be combined according to the CIP specification (see IEC 62026-3). This element shall be provided for DeviceNet. If device does not support I/O connections through the MasterSlave connection set, this list shall be empty
	PolledIOConnection	O	[0..1]	
	BitStrobeConnection	O	[0..1]	
	choice of	O	[0..1]	
	COSConnection	S	[1..1]	
	CyclicConnection	S	[1..1]	
	MulticastPollingConnection	O	[0..1]	
MulticastPollingConnection	STRUCT			Represents the Multicast Polled IO connection
	MasterSlaveConnection	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
Originator2TargetParameters	STRUCT			Originator to target connection parameters. See ISO 15745-3:2003, Table A.24
	rpi	O	[0..1]	
	minRpi (ENIP V1.2)	O	[0..1]	
	maxRpi (ENIP V1.2)	O	[0..1]	
	ConnectionParameters	M	[1..1]	
	choice of	M	[1..*]	
	Size	S	[1..1]	
	Format	S	[1..1]	
PolledIOConnection	STRUCT			Represents the Polled IO connection
	MasterSlaveConnection	M	[1..1]	
PossibleConnections	STRUCT			Represents all possible connections that can be made to this device
	maxSafetyConnections	O	[0..1]	
	maxSafetyInputCnxns	O	[0..1]	
	maxSafetyOutputCnxns	O	[0..1]	
	defaultSafetyConnections	O	[0..1]	
	Capacity	O	[0..1]	
	CIPConnection	O	[0..*]	
	PolledIOConnection	O	[0..1]	
	BitStrobeConnection	O	[0..1]	
	COSConnection	O	[0..1]	
	CyclicConnection	O	[0..1]	
	MulticastPollingConnection	O	[0..1]	
	SafetyInputConnection	O	[0..*]	
	SafetyOutputConnection	O	[0..*]	
	CompoNetIO	O	[0..1]	
ProducedAssemblyReference	STRUCT			Provides CIPObjectAddress of the data produced on this IO connection,in order to reference what is the I/O assembly attached to this connection. This allows the scanner to understand the members of the produced assembly.
	cip:CIPObjectAddress	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
Target2OriginatorParameters	STRUCT			Target to originator connection parameters. See ISO 15745-3:2003, Table A.24
	rpi	O	[0..1]	
	minRpi (ENIP V1.2)	O	[0..1]	
	maxRpi (ENIP V1.2)	O	[0..1]	
	ConnectionParameters	M	[1..1]	
	choice of	M	[1..*]	
	Size	S	[1..1]	
	Format	S	[1..1]	
TransportTypeExclusiveOwner	STRUCT			See transportTypeExclusiveOwner
	transportTypeExclusiveOwner	M	[1..1]	
TransportTypeInputOnly	STRUCT			See transportTypeInputOnly
	transportTypeInputOnly	M	[1..1]	
TransportTypeListenOnly	STRUCT			See transportTypeListenOnly
	transportTypeListenOnly	M	[1..1]	
TransportTypeRedundantOwner	STRUCT			See transportTypeRedundantOwner
	transportTypeRedundantOwner	M	[1..1]	
TriggerAndTransport	STRUCT			Represents the Trigger and Transport keyword of the Connection Manager Section of an EDS-file. See ISO 15745-3:2003, A.4.1.4.9
	class0	O	[0..1]	
	class1	O	[0..1]	
	class2	O	[0..1]	
	class3	O	[0..1]	
	class4	O	[0..1]	
	class5	O	[0..1]	
	class6	O	[0..1]	
	triggerCyclic	O	[0..1]	
	triggerChangeOfState	O	[0..1]	
	triggerApplication	O	[0..1]	
	server	O	[0..1]	
	choice of	M	[1..1]	
	TransportTypeListenOnly	S	[1..1]	
	TransportTypeInputOnly	S	[1..1]	
	TransportTypeExclusiveOwner	S	[1..1]	
	TransportTypeRedundantOwner	S	[1..1]	
	cip:ReservedBits	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicy	
SafetyInputConnection	STRUCT			Defines one supported CIP Safety Input connection
	async	M	[1..1]	
	maxConsumerNumber	O	[0..1]	
	CIPConnection	M	[1..1]	
SafetyOutputConnection	STRUCT			Defines one supported CIP Safety Output connection
	maxConsumerNumber	O	[0..1]	
	CIPConnection	M	[1..1]	
Scaling	STRUCT			Scaling of a parameter. See ISO 15745-2:2003, A.4.1.4.6
	offset	M	[1..1]	
	base	M	[1..1]	
	multiplier	M	[1..1]	
	div	M	[1..1]	
	precision	O	[0..1]	
Size	STRUCT			See ISO 15745-3:2003, Table A.24
	choice of	M	[1..1]	
	cip:Constant	S	[1..1]	
	cip:ParameterReference	S	[1..1]	
UserDefinedBus	STRUCT			Represents the CIP protocol specific part of NetworkInfo
	CIPNode	M	[1..1]	
a, b Additional implementation hints regarding Config1 and Config2 are provided in Annex A.				

10 Communication data types

The data types specified in Clause 10 are used with the following services:

- Connect service,
- Transaction service,
- Disconnect service,
- Abort service,
- Sequence service.

The service arguments contain the address information and the communication data (explained in Table 12 and Table 13).

The data types described in Clause 10 are defined for the following namespace.
Namespace: fdtcipcomm

Table 12 – Simple communication data types

Data type	Definition	Description
communicationReference	UUID	Mandatory internal FDT value which uniquely identifies a connection to a device. It is allocated by the Communication Channel during the ConnectRequest. The value is used by subsequent communication calls up to and including DisconnectRequest or Abort
delayTime	UDINT	Delay time in [ms] between two communication calls
extendedStatusCode	ARRAY OF USINT	CIP extended status code further elaborates upon the CIP status code and may be present in an Error Response message from a CIP object. (CIP range: 0-255 words) (DeviceNet: 1 byte) This information is formatted as a hex string to cover the CIP extended status codes. This information is protocol specific
sequenceTime	UDINT	Period of time in [ms] for the whole sequence
statusCode	USINT	CIP status code, which is present in the General Status Code field of a Response message from a CIP object. For DeviceNet, this is provided only in error cases

Table 13 – Structured communication data types

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
Abort	STRUCT			Describes the abort. An abort cancels all outstanding requests and closes the connection
	communicationReference	M	[1..1]	
ConnectRequest	STRUCT			Element used with ConnectRequest call to identify the CIP node (device) with which a communication connection should be established
	fdt:systemTag	O	[0..1]	
	cip:CIPPath	M	[1..1]	
ConnectResponse	STRUCT			Element used with the ConnectResponse call used to convey a unique value – the communicationReference – which should be used in subsequent calls on this communication connection. ConnectResponse contains the CIPDevice element as defined in DTMCIPDataTypeSchema.xml, which is used to acknowledge that the connection to the requested nodeID is actually established
	communicationReference	M	[1..1]	
	cip:CIPDevice	M	[1..1]	

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
DataExchangeRequest	STRUCT			Element used with the TransactionRequest call to describe the communication request to a particular object within the CIP node (the CIP node is associated with the connection identified by the connectionReference). The object address is specified using the CIPObjectAddress element. The service to perform is specified using the Service element. If data is required by the service it is stored in the fdt:CommunicationData element
	communicationReference	M	[1..1]	
	cip:serviceCode	M	[1..1]	
	cip:CIPObjectAddress	M	[1..1]	
	fdt:CommunicationData	O	[0..1]	
DataExchangeResponse	STRUCT			Element used with the TransactionResponse call to return the result of a TransactionRequest. Depending on the network, result codes are returned in the ServiceResponse
	communicationReference	M	[1..1]	
	ServiceResponse	M	[1..1]	
	fdt:CommunicationData	O	[0..1]	
DisconnectRequest	STRUCT			Element used with the DisconnectRequest call to identify the connection, which should be terminated
	communicationReference	M	[1..1]	
DisconnectResponse	STRUCT			Element used with DisconnectResponse to indicate that the connection identified by the communicationReference has been terminated
	communicationReference	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]	
ServiceResponse	STRUCT			CIP service response and status codes. All error codes are described in IEC 61158-6-2:2019, 4.1.11
	cip:serviceCode	M	[1..1]	
	statusCode	M	[1..1]	
	extendedStatusCode	O	[0..1]	

11 Channel parameter data types

The data types specified in Clause 11 are used with the following services:

- ReadChannelData service,
- WriteChannelData service.

Channels in a DTM can be used to represent the "Process values" available on that device. These are sometimes called Process Channels. A process control system (i.e. some external system which monitors values on a device) can query each of the DTM's channels for its channel parameters. The channel parameter schema describes the process values so that an external system can use the information to access and interpret the values from the device during normal device runtime. The external system might not use FDT to access the values.

Information about the available channels (if there are any) is included in the information returned from the GetChannels service call.

Data types used by the services ReadChannelData and WriteChannelData are specified in Table 14 and Table 15.

These data types can be used by a DTM (e.g. slave/adapter device's DTM) to describe its I/O assemblies – data format and constituent Params (providing similar information to that found in the [IO_Info]/[Variant_IO_Info]/[Connection Manager], [Assembly] and [Params] sections of an EDS file) – and by a master/scanner device's DTM to describe the objects used to access a shadow of the slave device's I/O data. The Process Channel of the master DTM also refers to the child DTM and the Process Channel of the child DTM, which describes the assembly data layout within the master device.

The data types described in Clause 11 are defined for following namespace.
Namespace: cipchannel

Table 14 – Simple channel parameter data types

Data type	Definition	Description
assemblySize	USINT UDINT (ENIP V1.2 only)	Length of the assembly data in bytes
frameApplicationTag	STRING	Frame Application specific tag used for identification and navigation
gatewayBusCategory	UUID	Unique identifier for a supported bus type (DeviceNet, Ethernet/IP, ControlNet or CompoNet) according to the specific CATID
helpMessage	STRING	CIP assembly, parameter or I/O connection help string
memberPosition	UDINT	Zero based bit offset. Position of the member data in the assembly data. This has to be calculated from the Assembly structure information
memberSize	UDINT	Number of bits. Length of the member data in the assembly data
protectedByChannelAssignment	BOOL	This flag is set by the client. If the flag is set, DTM is not allowed to change the I/O connection definition

Table 15 – Structured channel parameter data types

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
AssemblyMember	STRUCT			Describes a member of an assembly. Provided is the bitPosition from the start of the assembly data block and the bitLength in bits, and the FDT channel reference of the channel which describes the member data. The reference to the data of the AssemblyMember can be a) a ParameterReference to the list of parameters derived from the deviceDTM by GETParametersList; b) an AssemblyMemberReference references another Assembly. So this is then a nested assembly; c) an FDT ChannelReference points to a channel provide by the Device DTM; d) a CIPObject Address points to the attribute holding the data in the CIP way of addressing. If the member is a constant, it is expressed in this way
	memberPosition	M	[1..1]	
	memberSize	M	[1..1]	
	choice of	M	[1..1]	
	AssemblyMemberReference	S	[0..1]	
	fdt:ChannelReference	S	[0..1]	
	cip:CIPObjectAddress	S	[1..1]	
	cip:Constant	S	[1..1]	
AssemblyMemberReference	STRUCT			Reference to the description of an assembly member
	fdt:idref	M	[1..1]	
	cip:bitOffset	O	[0..1]	
AssemblyMembers	STRUCT			The collection of AssemblyMembers. This member is available only if the FDT channel object represents an assembly; otherwise channel represents a CIP object
	AssemblyMember	O	[0..*]	
ChannelReference	STRUCT			Refers to an FDT channel and an CIP object reference
	cip:bitOffset	M	[1..1]	
	fdt:ChannelReference	M	[1..1]	
	cip:CIPObjectAddress	M	[1..1]	

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
FDTChannel	STRUCT			Describes the Process Channel in detail
	fdt:tag	M	[1..1]	
	fdt:id	M	[1..1]	
	protectedByChannelAssignment	M	[1..1]	
	fdt:dataType	M	[1..1]	
	assemblySize	M	[1..1]	
	fdt:signalType	M	[1..1]	
	frameApplicationTag	O	[0..1]	
	helpMessage	O	[0..1]	
	fdt:SemanticInformation	O	[0..1]	
	ServiceSet	M	[1..1]	
	cip:CIPObjectAddress	M	[1..1]	
	AssemblyMembers	O	[0..1]	
FDTChannelType	STRUCT			Description of the channel component in case of channels with gateway functionality. States the version number of the DTM and, optionally, the fieldbus category ID
	gatewayBusCategory	O	[0..1]	
	fdt:VersionInformation	M	[1..1]	
ServiceSet	STRUCT			The collection of supported CIP Service Codes
	cip:Service	M	[1..*]	

12 Device identification

12.1 Device type identification data types

The IEC 61784 CPF 2 device type identification data types provide general data types with a protocol specific semantic (see Table 16) as well as data types without such a mapping (see Table 17 and Table 18).

The data types described in this subclause are defined for following namespace:
Namespace: cipident

Table 16 – Identification data types with protocol specific mapping

IEC 61784 CPF 2 attribute name	Semantic element name	Data request in physical device	Protocol specific name	IEC 61784 CPF 2 data format	FDT data type (display format)	Specific reference
busProtocol	IdBusProtocol	For all DeviceNet Devices: protocol_CIP_DeviceNet For all Ethernet/IP Devices: protocol_CIP_EthernetIP For all ControlNet Devices: protocol_CIP_ControlNet For all CompoNet Devices: protocol_CIP_CompoNet	-	-	Enumeration (protocol_CIP_DeviceNet | protocol_CIP_EthernetIP | protocol_CIP_ControlNet | protocol_CIP_CompoNet)	-

Table 17 – Simple identification data types with protocol independent semantics

Data type	Definition	Description
idDTMSupportLevel	enumeration (genericSupport | profileSupport | blockspecificProfileSupport | specificSupport | identSupport)	Enumeration (see IEC 62453-2)
match	STRING	Used by a DTM to define a regular expression, which shall match the scanned physical identification information
nomatch	STRING	Used by a DTM to define a regular expression, which shall not match the scanned physical identification information. Used by Device DTM to indicate if identification information may not match

Table 18 – Structured identification data types with protocol independent semantics

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
RegExpr	STRUCT			Includes regular expression string – either for match or nomatch
	match	O	[0..1]	
	nomatch	O	[0..1]	

12.2 Topology scan data types

The data type CIPDevice (see Table 9), is used with the Scan service response.

This data type describes one entry in the list of scanned devices.

12.3 Scan identification data types

Subclause 12.3 defines data types that are used to provide the scan response of a CIP network (see Table 19 and Table 20).

The data types described in this subclause are defined for following namespace:
Namespace: cipdevscanid

Table 19 – Simple scan identification data types

Data type	Definition	Description
configuredState	enumeration (configuredAndPhysicallyAvailable | configuredAndNotPhysicallyAvailable | availableButNotConfigured | notApplicable)	A communication master shall indicate in this attribute, if the scan response is related to a detected physical device, which is configured or unconfigured
resultState	enumeration (provisional | final | error)	Identifies if the result is one of the provisional results or the final result of the split scan results

Table 20 – Structured scan identification data types

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
IdBusProtocol	STRUCT			This element contains exactly one attribute, which contains the value of the scanned physical device. This element has semantic meaning therefore has a prefix "Id" for better identification
	cipident:busProtocol	O	[0..1]	
	cipident:RegExpr	O	[0..*]	
ScanIdentification	STRUCT			These elements contain all elements for the appropriate protocol variant
	configuredState	O	[0..1]	
	fdt:CommunicationError	O	[0..1]	
	IdBusProtocol	M	[1..1]	
	cip:CIPDevice	M	[1..1]	
ScanIdentifications	STRUCT			Collection of ScanIdentification elements
	fdt:protocolId	M	[1..1]	
	resultState	M	[1..1]	
	ScanIdentification	O	[0..*]	

12.4 Device type identification data types

Subclause 12.4 defines data types that are used to provide protocol specific information for device types (see Table 21).

The data types described in this subclause are defined for following namespace:
Namespace: cipdevid

Table 21 – Structured device type identification data types

Data type	Definition			Description
	Elementary data type	Usage	Multiplicity	
DeviceIdentification	STRUCT			This element contains all elements for the appropriate protocol variant
	cipident:idDTMSupportLevel	M	[1..1]	
	IdBusProtocol	M	[1..1]	
	cip:CIPDeviceIdentity	M	[1..1]	
	IdDeviceType	O	[0..*]	
	IdVendorID	O	[0..*]	
	IdRevision	O	[0..*]	
DeviceIdentifications	STRUCT			Collection of DeviceIdentification elements
	fdt:protocolId	M	[1..1]	
	DeviceIdentification	O	[0..*]	
IdBusProtocol	STRUCT			This element contains exactly one attribute, which contains the value of the scanned physical device. This element has semantic meaning therefore has a prefix "Id" for better identification
	cipident:busProtocol	O	[0..1]	
	cipident:RegExpr	O	[0..*]	
IdVendorId	STRUCT			Represents the vendor id
	cipident:RegExpr	O	[0..*]	
IdDeviceType	STRUCT			Represents the device type
	cipident:RegExpr	O	[0..*]	
IdRevision	STRUCT			Represents the revision
	cipident:RegExpr	O	[0..*]	
IdproductName	STRUCT			Represents the product name
	cip:productName	M	[1..1]	
	cipident:RegExpr	O	[0..*]	

Annex A
(informative)

Implementation hints

A.1   Addressing in CompoNet DTMs

In CompoNet the Node Address can be set on the device using switches (see [10], Chapter 9-3). This same address is used to set the Address on the DTM.

As for all other CIP protocols, the "UserDefinedBus" Addressing is used in the DTM's Parameter Document. Since the CompoNet Node Address range is limited to 127, the "ShortIdentifier" can be used to specify the address within the "UserDefinedBus" data type.

CompoNet defines different types of devices, with are specified in the EDS file by the Device Category keyword (see [10], Chapter 7 and Table A.1).

The Node Address range depends on the Device Category, as defined in Table A.1.

The address used for communication on Layer 2 (Media Access Control Address, MAC), i.e. the MAC ID, is calculated from the Device Type and the Node address, in accordance to Table A.1 (see also [10], Chapters 1-4).

Table A.1 – CompoNet relationship between Device Category, Node Address, MAC ID

Device Category	Value	Node Address	Node Address length	Prefix coding bit 9-7	MAC ID
Master	0		6-bit	0x111	0x1C0
Word IN	1	0x00-0x3F	6-bit	0x000	0x0-0x3F
Word OUT	2	0x00-0x3F	6-bit	0x001	0x40-0x7F
Word MIX	3	0x00-0x3F	6-bit	0x000	0x0-0x3F
Bit IN	4	0x00-0x7F	7-bit	0x01*	0x80-0xFF
Bit OUT	5	0x00-0x7F	7-bit	0x10*	0x100-0x17F
Bit MIX	6	0x00-0x7F	7-bit	0x01*	0x80-0xFF
Repeater	7	0x00-0x3F	6-bit	0x110	0x180-0x1BF

The MAC ID shall be used for direct communication, and not the Node Address. Since the length of the MAC ID is 9 bits, the short identifier that is used within the "UserDefinedBus" element of the DTM's Parameter Document cannot be used, as it is limited to one octet.

For addressing the DTM therefore uses the Node Address with a prefix. The Prefix depends on the Device Type as indicated in Table A.1. The prefix and the Node Address are combined to build the MAC ID, which is provided through the ExtendedIdentifier.

EXAMPLE

Word IN at Node Address 1	is MAC ID	0x0001
Word OUT at Node Address 5	is MAC ID	0x0045
Bit IN at Node Address 127	is MAC ID	0x00FF
Bit OUT at Node Address 127	is MAC ID	0x017F

When doing communication in FDT (slave request communication from master) this MAC ID is used in the ExtendedIdentifier. The notation is always in hexadecimal format.

A.2   Displaying addresses of CompoNet DTMs

As there are different types of devices according to the Device Category but they can have the same Node Address, there should be a way to distinguish devices of different Device Categories. The proposal is to add the Device Category in the name of the DTM, as shown for example in Figure A.1.
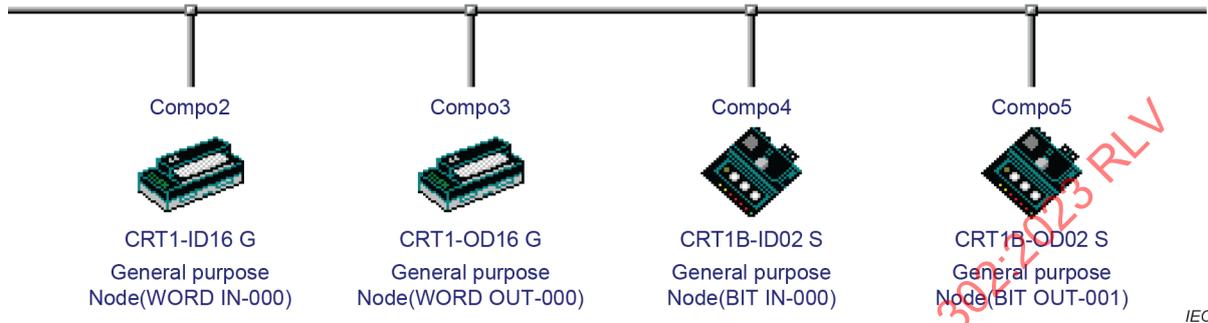

Compo2	Compo3	Compo4	Compo5
CRT1-ID16 G	CRT1-OD16 G	CRT1B-ID02 S	CRT1B-OD02 S
General purpose Node(WORD IN-000)	General purpose Node(WORD OUT-000)	General purpose Node(BIT IN-000)	General purpose Node(BIT OUT-001)

IEC

Figure A.1 – Examples of DTM naming for CompoNet

A.3   Handling of Config1 and Config2 elements in EtherNet/IP

During the CIP Forward_Open service an optional data segment can be appended to the path attribute of this service. The Config1 and Config2 elements are intended to be used to transfer this information from the Device DTM to the Parent DTM.

During the CIP Forward_Open service the data segments given in Config1 and Config2 are appended to the path attribute of this service. The path of the service is represented by the cip:ePath attribute in the CIPConnection element.

It is recommended to concatenate the configuration buffers Config1 and Config2 to the cip:ePath attribute in the element CIPConnection if required.

To be closer to the CIP forward_open request (See 3-5.5.1.11 Connection Path and example "Table 3-5.15" in [5]) the buffers shall be concatenated as follows.

The configuration buffers config1 and config2 are concatenated with a leading segment sub-type identifier (0x80), the configuration sizes in words (config1+config2) followed by a trailing pad byte if the size of the configuration buffer is not even number of bytes:

 cip:ePath

 + 1 byte segment Sub-Type: 0x80 (Simple Data Segment)

 + 1 byte size of the configuration buffers config1 and config2 (in words)

 + Configuration buffer Config1

 + Configuration buffer Config2

[+ 1 pad byte (0x00) if size of configuration buffers config1 and config2 modulo 2 is not 0].

The Format element of Config1 and Config2 shall not be used.

Bibliography

[1]   IEC 62453 (all parts), *Field device tool (FDT) interface specification*

[2]   IEC TR 62453-502:2009, *Field device tool (FDT) interface specification – Part 502: Communication implementation for common object model – IEC 61784 CPF 2*

[3]   FDT Interface Specification V1.2.1, Order No. of FDT Group: 0001-0001-002

[4]   FDT Interface Specification V1.2, Order No. of FDT Joint Interest Group: 0001-0001-001

[5]   ODVA: THE CIP NETWORKS LIBRARY – Volume 1: Common Industrial Protocol (CIP™) – Edition 3.5, available at <http://www.odva.org>

[6]   ODVA: THE CIP NETWORKS LIBRARY – Volume 2: EtherNet/IP™ Adaptation of CIP – Edition 1.5, available at <http://www.odva.org>

[7]   ODVA: THE CIP NETWORKS LIBRARY – Volume 3: DeviceNet™ Adaptation of CIP – Edition 1.5, available at <http://www.odva.org>

[8]   ControlNet International: THE CIP NETWORKS LIBRARY – Volume 4: ControlNet™ Adaptation of CIP – Edition 1.1, available at <http://www.controlnet.org>

[9]   ODVA: THE CIP NETWORKS LIBRARY – Volume 5, CIP Safety™, Edition 2.14, available at <http://www.odva.org>

[10]   ODVA: THE CIP NETWORKS LIBRARY – Volume 6: CompoNet™ Adaptation of CIP – Edition 1.7, available at http://www.odva.org

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SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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SPÉCIFICATION DES INTERFACES DES OUTILS DES DISPOSITIFS DE TERRAIN (FDT) –

Partie 302: Intégration des profils de communication – CPF 2 de l'IEC 61784

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Cette troisième édition annule et remplace la deuxième édition parue en 2016. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) prise en charge améliorée de l'Ethernet IP (voir 9.3, Article 10, et 12.4).

Chaque partie de la série IEC 62453-3xy doit être utilisée conjointement avec l'IEC 62453-2.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
65E/1031/FDIS	65E/1032/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Une liste de toutes les parties de la série IEC 62453, publiées sous le titre général *Spécification des interfaces des outils des dispositifs de terrain (FDT)*, se trouve sur le site Web de l'IEC.

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INTRODUCTION

La présente partie de l'IEC 62453 constitue une spécification d'interface pour les développeurs des composants des outils des dispositifs de terrain (FDT ou Field Device Tool en anglais) afin de prendre en charge le contrôle de fonction et l'accès aux données dans une architecture client/serveur. La spécification résulte d'un processus d'analyse et de conception destiné à réaliser des interfaces normalisées et permettre ainsi à de nombreux fournisseurs de développer des serveurs et des clients dans le cadre d'une interaction ininterrompue répondant à leur besoin.

L'intégration de bus de terrain dans les systèmes de commande nécessite d'effectuer quelques tâches supplémentaires. Outre les outils spécifiques à un bus de terrain et aux dispositifs, l'intégration de ces outils dans des outils d'ingénierie ou de planification à l'échelle d'un système de plus haut niveau s'avère nécessaire. La définition claire des interfaces d'ingénierie faciles à utiliser pour tous les outils concernés revêt une grande importance, en particulier, pour une utilisation dans des systèmes de commande importants et hétérogènes, généralement dans le domaine de l'industrie de transformation.

Un composant logiciel spécifique à un équipement, appelé gestionnaire de type d'équipement (DTM ou Device Type Manager en anglais) est fourni par le fabricant de dispositifs de terrain avec son équipement. Le DTM est intégré dans des outils d'ingénierie par l'intermédiaire des interfaces FDT définies dans la présente spécification. L'approche d'intégration s'applique en général à tous les types de bus de terrain et satisfait ainsi aux exigences relatives à l'intégration de différents types d'équipements dans des systèmes de commande hétérogènes.

La Figure 1 représente l'alignement de l'IEC 62453-302 dans la structure de la série IEC 62453 [1].
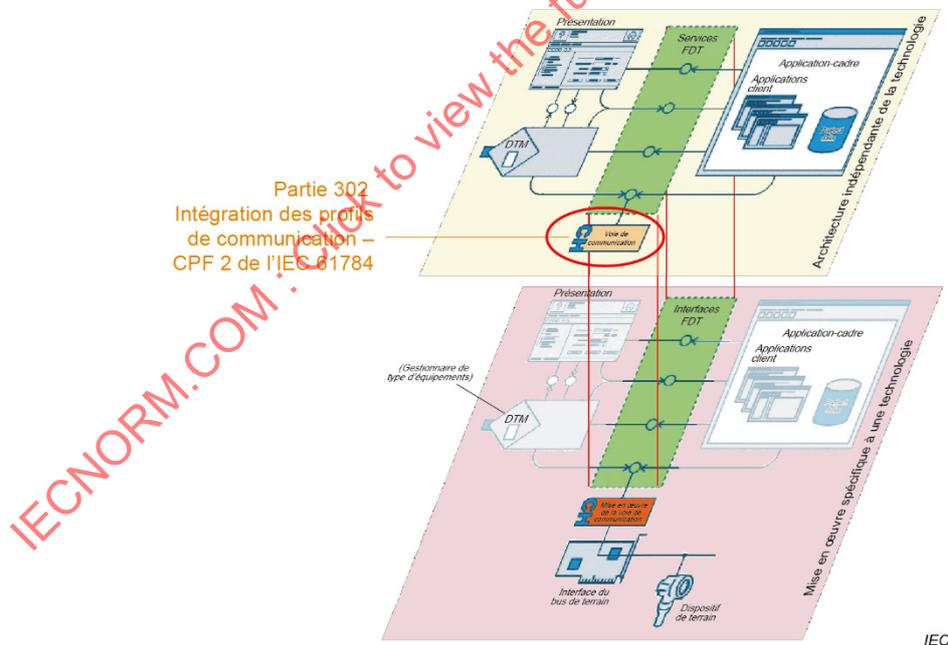

Figure 1 – Partie 302 de la série IEC 62453

NOTE   Pour un exemple de mise en œuvre spécifique à la technologie du présent document, voir [2].

SPÉCIFICATION DES INTERFACES DES OUTILS DES DISPOSITIFS DE TERRAIN (FDT) –

Partie 302: Intégration des profils de communication – CPF 2 de l'IEC 61784

1 Domaine d'application

La présente partie de l'IEC 62453 fournit des informations sur l'intégration de la technologie CIP™ dans la spécification des interfaces des outils des dispositifs de terrain (FDT) (IEC 62453-2). La Famille de profils de communication 2 (communément appelée CIP™[1]) définit des profils de communication basés sur les normes IEC 61158-2 Type 2, IEC 61158-3-2, IEC 61158-4-2, IEC 61158-5-2, IEC 61158-6-2 et IEC 62026-3. Les profils de base CP 2/1 (ControlNet™[2]), CP 2/2 (EtherNet/IP™[3]) et CP 2/3 (DeviceNet™[1]) sont définis dans l'IEC 61784-1 et l'IEC 61784-2. Un Profil de communication supplémentaire (CompoNet™[1]), également basé sur CIP™, est défini dans l'IEC 62026-7.

La présente partie de l'IEC 62453 spécifie les services de communication et autres services.

La présente spécification ne contient pas la spécification des outils FDT et ne la modifie pas.

2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 61158-2, *Réseaux de communication industriels – Spécifications des bus de terrain – Partie 2: Spécification et définition des services de la couche physique*

IEC 61158-3-2[4], *Réseaux de communication industriels – Spécifications des bus de terrain – Partie 3-2: Définition des services de la couche liaison de données – Éléments de type 2*

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[1] CIP™ (Common Industrial Protocol), DeviceNet™ et CompoNet™ sont les appellations commerciales de Open DeviceNet Vendor Association, Inc (ODVA). Cette information est donnée à l'intention des utilisateurs du présent document et ne signifie nullement que l'IEC approuve ou recommande le détenteur de la marque ou de l'un quelconque de ses produits. La conformité à la présente norme n'exige pas l'emploi des appellations commerciales CIP™, DeviceNet™ ou CompoNet™. L'utilisation des appellations commerciales CIP™, DeviceNet™ ou CompoNet™ nécessite l'autorisation de Open DeviceNet Vendor Association, Inc.

[2] ControlNet™ est l'appellation commerciale de ControlNet International, Ltd. Cette information est donnée à l'intention des utilisateurs du présent document et ne signifie nullement que l'IEC approuve ou recommande le détenteur de la marque ou de l'un quelconque de ses produits. La conformité à ce profil n'exige pas l'emploi de l'appellation commerciale ControlNet™. L'utilisation de l'appellation commerciale ControlNet™ nécessite l'autorisation de ControlNet International, Ltd.

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[4] Il existe une version consolidée du présent document, comprenant la deuxième édition (2014-08) [documents 65C/759/FDIS et 65C/769/RVD] et son amendement 1 (2019-04) [documents 65C/945/FDIS et 65C/954/RVD].

IEC 61158-4-2, *Réseaux de communication industriels – Spécifications des bus de terrain – Partie 4-2: Spécification du protocole de la couche liaison de données – Éléments de type 2*

IEC 61158-5-2:2019, *Réseaux de communication industriels – Spécifications des bus de terrain – Partie 5-2: Définition des services de la couche application – Éléments de type 2*

IEC 61158-6-2:2019, *Réseaux de communication industriels – Spécifications des bus de terrain – Partie 6-2: Spécification du protocole de la couche liaison de données – Éléments de type 2*

IEC 61784-1, *Réseaux de communication industriels – Profils – Partie 1: Profils de bus de terrain*

IEC 61784-2, *Réseaux de communication industriels – Profils – Partie 2: Profils de bus de terrain supplémentaires pour les réseaux en temps réel fondés sur l'ISO/IEC/IEEE 8802-3*

IEC 61784-3-2:2021, *Réseaux de communication industriels – Profils – Partie 3-2: Bus de terrain de sécurité fonctionnelle – Spécifications supplémentaires pour CPF 2*

IEC 62026-3, *Appareillage à basse tension – Interfaces appareil de commande-appareil (CDI) – Partie 3: DeviceNet*

IEC 62026-7, *Appareillage à basse tension – Interfaces appareil de commande-appareil (CDI) – Partie 7: CompoNet*

IEC 62453-1:–[5], *Spécification des interfaces des outils des dispositifs de terrain (FDT) – Partie 1: Vue d'ensemble et guide*

IEC 62453-2:2022, *Spécification des interfaces des outils des dispositifs de terrain (FDT) – Partie 2: Concepts et description détaillée*

ISO 15745-2:2003, *Systèmes d'automatisation industrielle et intégration – Cadres d'intégration d'application pour les systèmes ouverts – Partie 2: Description de référence pour les systèmes de contrôle fondés sur l'ISO 11898*

ISO 15745-3:2003, *Systèmes d'automatisation industrielle et intégration – Cadres d'intégration d'application pour les systèmes ouverts – Partie 3: Description de référence pour les systèmes de contrôle fondés sur la CEI 61158*

3   Termes, définitions, symboles, abréviations et conventions

3.1   Termes et définitions

Pour les besoins du présent document, les termes et les définitions de l'IEC 62453-1 et l'IEC 62453-2 s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http:www.iso.org/obp

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[5]   En cours d'établissement. Stade au moment de la publication: IEC/RPUB 62453-1:2022.
     À publier conjointement avec le présent document.

3.2 Symboles et abréviations

Pour les besoins du présent document, les symboles et les abréviations de l'IEC 62453-1, l'IEC 62453-2 ainsi que les suivants s'appliquent.

CIP™　　　　Common Industrial Protocol (Protocole industriel commun)

EDS　　　　Electronic Data Sheet (Fiche technique électronique)

3.3 Conventions

3.3.1 Dénominations des types de données et références aux types de données

Les conventions pour la dénomination et le référencement des types de données sont décrites dans l'IEC 62453-2:2022, Article A.1.

3.3.2 Vocabulaire relatif aux exigences

Les expressions suivantes sont utilisées pour spécifier des exigences.

Utilisation de "doit" ou "obligatoire"	Aucune exception tolérée.
Utilisation de "il convient de" ou "recommandé"	Forte recommandation. Il peut être légitime, dans des cas particuliers exceptionnels, de s'écarter du comportement décrit.
Utilisation de "peut" ou "facultatif"	La fonction ou le comportement peut être donné(e), selon des conditions définies.

4　Catégorie de bus

Le protocole CPF 2 de l'IEC 61784 est identifié dans l'élément protocolId du type structuré de données "fdt:BusCategory" par les identificateurs uniques suivants, tels que spécifiés dans le Tableau 1.

Tableau 1 – Identificateurs du protocole

Valeur d'identificateur	Nom de Protocole	Description
19B91472-EDB9-4e8c-BB61-516EEC79C1C0	"CIP DeviceNet"	Prise en charge de CP 2/3 (DeviceNet)
6CD80F51-019D-4e60-AEAC-B10144943B4B	"CIP EthernetIP"	Prise en charge de CP 2/2 (EtherNet/IP)
C290CE23-62EA-478c-97F2-97EFEC602E05	"CIP ControlNet"	Prise en charge de CP 2/1 (ControlNet)
089BB2BC-B75A-11DB-8314-0800200C9A66	"CIP CompoNet"	Prise en charge de CompoNet

Le Tableau 2 présente les identificateurs de couche physique qui peuvent être utilisés pour DeviceNet.

Tableau 2 – Identificateurs de couche physique pour DeviceNet

Valeur d'identificateur	Description
23E6EFA5-B1DA-11E2-9D9C-005056C00008	DeviceNet standard

Le Tableau 3 présente les identificateurs de couche physique qui peuvent être utilisés pour ControlNet.

Tableau 3 – Identificateurs de couche physique pour ControlNet

Valeur d'identificateur	Description
30F4EF13-B1DA-11E2-9D9C-005056C00008	Support coaxial de ControlNet
30F4EF14-B1DA-11E2-9D9C-005056C00008	Support fibre de ControlNet
30F4EF15-B1DA-11E2-9D9C-005056C00008	Port d'accès réseau (NAP ou Network Access Port en anglais) de ControlNet

Le Tableau 4 présente les identificateurs de couche physique qui peuvent être utilisés pour Ethernet/IP.

Tableau 4 – Identificateurs de couche physique pour Ethernet/IP

Valeur d'identificateur	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
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

Le Tableau 5 présente les identificateurs de couche physique qui peuvent être utilisés pour CompoNet.

Tableau 5 – Identificateurs de couche physique pour CompoNet

Valeur d'identificateur	Description
475B2CB0-B1DA-11E2-9D9C-005056C00008	CompoNet standard
475B2CAF-B1DA-11E2-9D9C-005056C00008	Câble IP67 CompoNet

Le Tableau 6 présente les identificateurs de couche liaison de données.

Tableau 6 – Identificateurs de couche liaison de données

Valeur d'identificateur	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   Accès aux données d'instance et d'équipement

Les services InstanceDataInformation et DeviceDataInformation doivent fournir l'accès au moins à tous les paramètres définis dans la section Params de l'EDS.

6   Comportement spécifique à un protocole

Le protocole CPF 2 de l'IEC 61784 comporte des exigences spécifiques relatives à la configuration des bus de terrain principaux.

Il est très important de maintenir la synchronisation entre le fournisseur de données et le consommateur de données. Par conséquent, le fournisseur de données doit être informé des modifications éventuelles des données fournies. Par exemple, dans le cas où les données fournies sont modifiées par le DTM analyseur/principal, le DTM subordonné/adaptateur doit recevoir le nouvel ensemble de données.

NOTE   Pour une description de l'échange de données entre les DTM, voir l'IEC 62453-2:2022, 6.3 (Configuration du bus de terrain principal ou du programmateur de communication).

7   Utilisation spécifique à un protocole des types de données généraux

Le Tableau 7 présente le mode d'utilisation des types de données généraux, définis dans l'IEC 62453-2 au sein de l'espace de noms "fdt", avec les équipements de la CPF 2 de l'IEC 61784.

Conformément à l'IEC 62453-2, au moins un jeu d'informations sémantiques (un par protocole de bus de terrain pris en charge) doit être fourni pour chaque objet de données accessible, en utilisant le type de données général "SemanticInformation". Le type de données "applicationDomain" correspondant doit avoir la valeur "FDT_CIP" et le type de données "semanticId" doit avoir une valeur appropriée, telle que spécifiée dans le Tableau 7).

Tableau 7 – Utilisation spécifique à un protocole des types de données généraux

Type de données	Description d'utilisation
fdt:address	Le type de données "address" (adresse) n'est pas obligatoire pour les paramètres présentés dans les DTM. Mais si l'adresse est utilisée, la chaîne doit être construite conformément aux règles du semanticId. Cela signifie que le type de données "semanticId" est toujours le même que le type de données "address"
fdt:protocolId	Voir l'Article 4.
fdt:deviceTypeId	Tel que défini dans l'objet Identity (voir IEC 61158-5-2:2019, 6.2.1.2.2)

Type de données	Description d'utilisation
fdt:deviceTypeInformation	Un DTM CIP doit fournir le chemin du fichier EDS spécifique à l'équipement avec ce type de données. Pour la certification DTM, le chemin du fichier EDS certifié doit être donné ici. Les informations EDS sont accessibles au moyen de • IDtmParameter::GetParameters() • IDtmInformation::GetInformation()
fdt:deviceTypeInformationPath	Chemin du fichier EDS qui est également fourni au moyen de l'attribut "deviceTypeInformation" L'attribut contient le chemin complet du fichier EDS, y compris le nom du fichier dans la notation URL. Pour les équipements CIP, il est obligatoire de fournir des informations pour ce type de données. Cet attribut est spécifique à FDT 1.2.1 (voir IEC 62453-52 et [3]). Par conséquent, il ne doit pas être fourni si le DTM fonctionne dans les Applications Cadres basées sur FDT 1.2 (voir [3])
fdt:manufacturerId	Tel que défini dans l'objet Identity (voir IEC 61158-5-2:2019, 6.2.1.2.2)
fdt:semanticId fdt:applicationDomain	L'applicationDomain est: FDT_CIP. Les données qui sont contenues dans les objets sont adressables au moyen de classId, instanceId et attributeId. Ces données peuvent être des variables ou des blocs composés de données. Le semanticID est directement basé sur les informations d'adresse CIP: Le semanticId est: CLASSxx.INSTANCEyy.ATTRIBUTEzz xx classId yy instanceId zz attributeId xx, yy, zz sont basés sur le format décimal sans "0" de début. Dans la mesure où "ATTRIBUTE" est conditionnel dans le CIP, il peut être omis dans certains cas. Dans ce cas, le semanticId est: CLASSxx.INSTANCEyy
fdt:tag	Ensemble CIP, nom de paramètre ou nom d'une connexion E/S (dans le contexte des données de voie)

8   Types communs de données spécifiques à un protocole

Le Tableau 8 et le Tableau 9 spécifient les types communs de données spécifiques à un protocole, utilisés dans la définition d'autres types de données.

Les types de données décrits à l'Article 8 sont définis pour l'espace de noms suivant:
Espace de noms: cip

Tableau 8 – Types simples communs de données spécifiques à un protocole

Type de données	Définition	Description
arrayDimensions	STRING	Représente les dimensions d'un tableau, voir [5], Annexe C
attributeId	USINT	Identificateur d'attribut CIP
bitOffset	UDINT	Décalage de bits d'un paramètre dans un ensemble
cipStatus	UINT	cipStatus représente l'attribut Status (Statut) (attribut 5) de l'objet Identity. Voir IEC 61158-5-2:2019, 6.2.1.2.2
classId	UINT	Identificateur de classe CIP
constValue	UDINT	Représente la valeur constante utilisée dans le type de données Constant
dataType	enumeration (byte | float | double | int | unsigned | enumerator | bitEnumerator | index | ascii | password | bitString | hexString | date | time | dateAndTime | duration | binary | structured | dtmSpecific)	Définit les différentes énumérations des types de données CIP
deviceType	UINT	Représente l'attribut DeviceType (attribut 2) de l'objet Identity. Voir IEC 61158-5-2:2019, 6.2.1.2.2
ePath	ARRAY OF USINT	CIP EPATH, voir IEC 61158-6-2:2019, 4.1.9.
extendedIdentifier	STRING	Représente l'adresse de l'équipement CIP dans le CIPNodeID si l'adresse utilisée sur ce réseau CIP est un nom ou une adresse IP. L'extendedIdentifier doit être utilisé pour les réseaux CompoNet afin de couvrir l'ID de MAC CompoNet. Voir aussi shortIdentifier
instanceId	UINT	Identificateur d'instance d'objet CIP
majorRevision	USINT	Représente l'attribut Major Revision (révision majeure) (attribut 4.1) de l'objet Identity. Voir IEC 61158-5-2:2019, 6.2.1.2.2
minorRevision	USINT	Représente l'attribut Minor Revision (révision mineure) (attribut 4.2) de l'objet Identity. IEC 61158-5-2:2019, 6.2.1.2.2
portNumber	UINT	Représente l'attribut portnumber (numéro de port) au sein d'un équipement CIP de pontage ou de routage pour acheminer un message vers un autre segment.
productCode	UINT	Représente l'attribut Product code (Code de produit) (attribut 3) de l'objet Identity. Voir IEC 61158-5-2:2019, 6.2.1.2.2
productName	STRING	Représente l'attribut Product name (Nom de produit) (attribut 7) de l'objet Identity. Voir IEC 61158-5-2:2019, 6.2.1.2.2
serialNumber	ARRAY OF USINT	Représente l'attribut Serialnumber (Numéro de série) (attribut 6) de l'objet Identity. Voir IEC 61158-5-2:2019, 6.2.1.2.2. Si le SerialNumber n'est pas connu en raison d'une configuration hors ligne, il convient alors de retourner un 0.
serviceCode	USINT	Code de service CIP. Il s'agit d'une fonction ou d'une méthode, prise en charge par un objet ou attribut CIP
serviceName	STRING	Nom de service CIP. Il s'agit d'une fonction ou d'une méthode, prise en charge par un objet ou attribut CIP. Cet attribut fournit des informations supplémentaires interprétables par l'utilisateur relatives au code de service associé

Type de données	Définition	Description
shortIdentifier	USINT	Représente l'adresse de l'équipement CIP dans le CIPNodeID si l'adresse utilisée sur ce réseau CIP est une adresse simple. Voir aussi extendedIdentifier
symbolicAddress	STRING	Représente un nom de composant à l'intérieur de l'équipement
vendorID	UINT	Représente l'attribut Vendor ID (Identificateur de vendeur) (attribut 1) de l'objet Identity. Voir IEC 61158-5-2:2019, 6.2.1.2.2

Tableau 9 – Types structurés communs de données spécifiques à un protocole

Type de données	Définition			Description
	Type de données élémentaire	Utilisation	Multipli-cité	
CIPDevice	STRUCT			Spécifie un équipement CIP. CIPDevice contient les informations relatives au fabricant et à l'équipement (l'objet Identity), contenues dans chaque nœud CIP
	cipStatus	M	[1..1]	
	CIPPath	M	[1..1]	
	CIPDeviceIdentity	M	[1..1]	
CIPDeviceIdentity	STRUCT			Représente la partie statique de l'objet Identity de l'équipement CIP. Voir IEC 61158-5-2:2019, 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			Identificateur utilisé pour identifier un nœud (équipement) particulier sur un réseau CIP. Par exemple: ID de MAC (Media Access Control (Commande d'accès au support) CIP (1 octet) pour DeviceNet et ControlNet; adresse IP pour EtherNet/IP. La taille étant différente d'un protocole à l'autre, la structure utilisée contient deux attributs: un identificateur étendu (chaîne de n octets) et un identificateur court (entier non signé de 1 octet). Seul l'un de ceux-ci doit être utilisé.
	choice of	M	[1..1]	
	ExtendedIdentifier	S	[1..1]	
	ShortIdentifier	S	[1..1]	

Type de données	Définition			Description
	Type de données élémentaire	Utilisation	Multipli-cité	
CIPObjectAddress	STRUCT			Adresse d'objet CIP telle que CIPObjectId, CIPSymbolicAddress ou HexAddress
	choice of	M	[1..1]	
	CIPObjectId	S	[1..1]	
	CIPSymbolicAddress	S	[1..1]	
	HexAddress	S	[1..1]	
CIPObjectId	STRUCT			Informations "address" de classId, instanceId et attributeId (conditionnel) CIP pour un objet et un attribut CIP. En cas d'utilisation dans une Voie de Processus (Process Channel), il s'agit vraisemblablement d'un objet Assembly (Ensemble) ou d'un objet Parameter (Paramètre).
	classId	M	[1..1]	
	instanceId	M	[1..1]	
	attributeId	O	[0..1]	
CIPPath	STRUCT			"Adresse" complète du nœud CIP (équipement). En général, elle est constituée du Node ID (Identificateur de nœud) stocké dans l'élément CIPNodeID. L'élément RoutingPath permet de transférer des informations de routage supplémentaires qui peuvent être utilisées par le composant de communication FDT CIP.
	RoutingPath	O	[0..1]	
	CIPNodeID	M	[1..1]	
CIPSymbolicAddress	STRUCT			Il n'est pas nécessaire de connaître les attributs classId, instanceId et attributeId, une adresse symbolique peut également être utilisée. CIPSymbolicAddress, HexAddress ou CIPObjectId peut être utilisé pour DataExchangeRequest
	symbolicAddress	M	[1..1]	
Constante	STRUCT			Une valeur constante
	constValue	M	[1..1]	
ExtendedIdentifier	STRUCT			Voir l'attribut extendedIdentifier
	extendedIdentifier	M	[1..1]	
HexAddress	STRUCT			Adresse d'objet CIP comme ePath
	ePath	O	[0..1]	
LinkAddress	STRUCT			Représente le CIPNodeID au sein d'un Segment
	CIPNodeID	M	[1..1]	
ParameterReference	STRUCT			Référence à une description de paramètre
	fdt:idref	M	[1..1]	
	bitOffset	O	[0..1]	
ReservedBits	STRUCT			Utilisé chaque fois que des bits réservés sont nécessaires

Type de données	Définition			Description
	Type de données élémentaire	Utilisation	Multipli-cité	
RoutingPath	STRUCT			Toute information supplémentaire de routage de réseau CIP, qui peut être comprise par la Voie de communication (Communication Channel)
	Segment	M	[1..1]	
Segment	STRUCT			Représente le chemin qu'un message doit suivre pour atteindre l'équipement CIP adressé
	portNumber	M	[1..1]	
	LinkAddress	M	[1..1]	
	Segment	O	[0..1]	
Service	STRUCT			Service CIP identifié par serviceCode et serviceName. Le code de service CIP est une fonction ou une méthode, prise en charge par un objet ou attribut CIP
	serviceCode	M	[1..1]	
	serviceName	O	[0..1]	
ShortIdentifier	STRUCT			Voir l'attribut shortdIdentifier
	shortIdentifier	M	[1..1]	

9 Types de données de gestion de réseau

9.1 Généralités

Les types de données spécifiés à l'Article 9 sont utilisés avec les services suivants:

- service NetworkManagementInfoRead;
- service NetworkManagementInfoWrite.

9.2 Adresse de nœud (Node address)

Le CIPNodeID est stocké dans l'élément busAddress du type de données fdt:DeviceAddress. Il n'est pas utilisé pour CompoNet, car le principal a une adresse fixe. Étant donné qu'il s'agit d'un élément obligatoire, la recommandation est d'utiliser la valeur "0".

NOTE   Des conseils de mise en œuvre supplémentaires concernant l'adressage dans CompoNet sont fournis à l'Annexe A.

9.3 Analyseur/principal – Ensemble de paramètres de bus (CIP)

L'information est envoyée à l'analyseur/principal CIP au sein de l'élément UserDefinedBus du type de données NetworkInfo, en utilisant les types de données spécifiés dans le Tableau 10 et le Tableau 11. Cette information doit être établie pour configurer la liste de balayage de l'analyseur/principal.

Les types de données décrits dans le présent paragraphe sont définis pour l'espace de noms suivant:
Espace de noms: cippar

Tableau 10 – Types simples de données de configuration de bus de terrain

Type de données	Définition	Description
async	USINT	Voir Tableau 7-2.5 de la référence [9] Utilisation du champ Gestionnaire de connexion de sécurité. Il s'agit d'un champ exclusif de sécurité CIP. S'applique seulement aux connexions productrices. Il convient que le champ soit vide pour les connexions consommatrices. Utilisé pour calculer le temps de réaction du réseau (Network Reaction Time)
base	UINT	Paramètres de mise à l'échelle conformément à l'ISO 15745-2:2003, A.4.1.4.6
class0	BOOL	Attribution de masque de bits Déclencheur et Transport. Voir ISO 15745-3:2003, Tableau A.25
class1	BOOL	
class2	BOOL	
class3	BOOL	
class4	BOOL	
class5	BOOL	
class6	BOOL	
compoNetDeviceCategory	USINT	Définit les différentes catégories d'équipements CompoNet. Voir référence [10], Chapitre 7-4
compoNetIOLength	UINT	Voir référence [10], Chapitre 7-5
compoNetIOLengthUnit	USINT	
connectionId	STRING	Identifie de façon unique la connexion au sein du DTM.
connectionNameString	STRING	Format d'entrée de connexion conformément à l'ISO 15745-3:2003, Tableau A.24
connectionTypeMulticast	BOOL	Voir Attribution de bits de Paramètres de connexion. Voir ISO 15745-3:2003, Tableau A.26
connectionTypeNULL	BOOL	
connectionTypePoint2Point	BOOL	
consumedConnectionSize	UINT	Nombre maximal d'octets reçus par cette connexion
defaultConnection	BOOL	Indique si la CIPConnection est une connexion par défaut ou non
defaultSafetyConnections	USINT	Voir Tableau 7-2.4 de la référence [9] Mots-clés de la section Gestionnaire de connexion de sécurité. Numéro d'instance
defaultValue	STRING	Représente la valeur de l'attribut à l'état hors ligne
div	UINT	Paramètres d'échelle. Voir ISO 15745-2:2003, A.4.1.4.6
expectedPacketRate	UINT	L'analyseur détermine ce paramètre. Il peut y avoir une raison pour laquelle le subordonné fournit ce paramètre au principal
fixedSizeSupported	BOOL	Attribution de bits de Paramètres de connexion. Voir ISO 15745-3:2003, Tableau A.26
helpString	STRING	Format d'entrée de connexion. Voir ISO 15745-3:2003, Tableau A.24
inhibitTime	UINT	Facultatif pour COS, mais n'est pas valable pour les autres types de connexions. L'analyseur détermine ce paramètre. Il peut y avoir une raison pour laquelle le subordonné fournit ce paramètre au principal
maxCIPConnections	UINT	Capacité de communication. Voir Chapitre 7-3.6.11.7 de la référence [5]

Type de données	Définition	Description
maxConsumerNumber	USINT	Voir Tableau 7-2.4 de la référence [9] Mots-clés de la section Gestionnaire de connexion de sécurité. Il s'agit d'un champ exclusif de sécurité CIP. Lorsque des dispositifs de sécurité souhaitent définir des connexions en multidiffusion et lorsqu'il est nécessaire qu'ils limitent le nombre maximal de consommateurs à une valeur inférieure à la valeur maximale par défaut (valeur égale à 15), ce champ peut définir la limite de produit. Si ce champ est vide, le SNCT doit toujours utiliser la valeur par défaut 15 pour le nombre maximal de connexions en multidiffusion. Ce champ peut être laissé vide pour les connexions en monodiffusion.
maxEMConnections	UINT	Capacité de communication. Voir Chapitre 7-3.6.11.7 de la référence [5]
maxIOConnections	UINT	
maxRPI	UDINT	Intervalle maximal entre paquets pris en charge par l'équipement. Le RPI est fourni par le DTM de l'équipement au DTM principal uniquement avec une valeur par défaut. Comme le DTM principal n'a qu'une vue d'ensemble de tous les RPI ajustés, il est possible que le DTM principal change/adapte cette valeur, c'est pourquoi des valeurs minimale et maximale sont nécessaires.
maxSafetyConnections	USINT	Voir Tableau 7-2.2 de la référence [9] Mots-clés de la section Gestionnaire de connexion de sécurité. Facultatif
maxSafetyInputCnxns	USINT	
maxSafetyOutputCnxns	USINT	
minRPI	UDINT	Intervalle minimal entre paquets exigé par l'équipement. Le RPI est fourni par le DTM de l'équipement au DTM principal uniquement avec une valeur par défaut. Comme le DTM principal n'a qu'une vue d'ensemble de tous les RPI ajustés, il est possible que le DTM principal change/adapte cette valeur, c'est pourquoi des valeurs minimale et maximale sont nécessaires.
multiplier	UINT	Paramètres d'échelle. Voir ISO 15745-2:2003, A.4.1.4.6
offset	INT (Interval)	
precision	UINT	
priorityHigh	BOOL	Attribution de bits de Paramètres de connexion. Voir ISO 15745-3:2003, Tableau A.26
priorityLow	BOOL	
priorityScheduled	BOOL	
priorityUrgent (ENIPV1.2)	BOOL	
producedConnectionSize	UINT	Nombre maximal d'octets transmis par cette connexion
realTimeTransferFormat	USINT	Attribution de bits de Paramètres de connexion. Voir ISO 15745-3:2003, Tableau A.26
rpi	UDINT	Intervalle de paquet exigé en microsecondes: mesure de la fréquence de demande par l'application d'origine de transmission de données provenant de l'application cible. Voir ISO 15745-3:2003, Tableau A.24 Section Gestionnaire de connexion
scId	ARRAY OF USINT	Identificateur de configuration de sécurité. Voir IEC 61784-3-2:2021, 6.6.5.18

Type de données	Définition	Description
server	BOOL	Attribution de masque de bits Déclencheur et Transport. Voir ISO 15745-3:2003, Tableau A.25
transportTypeExclusiveOwner	BOOL	
transportTypeInputOnly	BOOL	
transportTypeListenOnly	BOOL	
transportTypeRedundantOwner	BOOL	
triggerApplication	BOOL	
triggerChangeOfState	BOOL	
triggerCyclic	BOOL	
unId	ARRAY OF USINT	UNID cible Voir IEC 61784-3-2:2021, 6.6.5.19
variableSizeSupported	BOOL	Attribution de bits de Paramètres de connexion. Voir ISO 15745-3:2003, Tableau A.26

Tableau 11 – Types structurés de données de configuration de bus de terrain

Type de données	Définition			Description
	Types de données élémentaires	Utilisation	Multiplicité	
AssemblyMemberDefinition	STRUCT			Représente tous les membres d'un ensemble
	fdt:id	O	[0..1]	
	fdt:tag	M	[1..1]	
	fdt:descriptor	O	[0..1]	
	cip:dataType	M	[1..1]	
	defaultValue	O	[0..1]	
	cip:arrayDimensions	O	[0..1]	
	Échelle	O	[0..1]	
	cip:CIPObjectAddress	O	[0..1]	
	fdt:BitEnumeratorEntries	O	[0..1]	
	fdt:EnumeratorEntries	O	[0..1]	
	fdt:Unit	O	[0..1]	
	fdt:Ranges	O	[0..1]	
	fdt:SubstituteValue	O	[0..1]	
AssemblyMemberDefinitions	STRUCT			Voir la définition de AssemblyMember
	AssemblyMemberDefinition	O	[0..*]	
BitStrobeConnection	STRUCT			Représente la connexion E/S Bitstrobe
	MasterSlaveConnection	M	[1..1]	
Capacité	STRUCT			Capacité de communication. Voir Chapitre 7-3.6.11.7 de la référence [5]
	MaxCIPConnections	O	[0..1]	
	MaxIOConnections	O	[0..1]	
	MaxEMConnections	O	[0..1]	