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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Field device integration (FDI®) –
Part 102-2: Profiles – EtherNet/IP

Intégration des appareils de terrain (FDI®) –
Partie 102-2: Profils – EtherNet/IP

IEC 62769-102-2:2023-04(en-fr)

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FIELD DEVICE INTEGRATION (FDI®) –

Part 102-2: Profiles – EtherNet/IP

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

Draft	Report on voting
65E/852/CDV	65E/910/RVC

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 in the IEC 62769 series, published under the general title *Field device integration (FDI®)*, 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 "http://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- withdrawn,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.

FIELD DEVICE INTEGRATION (FDI®) –

Part 102-2: Profiles – EtherNet/IP

1 Scope

This part of IEC 62769 defines the protocol-specific definitions (PSDs) as defined in IEC 62769-100 (annex on generic protocol extensions) for the Ethernet/IP protocol.

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 61804 (all parts), *Devices and integration in enterprise systems – Function blocks (FB) for process control and electronic device description language (EDDL)*

IEC 62541-100, *OPC Unified Architecture – Part 100: Device Interface*

IEC 62769-4:2022, *Field Device Integration (FDI®) – Part 4: FDI® Packages*

IEC 62769-5, *Field Device Integration (FDI®) – Part 5: Information Model*

IEC 62769-7, *Field Device Integration (FDI®) – Part 7: Communication Devices*

IEC 62769-100:2020, *Field Device Integration (FDI®) – Part 100: Profiles – Generic Protocols*

CIP01, ODVA.org: Volume One: Common Industrial Protocol (CIP™)-Edition 3.27

CIP02, ODVA.org: Volume Two: EtherNet/IP Adaptation of CIP-Edition 1.25

IETF RFC 1117, "Internet Numbers", August 1989, available at https://datatracker.ietf.org/doc/html/rfc1117

3 Terms, definitions, abbreviated terms and acronyms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions are given in IEC 61784-1, IEC 61804 (all parts), IEC 62541-100, IEC 62769-4, IEC 62769-5, and IEC 62769-7 apply.

ISO and IEC maintain terminology 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 Abbreviated terms and acronyms

For the purposes of this specification, the following abbreviations apply.

EDD	Electronic Device Description
EDDL	Electronic Device Description Language (see IEC 61804 (all parts))
FDI®[1]	Field Device Integration
FCG	FieldComm Group
XML	Extensible markup language (see REC-xml-20081126)
EDS	Electronic Data Sheet
PDU	Protocol Data Unit

4 Conventions

4.1 EDDL syntax

This document specifies content for the EDD component that is part of FDI® Communication Packages. The specification content using EDDL syntax uses the font `Courier New`. The EDDL syntax is used for method signature, variable, data structure and component declarations.

4.2 Capitalizations

The IEC 62769 series uses capitalized terms to emphasize that these terms have a FDI® specific meaning.

Some of these terms using an acronym as a prefix for example

- FDI® Client, or
- FDI® Server.

Some of these terms are compound terms such as:

- Communication Servers, or
- Profile Package.

Parameter names or attributes are concatenated to a single term, where the original terms start in this term with a capital letter such as:

- ProtocolSupportFile or
- ProtocolType.

Parameter names or attributes can also be constructed by using an underscore character to concatenate two or more terms such as:

- DEVICE_REV or
- DEVICE_MODEL

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[1] FDI is a registered trademark of the non-profit organization Fieldbus Foundation, Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance does not require use of the trade name. Use of the trade name requires permission of the trade name holder.

5 PSDs for EtherNet/IP

5.1 General

Clause 5 defines the protocol-specific definitions for EtherNet/IP. EtherNet/IP makes use of standard Ethernet and TCP/IP technology to transport CIP communications packets. The result is a common, open application layer on top of open and highly popular Ethernet and TCP/IP protocols (see CIP02). The EtherNet/IP uses the unconnected message which shall utilize the TCP/IP resource to move message across Ethernet.

5.2 Header

The HEADER string used to define EDD commands contains the information about what EtherNet/IP service is called and what object, instance and attribute are addressed by the service. It shall contain the attribute SERVICE_CODE and may, depending on the SERVICE_CODE, contain the attribute CLASS, INSTANCE, ATTRIBUTE and DatatypeMappings. The syntax is <attribute> = “<value>” per attribute, attributes are separated by a space. The value is provided as hexadecimal value, not as a decimal value.

For example, to read the number of objects supported by the device Service Get_Attribute_Single (0x0E) to the Message Router Object first instance the HEADER string is “SERVICE_CODE=\”0E\” CLASS=\”1\” INSTANCE=\”1\” ATTRIBUTE=\”1\””[2].

The values for SERVICE_CODE is restricted to hexadecimal values between 0 to FF, the values for CLASS and ATTRIBUTE are restricted to hexadecimal values between 0 to FFFF and the values for INSTANCE is restricted to hexadecimal values between 0 to FFFFFFFF (see CIP01).

Table 1 specifies the common EtherNet/IP SERVICE_CODE values and the usage of the attributes, as well as the used EDD COMMAND OPERATION.

2 NOTE That \ is used as escape character allowing “ in the HEADER string.

Table 1 – EtherNet/IP Functions and their representation in an EDD HEADER

Functionality	SERVICE_CODE(Hex)	CLASS(Hex)	INSTANCE(Hex)	ATTRIBUTE(Hex)	Operation (in EDD)	Request (in EDD)	Response (in EDD)
Get_Attributes_All	01	Object Class code	Instance ID	Attribute ID	R	-	Attribute Values
Set_Attributes_All	02	Object Class code	Instance ID	Attribute ID	W	Attribute Values	-
Get_Attribute_Single	0E	Object Class code	Instance ID	Attribute ID	R	-	Attribute Value
Set_Attribute_Single	10	Object Class code	Instance ID	Attribute ID	W	Attribute Value	-
Generic_Service	Any Service Code	Object Class code	Instance ID	Attribute ID	R/ W/ C	Object / Service Specific Data	Object / Service Specific Data

NOTE 1 The table lists the most common four services and what data is provided in the HEADER, REQUEST & RESPONSE parameters of an EDD command. There are several different common services, object specific services and/or vendor-specific services supported by the device. Few examples are Reset, Start, Read/Write Modbus Registers, etc. Any of these services can be accessed through the Generic_Service by specifying the correct service code, object class code, instance ID, attribute ID and Request data as per the EtherNet/IP specification.

NOTE 2 Based on the service, the instance ID and/or attribute ID may not be applicable for all the service. In such case it need mandatory to define the INSTANCE and/or ATTRIBUTE in EDD Header. For example, Get_Attributes_All doesn't need any attribute value so we can defined the EDD header like "SERVICE_CODE=\"01\" CLASS=\"1\" INSTANCE=\"1\""[a].

[a] \ is used as escape character allowing " in the HEADER string

Key

R/W/C The Operation (in EDD) is READ (R) or WRITE (W) or COMMAND (C)

The values of DatatypeMapping[Request|Reply] based on the EDD Command request and response datatype mapping. This information is mandatory only for the CIP special datatype like SHORT_STRING, STRING2, etc. The value should be in the format of the Key Value pair <index:CIP Datatype> where index starts from 0 in the order the EDD parameter defined in Request or Reply. Communication server responsible to use this information for the byte conversion.

Example: "HEADER "SERVICE_CODE=\"01\" CLASS=\"1\" INSTANCE=\"1\" DataTypeMappingRequest=\"6:SHORT_STRING;\ DataTypeMappingReply=\"6:SHORT_STRING;\""

Above example, defines the CIP datatype for the item 6 in the EDD request and item 6 in the EDD response, both has mapped to the CIP special datatype SHORT_STRING for the byte conversion.

The supported EDD datatypes and equivalent CIP datatypes are described in Table 2.

Table 2 – EDD datatype mapping with CIP datatype

EDD Datatype	CIP Datatype
BOOLEAN	BOOL
DOUBLE	LREAL
FLOAT	REAL
INTEGER	SINT, INT, DINT, LINT
UNSIGNED_INTEGER	USINT, UINT, UDINT, ULINT
ASCII	STRING, STRING2, SHORT_STRING
DATE_AND_TIME	DATE_AND_TIME
DATE	DATE
TIME	TIME_OF_DAY
DURATION	TIME

5.3 ProtocolIdentifier

The ProtocolIdentifier for EtherNet/IP shall be “urn:fdipsd:EtherNetIP”.

5.4 Address

Address shall be a value with the format IP Address. IP address in dotted decimal notation, for example “130.151.132.55” (see RFC 1117 for the format of IP addresses). It shall be represented in the string (e.g. using the regular expression "\d{1,3}\.\d{1,3}\.\d{1,3}\.\d{1,3}"). Along with IPAddress followed by TCP Port number to be used at the specified IP Address. Only port 0xAF12 is guaranteed to be available in an EtherNet/IP compliant device (see CIP02, 3-3.7). SetAddress is not supported.

5.5 Manufacturer

The Manufacturer is mapped to the *Vendor ID* (Attribute ID 1 of *Identity Object*, Class Code: 0x01) (see CIP01, 5A-2) and is defined as 16-bit unsigned integer. For FDI® Gateways, the EDD data type EUC of length 256 shall be used and therefore the length of the string is limited to 256.

5.6 DeviceModel

EtherNet/IP standard defines *Product Code* (Attribute ID 3 of *Identity Object*, Class Code: 0x01) (see CIP01, 5A-2) to specific device profiles and maintained by ODVA as 16-bit number. For FDI® Gateways the EDD data type EUC of length 256 shall be used and therefore the length of the string is limited to 256.

5.7 DeviceRevision

EtherNet/IP standard defines *Revision* (Attribute ID 4 of *Identity Object*, Class Code: 0x01) (see CIP01, 5A-2) as two 8-bit integers. Minor and Major and usually displayed separated with “.”. Example: – Major 2 and Minor 15 is displayed as “2.15”. But as the DeviceRevision is a 16-bit unsigned integer as per the Generic protocol [Part 100], this mapping is not possible as per the CIP specification. The FDI® communication server shall associate the Major Revision to this value, however the CIP specification doesn’t recommend Minor revision for matching the device with the FDI® Package.

5.8 SerialNumber

EtherNet/IP standard defines *Serial Number* (Attribute ID 6 of *Identity Object*, Class Code: 0x01) (see CIP01, 5A-2) as a 32-bit integer. This can be represented as a Hex-string. For FDI® Gateways the EDD data type EUC of length 256 shall be used and therefore the length of the string is limited to 256. For devices providing a longer string, the string is truncated at the end of the string.

5.9 Tag

No mapping is defined for Tag and Tag shall not be used.

5.10 ProfileId

No mapping is defined for ProfileId and ProfileId shall not be used.

5.11 Version

The EtherNet/IP Protocol Version (CIP Version) 1.0 shall be mapped to Version “1.0.0”.

5.12 ProtocolSupportFile

Protocol specific attachments are mentioned in the Package Catalog as defined in IEC 62769-5. The EtherNet/IP device provides the device configuration files called EDS (Electronic Data Sheet) which is a mandatory attachment for FDI® Device Package representing the CIP based devices. Table 3 specifies the parameters of the ProtocolSupportFile in the FDI® Device Package.

Table 3 – ProtocolSupportFile for FDI® Device Packages

Parameter	Description
Content Type	text/plain
Root Namespace	empty
Source Relationship	http://fdi-cooperation.com/2010/relationship/attachment-protocol
Filename	According to CIP01, Chapter 7

5.13 ExtendedDeviceRevision

EtherNet/IP standard defines *Revision* (Attribute ID 4 of *Identity Object*, Class Code: 0x01) (see CIP01, 5A-2) as two 8-bit integers. Minor and Major and usually displayed separated with “.”. Example: – Major 2 and Minor 15 is displayed as “2.15”. ExtendedDeviceRevision is type of VersionT (see IEC 62769-4:2022, Clause E.38) with the format of (major.minor.revision) the EtherNet/IP Revision shall be mapped as major.minor and revision shall be set default as 0.

6 Byte Ordering

In general EtherNet/IP device byte order is in Little-Endian. The FDI® communication server is responsible for transforming the byte order received from the slave device based on the EDD response datatype. The byte order conversion in communication server has to be done based on the EddDataTypeInfo (refer IEC IEC 62769-100:2020 Table 12) from Transfer function.

NOTE Byte conversion of CIP special datatype like (SHORT_STRING, STRING, STRING2) is based on the Datatype mapping defined in EDD header refer 5.2 for the information. Communication server is responsible to convert the bytes as defined in CIP01 based on the datatype mapped in the header.