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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Field device integration (FDI) –
Part 115-2: Profiles – Modbus-RTU

Intégration des appareils de terrain (FDI) –
Partie 115-2: Profils – Modbus-RTU

IEC 62769-115-2:2020-09(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIELD DEVICE INTEGRATION (FDI) –

Part 115-2: Profiles – Modbus-RTU

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International Standard IEC 62769-115-2 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

FCG_TS62769-115-2_Profiles_PSD ModbusRTU_1.1.0.4, a specification of the FieldComm Group, PROFIBUS Nutzerorganisation e. V., OPC Foundation and FDT Group, has served as a basis for the elaboration of this standard.

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

FDIS	Report on voting
65E/740/FDIS	65E/744/RVD

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

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

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- withdrawn,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 115-2: Profiles – Modbus-RTU

1 Scope

This part of IEC 62769 defines the protocol-specific definitions (PSDs) as defined in IEC 62769-7 on generic protocol extensions for the Modbus®[1]-RTU protocol in accordance with CPF 15 in IEC 61784-2.

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

IEC 61804 (all parts), *Function blocks (FB) for process control and Electronic Device Description Language (EDDL)*

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

IEC 62769-2, *Field Device Integration (FDI) – Part 2: FDI Client*

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

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

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

MOD06, *Modbus.org: MODBUS over serial line specification and implementation guide V1.02*

MOD12, *Modbus.org: MODBUS APPLICATION PROTOCOL SPECIFICATION, V1.1b3*

3 Terms, definitions, abbreviated terms and conventions

3.1 Terms and definitions

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

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[1] Modbus is the trademark of a product supplied by Schneider Electric USA, INC. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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3.2 Abbreviated terms

For the purposes of this specification, the following abbreviated terms apply.

EDD electronic device description

EDDL Electronic Device Description Language (see IEC 61804)

FDI™ Field Device Integration[2]

FCG FieldComm Group

XML Extensible Markup Language (see REC-xml-2081126)

3.3 Conventions

3.3.1 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.

3.3.2 Capitalizations

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

Some of these terms use an initialism 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 into 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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2 Field Device Integration (FDI) is the trademark of a product supplied by FieldComm Group. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

4 PSDs for ModbusRTU

4.1 General

Clause 4 defines the protocol-specific definitions for Modbus-RTU, which is the Modbus over serial line protocol using the transmission method RTU (remote terminal unit) in accordance with MOD06.

4.2 Header

The HEADER string used to define EDD commands contains the information about what Modbus function is called and what is addressed by the function. It shall contain the attribute FUNCTION and may, depending on the FUNCTION, contain the attribute SUBFUNCTION, READ_ADDRESS, READ_COUNT, WRITE_ADDRESS and WRITE_COUNT. The syntax is <attribute> = "<value>" per attribute; attributes are separated by a space. The value is provided as a decimal value, not as a hexadecimal value. For example, to read the device identification (function 43 (0x2B) and sub-function 14 (0x0E)), the HEADER string is "FUNCTION=\"43\" SUBFUNCTION=\"14\"".

NOTE The character \ is used as an escape character that allows " in the HEADER string.

The values for READ_ADDRESS, READ_COUNT, WRITE_ADDRESS, WRITE_COUNT are restricted to numeric values between 0 and 65 535. Table 1 specifies the allowed Modbus FUNCTION values and the usage of the attributes, as well as the used EDD COMMAND OPERATION.

Table 1 – Modbus functions and their representation in an EDD HEADER

Functionality	FUNCTION	SUBFUNCTION (Byte)	READ_ADDRESS	READ_COUNT	WRITE_ADDRESS	WRITE_COUNT	Operation (in EDD)[a]	Request (in EDD)	Response (in EDD)
Read coils	01	-	Starting address	Quantity of coils	-	-	R	-	Coil status
Read discrete inputs	02	-	Starting address	Quantity of inputs	-	-	R	-	Input status
Read holding registers	03	-	Starting address	Quantity of registers	-	-	R	-	Reg. value
Read input registers	04		Starting address	Quantity of input registers	-	-	R	-	Input register
Write single coil	05	-	-	-	Output address	-	W	Output value	Output value
Write single register	06	-	-	-	Reg. address		W	Register value	Register value
Read exception status	07	-	-	-	-	-	R	-	Output data
Diagnostics	08	2	-	-	-	-	R, C[b)]	Data	Data
Get comm event counter	11	-	-	-	-	-	R	-	Status + Event count

Functionality	FUNCTION	SUBFUNCTION (Byte)	READ_ADDRESS	READ_COUNT	WRITE_ADDRESS	WRITE_COUNT	Operation (in EDD)[a]	Request (in EDD)	Response (in EDD)
Get comm event log	12	-	-	-	-	-	R	-	Status + Event count + Message count + Events
Write multiple coils	15	-	-	-	Starting address	Quantity of outputs	W	Output values	-
Write multiple registers	16	-	-	-	Starting address	Quantity of registers	W	Register value	-
Report server ID	17	-	-	-	-	-	R	-	Server ID + Run indicator status + Additional data
Read file record	20	-	-	-	-	-	R	Sub-Req …	Sub-Req …
Write file record	21	-	-	-	-	-	W	Sub-Req …	Sub-Req …
Mask write register	22	-	-	-	Ref. address	-	W	And_Mask + Or_Mask	-
Read/write multiple registers	23	-	Read starting address	Quantity to read	Write starting address	Write starting quality	R, W, C[c]	Write register value	Read register value
Read FIFO queue	24	-	FIFO pointer address	-	-	-	R	-	FIFO Count + FIFO value register
Read device identification	43	14	Read device ID code + Object ID[d]	-	-	-	R	-	Conformity level + More follows + Next object ID + Number of objects + List of object ID, Object length, Object value

[a] R = READ, W = WRITE, C = COMMAND

[b] Depending on the SUBFUNCTION, either READ or COMMAND (e.g. for 01 – Restart communication options)

[c] Depending on whether the function EDD has to choose between READ, WRITE, or COMMAND, since this function allows independent READ and WRITE operations.

[d] Those two-byte values need to be combined to get a numeric value. For example, when Read device ID code 0x04 is chosen together with ObjectId 0x00 the value is 0x0400 = 1 024.

Table 1 also identifies what data shall be provided in the REQUEST of an EDD command. The CRC information is never included in the REQUEST or RESPONSE and needs to be handled by the communication infrastructure (FDI Gateway or FDI Communication Server). Also, length information (e.g. byte count) is excluded from REQUEST or RESPONSE and needs to be handled by the communication infrastructure.

4.3 ProtocolIdentifier

ProtocolIdentifier for ModbusRTU shall be "urn:fdipsd:ModbusRTU".

4.4 Address

Address shall be a value between 1 and 247. It shall be represented in the string as a decimal number without leading zeros (e.g. using the regular expression "`(1\d?\d?)|((24[0-7]?)|(2[0-3]\d?)|2\d?)|([1-9]\d?)`". Address maps to the slave node address in accordance with MOD06. SetAddress is not supported.

4.5 Manufacturer

Manufacturer is mapped to VendorName (ObjectId 0x00) received with Function 43 in Modbus. 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 end of the string is truncated.

4.6 DeviceModel

DeviceModel is mapped to ProductCode (ObjectId 0x01) received with Function 43 in Modbus. 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 end of the string is truncated.

4.7 DeviceRevision

Modbus contains a place to manage a device revision in MajorMinorRevision (ObjectId 0x02) received with Function 43. As this is an ASCII string, there is no mapping defined to DeviceRevision and DeviceRevision shall not be used.

4.8 SerialNumber

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

4.9 Tag

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

4.10 ProfileId

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

4.11 Version

The ModbusRTU Protocol Version 1.02 shall be mapped to Version "1.02.00".

4.12 ProtocolSupportFile

There shall be no use of ProtocolSupportFiles.

5 Example for ModbusRTU

5.1 General

In order to illustrate how the PSDs can be used to create EDDs for ModbusRTU, Subclauses 5.2 to 5.4 give the definition of an EDD command and the corresponding resulting Modbus Serial Line PDU is provided, as well as a successful return and an error returned, and how this affects the EDD.

5.2 Called functionality (success)

To illustrate the usage of EDD commands, the case should be considered of an EDD developer who wants to read some data from the Modbus device in the input registers.

Via a scan, the FDI application has already identified the device address as 1. So the actual PDU that should be generated is 0x 01 04 00 08 00 01 C2 95 (reading Input Register 9) and the response would be 0x 01 04 02 00 0A D3 20 (value 10) (see also Table 2).

Table 2 – Example Modbus PDU

Request		Response	
Field	Hex	Field	Hex
Device Address	01	Device Address	01
Function	04	Function	04
Starting Address Hi	00	Byte Count	02
Starting Address Lo	08	Input Req. 9 Hi	00
Quantity of Input Req. Hi	00	Input Register 9 Lo	0A
Quantity of Input Req. Lo	01	CRC Hi	D3
CRC Hi	C2	CRC Lo	20
CRC Lo	95		

5.3 Called functionality (Error)

To illustrate a failed communication, an error case is also shown in Table 3. So the same request as described in 5.2 could also lead to an error response 0x 01 84 04 73 63 indicating a "SERVER DEVICE FAILURE" in accordance with MOD12.

Table 3 – Example Modbus PDU with error response

Request		Response	
Field	Hex	Field	Hex
Device Address	01	Device Address	01
Function	04	Error Code	84
Starting Address Hi	00	Exception Code	04
Starting Address Lo	08	CRC Hi	73
Quantity of Input Req. Hi	00	CRC Lo	63
Quantity of Input Req. Lo	01		
CRC Hi	C2		
CRC Lo	95		