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Modbus

CE

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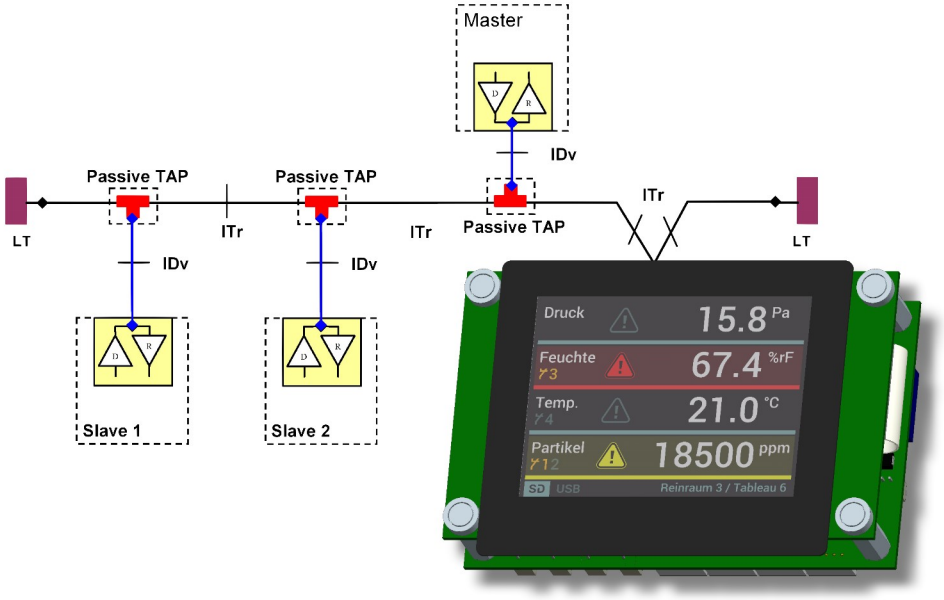

User Manual

Modbus RTU

Protocol description
for the TOUCH product line

09015050 • HB_EN_ModbusTouch • Rev. ST4-A • 01/17

Masthead

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Table of Content

1 Introduction

The Modbus protocol is a communication protocol that is based on a Master/Slave architecture. All FISCHER products work in the operating mode Modbus RTU.

This manual is designed for readers with a basic understanding of the Modbus protocol. There are references to relevant specialist literature about this topic at the end of this manual.

1.1 Modbus infrastructure

Communication with the FISCHER units requires a serial two-wire bus (2W) in compliance with the EIA/TIA-485 standard. All connected units must be connected to a joint reference potential by means of a third (common) line. The bus is connected using a 150Ω 0.5W resistor. The pull up/down resistors are usually set on the master. Usually, up to 32 slaves can be connected without a repeater.

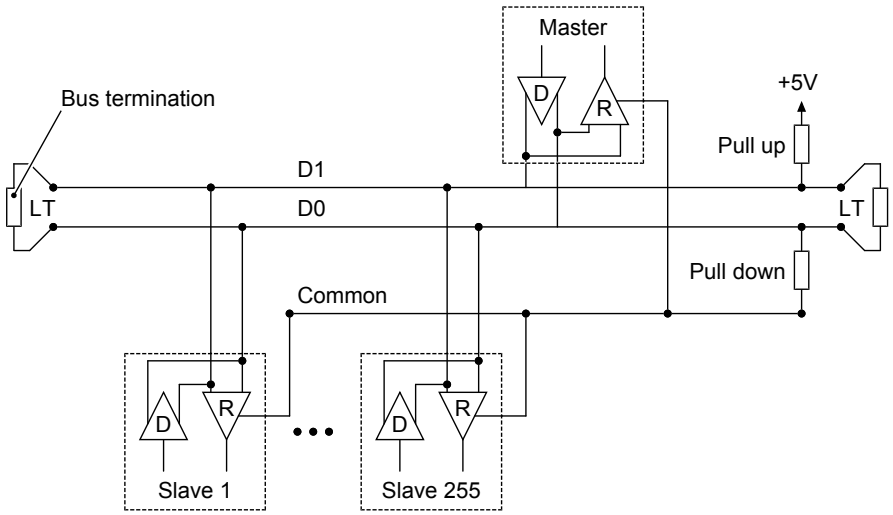


Fig. 1: Modbus infrastructure

NOTICE

Passive TAP

If the units are connected via a Passive TAP (e.g. T-adapter connection), the units can be disconnected from the bus without interrupting the bus.

1.2 Modbus RTU Protocol

The Modbus RTU transfers data in a binary form. A single master and up to 255 slaves can be connected at the same time to the serial Modbus.

The following basic rules apply.

- A Modbus transaction is only initialised by the Master.
- At the same time, only one Modbus transaction takes place.
- The Slave never sends data without a request from the Master.
- Slaves cannot communicate with each other.

1.3 Modbus Transaction

A Modbus transaction comprises two parts. A request from the Master and a response from the Slave.

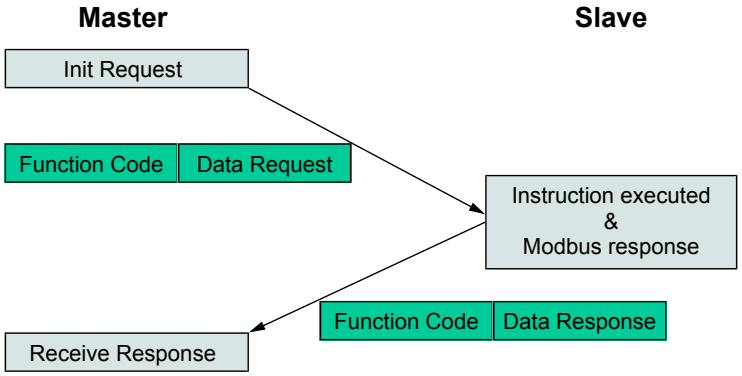


Fig. 2: Error-free request/response cycle

If an error occurs during a Modbus transaction, the Function Code is replaced with a special Function Code with an error indicator in the Modbus Response message and a more detailed description of the error in the data field is sent.

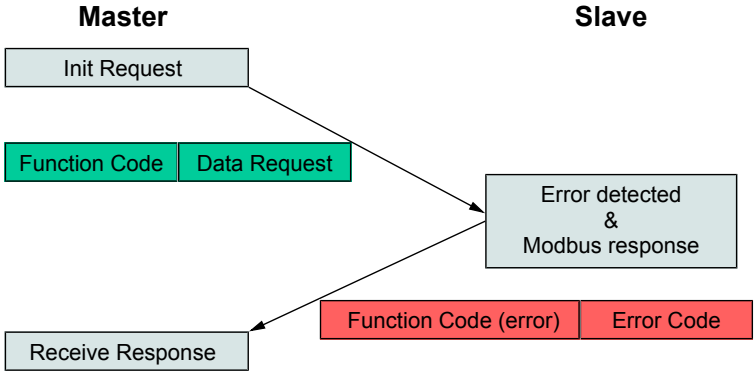


Fig. 3: Faulty request/response cycle

1.4 Modbus Frame

A Modbus data frame comprises two components.

- Protocoll Data Unit (PDU)
- Application Data Unit (ADU)

The inner data structure is the PDU and additional data fields are added for the encapsulation of the frame in the respective protocol of the data transmission.

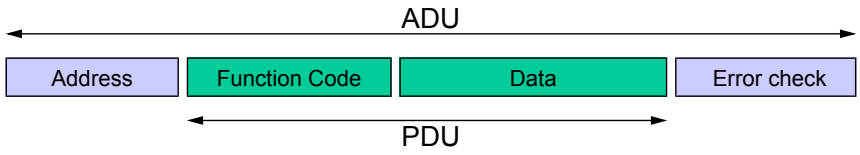


Fig. 4: MODBUS Frame

In the Modbus RTU protocol, the address field contains the Slave address. The address space comprises the addresses 1 to 255. If the Slave sends a Response, it positions its own address in the address field. This means that the Master 'knows' which Slave is sending. The Function Code states which action needs to be carried out. The following data field contains the Request and Response parameters. The error check field contains the result of a CRC review of the content of the transmission.

1.5 Modbus data transmission

In the RTU mode, each message is sent as a continuous binary flow of characters via the serial bus.

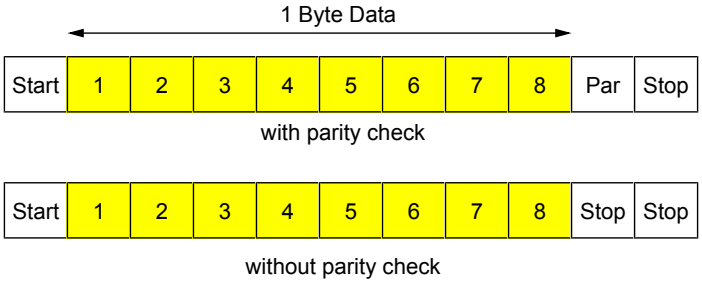


Fig. 5: Bit Sequence

The Even Parity is set as the default value for the parity bit. But an Odd Parity and No Parity can also be used. If No Parity is used, a further stop bit is added.

A Modbus message is set by the transferring unit in a so-called frame. The maximum size of a message is 256 byte. Start and end point of a frame are well defined. This allows the receiving unit to recognise the start and end of a message.

A transmission starts with a break of at least 3.5 characters (char). Then the frames are sent. Each frame must be followed by a pause interval (t3.5) with a length of at least 3.5 characters before the next frame is sent. There must be a pause interval (t1.5) with a length of at least 1.5 characters between two characters. The entire transmission must be sent as a continuous flow of characters.

If the idle intervals are not satisfied, the character flow stops and the transmission is declared invalid.

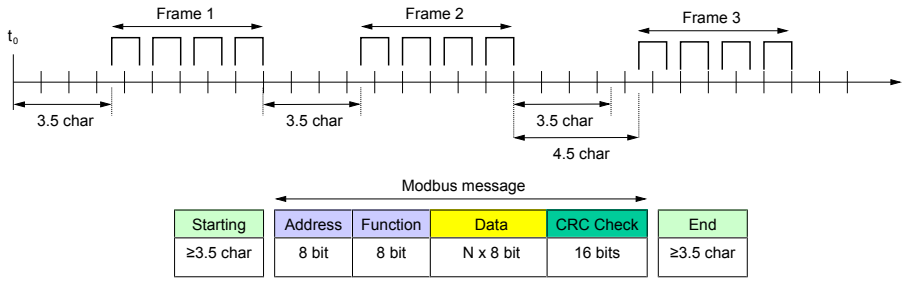


Fig. 6: Modbus Message Frame

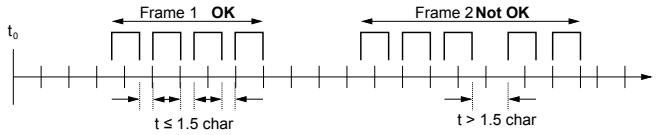


Fig. 7: Faulty transmission (example)

2 Functions

The Function Codes correspond to the Modbus Application Protocol v1.1b3. The illustrations of messages only contain the PDU. Slave address and checksums are not shown. Messages that comprise several bits are transferred first with the byte with the highest value (MSB), followed by the byte with the lowest value (LSB).

In the case of transmission errors, messages with invalid checksums or if a broadcast address is used, no response is sent by the Slave.

2.1 General

The Modus protocol has a series of options for access to the data:

Type	Access	Name	Code	Sub Code
Data	Bit	Read Coils	01	
		Read Discrete Inputs	02	
	16 Bit	Read Holding Register	03	
		Read Input Register	04	
		Write Single Register	06	
		Write Multiple Register	16	
		Mask Write Register	22	
		Read/Write Multiple Registers	23	
Diagnosis		Diagnosis	08	00; 10-15
		Report Server ID	17	
Other		Encapsulated Interface Transport: Read Device Identification	43	14

Note!

The FISCHER units only have one block for the four functions Read Coils, Read Input Register, Read Holding Register and Read Input Register in their application memory.

- 'Coils‘ and 'Discrete Inputs‘ can be read with both the Function Code 01 and also with the Function Code 02.
- 'Input Register‘ and 'Holding Register‘ can be read with both the Function Code 03 and also with the Function Code 04.

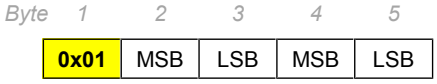
2.2 Bit access

2.2.1 Function Code [01] "Read Coils"

This Function Code is used to read the digital outputs.

Request

The request contains the address of the first bit that is to be read and the number of bits that need to be read.

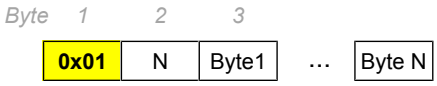


Byte	Field name	Size	Value range
1	Function Code	1 byte	0x01
2.3	Start Address	2 bytes	0x0000 to 0xFFFF
4.5	Number of outputs (coils)	2 bytes	1 to 2000 (0x7D0)

Response

The states of the digital outputs are summarised as bytes in the response. The number of bytes (N) is the result of the number of outputs divided by 8. If there is a rest, the number of bytes increases (N=N+1).

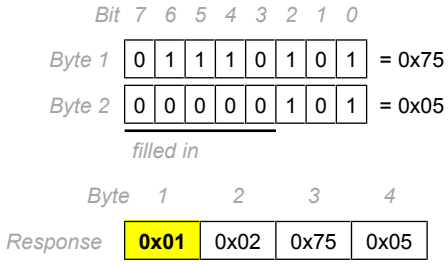
The states of the digital outputs from the bit with the lowest value are saved within a byte. A bit value of 0 corresponds to the status OFF; a bit value of 1 corresponds to the status ON.



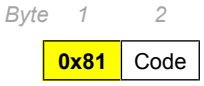
Byte	Field name	Size	Value range
1	Function Code	1 byte	0x01
2	Number of bytes	1 byte	N
3…	State of the outputs	N Bytes	8 Bit value

Example:

- Number of outputs: 11
- Number of bytes: 2



Error



Byte	Field name	Size	Value range
1	Function Code (error)	1 byte	0x81
2	Error code	1 byte	Code see table

The following error codes are possible:

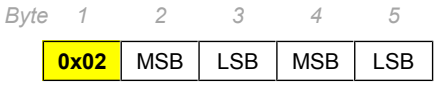
0x01	The function is not supported
0x02	An invalid address is referenced
0x03	The request does not correspond to the expected format; the number of requested outputs is greater than 2000

2.2.2 Function Code [02] "Read Discrete Inputs"

This Function Code is used to read the digital inputs.

Request

The request contains the address of the first bit that is to be read and the number of bits that need to be read.

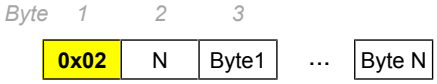


Byte	Field name	Size	Value range
1	Function Code	1 byte	0x02
2.3	Start Address	2 bytes	0x0000 to 0xFFFF
4.5	Number of inputs	2 bytes	1 to 2000 (0x7D0)

Response

The states of the digital inputs are summarised as bytes in the response. The number of bytes (N) is the result of the number of inputs divided by 8. If there is a rest, the number of bytes increases (N=N+1).

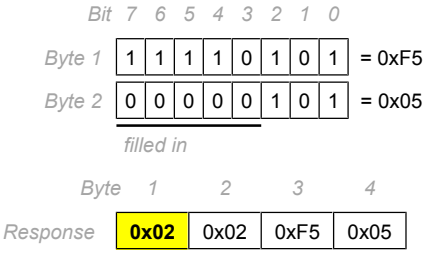
The states of the digital inputs from the bit with the lowest value are saved within a byte. A bit value of 0 corresponds to the status OFF; a bit value of 1 corresponds to the status ON.



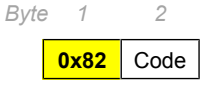
Byte	Field name	Size	Value range
1	Function Code	1 byte	0x02
2	Number of bytes	1 byte	N
3…	Number of inputs	N Bytes	8 Bit value

Example:

- Number of inputs: 11
- Number of bytes: 2



Error



Byte	Field name	Size	Value range
1	Function Code (error)	1 byte	0x82
2	Error code	1 byte	Code see table

The following error codes are possible:

0x01	The function is not supported
0x02	An invalid address is referenced
0x03	The request does not correspond to the expected format; the number of requested inputs is greater than 2000

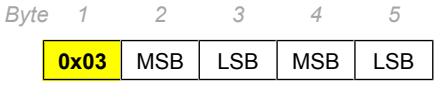
2.3 16 Bit Register Access

2.3.1 Function Code [03] "Read Holding Register"

This Function Code is used to read the Holding Register. The maximum possible number of registers that can be addressed in one message is 125.

Request

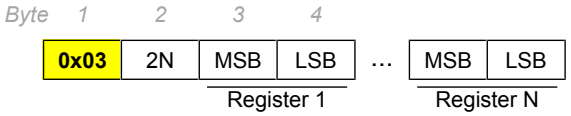
The request contains the address of the first register that is to be read and the number of registers that need to be read. The addressing of the register starts with 0; the numbering of the registers starts with 1.



Byte	Field name	Size	Value range
1	Function Code	1 byte	0x03
2.3	Start Address	2 bytes	0x0000 to 0xFFFF
4.5	Number of registers	2 bytes	0x0001 to 0x007D (1…125)

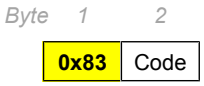
Response

The response contains two bytes for each read register; therefore the number of bytes is twice the number of registers (N).



Byte	Field name	Size	Value range
1	Function Code	1 byte	0x03
2	Number of bytes	2 bytes	2N
3.4	Holding Register	N x 2 Byte	16 Bit value

Error



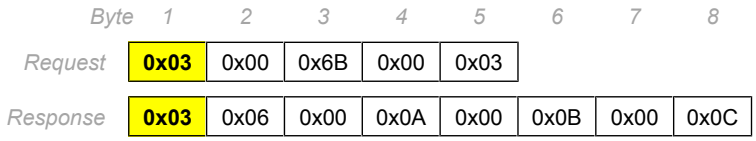
Byte	Field name	Size	Value range
1	Function Code (error)	1 byte	0x83
2	Error code	1 byte	Code see table

The following error codes are possible:

0x01	The function is not supported
0x02	An invalid address is referenced
0x03	The request does not correspond to the expected format; the number of requested registers is greater than 125

Example:

- Export Holding Register 108 to 110
- Content Register 108= 0x000A
- Content Register 109= 0x000B
- Content Register 110= 0x000C



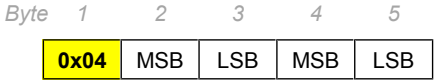
Request		Response	
Field name	**Value**	**Field name**	**Value**
Function Code	0x03	Function Code	0x03
Start Address MSB	0x00	Number of bytes	0x06
Start Address LSB	0x6B	Holding Register 108 MSB	0x00
Number of Registers MSB	0x00	Holding Register 108 LSB	0x0A
Number of Registers LSB	0x03	Holding Register 109 MSB	0x00
		Holding Register 109 LSB	0x0B
		Holding Register 110 MSB	0x00
		Holding Register 110 LSB	0x0C

2.3.2 Function Code [04] "Read Input Register"

This Function Code is used to read the input register. The maximum possible number of registers that can be addressed in one message is 125.

Request

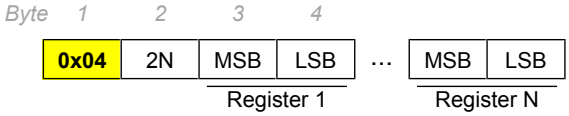
The request contains the address of the first register that is to be read and the number of registers that need to be read. The addressing of the register starts with 0; the numbering of the registers starts with 1.



Byte	Field name	Size	Value range
1	Function Code	1 byte	0x04
2.3	Start Address	2 bytes	0x0000 to 0xFFFF
4.5	Number of registers	2 bytes	0x0001 to 0x007D (1…125)

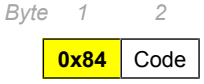
Response

The response contains two bytes for each read register; therefore the number of bytes is twice the number of registers.



Byte	Field name	Size	Value range
1	Function Code	1 byte	0x04
2	Number of bytes	2 bytes	2N
3.4	Content Register	N x 2 Byte	16 Bit value

Error



Byte		Size	Value range
1	Function Code (error)	1 byte	0x84
2	Error code	1 byte	Code see table

The following error codes are possible:

0x01	The function is not supported
0x02	An invalid address is referenced
0x03	The request does not correspond to the expected format; the number of requested registers is greater than 125

Example:

- Export Content Register 9
- Content Register 9= 0x000A

Byte	1	2	3	4	5
Request	**0x04**	0x00	0x08	0x00	0x01
Response	**0x04**	0x02	0x00	0x0A	

Request		Response	
Field name	**Value**	**Field name**	**Value**
Function Code	0x04	Function Code	0x04
Start Address MSB	0x00	Number of bytes	0x02
Start Address LSB	0x08	Input Register 9 MSB	0x00
Number of Registers MSB	0x00	Input Register 9 LSB	0x0A
Number of Registers LSB	0x01		

2.3.3 Function Code [06] "Write Single Register"

This Function Code is used to write a single Holding register.

Request

The request contains the address of the register that is to be written and value that is to be written.

Byte	1	2	3	4	5
	0x06	MSB	LSB	MSB	LSB

Byte	Field name	Size	Value range
1	Function Code	1 byte	0x06
2.3	Register Address	2 bytes	0x0000 to 0xFFFF
4.5	Register Value	2 bytes	0x0000 to 0xFFFF

Response

The response contains the address regster and the written value.

Byte	1	2	3	4	5
	0x06	MSB	LSB	MSB	LSB

Byte	Field name	Size	Value range
1	Function Code	1 byte	0x06
2	Register Address	2 bytes	0x0000 to 0xFFFF
3.4	Register Value	2 bytes	0x0000 to 0xFFFF

Error

Byte	1	2
	0x86	Code

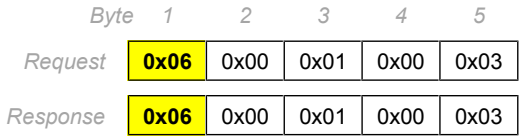
Byte		Size	Value range
1	Function Code (error)	1 byte	0x86
2	Error code	1 byte	Code see table

The following error codes are possible:

0x01	The function is not supported
0x02	An invalid address is referenced
0x03	The request does not correspond to the expected format

Example:

- Write register 2
- Value that needs to be written = 0x0003



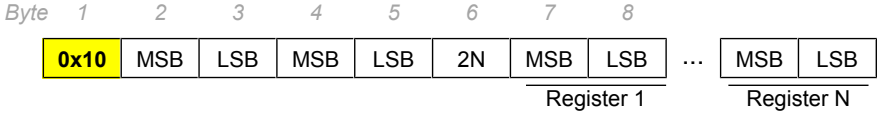
Request		Response	
Field name	**Value**	**Field name**	**Value**
Function Code	0x06	Function Code	0x06
Register Address MSB	0x00	Register Address MSB	0x00
Register Address LSB	0x01	Register Address LSB	0x01
Register Value MSB	0x00	Register Value MSB	0x00
Register Value LSB	0x03	Register Value LSB	0x03

2.3.4 Function Code [16] "Write Multiple Registers"

This Function Code is used to write a block of sequential registers. The maximum possible number of registers that can be addressed in one message is 123.

Request

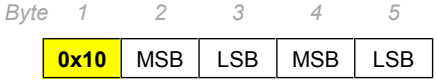
The request contains the address of the first register that is to be written and the number of registers that need to be written. The addressing of the register starts with 0; the numbering of the registers starts with 1.



Byte	Field name	Size	Value range
1	Function Code	1 byte	0x10
2.3	Start Address	2 bytes	0x0000 to 0xFFFF
4.5	Number of registers	2 bytes	0x0001 to 0x007B (1…123)
6	Number of bytes	1 byte	2 x N
7.8	Register Value	N x 2 Byte	Value

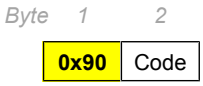
Response

The response contains the start address and the number of written registers.



Byte	Field name	Size	Value range
1	Function Code	1 byte	0x10
2.3	Start Address	2 bytes	0x0000 to 0xFFFF
4.5	Number of Registers	2 bytes	0x0001 to 0x007B (1…123)

Error



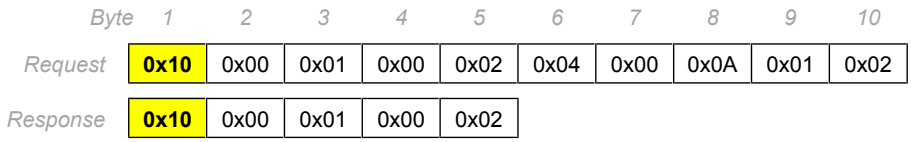
Byte		Size	Value range
1	Function Code (error)	1 byte	0x90
2	Error code	1 byte	Code see table

The following error codes are possible:

0x01	The function is not supported
0x02	An invalid address is referenced
0x03	The request does not correspond to the expected format; the number of requested registers is greater than 123; the number of data bytes does not match the number of registers

Example:

- Write 2 registers
- Start Address = 0x0001
- Content Register 2= 0x000A
- Content Register 3= 0x0102



Request		Response	
Field name	**Value**	**Field name**	**Value**
Function Code	0x10	Function Code	0x10
Start Address MSB	0x00	Start Address MSB	0x00
Start Address LSB	0x01	Start Address LSB	0x01
Number of Registers MSB	0x00	Number of Registers MSB	0x00
Number of Registers LSB	0x02	Number of Registers LSB	0x02
Number of bytes	0x04		
Register Value MSB	0x00		
Register Value LSB	0x0A		
Register Value MSB	0x01		
Register Value LSB	0x02		

2.3.5 Function Code [22] "Mask Write Register"

This Function Code is used to write individual bits into a Holding Register. Two masks are used for this:

- And_Mask and
- Or_Mask

The function algorithm is as follows:
Result = (Register value AND And_Mask) OR (Or_Mask AND (NOT And_Mask))

Example:

		Hex	Binary	
Register Value		12	0001 0010	
And_Mask	AND	F2	1111 0010	→ 0001 0010
				OR
Or_Mask		25	0010 0101	
NOT And_Mask	AND	0D	0000 1101	→ 0000 0101
Result		17	0001 0111	←

- If the OR_Mask has the value zero, the result is the logical AND from the value register and the AND_Mask.
- If, in contrast, the And_Mask has the value zero, the result is identical to the content of the OR_mask.

Request

The request contains the address of the register that is to be written and the masks.

Byte	1	2	3	4	5	6	7
	0x16	MSB	LSB	MSB	LSB	MSB	LSB

Byte	Field name	Size	Value range
1	Function Code	1 byte	0x16
2.3	Register Address	2 bytes	0x0000 to 0xFFFF
4.5	And_Mask	2 bytes	0x0000 to 0xFFFF
6.7	Or_Mask	2 bytes	0x0000 to 0xFFFF

Response

The response is an echo of the request.

Byte	1	2	3	4	5	6	7
	0x16	MSB	LSB	MSB	LSB	MSB	LSB

Byte	Field name	Size	Value range
1	Function Code	1 byte	0x16
2.3	Register Address	2 bytes	0x0000 to 0xFFFF
4.5	And_Mask	2 bytes	0x0000 to 0xFFFF
6.7	Or_Mask	2 bytes	0x0000 to 0xFFFF

Error

Byte	1	2
	0x96	Code

Byte		Size	Value range
1	Function Code (error)	1 byte	0x90
2	Error code	1 byte	Code see table

The following error codes are possible:

0x01	The function is not supported
0x02	An invalid address is referenced
0x03	The request does not correspond to the expected format;

Example:

- Write register 5
- And_Mask = 0x00F2
- Or_Mask = 0x0025

Byte	1	2	3	4	5	6	7
Request	0x16	0x00	0x04	0x00	0xF2	0x00	0x25
Response	0x16	0x00	0x04	0x00	0xF2	0x00	0x25

Request		Response	
Field name	**Value**	**Field name**	**Value**
Function Code	0x16	Function Code	0x16
Register Address MSB	0x00	Register Address MSB	0x00
Register Address LSB	0x04	Register Address LSB	0x04
And_Mask MSB	0x00	And_Mask MSB	0x00
And_Mask LSB	0xF2	And_Mask LSB	0xF2
Or_Mask MSB	0x00	Or_Mask MSB	0x00
Or_Mask LSB	0x25	Or_Mask LSB	0x25

2.3.6 Function Code [23] "Read/Write Register"

This Function Code is used to write new values in the Holding register and then export them. The maximum possible number of registers that can be written and/or read in one message is:

- Write: 121 registers
- Read: 125 registers

Request

The request contains the address of the first register that is to be read, the number of the register that is to be read, the address of the first written registers, the number of registers that need to be written, the number of transferred bytes and the new values. Each new register value comprises two bytes. N corresponds to the number of the register that is to be written.

Byte	1	2	3	4	5	6	7	8	9	10	11	12			
	0x17	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	2N	MSB	LSB	…	MSB	LSB
											Register 1			Register N	

Byte	Field name	Size	Value range
1	Function Code	1 byte	0x17
2.3	READ Start Address	2 bytes	0x0000 to 0xFFFF
4.5	READ Number of Registers	2 bytes	0x0000 to 0x007D (1…125)
6.7	WRITE Start Address	2 bytes	0x0000 to 0xFFFF
8.9	WRITE Number of Registers	2 bytes	0x0000 to 0x0079 (1…121)
10	WRITE Number of bytes	1 byte	2 x N
11.12	WRITE Register Value	N x 2 Byte	Value

Response

The response contains the number N of the read registers and their values.

Byte	1	2	3	4		
	0x17	2N'	MSB	LSB	…	MSB	LSB
			Register 1			Register N'	

Byte	Field name	Size	Value range
1	Function Code	1 byte	0x17
2	Number of bytes	1 byte	2 x N‘
3.4	READ Register Value	N‘ x 2 Byte	Value

Error

Byte	1	2
	0x97	Code

Byte		Size	Value range
1	Function Code (error)	1 byte	0x97
2	Error code	1 byte	Code see table

The following error codes are possible:

0x01	The function is not supported
0x02	An invalid address is referenced
0x03	The request does not correspond to the expected format; the number of requested registers is greater than 121 and/or 125; the number of data bytes does not match the number of registers

Example:

READ:

- 6 Registers
- Start Address Register 4 = 0x0003
- Values: 0x00FE, 0x0ACD, 0x0001, 0x0003, 0x000D, 0x00FF

WRITE:

- 3 Registers
- Start Address Register 15 = 0x000E
- All values: 0x00FF

Byte	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Request	**0x17**	0x00	0x03	0x00	0x06	0x00	0x0E	0x00	0x03	0x06	0x00	0xFF	0x00	0xFF	0x00	0xFF
Response	**0x17**	0x0C	0x00	0xFE	0x0A	0xCD	0x00	0x01	0x00	0x03	0x00	0x0D	0x00	0xFF		

Request		Response	
Field name	**Value**	**Field name**	**Value**
Function Code	0x17	Function Code	0x17
READ Start Address MSB	0x00	Number of registers	0x0C
READ Start Address LSB	0x03	READ Register Value MSB	0x00
READ Number of Registers MSB	0x00	READ Register Value LSB	0xFE
READ Number of Registers LSB	0x06	READ Register Value MSB	0x0A
WRITE Start Address MSB	0x00	READ Register Value LSB	0xCD
WRITE Start Address LSB	0x0E	READ Register Value MSB	0x00
WRITE Number of Registers MSB	0x00	READ Register Value LSB	0x01
WRITE Number of Registers LSB	0x03	READ Register Value MSB	0x00
WRITE Number of bytes	0x06	READ Register Value LSB	0x03

Request		Response	
Field name	**Value**	**Field name**	**Value**
WRITE Register Value MSB	0x00	READ Register Value MSB	0x00
WRITE Register Value LSB	0xFF	READ Register Value LSB	0x0D
WRITE Register Value MSB	0x00	READ Register Value MSB	0x00
WRITE Register Value LSB	0xFF	READ Register Value LSB	0xFF
WRITE Register Value MSB	0x00		
WRITE Register Value LSB	0xFF		

2.4 Diagnosis

2.4.1 Function Code [08] "Diagnostic"

This Function Code allows various diagnosis functions to be executed.

Request

The request contains the diagnosis function that needs to be run and the N x 2 data bytes. The Function Code contains a two-byte long sub-function that determines the diagnosis that needs to be executed.

Byte	Field name	Size	Value range
1	Function Code	1 byte	0x08
2.3	Sub-function	2 bytes	Code see table
4.5	Data	N x 2 Byte	

Sub-function

00	0x0000	"Read Query Data"
10	0x000A	"Clear Counters and Diagnostic Registers"
11	0x000B	"Return Bus Message Count"
12	0x000C	"Return Bus Communication Error Count"
13	0x000D	"Return Bus Exception Error Count"
14	0x000E	"Return Server Message Count"
15	0x000F	"Return Server No Response Count"

Sub-function [00] "Read Query Data"

The data bytes from the request are returned in the response.

Sub-function	Data (Request)	Data (Response)
00 00	User-defined	Echo Data (Request)

Sub-function [10] "Clear Counters and Diagnostic Registers"

All counters are reset to 0. The response contains the data bytes from the request.[(1)]

Sub-function	Data (Request)	Data (Response)
00 0A	00 00	Echo Data (Request)

Sub-function [11] "Return Bus Message Count"

The number of recognised messages on the bus that are returned since the last start of the unit.

Sub-function	Data (Request)	Data (Response)
00 0B	00 00	Number of messages

[(1)] Comm.: The counters are also reset when the supply is switched on.

Sub-function [12] "Return Bus Communication Error Count"

The number of recipient errors and messages with invalid checksum (CRC) is sent back.

Sub-function	Data (Request)	Data (Response)
00 0C	00 00	Number of errors

Sub-function [13] "Return Bus Exception Error Count"

The number of error responses generated by this unit since it was started last.

Sub-function	Data (Request)	Data (Response)
00 0D	00 00	Number of error responses

Sub-function [14] "Return Server Message Count"

The number of messages addressed to the unit is returned.

Sub-function	Data (Request)	Data (Response)
00 0E	00 00	Number of messages

Sub-function [15] "Return Server No Response Count"

The number of requests to which no response was sent is returned.

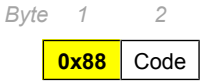
Sub-function	Data (Request)	Data (Response)
00 0F	00 00	Number of requests without a response

Response

The response corresponds to the request, however the content and number of data bytes depends on the executed diagnosis function (see above).

Byte	Field name	Size	Value range
1	Function Code	1 byte	0x08
2.3	Sub-function	2 bytes	
4.5	Data	N x 2 Byte	

Error



Byte		Size	Value range
1	Function Code (error)	1 byte	0x88
2	Error code	1 byte	Code see table

The following error codes are possible:

0x01	The function is not supported
0x03	The request does not correspond to the expected format;

2.4.2 Function Code [17] "Report Server ID"

The Function Code allows the query of unit-specific data.

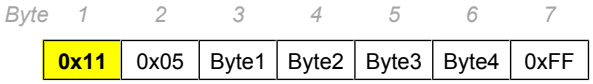
Request

The response only contains the Function Code.

Byte	Field name	Size	Value range
1	Function Code	1 byte	0x11

Response

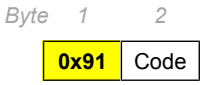
The response comprises one byte (number of bytes) and five data bytes. The first four data bytes contains the unit code, the last data byte is always 0xFF.



Byte	Field name	Size	Value range
1	Function Code	1 byte	0x11
2	Number of bytes	1 byte	0x05
3-6	Byte 1 … Byte 4	4 byte	Code see table
7	Close	1 byte	0xFF

Appliance,	Byte 1	Byte 2	Byte 3	Byte 4
EA15	0xEA	0x15	0xEA	0x15
EA16	0xEA	0x16	0xEA	0x16

Error



Byte	Field name	Size	Value range
1	Function Code (error)	1 byte	0x91
2	Error code	1 byte	Code see table

The following error codes are possible:

0x01	The function is not supported
0x03	The request does not correspond to the expected format

2.5 Other functions

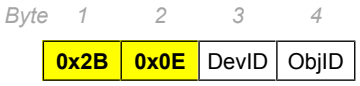
2.5.1 Function Code [43/14] "Read Device Identification"

This Function Code is used to read certain information about identification of the unit. The following object types are used in the FISCHER units:

Object ID	Object Name	Type	Category
0x00	VendorName	ASCII String	Basic
0x01	ProductCode	ASCII String	Basic
0x02	MajorMinorRevision	ASCII String	Basic
0x03	VendorUrl	ASCII String	Regular
0x04	ProductName	ASCII String	Regular
0x05	ModelName	ASCII String	Regular
0x06	UserApplicationName	ASCII String	Regular

Request

NOTICE! There are no objects of the Extended category.



Byte	Field name	Size	Value range
1	Function Code	1 byte	0x2B
2	MEI Typ[+)]	1 byte	0x0E
3	Read Device ID Code	1 byte	01 / 02 / 04
4	Object ID	1 byte	0x00 to 0xFF

[+)] MEI = Modbus Encapsulated Interface

Read Device ID

The Read Device ID Code (DevID) serves to specify the access. If the code is not correct, an error message with the code 0x03 is sent.

01	Access to objects of the Basic category	stream access
02	Access to objects of the Regular category	stream access
04	Access to a single object	individual access

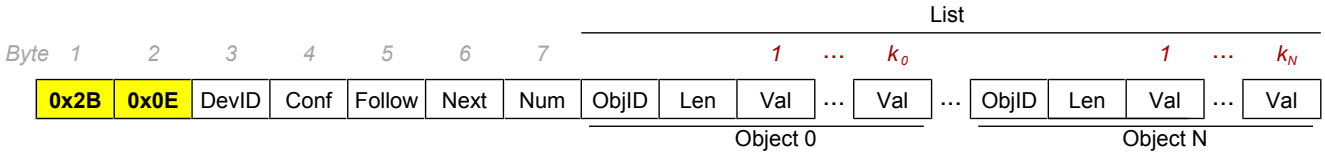
If the length of the requested information exceeds the maximum possible length of the PDU, several transactions (Request/Response) must be carried out.

Object ID

The Object ID Code states on which object of the 'stream access‘ should start. If the Object ID does not match the existing objects, the 'stream access‘ starts with the first object of the category. In the event of an 'individual access‘, an error message is generated with the error code 0x02.

Response

The response comprises several bytes with status information followed by a list with the requested object information.



Byte	Field name	Size	Value range
1	Function Code	1 byte	0x2B
2	MEI Type	1 byte	0x0E
3	Read Device ID Code	1 byte	01 / 02 / 03 / 04
4	Conformity Level	1 byte	0x83
5	More Follows	1 byte	0x00 / 0xFF
6	Next Object ID	1 byte	Object ID Number
7	Number of Objects	1 byte	
List of object data			
	Object(N).ID	1 byte	
	Object(N).Length	1 byte	
	Object(N).Value	k Byte	

Conformity Level

The Conformity Level specifies the information category and the access type that is supported.

0x83	Extended Identification	stream and individual access

More Follows

If the length of the requested information exceeds the maximum possible length of the PDU, several transactions (Request/Response) must be carried out. The 'More Follows‘ byte signalises whether or not further requests are required to transfer all information.

0x00	no further objects	
0xFF	other objects available	other transaction necessary

Next Object ID

If a further transaction is required (More Follows = FF), the Object ID for the following Request is stated at this point.

Otherwise (More Follows = 00) this value is useless and is set to 00.

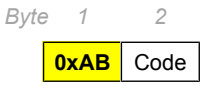
Number of Objects

This byte states the number N of the objects that are transferred in the response. In the case of 'individual access‘ the number of objects is = 01.

List of object data

Object(0).ID	Object ID of the first object in the response
Object(0).Length	Length of the object
Object(0).Value	Value of the object
…	
Object(N).ID	Object ID of the last object in the response
Object(N).Length	Length of the object
Object(N).Value	Value of the object

Error



Byte	Field name	Size	Value range
1	Function Code (error)	1 byte	0xAB (0x2B + 0x80)
2	Error code	1 byte	Code see table

The following error codes are possible:

0x01	The function is not supported
0x02	Invalid address (Object ID)
0x03	Invalid value (Read Device ID)

An Example

Request		Response	
Field name	**Value**	**Field name**	**Value**
Function Code	0x2B	Function Code	0x17
MEI Type	0x0E	MEI Type	0x0E
Read Device ID Code	0x01	Read Device ID Code	0x01
Object ID	0x00	Conformity Level	0x83
		More Follows	0x00
		Next Object ID	0x00
		Number of Objects	0x03
		Object(0).ID	0x00
		Object(0).Length	0x0C
		Object(0).Value	**FISCHER GmbH**
		Object(1).ID	0x01

Request		Response	
Field name	**Value**	**Field name**	**Value**
		Object(1).Length	0x04
		Object(1).Value	**EA15**
		Object(2).ID	0x02
		Object(2).Length	0x04
		Object(2).Value	**V1.0**

3 Data types

3.1 Integer (16 Bit)

- Standard format for register
- Comprises two bytes in a Modbus message
- The higher-valued byte (Bits 8 to 15) is always sent first
- The two-complement format is used for integers with a preceding sign.

	Value range
unsigned Integer	0 … 65535
signed Integer	-32768 … +32767

3.2 Integer (32 Bit)

- Corresponds to the standard register format with an extended value range.
- A 32 Bit large number comprises two registers (four bytes).
- The byte sequence can be changed between the Big Endian- (the value with the highest value first) and the Little Endian format (the value with the lowest value first). (see Register 10207 [▶ 36])

Example:

$284454020_{10} = 11223344_{16}$

Format	Reg. 1 MSB	Reg. 1 LSB	Reg. 2 MSB	Reg. 2 LSB
Big Endian	0x11	0x22	0x33	0x44
Little Endian	0x44	0x33	0x22	0x11

3.3 Float

- Flow comma figures are transferred in the IEEE-475 Single Precision format.
- It comprises two registers (four bytes).
- The byte sequence can be changed between the Big Endian- (the value with the highest value first) and the Little Endian format (the value with the lowest value first). (see Register 10207 [▶ 36])

Example:

$1234.56_{10} = 449A51EC_{16}$

Format	Reg. 1 MSB	Reg. 1 LSB	Reg. 2 MSB	Reg. 2 LSB
Big Endian	0x44	0x9A	0x51	0xEC
Little Endian	0xEC	0x51	0x9A	0x44

3.4 Character

- Character chains are transferred with two characters per register each
- The preceding sign is saved in the higher value byte (MSB) and the following characters in the lower value byte (LSB) of the register.
- The last character of character chain with an uneven length is always a zero (0x00).

Example:

Character string = "FISCHER"

Reg. 1 MSB	Reg. 1 LSB	Reg. 2 MSB	Reg. 2 LSB	Reg. 3 MSB	Reg. 3 LSB	Reg. 4 MSB	Reg. 4 LSB
'F'	'I'	'S'	'C'	'H'	'E'	'R'	'\0'
0x46	0x49	0x53	0x43	0x48	0x45	0x52	0x00

4 Addresses

4.1 Bit values

NOTICE

No differentiation is made between "Coils" and "Discrete inputs". All bit values can be read equally with the Function Codes 01 "Read Coils" and 02 "Read Discrete Inputs". Bit values cannot be written.

4.1.1 Switching outputs

Bit No.	Adr.	Description	Status ON	Status OFF
1	0	Switching output 1	1	0
2	1	Switching output 2		
3	2	Switching output 3		
4	3	Switching output 4		

4.1.2 Alarm messages

Channel1

Bit No.	Adr.	Description	Status ON	Status OFF
5	4	Message/colour change: low/red	1	0
6	5	Message/colour change: low/yellow		
7	6	Message/colour change: ok/green		
8	7	Message/colour change: high/yellow		
9	8	Message/colour change: high/red		
10	9	Acoustic alarm: low		
11	10	Acoustic alarm: high		
12	11	Acknowledge acoustic alarm		
13	12	not used		0
		…		
20	19	not used		0

Channel2

Bit No.	Adr.	Description	Status ON	Status OFF
21	20	Message/colour change: low/red	1	0
22	21	Message/colour change: low/yellow		
23	22	Message/colour change: ok/green		
24	23	Message/colour change: high/yellow		
25	24	Message/colour change: high/red		
26	25	Acoustic alarm: low		
27	26	Acoustic alarm: high		
28	27	Acknowledge acoustic alarm		
29	28	not used		0
		…		
36	35	not used		0

Channel3

Bit	Adr.	Description	Status	
No.			ON	OFF
37	36	Message/colour change: low/red	1	0
38	37	Message/colour change: low/yellow		
39	38	Message/colour change: ok/green		
40	39	Message/colour change: high/yellow		
41	40	Message/colour change: high/red		
42	41	Acoustic alarm: low		
43	42	Acoustic alarm: high		
44	43	Acknowledge acoustic alarm		
45	44	not used		0
		…		
52	51	not used		0

Channel4

Bit	Adr.	Description	Status	
No.			ON	OFF
53	52	Message/colour change: low/red	1	0
54	53	Message/colour change: low/yellow		
55	54	Message/colour change: ok/green		
56	55	Message/colour change: high/yellow		
57	56	Message/colour change: high/red		
58	57	Acoustic alarm: low		
59	58	Acoustic alarm: high		
60	59	Acknowledge acoustic alarm		
61	60	not used		0
		…		
68	67	not used		0

4.2 16 Bit Register

NOTICE

No differentiation is made between "Input Registers" and "Holding Registers". All values can be read equally with the Function Codes 04 "Read Input Registers" and 03 "Read Holding Registers".

The register 1 to 9999 can only be read. The remaining registers (≥ 10000) allow write/read access.

If an invalid value is written in a register, its original value is retained. The number of the first invalid parameter can be called up via the Register 1015. If a zero (0) is saved here, the last written configuration is valid.

Data type abbreviations

Type	Abb.	Description
Float	Float	Floating point number
unsigned Integer	uINT	Integer without sign
signed Integer	INT	Integer with sign
Character	char	Character string

4.2.1 Measured values

NOTICE! Read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description
1	0	2	Float	Measured value channel 1
3	2	2	Float	Measured value channel 2
5	4	2	Float	Measured value channel 3
7	6	2	Float	Measured value channel 4

4.2.2 Input signals

NOTICE! Read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description
9	8	2	Float	Input signal input 1
11	10	2	Float	Input signal input 2
13	12	2	Float	Input signal input 3
15	14	2	Float	Input signal input 4

4.2.3 Output signals

NOTICE! Read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description
17	16	2	Float	Output signal output 1
19	18	2	Float	Output signal output 2
21	20	2	Float	Output signal output 3
23	22	2	Float	Output signal output 4

4.2.4 Switching outputs

NOTICE! Read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description	Value ON	OFF
25	24	1	uINT	Status switch output 1	1	0
26	25	1	uINT	Status switch output 2		
27	26	1	uINT	Status switch output 3		
28	27	1	uINT	Status switch output 4		

4.2.5 Alarm messages

NOTICE! Read-only access

Channel 1

Reg. No.	Adr.	No. of Reg.	Format	Description	Values
29	**28**	**1**	**INT**	**Message/colour change**	
				low/red	*-2*
				low/*yellow*	*-1*
				ok/green	*0*
				high/yellow	*1*
				high/red	*2*
30	**29**	**1**	**INT**	**Acoustic alarm**	
				low	*-1*
				OFF	*0*
				high	*1*
31	**30**	**1**	**uINT**	**Confirmation acoustic alarm**	
				OFF	*0*
				ON	*1*

Channel 2

Reg. No.	Adr.	No. of Reg.	Format	Description	Values
32	**31**	**1**	**INT**	**Message/colour change**	
				low/red	*-2*
				low/yellow	*-1*
				ok/green	*0*
				high/yellow	*1*
				high/red	*2*
33	**32**	**1**	**INT**	**Acoustic alarm**	
				low	*-1*
				OFF	*0*
				high	*1*
34	**33**	**1**	**uINT**	**Confirmation acoustic alarm**	
				OFF	*0*
				ON	*1*

Channel 3

Reg. No.	Adr.	No. of Reg.	Format	Description	Values
35	**34**	**1**	**INT**	**Message/colour change**	
				low/red	*-2*
				low/yellow	*-1*
				ok/green	*0*
				high/yellow	*1*
				high/red	*2*
36	**35**	**1**	**INT**	**Acoustic alarm**	
				low	*-1*
				OFF	*0*
				high	*1*
37	**36**	**1**	**uINT**	**Confirmation acoustic alarm**	
				OFF	*0*
				ON	*1*

Channel 4

Reg. No.	Adr.	No. of Reg.	Format	Description	Values
38	**37**	**1**	**INT**	**Message/colour change**	
				low/red	*-2*
				low/yellow	*-1*
				ok/green	*0*
				high/yellow	*1*
				high/red	*2*
39	**38**	**1**	**INT**	**Acoustic alarm**	
				low	*-1*
				OFF	*0*
				high	*1*
40	**39**	**1**	**uINT**	**Confirmation acoustic alarm**	
				OFF	*0*
				ON	*1*

4.2.6 Units

NOTICE! Read-only access

The measurement unit that is shown is the result of the configuration of the respective channel.

Reg. No.	Adr.	No. of Reg.	Format	Description	max. no. Characters
41	40	3	char	Measurement unit channel 1	5
44	43	3	char	Measurement unit channel 2	
47	46	3	char	Measurement unit channel 3	
50	49	3	char	Measurement unit channel 4	

4.2.7 Unit information

NOTICE! Read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description	Values
1001	**1000**	**8**	**char**	**Serial number**	**16 characters**
1009	**1008**	**1**	**uINT**	**Unit code**	
				EA15	*0xEA15*
				EA16	*0xEA16*
1010	**1009**	**1**	**uINT**	**Firmware version**	**BCD coded**
1011	**1010**	**1**	**uINT**	**Number of channels**	
1012	**1011**	**1**	**uINT**	**Switching outputs**	
				not available	*0*
				available	*1*
1013	**1012**	**1**	**uINT**	**Status SD card**	
				SD off	*0*
				SD ok	*1*
				SD card almost full	*2*
				SD card full	*3*
1014	**1013**	**1**	**uINT**	**Status USB**	
				USB off	*0*
				USB connection	*1*
				USB on	*2*
1015	**1014**	**1**	**uINT**	**Error recognition via Modbus**	
				First invalid parameter	

4.2.8 Parameters

4.2.8.1 Display

NOTICE! Write/read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
10001	**10000**	**15**	**char**	**Unit designation**		**305**
				Values	*max. 29 char*	
10016	**10015**	**1**	**uINT**	**Date: year**		**—**
				Values	*2000 .. 2099*	
10018	**10017**	**1**	**uINT**	**Date: Day**		**—**
				Values	*1 .. 31*	
10019	**10018**	**1**	**uINT**	**Time: hours**		**—**
				Values	*0 .. 23*	
10020	**10019**	**1**	**uINT**	**Time: minutes**		**—**
				Values	*0 .. 59*	
10021	**10020**	**1**	**uINT**	**Time: seconds**		**—**
				Values	*0 .. 59*	
10022	**10021**	**1**	**uINT**	**Display**		**306**
				List view	*0*	
				Tile view	*1*	
10023	**10022**	**1**	**uINT**	**Colour scheme**		**307**

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
				Colour scheme 1 (dark)	*0*	
				Colour scheme 2 (light)	*1*	
10024	**10023**	**1**	**uINT**	**Brightness**		**19**
				100%	*0*	
				90%	*1*	
				80%	*2*	
				70%	*3*	
				60%	*4*	
				50%	*5*	
				40%	*6*	
				30%	*7*	
10025	**10024**	**1**	**uINT**	**Display**		**304**
				Unit designation	*0*	
				Date/time	*1*	
10026	**10025**	**1**	**uINT**	**Switch status**		**350**
				hide	*0*	
				show	*1*	
10027	**10026**	**1**	**uINT**	**Limit lines**		**347**
				hide	*0*	
				show	*1*	
10028	**10027**	**1**	**uINT**	**Auxiliary Lines**		**354**
				hide	*0*	
				show	*1*	
10029	**10028**	**1**	**uINT**	**Language**		**353**
				English	*0*	
				English	*1*	
				Spanish	*2*	
				FRENCH	*3*	
				Portuguese	*4*	
				Hungarian	*5*	
				Italian	*6*	
10030	**10029**	**1**	**uINT**	**Date format**		**409**
				dd.mm.yyyy	*0*	
				dd/mm/yyyy	*1*	
				dd-mm-yyyy	*2*	
				mm.dd.yyyy	*3*	
				mm/dd/yyyy	*4*	
				mm-dd-yyyy	*5*	
				yyyy.mm.dd	*6*	
				yyyy/mm/dd	*7*	
				yyyy-mm-dd	*8*	

4.2.8.2 Data logger

NOTICE! Write/read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
10031	**10030**	**1**	**uINT**	**Data logger**		**348**
				OFF ON	0 1	
10032	**10031**	**1**	**uINT**	**Data logger channel 1**		**308**
				OFF ON	0 1	
10033	**10032**	**1**	**uINT**	**Sampling rate channel 1**		**315**
				125 ms 250 ms 500 ms 1 s 2 s 3 s 4 s 5 s 6 s 7 s 8 s 9 s 10 s 30 s 1 min 5 min 10 min 15 min 20 min 30 min	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	
10034	**10033**	**1**	**uINT**	**Data logger channel 2**		**316**
				OFF ON	0 1	
10035	**10034**	**1**	**uINT**	**Sampling rate channel 2**		**323**
				125 ms 250 ms 500 ms 1 s 2 s 3 s 4 s 5 s 6 s 7 s 8 s 9 s 10 s 30 s 1 min 5 min 10 min 15 min 20 min 30 min	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
10036	**10035**	**1**	**uINT**	**Data logger channel 3**		**324**
				OFF ON	0 1	
10037	**10036**	**1**	**uINT**	**Sampling rate channel 3**		**331**
				125 ms 250 ms 500 ms 1 s 2 s 3 s 4 s 5 s 6 s 7 s 8 s 9 s 10 s 30 s 1 min 5 min 10 min 15 min 20 min 30 min	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	
10038	**10037**	**1**	**uINT**	**Data logger channel 4**		**332**
				OFF ON	0 1	
10039	**10038**	**1**	**uINT**	**Sampling rate channel 4**		**339**
				125 ms 250 ms 500 ms 1 s 2 s 3 s 4 s 5 s 6 s 7 s 8 s 9 s 10 s 30 s 1 min 5 min 10 min 15 min 20 min 30 min	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	
Event log						
10040	**10039**	**1**	**uINT**	**Event log**		**341**
				OFF ON	0 1	
10041	**10040**	**1**	**uINT**	**Log parameter changes**		**340**

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
				OFF ON	0 1	
10042	**10041**	**1**	**uINT**	**Log unit start**		**342**
				OFF ON	0 1	
10043	**10042**	**1**	**uINT**	**Log Limit thresholds channel 1**		**309**
				OFF ON	0 1	
10044	**10043**	**1**	**uINT**	**Log threshold low - red channel 1**		**314**
				OFF ON	0 1	
10045	**10044**	**1**	**uINT**	**Log threshold low red/yellow channel 1**		**311**
10046	**10045**	**1**	**uINT**	**Log threshold ok/green channel 1**		**312**
				OFF ON	0 1	
10047	**10046**	**1**	**uINT**	**Log threshold high/yellow channel 1**		**310**
				OFF ON	0 1	
10048	**10047**	**1**	**uINT**	**Log threshold high/red channel 1**		**313**
				OFF ON	0 1	
10049	**10048**	**1**	**uINT**	**Log Limit thresholds channel 2**		**317**
				OFF ON	0 1	
10050	**10049**	**1**	**uINT**	**Log threshold low - red channel 2**		**322**
				OFF ON	0 1	
10051	**10050**	**1**		**Log threshold low/yellow chan-nel 2**		**319**
				OFF ON	0 1	
10052	**10051**	**1**	**uINT**	**Log threshold ok/green channel 2**		**320**
				OFF ON	0 1	
10053	**10052**	**1**	**uINT**	**Log threshold high/yellow channel 2**		**318**
				OFF ON	0 1	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
10054	**10053**	**1**	**uINT**	**Log threshold high/red channel 2**		**321**
				OFF ON	0 1	
10055	**10054**	**1**	**uINT**	**Log Limit thresholds channel 3**		**325**
				OFF ON	0 1	
10056	**10055**	**1**	**uINT**	**Log threshold low - red channel 3**		**330**
				OFF ON	0 1	
10057	**10056**	**1**	**uINT**	**Log threshold low/yellow channel 3**		**327**
				OFF ON	0 1	
10058	**10057**	**1**	**uINT**	**Log threshold ok/green channel 3**		**328**
				OFF ON	0 1	
10059	**10058**	**1**	**uINT**	**Log threshold high/yellow channel 3**		**226**
				OFF ON	0 1	
10060	**10059**	**1**	**uINT**	**Log threshold high/red channel 3**		**329**
				OFF ON	0 1	
10061	**10060**	**1**	**uINT**	**Log Limit thresholds channel 4**		**333**
				OFF ON	0 1	
10062	**10061**	**1**	**uINT**	**Log threshold low - red channel 4**		**338**
				OFF ON	0 1	
10063	**10062**	**1**	**uINT**	**Log threshold low/yellow channel 4**		**335**
				OFF ON	0 1	
10064	**10063**	**1**	**uINT**	**Log threshold ok/green channel 4**		**336**
				OFF ON	0 1	
10065	**10064**	**1**	**uINT**	**Log threshold high/yellow channel 4**		**334**
				OFF ON	0 1	
10066	**10065**	**1**	**uINT**	**Log threshold high/red channel 4**		**337**
				OFF ON	0 1	

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
10067	**10066**	**1**	**uINT**	**Log switch output 1**		**343**
				OFF ON	0 1	
10068	**10067**	**1**	**uINT**	**Log switch output 2**		**344**
				OFF ON	0 1	
10069	**10068**	**1**	**uINT**	**Log switch output 3**		**345**
				OFF ON	0 1	
10070	**10069**	**1**	**uINT**	**Log switch output 4**		**346**
				OFF ON	0 1	

4.2.8.3 RS485 Interface / Modbus

NOTICE! Read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
10202	**10201**	**1**	**uINT**	**Baud rate**		**405**
				1200 baud 2400 baud 4800 baud 9600 baud 19200 baud 38400 baud 57600 baud	0 1 2 3 4 5 6	
10203	**10202**	**1**	**uINT**	**Data format**		**406**
				8 data bit no parity 1 stop bit	0	
				8 data bit no parity 2 stop bit	1	
				8 data bit uneven parity 1 stop bit	2	
				8 data bit uneven parity 2 stop bit	3	
				8 data bit even parity 1 stop bit	4	
				8 data bit even parity 2 stop bit	5	
10204	**10203**	**1**	**uINT**	**Slave address**		**404**
				1 .. 255		
10205	**10204**	**2**	**uINT**	**Waiting time Telegram end recognition**		**407**
				0 .. 10,000 ms		

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
10207	**10206**	**1**	**uINT**	**Byte sequence comprised values**		**408**
				Big Endian Little Endian	0 1	

4.2.8.4 Analogue inputs

4.2.8.4.1 Analogue input 1

NOTICE! Write/read-only access

MB: measuring range
MBA: start of measuring range
MBE; end of the measuring range

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
11001	**11000**	**5**	**char**	**Planned measures**		**21**
				max. 8 characters		
Input signal						
11006	**11005**	**1**	**uINT**	**Type:**		**244**
				Electricity	0	
				Voltage	1	
11007	**11006**	**2**	**Float**	**Signal min.**		**246**
				Electricity	0 .. 20.5 mA	
11009	**11008**	**2**	**Float**	**Signal max.**		**245**
				Electricity	0 .. 20.5 mA	
11011	**11010**	**2**	**Float**	**Signal min.**		**248**
				Voltage	0 .. 10.5 V	
11013	**11012**	**2**	**Float**	**Signal max.**		**247**
				Voltage	0 .. 10.5 V	
11015	**11014**	**1**	**—**	**—**		**—**
				always	0	
Pres. of measurem.						
11016	**11015**	**1**	**uINT**	**Receipt**		**412**
				Active	0	
				Inactive	1	
11017	**11016**	**1**	**uINT**	**Integer digits**		**24**
				Value	1 .. 6	
11018	**11017**	**1**	**uINT**	**Decimal Places**		**23**
				Value	0 .. 3	
11019	**11018**	**1**	**—**	**—**		**—**
				always	0	
Messages / Colour change						
11020	**11019**	**2**	**Float**	**Hysteresis**		**51**
				Value	0 .. |Measuring range|	
11022	**11021**	**2**	**Float**	**Deceleration**		**50**
				Value	0 .. 3,600,000 ms	
11024	**11023**	**1**	**uINT**	**Threshold low - red:**		**45**
				Off	0	
				on	1	
11025	**11024**	**2**	**Float**	**Threshold low - red:**		**49**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
11027	**11026**	**1**	**uINT**	**Threshold low - yellow**		**43**
				Off	0	
				on	1	
11028	**11027**	**2**	**Float**	**Threshold low - yellow**		**47**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
11030	**11029**	**1**	**uINT**	**Threshold high - yellow**		**42**
				Off	0	
				on	1	
11031	**11030**	**2**	**Float**	**Threshold high - yellow**		**46**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
11033	**11032**	**1**	**uINT**	**Threshold high - red**		**44**
				Off	0	
				on	1	
11034	**11033**	**2**	**Float**	**Threshold high - red**		**48**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
11036	**11035**	**1**	**uINT**	**News**		**36**
				Off	0	
				on	1	
11037	**11036**	**25**	**char**	**Message low - red**		**37**
				Text	max. 49 characters	
11062	**11061**	**25**	**char**	**Message low - yellow**		**38**
				Text	max. 49 characters	
11087	**11086**	**25**	**char**	**Message ok - green**		**39**
				Text	max. 49 characters	
11112	**11111**	**25**	**char**	**Message high - yellow**		**40**
				Text	max. 49 characters	
11137	**11136**	**25**	**char**	**Message high - red**		**41**
				Text	max. 49 characters	
Acoustic alarm						
11162	**11161**	**1**	**uINT**	**Alert**		**365**
				Off	0	
				on	1	
11163	**11162**	**1**	**uINT**	**Alarm low**		**364**
				Off	0	
				on	1	
11164	**11163**	**2**	**Float**	**Threshold low ON**		**369**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
11166	**11165**	**2**	**Float**	**Threshold low OFF**		**368**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
11168	**11167**	**2**	**uINT**	**Delay low**		**361**
					0 ... 3,600,000 ms	
11170	**11169**	**1**	**uINT**	**Alarm high**		**363**
				Off	0	
				on	1	
11171	**11170**	**2**	**Float**	**Threshold high ON**		**367**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
11173	**11172**	**2**	**Float**	**Threshold high OFF**		**366**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
11175	**11174**	**2**	**uINT**	**Delay high**		**360**
				Value	0 ... 3.600.00 ms	
11177	**11176**	**1**	**uINT**	**Accept**		**362**
				Off	0	
				on	1	
11178	**11177**	**2**	**uINT**	**Confirmation of process**		**359**
				Value	0 ... 7,200,000 ms	
Characteristic curve						
11180	**11179**	**1**	**uINT**	**Function**		**32**
				linear	0	
				root extracted	1	
				Flow	2	
11181	**11180**	**3**	**char**	**Unit**		**280**
				Lin. scaling	max. 5 characters	
11184	**11183**	**2**	**Float**	**Measuring range start**		**289**
				Lin. scaling	±999,999	
11186	**11185**	**2**	**Float**	**Measuring range end**		**288**
				Lin. scaling	±999,999	
11188	**11187**	**2**	**Float**	**Zero-point window**		**29**
				Value	0 .. 25 %	
11190	**11189**	**3**	**char**	**Unit**		**284**
				Non-lin. scaling	max. 5 characters	
11193	**11192**	**2**	**Float**	**Measuring range start**		**291**
				Non-lin. scaling	±999,999	
11195	**11194**	**2**	**Float**	**Measuring range end**		**290**
				Non-lin. scaling	±999,999	
11197	**11196**	**2**	**Float**	**k-factor (not implemented at this time)**		**33**
				Value	±10,000	
11199	**11198**	**2**	**uINT**	**Attenuation**		**28**
				Value	0 ... 30,000 ms	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
11201	**11200**	**2**	**Float**	**Offset correction**		**30**
				Value	–|Measuring range| … |Measuring range|	
11203	**11202**	**1**	**uINT**	**Limits**		**31**
				Off	0	
				on	1	

4.2.8.4.2 Analogue input 2

NOTICE! Write/read-only access

MB: measuring range
MBA: start of measuring range
MBE; end of the measuring range

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
12001	**12000**	**5**	**char**	**Planned measures**		**53**
				max. 8 characters		
Input signal						
12006	**12005**	**1**	**uINT**	**Type:**		**253**
				Electricity	0	
				Voltage	1	
12007	**12006**	**2**	**Float**	**Signal min.**		**255**
				Electricity	0 .. 20.5 mA	
12009	**12008**	**2**	**Float**	**Signal max.**		**254**
				Electricity	0 .. 20.5 mA	
12011	**12010**	**2**	**Float**	**Signal min.**		**257**
				Voltage	0 .. 10.5 V	
12013	**12012**	**2**	**Float**	**Signal max.**		**256**
				Voltage	0 .. 10.5 V	
12015	**12014**	**1**	**—**	**—**		**—**
				always	0	
Pres. of measurem.						
12016	**12015**	**1**	**uINT**	**Receipt**		**413**
				Active	0	
				Inactive	1	
12017	**12016**	**1**	**uINT**	**Integer digits**		**56**
				Value	1 .. 6	
12018	**12017**	**1**	**uINT**	**Decimal Places**		**55**
				Value	0 .. 3	
12019	**12018**	**1**	**—**	**—**		**—**
				always	0	
Messages / Colour change						
12020	**12019**	**2**	**Float**	**Hysteresis**		**83**
				Value	0 .. |Measuring range|	
12022	**12021**	**2**	**Float**	**Deceleration**		**82**
				Value	0 .. 3,600,000 ms	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
12024	**12023**	**1**	**uINT**	**Threshold low - red:**		**77**
				Off	0	
				on	1	
12025	**12024**	**2**	**Float**	**Threshold low - red:**		**81**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
12027	**12026**	**1**	**uINT**	**Threshold low - yellow**		**75**
				Off	0	
				on	1	
12028	**12027**	**2**	**Float**	**Threshold low - yellow**		**79**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
12030	**12029**	**1**	**uINT**	**Threshold high - yellow**		**74**
				Off	0	
				on	1	
12031	**12030**	**2**	**Float**	**Threshold high - yellow**		**78**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
12033	**12032**	**1**	**uINT**	**Threshold high - red**		**76**
				Off	0	
				on	1	
12034	**12033**	**2**	**Float**	**Threshold high - red**		**80**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
12036	**12035**	**1**	**uINT**	**News**		**68**
				Off	0	
				on	1	
12037	**12036**	**25**	**char**	**Message low - red**		**69**
				Text	max. 49 characters	
12062	**12061**	**25**	**char**	**Message low - yellow**		**70**
				Text	max. 49 characters	
12087	**12086**	**25**	**char**	**Message ok - green**		**71**
				Text	max. 49 characters	
12112	**12111**	**25**	**char**	**Message high - yellow**		**72**
				Text	max. 49 characters	
12137	**12136**	**25**	**char**	**Message high - red**		**73**
				Text	max. 49 characters	
Acoustic alarm						
12162	**12161**	**1**	**uINT**	**Alert**		**376**
				Off	0	
				on	1	
12163	**12162**	**1**	**uINT**	**Alarm low**		**375**
				Off	0	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
				on	1	
12164	**12163**	**2**	**Float**	**Threshold low ON**		**380**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
12166	**12165**	**2**	**Float**	**Threshold low OFF**		**379**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
12168	**12167**	**2**	**uINT**	**Delay low**		**372**
					0 ... 3,600,000 ms	
12170	**12169**	**1**	**uINT**	**Alarm high**		**374**
				Off	0	
				on	1	
12171	**12170**	**2**	**Float**	**Threshold high ON**		**378**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
12173	**12172**	**2**	**Float**	**Threshold high OFF**		**377**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
12175	**12174**	**2**	**uINT**	**Delay high**		**371**
				Value	0 ... 3.600.00 ms	
12177	**12176**	**1**	**uINT**	**Accept**		**373**
				Off	0	
				on	1	
12178	**12177**	**2**	**uINT**	**Confirmation of process**		**370**
				Value	0 ... 7,200,000 ms	
Characteristic curve						
12180	**12179**	**1**	**uINT**	**Function**		**64**
				linear	0	
				root extracted	1	
				Flow	2	
12181	**12180**	**3**	**char**	**Unit**		**281**
				Lin. scaling	max. 5 characters	
12184	**12183**	**2**	**Float**	**Measuring range start**		**293**
				Lin. scaling	±999,999	
12186	**12185**	**2**	**Float**	**Measuring range end**		**292**
				Lin. scaling	±999,999	
12188	**12187**	**2**	**Float**	**Zero-point window**		**61**
				Value	0 .. 25 %	
12190	**12189**	**3**	**char**	**Unit**		**285**
				Non-lin. scaling	max. 5 characters	
12193	**12192**	**2**	**Float**	**Measuring range start**		**295**
				Non-lin. scaling	±999,999	
12195	**12194**	**2**	**Float**	**Measuring range end**		**294**
				Non-lin. scaling	±999,999	

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
12197	**12196**	**2**	**Float**	**k-factor (not implemented at this time)**		**65**
				Value	±10,000	
12199	**12198**	**2**	**uINT**	**Attenuation**		**60**
				Value	0 ... 30,000 ms	
12201	**12200**	**2**	**Float**	**Offset correction**		**62**
				Value	–|Measuring range| … |Measuring range|	
12203	**12202**	**1**	**uINT**	**Limits**		**63**
				Off	0	
				on	1	

4.2.8.4.3 Analogue input 3

NOTICE! Write/read-only access

MB: measuring range
MBA: start of measuring range
MBE; end of the measuring range

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
13001	**13000**	**5**	**char**	**Planned measures**		**85**
				max. 8 characters		
Input signal						
13006	**13005**	**1**	**uINT**	**Type:**		**262**
				Electricity	0	
				Voltage	1	
13007	**13006**	**2**	**Float**	**Signal min.**		**264**
				Electricity	0 .. 20.5 mA	
13009	**13008**	**2**	**Float**	**Signal max.**		**263**
				Electricity	0 .. 20.5 mA	
13011	**13010**	**2**	**Float**	**Signal min.**		**266**
				Voltage	0 .. 10.5 V	
13013	**13012**	**2**	**Float**	**Signal max.**		**265**
				Voltage	0 .. 10.5 V	
13015	**13014**	**1**	**—**	**—**		**—**
				always	0	
Pres. of measurem.						
13016	**13015**	**1**	**uINT**	**Receipt**		**414**
				Active	0	
				Inactive	1	
13017	**13016**	**1**	**uINT**	**Integer digits**		**88**
				Value	1 .. 6	
13018	**13017**	**1**	**uINT**	**Decimal Places**		**87**
				Value	0 .. 3	
13019	**13018**	**1**	**—**	**—**		**—**
				always	0	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
Messages / Colour change						
13020	**13019**	**2**	**Float**	**Hysteresis**		**115**
				Value	0 .. |Measuring range|	
13022	**13021**	**2**	**Float**	**Deceleration**		**114**
				Value	0 .. 3,600,000 ms	
13024	**13023**	**1**	**uINT**	**Threshold low - red:**		**109**
				Off	0	
				on	1	
13025	**13024**	**2**	**Float**	**Threshold low - red:**		**113**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
13027	**13026**	**1**	**uINT**	**Threshold low - yellow**		**107**
				Off	0	
				on	1	
13028	**13027**	**2**	**Float**	**Threshold low - yellow**		**111**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
13030	**13029**	**1**	**uINT**	**Threshold high - yellow**		**106**
				Off	0	
				on	1	
13031	**13030**	**2**	**Float**	**Threshold high - yellow**		**110**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
13033	**13032**	**1**	**uINT**	**Threshold high - red**		**108**
				Off	0	
				on	1	
13034	**13033**	**2**	**Float**	**Threshold high - red**		**112**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
13036	**13035**	**1**	**uINT**	**News**		**100**
				Off	0	
				on	1	
13037	**13036**	**25**	**char**	**Message low - red**		**101**
				Text	max. 49 characters	
13062	**13061**	**25**	**char**	**Message low - yellow**		**102**
				Text	max. 49 characters	
13087	**13086**	**25**	**char**	**Message ok - green**		**103**
				Text	max. 49 characters	
13112	**13111**	**25**	**char**	**Message high - yellow**		**104**
				Text	max. 49 characters	
13137	**13136**	**25**	**char**	**Message high - red**		**105**
				Text	max. 49 characters	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
Acoustic alarm						
13162	**13161**	**1**	**uINT**	**Alert**		**387**
				Off	0	
				on	1	
13163	**13162**	**1**	**uINT**	**Alarm low**		**386**
				Off	0	
				on	1	
13164	**13163**	**2**	**Float**	**Threshold low ON**		**391**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
13166	**13165**	**2**	**Float**	**Threshold low OFF**		**390**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
13168	**13167**	**2**	**uINT**	**Delay low**		**383**
					0 ... 3,600,000 ms	
13170	**13169**	**1**	**uINT**	**Alarm high**		**385**
				Off	0	
				on	1	
13171	**13170**	**2**	**Float**	**Threshold high ON**		**389**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
13173	**13172**	**2**	**Float**	**Threshold high OFF**		**388**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
13175	**13174**	**2**	**uINT**	**Delay high**		**382**
				Value	0 ... 3.600.00 ms	
13177	**13176**	**1**	**uINT**	**Accept**		**384**
				Off	0	
				on	1	
13178	**13177**	**2**	**uINT**	**Confirmation of process**		**381**
				Value	0 ... 7,200,000 ms	
Characteristic curve						
13180	**13179**	**1**	**uINT**	**Function**		**96**
				linear	0	
				root extracted	1	
				Flow	2	
13181	**13180**	**3**	**char**	**Unit**		**282**
				Lin. scaling	max. 5 characters	
13184	**13183**	**2**	**Float**	**Measuring range start**		**297**
				Lin. scaling	±999,999	
13186	**13185**	**2**	**Float**	**Measuring range end**		**296**
				Lin. scaling	±999,999	
13188	**13187**	**2**	**Float**	**Zero-point window**		**93**
				Value	0 .. 25 %	
13190	**13189**	**3**	**char**	**Unit**		**286**
				Non-lin. scaling	max. 5 characters	

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
13193	**13192**	**2**	**Float**	**Measuring range start**		**299**
				Non-lin. scaling	±999,999	
13195	**13194**	**2**	**Float**	**Measuring range end**		**298**
				Non-lin. scaling	±999,999	
13197	**13196**	**2**	**Float**	**k-factor (not implemented at this time)**		**97**
				Value	±10,000	
13199	**13198**	**2**	**uINT**	**Attenuation**		**92**
				Value	0 ... 30,000 ms	
13201	**13200**	**2**	**Float**	**Offset correction**		**94**
				Value	–|Measuring range| … |Meas-uring range|	
13203	**13202**	**1**	**uINT**	**Limits**		**95**
				Off	0	
				on	1	

4.2.8.4.4 Analogue input 4

NOTICE! Write/read-only access

MB: measuring range
MBA: start of measuring range
MBE; end of the measuring range

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
14001	**14000**	**5**	**char**	**Planned measures**		**117**
				max. 8 characters		
Input signal						
14006	**14005**	**1**	**uINT**	**Type:**		**271**
				Electricity	0	
				Voltage	1	
14007	**14006**	**2**	**Float**	**Signal min.**		**273**
				Electricity	0 .. 20.5 mA	
14009	**14008**	**2**	**Float**	**Signal max.**		**272**
				Electricity	0 .. 20.5 mA	
14011	**14010**	**2**	**Float**	**Signal min.**		**275**
				Voltage	0 .. 10.5 V	
14013	**14012**	**2**	**Float**	**Signal max.**		**274**
				Voltage	0 .. 10.5 V	
14015	**14014**	**1**	**—**	**—**		**—**
				always	0	
Pres. of measurem.						
14016	**14015**	**1**	**uINT**	**Receipt**		**415**
				Active	0	
				Inactive	1	
14017	**14016**	**1**	**uINT**	**Integer digits**		**120**
				Value	1 .. 6	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
14018	**14017**	**1**	**uINT**	**Decimal Places**		**119**
				Value	0 .. 3	
14019	**14018**	**1**	**—**	**—**		**—**
				always	0	
Messages / Colour change						
14020	**14019**	**2**	**Float**	**Hysteresis**		**147**
				Value	0 .. |Measuring range|	
14022	**14021**	**2**	**Float**	**Deceleration**		**146**
				Value	0 .. 3,600,000 ms	
14024	**14023**	**1**	**uINT**	**Threshold low - red:**		**141**
				Off	0	
				on	1	
14025	**14024**	**2**	**Float**	**Threshold low - red:**		**145**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
14027	**14026**	**1**	**uINT**	**Threshold low - yellow**		**139**
				Off	0	
				on	1	
14028	**14027**	**2**	**Float**	**Threshold low - yellow**		**143**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
14030	**14029**	**1**	**uINT**	**Threshold high - yellow**		**138**
				Off	0	
				on	1	
14031	**14030**	**2**	**Float**	**Threshold high - yellow**		**142**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
14033	**14032**	**1**	**uINT**	**Threshold high - red**		**140**
				Off	0	
				on	1	
14034	**14033**	**2**	**Float**	**Threshold high - red**		**144**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
14036	**14035**	**1**	**uINT**	**News**		**132**
				Off	0	
				on	1	
14037	**14036**	**25**	**char**	**Message low - red**		**133**
				Text	max. 49 characters	
14062	**14061**	**25**	**char**	**Message low - yellow**		**134**
				Text	max. 49 characters	
14087	**14086**	**25**	**char**	**Message ok - green**		**135**
				Text	max. 49 characters	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
14112	**14111**	**25**	**char**	**Message high - yellow**		**136**
				Text	max. 49 characters	
14137	**14136**	**25**	**char**	**Message high - red**		**137**
				Text	max. 49 characters	
Acoustic alarm						
14162	**14161**	**1**	**uINT**	**Alert**		**398**
				Off	0	
				on	1	
14163	**14162**	**1**	**uINT**	**Alarm low**		**397**
				Off	0	
				on	1	
14164	**14163**	**2**	**Float**	**Threshold low ON**		**402**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
14166	**14165**	**2**	**Float**	**Threshold low OFF**		**401**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
14168	**14167**	**2**	**uINT**	**Delay low**		**394**
					0 ... 3,600,000 ms	
14170	**14169**	**1**	**uINT**	**Alarm high**		**396**
				Off	0	
				on	1	
14171	**14170**	**2**	**Float**	**Threshold high ON**		**400**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
14173	**14172**	**2**	**Float**	**Threshold high OFF**		**399**
				Threshold	MBA – ½|MB| ... MBE + ½|MB|	
14175	**14174**	**2**	**uINT**	**Delay high**		**393**
				Value	0 ... 3.600.00 ms	
14177	**14176**	**1**	**uINT**	**Accept**		**395**
				Off	0	
				on	1	
14178	**14177**	**2**	**uINT**	**Confirmation of process**		**392**
				Value	0 ... 7,200,000 ms	
Characteristic curve						
14180	**14179**	**1**	**uINT**	**Function**		**128**
				linear	0	
				root extracted	1	
				Flow	2	
14181	**14180**	**3**	**char**	**Unit**		**283**
				Lin. scaling	max. 5 characters	
14184	**14183**	**2**	**Float**	**Measuring range start**		**301**
				Lin. scaling	±999,999	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
14186	**14185**	**2**	**Float**	**Measuring range end**		**300**
				Lin. scaling	±999,999	
14188	**14187**	**2**	**Float**	**Zero-point window**		**125**
				Value	0 .. 25 %	
14190	**14189**	**3**	**char**	**Unit**		**287**
				Non-lin. scaling	max. 5 characters	
14193	**14192**	**2**	**Float**	**Measuring range start**		**303**
				Non-lin. scaling	±999,999	
14195	**14194**	**2**	**Float**	**Measuring range end**		**302**
				Non-lin. scaling	±999,999	
14197	**14196**	**2**	**Float**	**k-factor (not implemented at this time)**		**129**
				Value	±10,000	
14199	**14198**	**2**	**uINT**	**Attenuation**		**124**
				Value	0 ... 30,000 ms	
14201	**14200**	**2**	**Float**	**Offset correction**		**126**
				Value	–|Measuring range| … |Measuring range|	
14203	**14202**	**1**	**uINT**	**Limits**		**127**
				Off	0	
				on	1	

4.2.8.5 Analogue outputs

4.2.8.5.1 Analogue output 1

NOTICE! Write/read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
15001	**15000**	**1**	**uINT**	**Assignment**		**174**
				Not assigned	0	
				Channel 1	1	
				Channel 2	2	
				Channel 3	3	
				Channel 4	4	
15002	**15001**	**1**	**uINT**	**Type**		**183**
				Electricity	0	
				Voltage	1	
15003	**15002**	**2**	**Float**	**Output min.**		**182**
				Electricity	0 ... 21.5 mA	
15005	**15004**	**2**	**Float**	**Output max.**		**181**
				Electricity	0 ... 21.5 mA	
15007	**15006**	**2**	**Float**	**Output min.**		**186**
				Voltage	0 ... 10.5 V	
15009	**15008**	**2**	**Float**	**Output max.**		**185**
				Voltage	0 ... 10.5 V	
15011	**15010**	**2**	**Float**	**Limit min.**		**176**
				Electricity	0 ... 21.5 mA	
15013	**15012**	**2**	**Float**	**Limit max.**		**175**
				Electricity	0 ... 21.5 mA	
15015	**15014**	**2**	**Float**	**Limit min.**		**188**
				Voltage	0 ... 10.5 V	
15017	**15016**	**2**	**Float**	**Limit max.**		**187**
				Voltage	0 ... 10.5 V	
15019	**15018**	**2**	**Float**	**Error signal**		**173**
				Electricity	0 ... 21.5 mA	
15021	**15020**	**2**	**Float**	**Error signal**		**189**
				Voltage	0 ... 10.5 V	
15023	**15022**	**3**	**—**	**—**		**—**
				always	0	

4.2.8.5.2 Analogue output 2

NOTICE! Write/read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
15026	**15025**	**1**	**uINT**	**Assignment**		**192**
				Not assigned	0	
				Channel 1	1	
				Channel 2	2	
				Channel 3	3	
				Channel 4	4	

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
15027	**15026**	**1**	**uINT**	**Type**		**201**
				Electricity	0	
				Voltage	1	
15028	**15027**	**2**	**Float**	**Output min.**		**200**
				Electricity	0 .. 21.5 mA	
15030	**15029**	**2**	**Float**	**Output max.**		**199**
				Electricity	0 .. 21.5 mA	
15032	**15031**	**2**	**Float**	**Output min.**		**204**
				Voltage	0 .. 10.5 V	
15034	**15033**	**2**	**Float**	**Output max.**		**203**
				Voltage	0 .. 10.5 V	
15036	**15035**	**2**	**Float**	**Limit min.**		**194**
				Electricity	0 .. 21.5 mA	
15038	**15037**	**2**	**Float**	**Limit max.**		**193**
				Electricity	0 .. 21.5 mA	
15040	**15039**	**2**	**Float**	**Limit min.**		**206**
				Voltage	0 .. 10.5 V	
15042	**15041**	**2**	**Float**	**Limit max.**		**205**
				Voltage	0 .. 10.5 V	
15044	**15043**	**2**	**Float**	**Error signal**		**191**
				Electricity	0 .. 21.5 mA	
15046	**15045**	**2**	**Float**	**Error signal**		**207**
				Voltage	0 .. 10.5 V	
15048	**15047**	**3**	**—**	**—**		**—**
				always	0	

4.2.8.5.3 Analogue output 3

NOTICE! Write/read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
15051	**15050**	**1**	**uINT**	**Assignment**		**210**
				Not assigned	0	
				Channel 1	1	
				Channel 2	2	
				Channel 3	3	
				Channel 4	4	
15052	**15051**	**1**	**uINT**	**Type**		**219**
				Electricity	0	
				Voltage	1	
15053	**15052**	**2**	**Float**	**Output min.**		**218**
				Electricity	0 .. 21.5 mA	
15055	**15054**	**2**	**Float**	**Output max.**		**217**
				Electricity	0 .. 21.5 mA	
15057	**15056**	**2**	**Float**	**Output min.**		**222**
				Voltage	0 .. 10.5 V	

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
15059	**15058**	**2**	**Float**	**Output max.**		**221**
				Voltage	0 .. 10.5 V	
15061	**15060**	**2**	**Float**	**Limit min.**		**212**
				Electricity	0 .. 21.5 mA	
15063	**15062**	**2**	**Float**	**Limit max.**		**211**
				Electricity	0 .. 21.5 mA	
15065	**15064**	**2**	**Float**	**Limit min.**		**224**
				Voltage	0 .. 10.5 V	
15067	**15066**	**2**	**Float**	**Limit max.**		**223**
				Voltage	0 .. 10.5 V	
15069	**15068**	**2**	**Float**	**Error signal**		**209**
				Electricity	0 .. 21.5 mA	
15071	**15070**	**2**	**Float**	**Error signal**		**225**
				Voltage	0 .. 10.5 V	
15073	**15072**	**3**	**—**	**—**		**—**
				always	0	

4.2.8.5.4 Analogue output 4

NOTICE! Write/read-only access

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
15076	**15075**	**1**	**uINT**	**Assignment**		**228**
				Not assigned	0	
				Channel 1	1	
				Channel 2	2	
				Channel 3	3	
				Channel 4	4	
15077	**15076**	**1**	**uINT**	**Type**		**237**
				Electricity	0	
				Voltage	1	
15078	**15077**	**2**	**Float**	**Output min.**		**236**
				Electricity	0 .. 21.5 mA	
15080	**15079**	**2**	**Float**	**Output max.**		**235**
				Electricity	0 .. 21.5 mA	
15082	**15081**	**2**	**Float**	**Output min.**		**240**
				Voltage	0 .. 10.5 V	
15084	**15083**	**2**	**Float**	**Output max.**		**239**
				Voltage	0 .. 10.5 V	
15086	**15085**	**2**	**Float**	**Limit min.**		**230**
				Electricity	0 .. 21.5 mA	
15088	**15087**	**2**	**Float**	**Limit max.**		**229**
				Electricity	0 .. 21.5 mA	
15090	**15089**	**2**	**Float**	**Limit min.**		**242**
				Voltage	0 .. 10.5 V	
15092	**15091**	**2**	**Float**	**Limit max.**		**241**
				Voltage	0 .. 10.5 V	

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
15094	**15093**	**2**	**Float**	**Error signal**		**227**
				Electricity	0 .. 21.5 mA	
15096	**15096**	**2**	**Float**	**Error signal**		**234**
				Voltage	0 .. 10.5 V	
15098	**15097**	**3**	**—**	**—**		**—**
				always	0	

4.2.8.6 Switching outputs

4.2.8.6.1 Switching output 1

NOTICE! Write/read-only access

MB: measuring range
MBA: start of measuring range
MBE; end of the measuring range

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
16001	**16000**	**1**	**uINT**	**Assignment**		**148**
				Not assigned	0	
				Channel 1	1	
				Channel 2	2	
				Channel 3	3	
				Channel 4	4	
16002	**16001**	**1**	**uINT**	**Contact type**		**150**
				Make contact	0	
				Break contact	1	
16003	**16002**	**1**	**uINT**	**Function**		**149**
				Hysteresis	0	
				Window	1	
16004	**16003**	**2**	**Float**	**Switch-on point and/or Window max.**		**152**
				Value	MBA – ½|MB| … MBE + ½|MB|	
16006	**16005**	**2**	**Float**	**Switch-off point and/or Window min.**		**153**
				Value	MBA – ½|MB| … MBE + ½|MB|	
16008	**16007**	**2**	**uINT**	**Switching delay**		**151**
				Value	0 ... 10,800,000 ms	

4.2.8.6.2 Switching output 2

NOTICE! Write/read-only access

MB: measuring range
MBA: start of measuring range
MBE; end of the measuring range

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
16010	**16009**	**1**	**uINT**	**Assignment**		**154**
				Not assigned	0	
				Channel 1	1	
				Channel 2	2	
				Channel 3	3	
				Channel 4	4	
16011	**16010**	**1**	**uINT**	**Contact type**		**156**
				Make contact	0	
				Break contact	1	

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
16012	**16011**	**1**	**uINT**	**Function**		**155**
				Hysteresis	0	
				Window	1	
16013	**16012**	**2**	**Float**	**Switch-on point and/or Window max.**		**158**
				Value	MBA – ½|MB| … MBE + ½|MB|	
16015	**16014**	**2**	**Float**	**Switch-off point and/or Window min.**		**159**
				Value	MBA – ½|MB| … MBE + ½|MB|	
16017	**16016**	**2**	**uINT**	**Switching delay**		**157**
				Value	0 ... 10,800,000 ms	

4.2.8.6.3 Switching output 3

NOTICE! Write/read-only access

MB: measuring range
MBA: start of measuring range
MBE; end of the measuring range

Reg. No.	Adr.	No. of Reg.	Format	Description		Parameter
16019	**16018**	**1**	**uINT**	**Assignment**		**160**
				Not assigned	0	
				Channel 1	1	
				Channel 2	2	
				Channel 3	3	
				Channel 4	4	
16020	**16019**	**1**	**uINT**	**Contact type**		**162**
				Make contact	0	
				Break contact	1	
16021	**16020**	**1**	**uINT**	**Function**		**161**
				Hysteresis	0	
				Window	1	
16022	**16021**	**2**	**Float**	**Switch-on point and/or Window max.**		**164**
				Value	MBA – ½|MB| … MBE + ½|MB|	
16024	**16023**	**2**	**Float**	**Switch-off point and/or Window min.**		**165**
				Value	MBA – ½|MB| … MBE + ½|MB|	
16026	**16025**	**2**	**uINT**	**Switching delay**		**163**
				Value	0 ... 10,800,000 ms	

4.2.8.6.4 Switching output 4

NOTICE! Write/read-only access

MB: measuring range
MBA: start of measuring range
MBE; end of the measuring range

Reg. No.	Adr.	No. of Reg.	Format	Description		Para-meter
16028	**16027**	**1**	**uINT**	**Assignment**		**166**
				Not assigned	0	
				Channel 1	1	
				Channel 2	2	
				Channel 3	3	
				Channel 4	4	
16029	**16028**	**1**	**uINT**	**Contact type**		**168**
				Make contact	0	
				Break contact	1	
16030	**16029**	**1**	**uINT**	**Function**		**167**
				Hysteresis	0	
				Window	1	
16031	**16030**	**2**	**Float**	**Switch-on point and/or Window max.**		**170**
				Value	MBA – ½|MB| … MBE + ½|MB|	
16033	**16032**	**2**	**Float**	**Switch-off point and/or Window min.**		**171**
				Value	MBA – ½|MB| … MBE + ½|MB|	
16035	**16034**	**2**	**uINT**	**Switching delay**		**169**
				Value	0 ... 10,800,000 ms	

5 Glossary

ADU

The Application Data Unit (ADU) is the complete command / data block of the communication protocol.

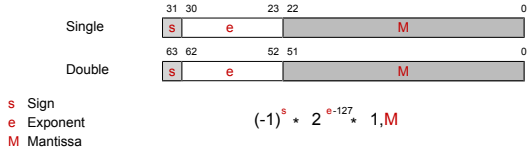
char

Abbreviation for character Char as a data type defines that the individual characters of a memory area each comprise (usually) 8 bits that represent a displayable character (letter, digit, special character...). The content of the memory point states which sign this is.

EIA-485

EIA-485, also called RS-485, is an industrial standard for an interface with asynchronous serial data transmission.

IEEE-475



The IEEE754 standard stipulates several data formats. The most important are the single and the double format. These formats comprise a sign bit s, the exponent e and the mantissa m.

Master/Slave

Master/Slave is a type of hierarchical administration of access to a common resource usually in the shape of a common data channel. A participant is the Master, all others are the Slaves. The Master is the only one authorised to access the joint resource without request. The Save cannot access the common resource on its own; it must wait until it is requested by the Master.

Message

Process of the transmission of data between a sender and one or more recipients.

PDU

The Protocol Data Unit (PDU) is the data block of a message.

Request

The request by a Master to a Slave to carry out the Function Code the transmission contains.

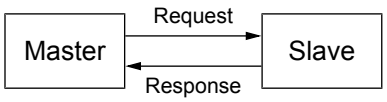
Response

Response by the Slave to the Master to a Request.

RTU

Remote Terminal Unit

Transaction



A transaction comprises a request from the Master and a response from the Slave.

6 Attachments

6.1 Literature

„IEEE Standard for Floating-Point Arithmetic.“ 29. 08 2008. <http://ieeexplore.ieee.org/document/4610935/>.

„Modbus Application Protocol v1.1b3.“ 26. 04 2012. <http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf>.

6.2 Changes

2017-01-13 First issued