

Modbus parameter specifications for “emb Standard Series”



FläktWoods

"ebm standard series" Modbus parameters

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1. Protocol framework

Data are transferred using the Modbus protocol defined in these specifications exclusively in an environment defined as a master/slave system. The orderly progression of data is defined by the master. A slave is required to respond to its command prompt. For this reason, it is important to ensure that no slave address is assigned more than once when constructing a system.

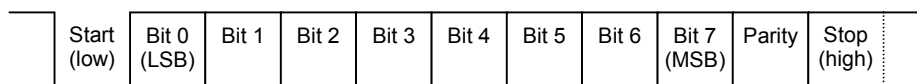
A twisted pair wire with RS485 standard should preferably be used.

Only RTU transmission mode is supported (see MODBUS over Serial Line Specification & Implementation guide V1.0, chapter 2.5.1)

ASCII transmission mode is not supported!

1.1 Structure of a byte

According to the MODBUS over Serial Line Specification & Implementation guide V1.0. a byte has the following structure:



The parity bit has the parity "Even".

This means that the number of all data bits, including the parity bit with the value 1 ("high") is even (i.e. 0, 2, 4, 6, 8).

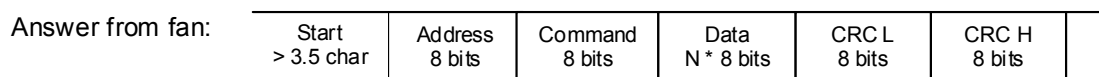
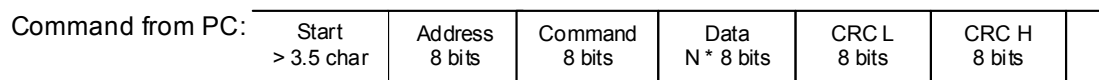
"Odd parity" and "No parity" are not supported!

The transmission rate is 19,200 baud.

This value is equivalent to the basic setting corresponding to the MODBUS over Serial Line Specification & Implementation guide V1.0. Other transmission rates are not supported!

1.2. Communications process

The MODBUS over Serial Line Specification & Implementation guide V1.0 defines the following framework for the transmission protocol:



In contrast to the general specifications, the maximum telegram length is 17 bytes!

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1.2.1 Command from PC

Initial synchronisation:

A transmission pause of at least 3.5 bytes is used for initial synchronisation.
The following byte is then interpreted as the first byte of a frame (i.e. address).
The pause between the individual bytes of a frame may be a maximum of 1.5 bytes.

Address:

The address field has a size of 8 bits.
The address values 1..247 are permissible
The address 0 is reserved for broadcast commands (i.e. commands to all fans in the network).

Command:

The following commands from the "MODBUS Application Protocol Specification V1.1" general specifications are supported:

| Code | Command |
|------|-------------------------|
| 0x03 | Read holding register |
| 0x04 | Read input register |
| 0x06 | Write single register |
| 0x08 | Diagnostics |
| 0x10 | Write multiple register |

Other commands are not supported.

The following additional commands are defined for the purpose of diagnostics:

| Code | Command |
|------|--------------------|
| 0x40 | Read RAM register |
| 0x41 | Write RAM register |

Data:

Depending on the command concerned, the number of data bytes and their meaning may differ.
Please refer to 1.3 Data bytes:

CRC L / CRC H

A CRC checksum is defined for the complete telegram.
The polynomial for defining the checksum is $1 + x^2 + x^{15} + x^{16}$ (i.e. XOR link to 0xA001).
The initial value is 0xFFFF.

The low byte of checksum is transmitted first, then the high byte.

More detailed information about calculating the checksum can be found in the "MODBUS over Serial Line Specification & Implementation guide V1.0".

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1.2.2 Answer from fan

A fan will only answer if

- it receives a message through its own address.
No answer will be sent to a broadcast address.
- the telegram length is at most 17 bytes.
- the correct number of data bytes have been sent so that the telegram can be interpreted.
- the checksum has been correctly recognised.

Initial synchronisation:

After the command from the PC has been completed, the fan will wait for *at least* one transmission pause of 3.5 bytes.

Depending on the command and on the processing time, the pause may be much longer (until the fan has received all the data it has requested)

Address:

The address is repeated by the command from the PC (i.e. its own fan address)

Command:

If the command can be processed, the command code will be repeated.

If the command cannot be processed, the fan will answer with an exception.

Here, the MSB is set to command.

The command byte is then, for example, 0x83 for the command "Read holding register (0x03)".

Data:

Depending on the command concerned, the number of data bytes and their meaning may differ.

Please refer to 1.3 Data bytes.

CRC L / CRC H

A CRC checksum is defined via the complete telegram.

The way the checksum is defined is no different from the procedure described above for the command from PC.

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1.3 Data bytes

1.3.1 Read holding register

Command code: 0x03

This command is used to read off the content of a number of holding registers. Holding registers are parameters that can be both read- and write-accessed

Command from PC:

4 data bytes are transmitted:

- 1st holding register MSB address
- 1st holding register LSB address
- Number of MSB addresses to be read
- Number of LSB addresses to be read

The description of the holding registers can be found at a later point.

Answer from fan:

The following data bytes are transmitted:

- Byte count (number of addresses to be read * 2)
- Data in 1st holding register MSB
- Data in 1st holding register LSB

Optional:

- Data from the following holding registers (0..n)

Exception codes:

In case of error, only one data byte (the exception code) will be transmitted

Exception codes:

- 0x02: Permissible range of the holding registers 0xD000 ... 0xD37F exceeded
0x03: Maximum telegram length for answer (17 bytes) exceeded
i.e. either more than 6 holding registers or 0 holding registers were requested.
0x04: A holding register cannot be read due to a defect in the electronics

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1.3.2 Read input register

Command code: 0x04

This command is used to read off the content of a number of input registers. Input registers are parameters that only have read access

Command from PC:

4 data bytes are transmitted:

- 1st input register MSB address
- 1st input register LSB address
- Number of MSB addresses to be read
- Number of LSB addresses to be read

The description of the input registers can be found at a later point.

Answer from fan:

The following data bytes are transmitted:

- Byte count (number of addresses to be read * 2)
- Data in 1st holding register MSB
- Data in 1st holding register LSB

Optional:

- Data from the following input registers (0..n)

Exception codes:

In case of error, only one data byte (the exception code) will be transmitted

Exception codes:

0x02: Permissible range of the input registers 0xD000 ... 0xD01F exceeded

0x03: Maximum telegram length for answer (17 bytes) exceeded
i.e. either more than 6 input registers or 0 input registers were requested.

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1.3.3 Write single register

Command code: 0x06

This command is used to write the content of *one* holding register.

Command from PC:

4 data bytes are transmitted:

- Holding register MSB address
- Holding register LSB address
- MSB data to be written
- LSB data to be written

The description of the holding registers can be found at a later point.

Answer from fan:

4 data bytes are transmitted:

- Holding register MSB address
- Holding register LSB address
- MSB data to be written
- LSB data to be written

Exception codes:

In case of error, only one data byte (the exception code) will be transmitted

Exception codes:

- 0x02: Permissible range of the holding registers 0xD000 ... 0xD37F exceeded
- 0x04: - The holding register cannot be written due to a defect in the electronics
- There is no write protection in this authorisation level (password).

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1.3.4 Diagnostics

Command code: 0x08

This command is used to check the Modbus function

Command from PC:

The following data bytes are transmitted:

- MSB subfunction code
- LSB subfunction code
- 1 - 11 data bytes

Only subfunction code 0000 is supported!

Answer from fan:

The following data bytes are transmitted:

- MSB subfunction code
- LSB subfunction code
- 1 - 11 data bytes

Exception codes:

In case of error, only one data byte (the exception code) will be transmitted

Exception codes:

0x01: Subfunction code not supported (≠ 0000)

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1.3.5 Write multiple register

Command code: 0x10

This command is used to write the content of *several* holding registers.

Command from PC:

The following data bytes are transmitted:

- Holding register MSB address
- Holding register LSB address
- Number of MSB addresses to be written
- Number of LSB addresses to be written
- Byte count (number of addresses to be written * 2)
- Data to be written in 1st MSB holding register
- Data to be written in 1st LSB holding register

Optional:

- Data to be written to the following holding registers (0..n)

The description of the holding registers can be found at a later point.

Answer from fan:

4 data bytes are transmitted:

- Holding register MSB address
- Holding register LSB address
- Number of MSB addresses to be written
- Number of LSB addresses to be written

Exception codes:

In case of error, only one data byte (the exception code) will be transmitted

Exception codes:

- 0x02: Permissible range of the holding registers 0xD000 ... 0xD37F exceeded
- 0x03: - Maximum telegram length for answer (17 bytes) exceeded
i.e. either more than 4 holding register data or 0 input register data were defined.
- Byte count $\neq 2 * \text{number of registers}$
- Number of data bytes $\neq \text{byte count}$
- 0x04: - The holding register cannot be written due to a defect in the electronics
- There is no write protection in this authorisation level (password).

1.3.8 Other commands

All other commands are not supported.

A command is always answered with exception code 0x01.

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2 Holding registers

2.1 Overview

The holding registers are stored in the RAM and in the EEPROM of the fan.
Depending on the range concerned, access times (and thus also answer times) may differ

The following ranges are defined:

| Address | Range | Typical read access time | Typical write access time |
|---------------|-----------------|--------------------------|---------------------------|
| D000 ... D0FF | RAM | 1µs / byte | 1µs / byte |
| D100 ... D17F | EEPROM internal | 2µs / byte | 4ms / byte |
| D180 ... D37F | EEPROM external | 500µs / byte | 6.5ms / byte |

The following list gives an overview of all parameters.

Apart from the Modbus address and the designation, it shows which authorisation level is required to write a parameter, and the address of the memory space for default setting and customer setting (if applicable).

The function of the parameters is described in the following chapters

| Modbus Address | Designation | Write ebm-papst | Write Customer | Write End customer | Default Address | Cust. setting Address |
|----------------------|------------------------------------|-----------------|-----------------|--------------------|-----------------|-----------------------|
| D000 | Reset | X | X | X | - | - |
| D001 | Default set value | X | X | X | - | - |
| D002 D003 D004 | Password | X | X | X | - | - |
| D005 | Control default setting | X | X ^{*)} | - | - | - |
| D006 | Control customer setting | X | X | X ^{*)} | - | - |
| D007 | Reserved | X | - | - | - | - |
| D008 | Reserved | X | - | - | - | - |
| D009 | Operating hours counter | X | - | - | - | - |
| D00A | Operating minutes counter | X | - | - | - | - |
| D00B | Reserved | - | - | - | - | - |
| D00C - D0FF | Vacant | - | - | - | - | - |
| D100 | Fan address | X | X | X | D280 | D200 |
| D101 | Source set value | X | X | X | D281 | D201 |
| D102 | Running direction | X | - | - | D282 | - |
| D103 | Store set value | X | X | X | D283 | D203 |
| D104 | Day/night switch internal/external | X | X | X | D284 | D204 |
| D105 | Day/night internal | X | X | X | D285 | D205 |
| D106 | Control mode (day) | X | X | X | D286 | D206 |
| D107 | Control mode (night) | X | X | X | D287 | D207 |
| D108 | Control function (day) | X | X | X | D288 | D208 |
| D109 | Control function (night) | X | X | X | D289 | D209 |
| D10A | P factor (day) | X | X | X | D28A | D20A |
| D10B | P factor (night) | X | X | X | D28B | D20B |
| D10C | I factor (day) | X | X | X | D28C | D20C |
| D10D | I factor (night) | X | X | X | D28D | D20D |

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| Modbus Address | Designation | Write ebm-papst | Write Customer | Write End customer | Default Address | Cust. setting Address |
|----------------|---|--------------------|-------------------|--------------------------|--------------------|--------------------------|
| D10E | Max. modulation level (day) | X | X | - | D28E | D20E |
| D10F | Max. modulation level (night) | X | X | - | D28F | D20F |
| D110 | Min. modulation level (day) | X | X | X | D290 | D210 |
| D111 | Min. modulation level (night) | X | X | X | D291 | D211 |
| D112 | Motor stop enable (day) | X | X | X | D292 | D212 |
| D113 | Motor stop enable (night) | X | X | X | D293 | D213 |
| D114 | Set value (day) | X | X | X | D294 | D214 |
| D115 | Set value (night) | X | X | X | D295 | D215 |
| D116 | Starting modulation level | X | - | - | D296 | - |
| D117 | Max. permissible modulation level | X | - | - | D297 | - |
| D118 | Min. permissible modulation level | X | - | - | D298 | - |
| D119 | Max. speed | X | X | - | D299 | D219 |
| D11A | Max. permissible speed | X | - | - | D29A | - |
| D11B | Reserved | X | - | - | D29B | - |
| D11C | Number of poles | X | - | - | D29C | - |
| D11D | Vacant | X | X | X | D29D | D21D |
| D11E | Min. DC-link voltage | X | - | - | D29E | - |
| D11F | Ramp-up curve | X | X | X | D29F | D21F |
| D120 | Ramp-down curve | X | X | X | D2A0 | D220 |
| D121 | Reserved | X | - | - | D2A1 | - |
| D122 | Reserved | X | - | - | D2A2 | - |
| D123 | Reserved | X | - | - | D2A3 | - |
| D124 | Reserved | X | - | - | D2A4 | - |
| D125 | Reserved | X | - | - | D2A5 | - |
| D126 | Reserved | X | - | - | D2A6 | - |
| D127 | Reserved | X | - | - | D2A7 | - |
| D128 | Limit speed | X | - | - | D2A8 | - |
| D129 | Vacant | X | X | X | D2A9 | D229 |
| D12A | Potentiometer characteristic, day - point 1 X-coordinate | X | X | X | D2AA | D22A |
| D12B | Potentiometer characteristic, day - point 1 Y-coordinate | X | X | X | D2AB | D22B |
| D12C | Potentiometer characteristic, day - point 2 X-coordinate | X | X | X | D2AC | D22C |
| D12D | Potentiometer characteristic, day - point 2 Y-coordinate | X | X | X | D2AD | D22D |
| D12E | Control function switch external/internal | X | X | X | D2AE | D22E |
| D12F | Control limitation | X | - | - | D2AF | - |
| D130 | 0..10V output function | X | X | - | D2B0 | D230 |
| D131 | Reserved | X | - | - | D2B1 | - |
| D132 | Reserved | X | - | - | D2B2 | - |
| D133 | Reserved | X | - | - | D2B3 | - |
| D134 | Reserved | X | - | - | D2B4 | - |
| D135 | Max. power | X | - | - | D2B5 | - |
| D136 | Reserved | X | - | - | D2B6 | - |
| D137 | Reserved | X | - | - | D2B7 | - |
| D138 | Reserved | X | - | - | D2B8 | - |
| D139 | Reserved | X | - | - | D2B9 | - |
| D13A | Reserved | X | - | - | D2BA | - |
| D13B | Max. coil current | X | - | - | D2BB | - |
| D13C | Potentiometer characteristic, night - | X | X | X | D2BC | D23C |

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| Modbus Address | Designation | Write ebm-papst | Write Customer | Write End customer | Default Address | Cust. setting Address |
|----------------|---|--------------------|-------------------|--------------------------|--------------------|--------------------------|
| | point 1 X-coordinate | | | | | |
| D13D | Potentiometer characteristic, night - point 1 Y-coordinate | X | X | X | D2BD | D23D |
| D13E | Potentiometer characteristic, night - point 2 X-coordinate | X | X | X | D2BE | D23E |
| D13F | Potentiometer characteristic, night - point 2 Y-coordinate | X | X | X | D2BF | D23F |
| D140 | 0..10V output characteristic- point 1 X | X | X | X | D2C0 | D240 |
| D141 | 0..10V output characteristic - point 1 Y | X | X | X | D2C1 | D241 |
| D142 | 0..10V output characteristic - point 2 X | X | X | X | D2C2 | D242 |
| D143 | 0..10V output characteristic - point 2 Y | X | X | X | D2C3 | D243 |
| D144 | Reserved | X | X | - | D2C4 | D244 |
| D145 | Limit speed for running monitor | X | - | - | D2C5 | D245 |
| D146 - D15B | Vacant | X | X | X | D2C6 - D2DB | D246 - D25B |
| D15C | Bypass function on/off | X | X | - | D2DC | D25C |
| D15D | Bypass function set value | X | X | - | D2DD | D25D |
| D15E | Bypass function time lag | X | X | - | D2DE | D25E |
| D15F | Vacant | X | X | X | D2DF | D25F |
| D160 | Min. sensor value | X | X | X | D2E0 | D260 |
| D161 | | | | | D2E1 | D261 |
| D162 | Max. sensor value | X | X | X | D2E2 | D262 |
| D163 | | | | | D2E3 | D263 |
| D164 - D169 | Sensor unit | X | X | X | D2E4 - D2E9 | D264 - D269 |
| D170 - D17F | Customer data | X | X | - | D2F0 - D2FF | D270 - D27F |
| | | | | | | |
| D180 | Operating hours counter (backup) | X | - | - | - | - |
| D181 | Reserved | X | - | - | - | - |
| D182 | Error indicator | X | - | - | - | - |
| D183 | Vacant | X | - | - | - | - |
| D184 | 1st error | X | - | - | - | - |
| D185 | 1st error timing | X | - | - | - | - |
| D186 | Error history | X | - | - | - | - |
| D19F | Error history timing | | | | | |
| D1A0 | Reference value of DC-link voltage | X | - | - | - | - |
| D1A1 | Reference value of DC-link current | X | - | - | - | - |
| D1A2 | Fan serial number | X | - | - | - | - |
| D1A3 | | | | | | |
| D1A4 | Fan production date | X | - | - | - | - |
| D1A5 - D1AA | Fan type | X | - | - | - | - |
| D1AB - D1AC | Reserved | X | - | - | - | - |
| D1AD - D1AE | Reserved | X | - | - | - | - |
| D1AF | Reserved | X | - | - | - | - |
| D1B0 | Reserved | X | - | - | - | - |
| D1B1 | Reserved | X | - | - | - | - |
| D1B2 | Reserved | X | - | - | - | - |
| D1B3 | Reserved | X | - | - | - | - |

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| Modbus Address | Designation | Write ebm-papst | Write Customer | Write End customer | Default Address | Cust. setting Address |
|----------------|-------------|--------------------|-------------------|--------------------------|--------------------|--------------------------|
| D1B4 - D1B5 | Reserved | X | - | - | - | - |
| D1B6 - D1BF | Reserved | X | - | - | - | - |
| D1C0 - D1C1 | Reserved | X | - | - | - | - |
| D1C2 - D1C9 | Reserved | X | - | - | - | - |
| D1CA - D1D1 | Reserved | X | - | - | - | - |
| D1D2 - D1D9 | Reserved | X | - | - | - | - |
| D1DA - D1E1 | Reserved | X | - | - | - | - |
| D1E2 - D1FF | vacant | X | - | - | - | - |
| D300 - D317 | Reserved | X | - | - | - | - |
| D318 - D32F | Reserved | X | - | - | - | - |
| D330 - D347 | Reserved | X | - | - | - | - |
| D348 - D35F | Reserved | X | - | - | - | - |
| D360 - D37E | Vacant | X | - | - | - | - |
| D37F | Reserved | X | - | - | - | - |

*) only in part

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2.2 Reset

Address : D000
Write authorisation : ebm-papst, customer, end customer

Encoding:

| | | | | | | | | |
|-----|---|---|---|---|-------|-------|-----------|---------|
| MSB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LSB | 0 | 0 | 0 | 0 | Reset | Error | Parameter | AWS Rst |

A bit will trigger the following action in the fan when it is set:

Reset : Software reset (includes "Reset error" and "Adopt parameters")
The software is launched at the start of booting
Error : Errors are reset
Parameter : All parameters are copied from the EEPROM into the RAM
This bit must be set to validate revised parameters
AWS reset : User software reset
(includes "Reset error" and "Adopt parameters")
The software is launched at the start of user software

After the action has been executed, the bit will automatically be reset by the fan.

When reset (bit 3), the program will be relaunched at the start of booting. Commands from PC will then be neither answered nor executed for a few seconds.

Reset (bit 3) is only recommended if a new user software is to be loaded by booting (because communication is interrupted).

If the software should only be relaunched, user software reset (bit 0) is recommended. Communication is then not interrupted.

2.3 Specified set value

Address : D001
Write authorisation : ebm-papst, customer, end customer

The parameter "Specified set value" is used in Modbus to specify a set value for each control mode. The condition for this is that the "Source set value" RS485 (1) is specified (cf. 2.13 Source set value). Otherwise, the parameter will have no function.

If the "Store" function is activated in the parameter "Store set value", the value in the set value parameter (EEPROM) will be stored every time the specified set value is write-accessed (see 2.24 Set value (EEPROM))

The external "Day/night" input and the "Day/night internal" parameter are used to select whether the value is to be stored in "Set value day" or "Set value night" (see 2.17 Day/night internal).

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Following a reset, the motor will again run with this value, providing the parameter record "Day" or "Night" has not been changed. (see 2.15 Store set value)

Important!

If the "Store set value" function is activated and the parameter record is changed (from day to night or vice versa), the specified set value will automatically be changed to the corresponding parameter "Set value day" or "Set value night"!

Encoding:

Note: The 4 LSBits are of no relevance for the set value and will always be assumed to be 0.

a) in closed loop speed control

The specified set value denotes a speed:

$$\text{Specified set value [1/min]} = \frac{\text{Data bytes}}{64000} \cdot n_{\text{Max}} [1/min]$$

nMax [rpm] ... maximum speed in revs per minute (see 2.28 Maximum speed)

The value zero means motor standstill

b) in open loop PWM control

The specified set value denotes a modulation level:

$$\text{Specified set value [\%]} = \frac{\text{Data bytes}}{65536} \cdot 100\%$$

The value zero means motor standstill

c) in closed loop sensor control

The specified set value denotes a sensor variable:

A sensor that converts the control variable into a voltage of 0..10V or a current of 4..20mA must be connected to the fan.

A set value can be entered for the output voltage or the output current of the sensor used.

The specified set value for the control variable is then made up of the set value parameter and the Rg(U/I) characteristic of the sensor used.

Rg (U) = Control variable, voltage-dependent

$$\text{Specified set value [V]} = \frac{\text{Data bytes}}{65536} \cdot 10V$$

"ebm standard series" Modbus parameters

$$\begin{aligned}\text{Specified set value [unit (Rg)]} &= Rg (\text{set value [V]}) \\ &= Rg \left(\frac{\text{data bytes}}{65536} \cdot 10V \right)\end{aligned}$$

or

Rg (U) = Control variable, current-dependent

$$\text{Specified set value [mA]} = \frac{\text{Data bytes}}{65536} \cdot 16\text{mA} + 4\text{mA}$$

$$\begin{aligned}\text{Specified set value [unit (Rg)]} &= Rg (\text{set value [V]}) \\ &= Rg \left(\frac{\text{data bytes}}{65536} \cdot 16\text{mA} + 4\text{mA} \right)\end{aligned}$$

2.4 Password

Address : D002 - D004
Write authorisation : ebm-papst, customer, end customer

Encoding:

$$\text{Password} = \text{Data bytes}$$

In order to prevent unauthorised writing of certain parameters, these are only written if the correct password for the necessary authorisation is entered at this point.

If a user forgets to reset the password, this will automatically be reset to 0x000000000000 after one hour.

When the "Password" parameter is read, the value 0 is always output to prevent a user with a lower authorisation level gaining access to a password to a higher level.

"ebm standard series" Modbus parameters

2.5 Control default setting

Address : D005
Write authorisation : ebm-papst, customer (in part)

Encoding:

| | | | | | | | | |
|-----|---|---|---|---|---|-------|--------|--------|
| MSB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LSB | 0 | 0 | 0 | 0 | 0 | Error | D -> W | W -> D |

Setting the bit D -> W causes all parameters in the data range (D100..D17F) to be copied to the default setting (range D280..D2FF).

The authorisation level "ebm-papst" is needed to set this bit!

Setting the bit W -> D causes all parameters in the default setting (D280..D2FF) to be copied to the data range (range D100..D17F).

The authorisation level "customer" is sufficient to set this bit.

Once the copying process is complete, the bit is automatically reset by the fan.

If an error is detected during the copying process, the "Error" bit will be set and the copy process cancelled

2.6 Control customer setting

Address : D006
Write authorisation : ebm-papst, customer, end customer (in part)

Encoding:

| | | | | | | | | |
|-----|---|---|---|---|---|-------|--------|--------|
| MSB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LSB | 0 | 0 | 0 | 0 | 0 | Error | D -> K | K -> D |

Setting the bit D -> K causes all parameters in the data range (D100..D17F) for which the customer has write authorisation to be copied to the customer setting (range D200..D27F). The minimum authorisation level needed to set this bit is "customer"!

Setting the bit K -> D causes all parameters in the customer setting (range D200..D27F) for which the customer has write authorisation to be copied to the data range (D100..D17F).

The authorisation level "end customer" is sufficient to set this bit.

Once the copying process is complete, the bit is automatically reset by the fan.

If an error is detected during the copying process, the "Error" bit will be set and the copy process cancelled

"ebm standard series" Modbus parameters

2.9 Operating hours counter

Address : D009
Write authorisation : ebm-papst

Encoding:

Operating hours [h] = Data bytes

After every hour the fan runs, the operating hours counter increases by 1.
The holding register D180 "operating hours counter backup" is updated whenever a change is made.

With 16 bits, a maximum of 65,535 hours (approx. 7.5 years) can be counted.
If the operating hours counter overshoots this figure, it will no longer be written, i.e. it will stay on 65,535.

2.10 Operating minutes counter

Address : D00A
Write authorisation : ebm-papst

Encoding:

Operating minutes [h] = Data bytes

After every full minute the fan runs, the operating minutes counter increases by 1.

"ebm standard series" Modbus parameters

2.12 Fan address

Address : D100
Write authorisation : ebm-papst, customer, end customer

Encoding:

Fan address = Data byte (LSB)

The MSB is of no relevance!

Permissible range of values: 1...247

2.13 Source set value

Address : D101
Write authorisation : ebm-papst, customer, end customer

Encoding:

This parameter specifies the source from which the set value is taken:

| Value | Source set value |
|-------|--|
| 0 | Analogue input 0..10V |
| 1 | RS485 (specified set value parameter D001) |

The MSB is of no relevance!

Permissible range of values: 0...1

2.14 Running direction

Address : D102
Write authorisation : ebm-papst

Encoding:

This parameter specifies the running direction

| Value | Running direction |
|-------|-------------------|
| 0 | Anticlockwise |
| 1 | Clockwise |

The MSB is of no relevance!

Permissible range of values: 0...1

"ebm standard series" Modbus parameters

2.15 Store set value

Address : D103
Write authorisation : ebm-papst, customer, end customer

Encoding:

This parameter specifies whether or not an incoming specified set value (D001) is also stored in the EEPROM under set value (EEPROM) (D114 / D115).

| Value | Function |
|-------|--|
| 0 | Set value is not stored The fan is stationary after a reset |
| 1 | Set value is stored in EEPROM After reset, the fan will run with the stored set value |

The MSB is of no relevance!

Permissible range of values: 0...1

2.16 Day/night switch external/internal

Address : D104
Write authorisation : ebm-papst, customer, end customer

Encoding:

This parameter specifies whether the external input or the internal parameter is to be used to switch between parameter record "Day" and parameter record "Night".

| Value | Day / night switch by ... |
|-------|--|
| 0 | External input |
| 1 | Parameter "Day/night internal" (see 2.17 Day/night internal) |

The MSB is of no relevance!

Permissible range of values: 0...1

"ebm standard series" Modbus parameters

2.17 Day/night internal

Address : D105
Write authorisation : ebm-papst, customer, end customer

Encoding:

This parameter specifies whether the parameter record "Day" or the parameter record "Night" is used.
The specification in this parameter is only applicable if the parameter "Day/night switch external/internal" has the value "internal" (1) (see 2.16 Day/night switch external/internal).

| Value | Parameter set |
|-------|---------------|
| 0 | Day |
| 1 | Night |

The MSB is of no relevance!

Permissible range of values: 0...1

The new value immediate becomes applicable when this parameter is written (no reset necessary).

2.18 Control mode

Address "Day" : D106
Address "Night" : D107
Write authorisation : ebm-papst, customer, end customer

The external "Day/night" input and the "Day/night internal" parameter are used to select whether the value in "Control mode day" or "Control mode night" is applicable (see 2.17 Day/night internal).

Encoding:

| Value | Control mode |
|-------|----------------------------|
| 0 | closed loop speed control |
| 1 | closed loop sensor control |
| 2 | open loop PWM control |

The MSB is of no relevance!

Permissible range of values: 0...2

"ebm standard series" Modbus parameters

2.19 Control function

Address "Day" : D108
Address "Night" : D109
Write authorisation : ebm-papst, customer, end customer

The external "Day/night" input and the "Day/night internal" parameter are used to select whether the value in "Control function day" or "Control function night" is applicable (see 2.17 Day/night internal).

The specification in these parameters is only applicable if the parameter "Control function switch external/internal" has the value "internal" (1) (see 2.40 Control function switch external/internal). Otherwise, both parameters will have no function.

The control function specifies how the control variable is defined from the set value and the actual value

Encoding:

| Value | Control function |
|-------|--|
| 0 | Positive: $\text{Control variable} = \text{Set value} - \text{Actual value}$ |
| 1 | Negative: $\text{Control variable} = \text{Actual value} - \text{Set value}$ |

A positive control function causes the modulation level of the fan to decrease as the actual value is increased.
A negative control function causes the modulation level of the fan to increase as the actual value is increased.

Remarks:

For sensor control with temperature sensor, a positive control function equates to "heat" and a negative control function equates to "cool".

In "closed loop speed control" mode, only a positive control function is logical. For this reason, the parameter "Control function" has no function in the "closed loop speed control" mode and is always assumed to be positive.

"ebm standard series" Modbus parameters

2.20 Control parameters

2 control parameters are provided for closed loop speed control and closed loop sensor control:

- P factor k_p
- I factor k_i

| | |
|-----------------------------|-------------------------------------|
| Address of P factor "Day" | : D10A |
| Address of P factor "Night" | : D10B |
| Address of I factor "Day" | : D10C |
| Address of I factor "Night" | : D10D |
| Write authorisation | : ebm-papst, customer, end customer |

The external input "day/night" and the parameter "day/night internal" are used to select whether the values in "P factor / I factor day" or the values in "P factor / I factor night" are applicable (see 2.17 Day/night internal).

Encoding:

Each control parameter consists of 2 bytes.

a) P factor

$$P \text{ factor} = \frac{\text{Data bytes}}{256} \cdot 100\%$$

This means that values can be set for the P factor between 0 and 25,600%, in steps of 0.39%

b) I factor

$$I \text{ factor} = \frac{\text{Data bytes}}{65536} \cdot 100\%$$

This means that values can be set for the I factor between 0 and 100%, in steps of 0.00153%

Remarks concerning control behaviour:

The fan control computes a new modulation level according to the equation below after each scanning cycle time $T_a = 50\text{ms}$:

$$a(n) = \frac{k_p}{100\%} \cdot xd(n) + \sum_{i=0}^n \frac{k_i}{100\%} \cdot xd(i)$$

$a(n)$ Modulation level at time n ; standardised to range 0..65536; i.e. 65536 \rightarrow 100%

$xd(n)$ Standardised control variable at time n (set value – actual value)

k_p P factor in %

k_i I factor in %

The standardised control variable is calculated from the set value and the actual value.

Set value and actual value are also standardised:

- to maximum speed in closed loop speed control
- to minimum and maximum sensor values in closed loop sensor control

"ebm standard series" Modbus parameters

The standardised control equation stated above and the generally applicable control equation

$$A(n) = kr \cdot \left(Xd(n) + \frac{Ta}{Tn} \sum_{i=0}^n Xd(i) \right)$$

$A(n)$ Modulation level at time n (0..100%)

$Xd(n)$ Absolute control variable at time n (set value – actual value)

kr Proportional coefficient

Tn Adjusting time

Ta Scanning cycle time

... can be converted to each other with

$$kr = \frac{kp}{\text{Max. ref. value} - \text{Min. ref. value}} \quad \text{and} \quad kp = kr \cdot (\text{max. ref. value} - \text{min. ref. value})$$

$$Tn = \frac{kp}{ki} \cdot Ta \quad \text{and} \quad ki = \frac{Ta}{Tn} \cdot kr \cdot (\text{max. ref. value} - \text{min. ref. value})$$

where

$$Ta = 50ms$$

In closed loop speed control:

$$\text{Max. ref. value} = 1.024 \cdot nMax$$

$$\text{Min. ref. value} = 0$$

$nMax$ Maximum speed [1/min]

In closed loop sensor control:

$$\text{Max. ref. value} = \text{Max. sensor value}$$

$$\text{Min. ref. value} = \text{Min. sensor value}$$

Max. sensor value Sensor variable for $U = 10V$

Min. sensor value Sensor variable for $U = 0V$

"ebm standard series" Modbus parameters

2.21 Maximum modulation level

Address "Day" : D10E
Address "Night" : D10F
Write authorisation : ebm-papst, customer

The external "Day/night" input and the "Day/night internal" parameter are used to select whether the value in "Maximum modulation level day" or "Maximum modulation level night" is applicable (see 2.17 Day/night internal).

Encoding:

$$\text{Max. modulation level [\%]} = \frac{\text{Data byte}}{256} \cdot 100\%$$

The MSB is of no relevance!

Limitation:

8% < Maximum modulation level < Maximum permissible modulation level
(see 2.26 Maximum permissible modulation level)

2.22 Minimum modulation level

Address "Day" : D110
Address "Night" : D111
Write authorisation : ebm-papst, customer, end customer

The external "Day/night" input and the "Day/night internal" parameter are used to select whether the value in "Minimum modulation level day" or "Minimum modulation level night" is applicable (see 2.17 Day/night internal).

Encoding:

$$\text{Min. modulation level [\%]} = \frac{\text{Data byte}}{256} \cdot 100\%$$

The MSB is of no relevance!

Limitation:

Minimum modulation level > Minimum permissible modulation level
(see 2.27 Minimum permissible modulation level)

"ebm standard series" Modbus parameters

2.23 Motor stop enable

Address "Day" : D112
Address "Night" : D113
Write authorisation : ebm-papst, customer, end customer

The external "Day/night" input and the "Day/night internal" parameter are used to select whether the value in "Motor stop enable day" or "Motor stop enable night" is applicable (see 2.17 Day/night internal).

Encoding:

| Value | Motor stop |
|-------|---|
| 0 | Motor runs continuously (even if set value = 0) |
| 1 | Motor stops if set value = 0 |

The MSB is of no relevance!

2.24 Set value (EEPROM)

Address "Day" : D114
Address "Night" : D115
Write authorisation : ebm-papst, customer, end customer

The specification in these parameters are only applicable if the parameter "Source set value" has the value "RS485" (1) (see 2.13 Source set value) and the function "Store set value" is activated (see 2.15 Store set value). Otherwise, both parameters will have no function.

If the parameter "Specified set value" is changed, the corresponding parameters "Set value day" and "Set value night" will automatically be set to the same value providing the function "Store set value" is activated (see 2.3 Specified set value, 2.15 Store set value).

The external "Day/night" input and the "Day/night internal" parameter are used to select whether the value is to be stored in "Set value day" or in "Set value night" (see 2.17 Day/night internal).

As the specified set value is stored in the volatile memory, it is necessary to store this value (as necessary) in the non-volatile memory. The parameter "Set value (EEPROM)" is provided to this end.

Encoding:

Note: The 4 LSBits are of no relevance for the set value and will always be assumed to be 0.

"ebm standard series" Modbus parameters

a) in closed loop speed control

The set value denotes a speed:

$$\text{Set value [1/min]} = \frac{\text{Data bytes}}{64000} \cdot n\text{Max [1/min]}$$

nMax [rpm] ... maximum speed in revs per minute (see 2.28 Maximum speed)

The value zero means motor standstill

b) in open loop PWM control

The set value denotes a modulation level:

$$\text{Set value [\%]} = \frac{\text{Data bytes}}{65536} \cdot 100\%$$

The value zero means motor standstill

c) in closed loop sensor control

The set value denotes a sensor variable:

A sensor that converts the control variable into a voltage of 0..10V or a current of 4..20mA must be connected to the fan.

A set value can be entered for the output voltage or the output current of the sensor used.

The set value for the control variable is then made up of the set value parameter and the Rg(U/I) characteristic of the sensor used.

Rg (U) = Control variable, voltage-dependent

$$\text{Set value [V]} = \frac{\text{Data bytes}}{65536} \cdot 10V$$

$$\begin{aligned}\text{Set value [unit (Rg)]} &= Rg(\text{set value [V]}) \\ &= Rg\left(\frac{\text{data bytes}}{65536} \cdot 10V\right)\end{aligned}$$

or

Rg (I) = Control variable, current-dependent

$$\text{Set value [mA]} = \frac{\text{Data bytes}}{65536} \cdot 16mA + 4mA$$

$$\begin{aligned}\text{Set value [unit (Rg)]} &= Rg(\text{set value [V]}) \\ &= Rg\left(\frac{\text{data bytes}}{65536} \cdot 16mA + 4mA\right)\end{aligned}$$

"ebm standard series" Modbus parameters

2.25 Starting modulation level

Address : D116
Write authorisation : ebm-papst

Starting modulation level specifies the PWM with which the motor is started after a start command.

Encoding:

$$\text{Starting modulation level [\%]} = \frac{\text{Data byte}}{256} \cdot 100\%$$

The MSB is of no relevance!

The motor always starts with the starting modulation level.

A large starting modulation level will result in high current draw at when the engine is started!

2.26 Maximum permissible modulation level

Address : D117
Write authorisation : ebm-papst

This parameter defines the upper limit for the maximum modulation level (see 2.21 Maximum modulation level).

Encoding:

$$\text{Max. perm. modulation level [\%]} = \frac{\text{Data byte}}{256} \cdot 100\%$$

The MSB is of no relevance!

2.27 Minimum permissible modulation level

Address : D118
Write authorisation : ebm-papst

This parameter defines the lower limit for the minimum modulation level (see 2.22 Minimum modulation level).

Encoding:

$$\text{Min. perm. modulation level [\%]} = \frac{\text{Data byte}}{256} \cdot 100\%$$

The MSB is of no relevance!

If too small a value is selected for this parameter (especially values < 8%), the motor may shut down with the error "Motor locked"!

"ebm standard series" Modbus parameters

2.28 Maximum speed

Address : D119
Write authorisation : ebm-papst, customer

This parameter has two functions:

- All parameters with speed specifications (set values, actual values) are related to this value. The value 64,000 in these speed specifications is equivalent to the maximum speed value specified here.
- In control modes "closed loop sensor control" and "open loop PWM control", the speed is limited to the value specified here. (speed is in any case controlled in closed loop speed control).

Encoding:

Max. speed [1/min] = Data bytes

The maximum speed is made up of 2 bytes.

Limitation:

Maximum speed < Maximum permissible speed (see 2.29 Maximum permissible speed)

2.29 Maximum permissible speed

Address : D11A
Write authorisation : ebm-papst

This parameter defines the upper limit for the maximum speed (see 2.28 Maximum speed).

Encoding:

Max. perm. speed [1/min] = Data bytes

The maximum permissible speed is made up of 2 bytes.

"ebm standard series" Modbus parameters

2.31 Number of poles

Address : D11C
Write authorisation : ebm-papst

Encoding:

Number of motor poles = Data byte

The MSB is of no relevance!

Comment:

If the figure entered in the parameter "Number of poles" differs from the actual number of poles on the motor, the actual speed will not be correctly computed!

"ebm standard series" Modbus parameters

2.32 Minimum DC-link voltage

Address : D11E
Write authorisation : ebm-papst

Encoding:

$$U_z \text{ min [V]} = \frac{\text{Data byte}}{256} \cdot \text{Reference } U_z \text{ [V]}$$

Reference Uz reference variable DC-link voltage (see 2.59 Reference value of DC-link voltage).

The MSB is of no relevance!

This parameter defines the limit value for the DC-link voltage. If this value is undercut, a DC-link undervoltage error is triggered.

2.33 Ramp-up curve / ramp-down curve

Address of ramp-up curve : D11F
Address of ramp-down curve : D120
Write authorisation : ebm-papst, customer, end customer

These parameters define the ramp time for a set value change of 256 steps (i.e. the time for a change of MSB set value by one step).
The parameter "Ramp-up curve" defines the time for a positive change of set value.
The parameter "Ramp-down curve" defines the time for a negative change of set value.

With closed loop speed control, 256 steps correspond to a change in speed of
 $\Delta n \text{ [rpm]} = n_{\text{Max}} \text{ [rpm]} / 250$

in open loop PWM control, 256 steps correspond to a change of PWM of
 $\Delta \text{PWM} [\%] = 0.39\%$

Encoding:

$$\text{Time for set value to change by 256 steps [ms]} = \text{Data byte} \cdot 10\text{ms}$$

The MSB is of no relevance!

The result of a change from the minimum value 0 to the maximum value 64,000 is a ramp-up time or ramp-down time of

$$\text{Ramp time [s]} = 250 \cdot \text{Time for set value to change by 256 steps [ms]} = \text{Data byte} \cdot 2.5\text{s}$$

If the value is 0, the new set value is immediately effective, without any time lag.

"ebm standard series" Modbus parameters

2.38 Limit speed

Address : D128
Write authorisation : ebm-papst

This parameter defines the limit value for the safety function "limit speed". The speed control in this safety function ensures that the limit speed for the impeller is not exceeded.

Encoding:

Limit speed [1/min] = Data bytes

Comment:

The limit speed is not related to the maximum speed!

2.39 Potentiometer characteristic

Address of Point 1 X-coordinate "Day" : D12A
Address of Point 1 Y-coordinate "Day" : D12B
Address of Point 2 X-coordinate "Day" : D12C
Address of Point 2 Y-coordinate "Day" : D12D

Address of Point 1 X-coordinate "Night" : D13C
Address of Point 1 Y-coordinate "Night" : D13D
Address of Point 2 X-coordinate "Night" : D13E
Address of Point 2 Y-coordinate "Night" : D13F

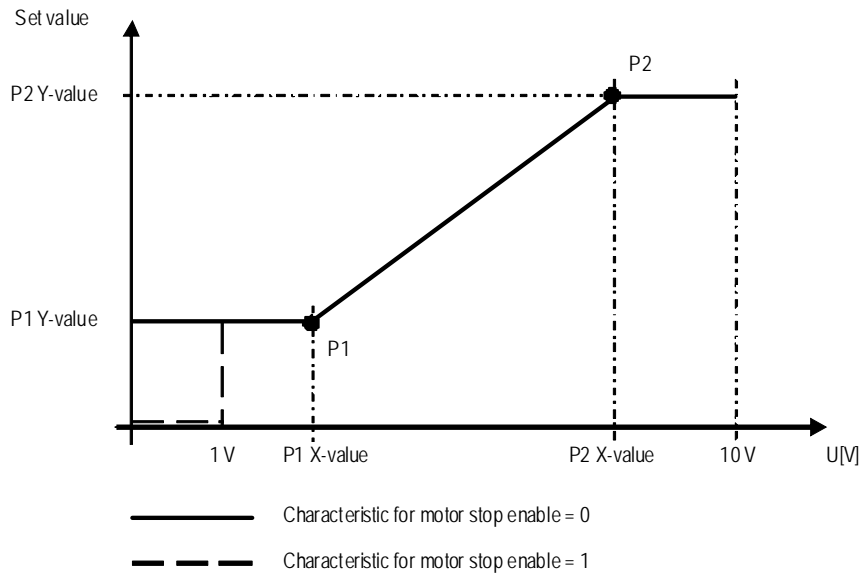
Write authorisation : ebm-papst, customer, end customer

2 different characteristics can be defined.

The external "Day/night" input and the "Day/night internal" parameter are used to select whether the "day" values or the "night" values are applicable (see 2.17 Day/night internal).

"ebm standard series" Modbus parameters

These parameters are used to assign a set value to the voltage at the control input.



Points P1 and P2 may be moved at random within the diagram.

Encoding:

The X-coordinate defines a voltage value between 0...10V for the analogue input:

$$U[V] (P_x) = \frac{\text{Data byte}}{65536} \cdot 10V$$

The Y-coordinate defines the associated set value for this point. Depending on the control mode concerned, this may be a speed (closed loop speed control), a sensor variable (closed loop sensor control) or a modulation level (open loop PWM control).

a) closed loop speed control:

$$\text{Set value [1/min]} = \frac{\text{Data byte}}{64000} \cdot nMax [1/min]$$

nMax [rpm] ... maximum speed in revs per minute (see 2.28 Maximum speed)

b) in open loop PWM control

$$\text{Set value [\%]} = \frac{\text{Data byte}}{65536} \cdot 100\%$$

"ebm standard series" Modbus parameters

c) in closed loop sensor control

The set value for the control variable is then made up of the set value parameter and the Rg(U/I) characteristic of the sensor used.

Rg (U) = Control variable, voltage-dependent

$$\text{Set value [V]} = \frac{\text{Data byte}}{65536} \cdot 10V$$

$$\begin{aligned}\text{Set value [unit (Rg)]} &= \text{Rg (set value [V])} \\ &= \text{Rg} \left(\frac{\text{data byte}}{65536} \cdot 10V \right)\end{aligned}$$

or

Rg (U) = Control variable, current-dependent

$$\text{Set value [mA]} = \frac{\text{Data byte}}{65536} \cdot 16mA + 4mA$$

$$\begin{aligned}\text{Set value [unit (Rg)]} &= \text{Rg (set value [V])} \\ &= \text{Rg} \left(\frac{\text{data byte}}{65536} \cdot 16mA + 4mA \right)\end{aligned}$$

For voltages at the analogue input that are less than the value defined by the point 1 X-coordinate, the set value is the value defined in the point 1 Y-coordinate.

For voltages at the analogue input that are greater than the value defined by the point 2 X-coordinate, the set value is the value defined in the point 2 Y-coordinate.

In between, the set value changes linearly between the two values specified in the Y-coordinates (see chart above).

Limitation:

X-coordinate (point 1) \leq X-coordinate (point 2)

Comment:

If Y-coordinate (point 1) > Y-coordinate (point 2) is selected, the gradient of the characteristic will be negative. In such cases, the motor stop function will become effective at a voltage > 9V at the analogue input

"ebm standard series" Modbus parameters

2.40 Control function switch external/internal

Address : D12E
Write authorisation : ebm-papst, customer, end customer

Encoding:

This parameter specifies whether the control function is determined by the external input or by the internal parameter.

| Value | Control function determined by ... |
|-------|--|
| 0 | External input |
| 1 | "Control function" parameter (see 2.19 Control function) |

The MSB is of no relevance!

Permissible range of values: 0...1

2.41 Control limitation

Address : D12F
Write authorisation : ebm-papst

This parameter defines which limitation functions are activated.

Encoding:

| | | | | | | | |
|----------|----------|---|---|---|----------|---|---|
| Reserved | Reserved | 0 | 0 | 0 | Reserved | I | P |
|----------|----------|---|---|---|----------|---|---|

The MSB is of no relevance!

I Coil current limitation
P Power limitation

"ebm standard series" Modbus parameters

2.42 0..10V output

2.42.1 0..10V output function

Address of function : D130
Write authorisation : ebm-papst, customer

This parameter defines the output parameter at the 0..10V output

Encoding:

| Value | Output parameter |
|-------|----------------------------------|
| 0 | Modulation level (specification) |
| 1 | Actual speed |

Applications:

a) Modulation level (value = 0)

This configuration causes the specification for the modulation level to be output at the 0..10V output. This signal can be connected to the set value input for other fans. These will then run with the same modulation level.

b) Actual speed (value = 1)

This configuration causes a voltage proportional to the speed to be output at the 0..10V output. The value 10V is achieved for a speed $n = 1.02 * n_{Max}$

The signal can be used to evaluate the actual speed.

"ebm standard series" Modbus parameters

2.42.2..10V output characteristic

Address of Point 1 X-coordinate "Day" : D140

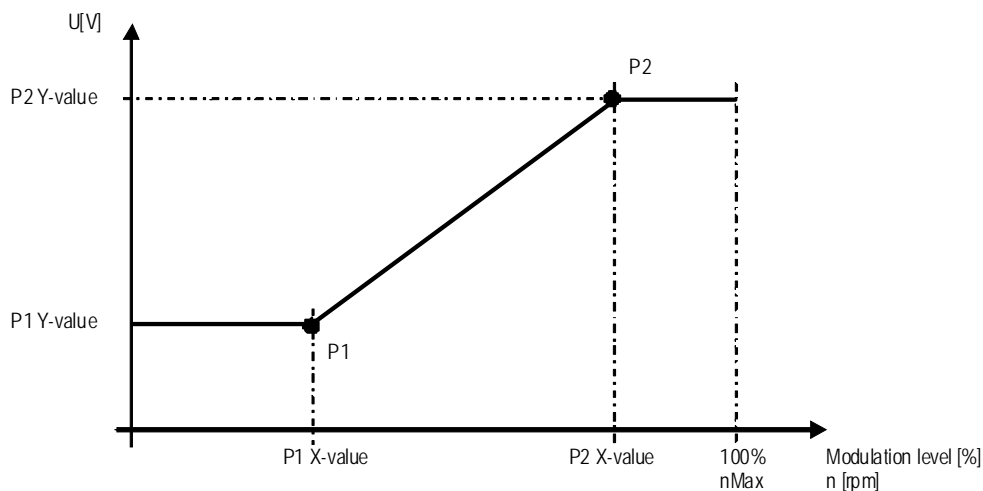
Address of Point 1 Y-coordinate "Day" : D141

Address of Point 2 X-coordinate "Day" : D142

Address of Point 2 Y-coordinate "Day" : D143

Write authorisation : ebm-papst, customer, end customer

These parameters are used to assign a voltage from the 0...10V output to a value defined by the parameter "0..10V output function".



Points P1 and P2 may be moved at random within the diagram.

Encoding:

0..10V output function = modulation level

The X-coordinate defines a modulation level

$$\text{Modulation level [\%]} (Px) = \frac{\text{Data bytes}}{65536} \cdot 100\%$$

0..10V output function = actual speed

The X-coordinate defines a speed

$$n [1/min] (Px) = \frac{\text{Data bytes}}{64000} \cdot n_{Max}$$

n_{Max} [rpm] ... maximum speed in revs per minute (see 2.28 Maximum speed)

"ebm standard series" Modbus parameters

The Y-coordinate defines the associated voltage at the 0..10V output:

$$U[V] (Px) = \frac{Data\ byte}{65536} \cdot 10V$$

Limitation:

X-coordinate (point 1) \leq X-coordinate (point 2)

Applications:

A characteristic with the following values is recommended

P1X = 0x0000 0% / 0 rpm

P1Y = 0x0000 0V

P2X = 0xFF00 100% / 1.02 * nMax

P2Y = 0xFF00 10V

In this case:

$$U_{0..10V} [V] = \frac{Modulation\ level\ (specified)\ [%]}{100} \cdot 10V$$

and

$$U_{0..10V} = \frac{n\ Actual\ [1/min]}{1.02 \cdot n\ Max\ [1/min]} \cdot 10V$$

nMax [rpm] ... maximum speed in revs per minute (see 2.28 Maximum speed)

A cascaded startup of the motors can be achieved by shifting the characteristic parallel downwards.

"ebm standard series" Modbus parameters

2.46 Maximum power

Address of maximum power : D135
Write authorisation : ebm-papst

Encoding:

$$P_{max} [W] = \frac{\text{Data byte}}{256} \cdot \text{reference } U_z [V] \cdot \text{reference } I_z [A]$$

P max maximum power

Reference Uz reference variable DC-link voltage (see 2.59 Reference value of DC-link voltage).

Reference Iz reference variable DC-link current (see 2.60 Reference value of DC-link current).

The MSB is of no relevance!

The motor will limit the power to the value specified here if the function in the parameter "Control limitation" is activated (see 2.41 Control limitation).

2.48 Maximum coil current

Address : D13B
Write authorisation : ebm-papst

Encoding:

$$I_{max, eff} [A] = \frac{\text{Data byte}}{170} \cdot \text{reference } I_z [A]$$

Reference Iz reference variable DC-link current (see 2.60 Reference value of DC-link current).

The MSB is of no relevance!

If the function in the parameter "Control limitation" is activated, the motor will limit the coil current (effective value) to the value specified here (see 2.41 Control limitation).

The coil current is made up of the DC-link current * modulation level

"ebm standard series" Modbus parameters

2.50 Limit speed for running monitor

Address : D145
Write authorisation : ebm-papst

Encoding:

The limit speed for the running monitor is made up of the parameter and the maximum speed:

$$\text{Limit speed for running monitor [1/min]} = \frac{\text{Data bytes}}{64000} \cdot nMax [1/min]$$

nMax [rpm] ... maximum speed (in revs per minute) - see 2.28 Maximum speed

If the actual speed (see 3.8 Actual speed) is less than the limit speed for the running monitor, the error relay will trip. The flag "n_Low" is set in the "Warning" input register (see 3.10 Warning)
If "Limit speed for running monitor" = 0, the entire function is deactivated.

"ebm standard series" Modbus parameters

2.51 Bypass function on/off

Address : D15C
Write authorisation : ebm-papst, customer

Encoding:

This parameter specifies whether the bypass function is active or inactive.

| Value | Bypass function |
|-------|-----------------|
| 0 | Inactive |
| 1 | Active |

The MSB is of no relevance!
Permissible range of values: 0...1

2.52 Bypass function set value

Address : D15D
Write authorisation : ebm-papst, customer

If no command is sent to the fan for the time specified in the parameter "Bypass function time lag" (see 2.53 Bypass function time lag), the fan will automatically switch to the set value specified here, providing the bypass function is activated (see 2.51 Bypass function on/off).

Encoding:

Remark: The encoding corresponds to the encoding of the specified set value (D001)
The 4 LSBits are of no relevance for the set value and will always be assumed to be 0.

a) in closed loop speed control

The bypass set value denotes a speed:

$$\text{Bypass set value [1/min]} = \frac{\text{Data bytes}}{64000} \cdot n_{\text{Max}} [1/min]$$

nMax [rpm] ... maximum speed in revs per minute (see 2.28 Maximum speed)

The value zero means motor standstill

b) in open loop PWM control

The bypass set value denotes a modulation level:

$$\text{Bypass set value [%]} = \frac{\text{Data bytes}}{65536} \cdot 100\%$$

The value zero means motor standstill

"ebm standard series" Modbus parameters

c) in closed loop sensor control

The bypass set value denotes a sensor variable:

A sensor that converts the control variable into a voltage of 0..10V or a current of 4..20mA must be connected to the fan.

A set value can be entered for the output voltage or the output current of the sensor used.

The bypass set value for the control variable is then made up of the set value parameter and the $R_g(U/I)$ characteristic of the sensor used.

$R_g(U)$ = Control variable, voltage-dependent

$$\text{Bypass set value [V]} = \frac{\text{Data bytes}}{65536} \cdot 10V$$

$$\begin{aligned}\text{Bypass set value [unit (R}_g\text{)]} &= R_g(\text{bypass set value [V]}) \\ &= R_g\left(\frac{\text{data bytes}}{65536} \cdot 10V\right)\end{aligned}$$

or

$R_g(U)$ = Control variable, current-dependent

$$\text{Bypass set value [mA]} = \frac{\text{data bytes}}{65536} \cdot 16mA + 4mA$$

$$\begin{aligned}\text{Bypass set value [unit (R}_g\text{)]} &= R_g(\text{bypass set value [V]}) \\ &= R_g\left(\frac{\text{data bytes}}{65536} \cdot 16mA + 4mA\right)\end{aligned}$$

2.53 Bypass function time lag

Address : D15E
Write authorisation : ebm-papst, customer

If no command is sent to the fan for the time specified here, the fan will automatically switch to the bypass function set value (see 2.52 Bypass function set value), providing the bypass function is activated (see 2.51 Bypass function on/off).

Encoding:

$$\text{Bypass function time lag [ms]} = \text{Data byte} \cdot 100ms$$

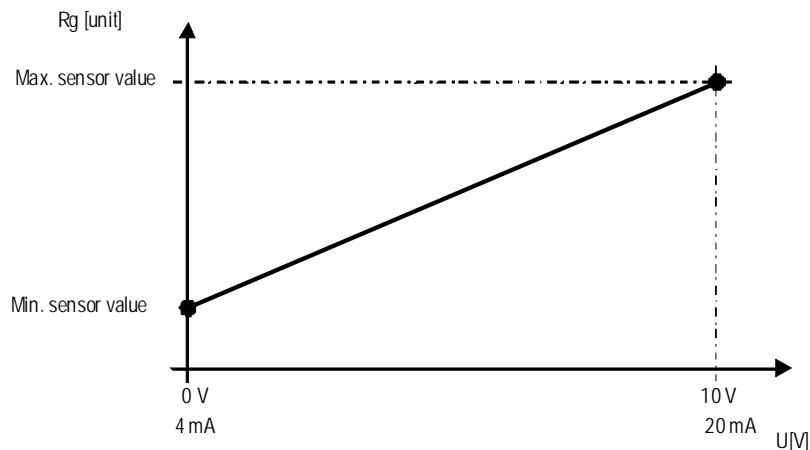
The MSB is of no relevance!

"ebm standard series" Modbus parameters

2.54 Sensor

Address for min. sensor value : D160 / D161
Address for max. sensor value : D162 / D163
Address for sensor unit : D164 - D169
Write authorisation : ebm-papst, customer, end customer

These values define the characteristic of the specified sensor as shown in the chart below.



The necessary data for min. sensor value and max. sensor value can be found in the data sheet for the sensor.

These parameters are only intended for use in the PC. The behaviour of the fan is not influenced by these parameters.

Encoding:

a) Minimum sensor value

Min. sensor value [phys.unit] = Data bytes

The minimum sensor value is stored in "float" format!

b) Maximum sensor value

Max. sensor value [phys.unit] = Data bytes

The maximum sensor value is stored in "float" format!

c) Sensor unit

Sensor unit [ASCII] = Data bytes

The sensor unit is stored in "ASCII" format!

"ebm standard series" Modbus parameters

2.55 Customer data

Address : D170 - D17F
Write authorisation : ebm-papst, customer

For the customer, there are a total of 16 parameter (each with 16 bit) in this range.
Any values required can be stored here.

The behaviour of the fan is not influenced by these parameters.

2.56 Operating hours counter (backup)

Address : D180
Write authorisation : ebm-papst

Encoding:

Operating hours [h] = Data bytes

This parameter is a backup copy of the parameter D009 "Operating hours counter" (see 2.9 Operating hours counter). The parameter is continuously updated.

"ebm standard series" Modbus parameters

2.58 Error history

| | |
|---------------------------------------|--|
| Address of error indicator | : D182 |
| Address of 1st error | : D184 |
| Address of 1st error timing | : D185 |
| Address of error history 1..13 | : D186, D188, D18A, D18C, D18E, D190, D192, D194, D196, D198, D19A, D19C, D19E |
| Address of error history timing 1..13 | : D187, D189, D18B, D18D, D18F, D191, D193, D195, D197, D199, D19B, D19D, D19F |
| Write authorisation | : ebm-papst |

A) 1st error

The first error that is detected in the service life of the fan is stored under the parameter "1st error". At the same time, the reading on the operating hour counter at this time is stored in the parameter "1st error timing". The parameters are written automatically by the fan.

B) Error history

The error history contains the last 13 errors that were detected in the fan. The record of each error includes the respective operating hours counter reading in the parameter "Error history timing". The parameters are written automatically by the fan.

The error indicator (D182) specifies the address of the last error to be detected in the error history. The previous error is then at the preceding address.

Example:

Error indicator = D196

Then:

| | | | |
|------|----------------------|------|--------------------------------|
| D196 | Last error (error n) | D197 | Timing of last error (error n) |
| D194 | Error n-1 | D195 | Timing of error n-1 |
| D192 | Error n-2 | D193 | Timing of error n-2 |
| D190 | Error n-3 | D191 | Timing of error n-3 |
| D18E | Error n-4 | D18F | Timing of error n-4 |
| D18C | Error n-5 | D18D | Timing of error n-5 |
| D18A | Error n-6 | D18B | Timing of error n-6 |
| D188 | Error n-7 | D189 | Timing of error n-7 |
| D186 | Error n-8 | D18D | Timing of error n-8 |
| D19E | Error n-9 | D19F | Timing of error n-9 |
| D19C | Error n-10 | D19D | Timing of error n-10 |
| D19A | Error n-11 | D19B | Timing of error n-11 |
| D198 | Error n-12 | D199 | Timing of error n-12 |

Every time a new error is detected, the error indicator increases by 2 and the error and its timing are stored at the address shown on the error indicator. The addresses are written automatically by the fan.

"ebm standard series" Modbus parameters

When the error indicator reaches the final value D19E, it will be reset to the initial value D186 when the next error is detected.

Encoding:

Error indicator:

Address of error indicator = Data bytes

Error:

| | | | | | | | | |
|-----|-------|-----|-----|-----------------|--------|-----|------|-----------------|
| MSB | Brake | 0 | 0 | 0 ^{*)} | UzHigh | 0 | TFEI | 0 |
| LSB | BLK | HLL | TFM | 0 ^{*)} | SKF | TFE | 0 | 0 ^{*)} |

If bit = 1, the error described below has been detected:

Brake: brake mode: set if exterior drive is applied in opposite direction with high speed for prolonged period

UzHigh: DC-link overvoltage

TFEI: Electronics interior overheated

BLK: Motor locked

HLL: Hall sensor error

TFM: Motor overheating

SKF: Communications error between bus controller and commutation controller

TFE: Output stage overheating

^{*)} The errors "DC-link undervoltage" and "Phase failure" and general error detection "Fan bad" will not be stored, even if they are set in the motor status (cf. 3.9 Motor status).

Comment:

The errors "Motor locked" and "Communication error" will only be stored if the last error was a different one, as a restart is permitted with these errors.

Error timing:

Error timing [h] = Data bytes

"ebm standard series" Modbus parameters

2.59 Reference value of DC-link voltage

Address : D1A0
Write authorisation : ebm-papst

To keep the resolution variable, all values for the DC-link voltage are based on this reference value.

Encoding:

$$\text{Reference } U_z [\text{mV}] = \text{Data bytes} \cdot 20\text{mV}$$

2.60 Reference value of DC-link current

Address : D1A1
Write authorisation : ebm-papst

To keep the resolution variable, all values for the DC-link current are based on this reference value.

Encoding:

$$\text{Reference } I_z [\text{mA}] = \text{Data bytes} \cdot 2\text{mA}$$

"ebm standard series" Modbus parameters

2.61 Production data

Production data means information data to enable the device concerned to be traced. The behaviour of the fan is not influenced by these parameters.

2.61.1 Fan serial number

Address : D1A2 / D1A3
Write authorisation : ebm-papst

The serial number is a continuous number count that is individually assigned to every ebm-papst fan.

Encoding:

Serial number = *Data bytes*

2.61.2 Fan production date

Address : D1A4
Write authorisation : ebm-papst

The production date specifies when the fan was manufactured by ebm-papst.

Encoding:

Production week = *Data byte (MSB)*

Production year = *Data byte (LSB)*

2.61.3 Fan type

Address : D1A5 - D1AA
Write authorisation : ebm-papst

Encoding:

The fan type is stored here in ASCII code

D1A5 contains the first two characters.

D1AA contains the last two characters.

"ebm standard series" Modbus parameters

3 Input registers

3.1 Overview

Input registers are stored in the RAM of the fan.
Input registers only have read access

The following list gives an overview of all parameters.
The function of the parameters is described in the following chapters

| Modbus Address | Designation |
|----------------|--|
| D000 | Identification |
| D001 | Max. number of bytes |
| D002 | Software name of bus controller |
| D003 | Software Version of bus controller |
| D004 | Software name of commutation controller |
| D005 | Software version of commutation controller |
| D010 | Actual speed |
| D011 | Motor status |
| D012 | Warning |
| D013 | DC-link voltage |
| D014 | DC-link current |
| D015 | Module temperature |
| D016 | Motor temperature |
| D017 | Electronics temperature |
| D018 | Current direction of rotation |
| D019 | Current modulation level |
| D01A | Current set value |
| D01B | Actual sensor value |
| D01C | Enable input status |
| D01D | Day/night parameter record |
| D01E | Current control function |
| D01F | Reserved |
| D020 | Reserved |
| D021 | Current power |
| D022 | Reserved |

"ebm standard series" Modbus parameters

3.2 Identification

Address : D000

Identification specifies the type of electronics and protocol concerned.

Encoding:

| Value | Device | Specification version |
|-------|----------------------|-----------------------|
| 00 01 | ebm standard series | 1.02 ^{*)} |
| 00 02 | ebm standard series | 2.01, 3.00 |
| 00 03 | Customer application | ^{*)} |
| 00 04 | Customer application | ^{*)} |

^{*)} Devices with identification \neq 0x0002 do not correspond to these specifications.
In such cases, the corresponding document should be used.

Important:
Devices complying with specifications V2.01 and V3.00 contain the same identification number (0x0002) and cannot be distinguished using this parameter.

3.3 Maximum number of bytes

Address : D001

This parameter specifies the maximum number of bytes that a telegram sent via Modbus may contain.

Encoding:

Max. number of bytes = Data bytes

3.4 Software name of bus controller

Address : D002

This parameter specifies the number of the software of the bus controller (without the version).

Encoding:

Software name = Data bytes

"ebm standard series" Modbus parameters

3.5 Software version of bus controller

Address : D003

This parameter specifies the software version of the bus controller.

Encoding:

Software version = *Data byte LSB*

The MSB is always 0.

3.6 Software name of commutation controller

Address : D004

This parameter specifies the number of the software of the commutation controller (without the version).

Encoding:

Software name = *Data bytes*

3.7 Software version of commutation controller

Address : D005

This parameter specifies the software version of the commutation controller.

Encoding:

Software version = *Data byte LSB*

The MSB is always 0.

"ebm standard series" Modbus parameters

3.8 Actual speed

Address : D010

Encoding:

The actual speed is made up of the speed parameter and the maximum speed:

$$\text{Actual speed [1/min]} = \frac{\text{Data bytes}}{64000} \cdot n_{\text{Max [1/min]}}$$

nMax [rpm] ... maximum speed (in revs per minute) - see 2.28 Maximum speed

Comment:

If the actual speed exceeds the value "1.02 * maximum speed", the display will be limited to the value "1.02 * maximum speed" (0xFFFF0)

3.9 Motor status

Address : D011

The motor status specifies errors currently detected in the fan.

Encoding:

| | | | | | | | | |
|-----|-------|-----|-----|-------|--------|-----|------|-----|
| MSB | Brake | 0 | 0 | UzLow | UzHigh | 0 | TFEI | 0 |
| LSB | BLK | HLL | TFM | FB | SKF | TFE | 0 | PHA |

If a bit is set, the error described below has been detected:

Brake: brake mode: set if exterior drive is applied in opposite direction with high speed for prolonged period
UzLow: DC-link undervoltage
UzHigh: DC-link overvoltage
TFEI: Electronics interior overheated

BLK: Motor locked
HLL: Hall sensor error
TFM: Motor overheating
FB: Fan bad (general error) *)
SKF: Communications error between master controller and slave controller
TFE: Output stage overheating
PHA: Phase failure

*) "Fan bad" is set for every error

"ebm standard series" Modbus parameters

3.10 Warning

Address : D012

A warning is a prestage to an error message, i.e. the limit value for the error message has almost been reached.

Encoding:

A set bit makes the warning active:

| | | | | | | | | |
|-----|---|-------|----------|---------|---------|---------|-------|----------|
| MSB | 0 | 0 | 0 | 0 | 0 | 0 | n_Low | Reserved |
| LSB | 0 | UzLow | TEI_high | TM_high | TE_high | P_Limit | 0 | I_Limit |

n_Low : Actual speed is less than limit speed for running monitor
(see 2.50 Limit speed for running monitor)

UzLow : DC-link voltage low

TEI_high : Temperature in electronics interior high

TM_high : Motor temperature high

TE_high : Output stage temperature high

P_Limit : Power limitation in mesh

I_Limit : Current limitation in mesh

3.11 DC-link voltage

Address : D013

Encoding:

$$U_z [V] = \frac{\text{Data byte}}{256} \cdot \text{reference } U_z [V]$$

Reference Uzreference variable DC-link voltage (see 2.59 Reference value of DC-link voltage).

"ebm standard series" Modbus parameters

3.12 DC-link current

Address : D014

Encoding:

$$I_z [A] = \frac{\text{Data byte}}{256} \cdot \text{reference } I_z [A]$$

Reference Izreference variable DC-link current (see 2.60 Reference value of DC-link current).

3.13 Module temperature

Address : D015

Encoding:

$$T_{\text{module}} [^{\circ}\text{C}] = \text{Data byte}$$

3.14 Motor temperature

Address : D016

Encoding:

$$T_{\text{motor}} [^{\circ}\text{C}] = \text{Data byte}$$

3.15 Electronics interior temperature

Address : D017

Encoding:

$$T_{\text{EI}} [^{\circ}\text{C}] = \text{Data byte}$$

"ebm standard series" Modbus parameters

3.16 Current direction of rotation

Address : D018

Encoding:

| Value | Current direction of rotation |
|-------|-------------------------------|
| 0 | Anticlockwise |
| 1 | Clockwise |

3.17 Current modulation level

Address : D019

Encoding:

$$\text{Modulation level} = \frac{\text{Data bytes}}{65536} \cdot 100\%$$

3.18 Current set value

Address : D01A

Encoding:

a) in closed loop speed control

The set value denotes a speed:

$$\text{Set value [1/min]} = \frac{\text{Data bytes}}{64000} \cdot n_{\text{Max}} [1/min]$$

nMax [rpm] ... maximum speed in revs per minute (see 2.28 Maximum speed)

The value zero means motor standstill

b) in open loop PWM control

The set value denotes a modulation level:

$$\text{Set value [\%]} = \frac{\text{Data bytes}}{65536} \cdot 100\%$$

The value zero means motor standstill

"ebm standard series" Modbus parameters

c) in closed loop sensor control

The set value denotes a sensor variable:

A sensor that converts the control variable into a voltage of 0..10V or a current of 4..20mA must be connected to the fan.

A set value can be entered for the output voltage or the output current of the sensor used.

The set value for the control variable is then made up of the set value parameter and the $R_g(U/I)$ characteristic of the sensor used.

$R_g(U)$ = Control variable, voltage-dependent

$$\text{Set value [V]} = \frac{\text{Data bytes}}{65536} \cdot 10V$$

$$\begin{aligned}\text{Set value [unit (R}_g\text{)]} &= R_g(\text{set value [V]}) \\ &= R_g\left(\frac{\text{data bytes}}{65536} \cdot 10V\right)\end{aligned}$$

or

$R_g(U)$ = Control variable, current-dependent

$$\text{Set value [mA]} = \frac{\text{Data bytes}}{65536} \cdot 16mA + 4mA$$

$$\begin{aligned}\text{Set value [unit (R}_g\text{)]} &= R_g(\text{set value [V]}) \\ &= R_g\left(\frac{\text{data bytes}}{65536} \cdot 16mA + 4mA\right)\end{aligned}$$

"ebm standard series" Modbus parameters

3.19 Actual sensor value

Address : D01B

The actual sensor value specifies the actual current value of the external sensor

Encoding:

$$\text{Actual value [V]} = \frac{\text{Data byte}}{65536} \cdot 10V$$

$$\begin{aligned}\text{Actual value [unit (Rg)]} &= Rg (U) \\ &= Rg \left(\frac{\text{data byte}}{65536} \cdot 10V \right)\end{aligned}$$

Actual value [V] = output voltage of sensor

Rg (U) = characteristic of sensor depending on voltage

3.20 Enable input status

Address : D01C

This parameter specifies the input enable status

Encoding:

| Value | Enable |
|-------|---------------------------------|
| 0 | Enable off (motor stop) |
| 1 | Enable on (motor start allowed) |

3.21 Day/night parameter record

Address : D01D

This parameter specifies which parameter record ("Day" or "Night") is in use.

If the parameter "Day/night switch external/internal" has the value "external" (0), the status of the external input "Parameter record" is shown here.

If the parameter "Day/night switch external/internal" has the value "internal" (1), the value of the parameter "Day/night internal" is shown here (see 2.16 Day/night switch external/internal, 2.17 Day/night internal).

Encoding:

| Value | Parameter set |
|-------|---------------|
| 0 | Day |
| 1 | Night |

"ebm standard series" Modbus parameters

3.22 Current control function

Address : D01E

If the parameter "Function control switch external/internal" has the value "external" (0), the status of the external input "Function control" is shown here.

If the parameter "Function control switch external/internal" has the value "internal" (1), the value of the parameter "Function control" is shown here (see 2.40 Control function switch external/internal, 2.19 Control function).

Encoding:

| Value | Control function |
|-------|--|
| 0 | Positive: $\text{Control variable} = \text{Set value} - \text{Actual value}$ |
| 1 | Negative: $\text{Control variable} = \text{Actual value} - \text{Set value}$ |

Remarks:

For sensor control with temperature sensor, a positive control function equates to "heat" and a negative control function equates to "cool".

"ebm standard series" Modbus parameters

3.25 Current power

Address : D021

Encoding:

$$P [W] = \frac{Data\ bytes}{65536} \cdot reference\ U_z [V] \cdot reference\ I_z [A]$$

Reference Uzreference variable DC-link voltage (see 2.59 Reference value of DC-link voltage)

Reference Izreference variable DC-link current (see 2.60 Reference value of DC-link current)