Interface Specification
Modbus TCP/IP for GMM and GHM

Modbus Parameter Specification for the external bus communications of Güntner Motor and Hybrid Management
(GMM EC, GMM sincon, GMM step, GMM phasecut, GHM spray, GHM pad and GHM pump)

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Contents

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2 Introduction

This document specifies the Modbus TCP/IP parameters as used in Güntner Motor Management (GMM) and Güntner Hybrid Management (GHM) systems of Güntner GmbH & Co. KG. It assumes the reader is familiar with the general Modbus specifications:
- Modbus Standard 2016
- Modbus TCP Messaging Guide 2016

The relevant documents are available online at modbus www.modbus.org

Any exceptions to the general Modbus specification are described in this document.

The Güntner Communicator Module GCM (W)LAN provides access via the **Modbus TCP/IP** network protocol to the **G**üntner **M**otor **M**anagement (**GMM EC, GMM sincon, GMM step, GMM phasecut**) and **G**üntner **H**ybrid **M**anagement (**GHM spray, GHM pad, GHM pump**) parameters.

For detailed information about operating conditions and functions, please refer to the relevant manuals:this information is not covered by this document.

You can download this information from the Products/Controls area at www.guentner.eu.

A GCM (W)LAN establishes a connection to a GMM, a GHM or a combination of at most one GMM and one GHM.

The following requirements must be fulfilled for operation:

Control unit type	Control unit software version (min.)	GCM module type	GCM (W)LAN software version (min.)
GMM EC	044	GCM (W)LAN GMM EC.1, ERP No: 5206083	3.0.18
GMM sincon	007	GCM (W)LAN Rail.1, ERP No.: 5206123	3.0.18
GMM step	005	GCM (W)LAN Rail.1, ERP No.: 5206123	3.0.18
GMM phasecut	004	GCM (W)LAN Rail.1, ERP No.: 5206123	3.0.18
GHM spray	014	GCM (W)LAN Rail.1, ERP No.: 5206123	3.0.18
GHM Pad	011	GCM (W)LAN Rail.1, ERP No.: 5206123	3.0.18
GHM pump	003	GCM (W)LAN Rail.1, ERP No.: 5206123	3.0.18

3 Commissioning and configuration

For the exact commissioning and configuration of the module, please refer to the operating instructions of the GCM (W)LAN.

You can download this at: www.guentner.eu → Products/Controls

The basic configuration (IP address and port) can be made via the configuration interface using a web browser.

To operate the Modbus TCP server, a corresponding **IP address** of the GCM (W)LAN must be configured or automatically assigned. If necessary, contact your IT administrator.

By default, the Modbus TCP server is running on **port 502**.

In addition to the IP address and the port, the **unit ID** must also be addressed with the Modbus master for each device type. This is usually to be configured as slave ID with the CIlient (Modbus master).

The unit identifiers of the respective device types are listed below.

Device type	Unit ID (Slave Address)
GMM EC	1
GMM EC (HDU-Variante)	2
GMM sincon	3
GMM step	4
GMM phasecut	5
GHM spray	6
GHM pad	7
GHM pump	8

Example:

Parameters for a GMM EC are addressed under <IP-Address>, Port 502, Unit ID 1

Parameters for GHM spray will be addressed under <IP-Address>, Port 502, Unit ID 6

4 Data types

The Modbus Protocol defines 2 types of data: coils (single bits) and registers.

The GCM (W) LAN provides **only** registers, which can then be queried via a client (Modbus master).

Holding register as well as Input registers are provided.

Holding registers can be read and written. Input registers can only be read.

5 Commands

Read Holding Register (Function code 03h)

By using this function, the user can read a set of holding registers. According to the standard, the set of registers may be equal to or greater than 1, but with the condition that all addressed registers exist in the desired range. For example, if addresses 1 to 3 and 6 to 10 are defined, and the user tries to read addresses 1 to 10, an exception is generated.

Read Input Register (Function code 04h)

These functions provide the same functionality as the previous (Read Holding Registers). Likewise, a group of contiguous registers can be read here.

Write Simple Register (Function code 06h)

This function allows the user to write a value into a single holding register.

6 Exceptions

If the GCM (W) LAN can not process the command, it responds with an exception. The exception code then gives additional clues as to why the command could not be processed.

Illegal Function (1), if an incorrect function code has been selected.

Illegal Data Address (2), if an invalid register address has been sent.

Server Device Failure (4), if there is a timeout during communication with the controller.

7 Timeouts

The Timeout should be configured to approx. 2 seconds, since the processing is Up to 1.8 seconds.

8 Register GMM

8.1 Holding Register Overview

The following table provides an overview of all available Holding Register. These are explained in detail in the following chapters.

8.1.1 Control Value

Address: 53248 (decimal) / D000h (hexadecimal)

Format: 16 bit unsigned

Range: 0-100

With this parameter the control value can be set. The control value is the speed of the fans in the range from 0 – 100%. This parameter will only be processed, if the operating mode 4 (Slave Extern Bus) is used (see Operating mode, page 15).

Register	GMM Control value															
Address (hex)	D000h															
Value (format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Controls value (0-100)							

8.1.2 Operating mode

Address: 53249 (decimal) / D001h (hexadecimal)

Format: 16 bit unsigned

Range: 0-4

With this parameter the operating mode of the GMM will be programmed.
Following operating modes may be used, which can be set in the service menu.

⚠ CAUTION

The manual mode overrides the operating mode.

8.1.2.1 Automatic Internal

In this mode, control is determined automatically on the basis of the setpoint defined internally. This setpoint is entered in the setpoints menu option.

8.1.2.2 Automatic External analog

In this mode is automatically set to the externally signaled command value from the analog input. Which input delivers the setpoint and which input delivers the actual value is set in the IO configuration.

8.1.2.3 Automatic External Bus

In this mode, the setpoint is written via the Modbus. The controller uses the last setpoint transmitted if communication problems arise. The external setpoint is written to the controller's setpoint register. If the mode is changed in the service menu, the setpoint can be changed in the controller.

8.1.2.4 Slave external analogue

In this mode, there is no internal control. Instead the control value on the slave input is scaled and forwarded to the individual spraying steps. The particular analog input to be used as the slave input is defined in the I/O configuration.

8.1.2.5 Slave External Bus

In this mode the internal control is deactivated. All parameters can be changed, but only the external control value will be used for setting the motor speed.
If the external communication is interrupted, the control will use the programmed setpoint (only if the watchdog is activated).

The following modes are available:

Value	Operating mode
0	Automatic Internal
1	Automatic External analog
2	Automatic External BUS
3	Slave External analog
4	Slave External BUS

Register	Mode of operation															
Address (hex)	D001h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Operating mode (0-4)							

8.1.3 Control Parameter Kp1

Address: 53250 (decimal) / D002h (hexadecimal)

Format: 16 bit unsigned

Range: 0-1000

With this register the control parameter Kp1 is programmed which is used by the PID controller. (see Watchdog, page 23 , for normal and emergency operation).

If the external communication is interrupted, the control will use this value. The value has to be multiplied by 10 for precision purposes.

The default depends on the type of the heat exchanger.

The value range is 1 – 1000 (= 0,1 – 100,0)

Register	Control Parameter Kp1															
Address (hex)	D002h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Control Parameter Kp1 (0-1000)															

8.1.4 Control Parameter Ti1

Address: 53251 (decimal) / D003h (hexadecimal)

Format: 16 bit unsigned

Range: 0-1000

With this register the control parameter Ti1 is programmed which is used by the PID controller. (see Watchdog, page 23, for normal and emergency operation).

The default depends on the type of the heat exchanger. Setting the value to Ti1 = 0 will deactivate the “I” component.

The range is 0... 1000 (seconds)

Register	Control Parameter Ti1															
Address (hex)	D003h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Control Parameter Ti1 (0-1000)															

8.1.5 Control parameter Td1

Address: 53252 (decimal) / D004h (hexadecimal)

Format: 16 bit unsigned

Value range: 0-1000

This register is used to program control parameter Td1 for the PID controller. (See Watchdog, page 23 for more information about normal operation and emergency operation). This value is used only in connection with the internal PID controller (differential component). The default value will depend on the type of heat exchanger used. The value Td1 =0 deactivates the “D” component of the PID controller.

The valid range is 0... 1000 (seconds)

Register	GMM control parameter Td1															
Address (hex)	D004h															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Control parameter Td1 (0-1000)															

8.1.6 Setpoint 1

Address:	53257 (decimal) / D009h (hexadecimal)
Format:	16 bit signed
Range:	0-1000

With this register the setpoint 1 will be programmed, which is used for the internal regulation of the GMM. The interpretation of this value can be set in the service menu (pressure or temperature). Following data ranges are permitted:

Pressure:	0.0 ... 50.0 bar / 0....725 psig (only if the used refrigerant is set to „bar“)
Temperature:	-30.0 .... 100.0 °C / -22.0 °F ... 212.0 °F

The value has to be multiplied by 10 for precision purposes.

Register	Setpoint 1															
Address (hex)	D009h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Setpoint 1 (0-1000)															

8.1.7 Setpoint 2

Address:	53258 (decimal) / D00Ah (hexadecimal)
Format:	16 bit signed
Range:	0-1000

With this register the setpoint 2 will be programmed, which is used for the internal control of the GMM. The interpretation of this value can be set in the service menu (pressure or temperature). Following data ranges are allowed:

Pressure:	0.0 ... 50.0 bar / 0....725 psig (only if the used refrigerant is set to „bar“)
Temperature:	-30.0 .... 100.0 °C / -22.0 °F ... 212.0 °F

The value has to be multiplied by 10 for precision purposes.

Register	Setpoint 2															
Address (hex)	D00Ah															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Setpoint 2 (0-1000)															

8.1.8 Watchdog

Address: 53259 (decimal) / D00Bh (hexadecimal)

Format: 16 bit unsigned

Range: 0-250 [s]

With this parameter it is possible to program the watchdog time. If the Modbus communication is interrupted, then after the Watchdog time the internal PID controller will take over control. The time will be counted in seconds after the reception of the last modbus message. The value 0 deactivates the watchdog. This parameter is only configurable via Modbus and not in the service menu.

Register	GMM Watchdog															
Address (hex)	D00Bh															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Watchdog (0-250)							

8.1.9 Refrigerant

Address: 53260 (decimal) / D00Ch (hexadecimal)
Format: 16 bit unsigned
Value range: 0-10

This parameter defines the refrigerant used in the heat exchanger. GMM EC keeps a record of the characteristic curve for the refrigerant used. This allows a conversion to be made between pressure and temperature.

The following refrigerants* can be selected:

Value	Refrigerant	Value	Refrigerant
0	bar (no refrigerant)	13	R1270
1	R134a	14	R32
2	R290	15	R407A
3	R404A	16	R407F
4	R407C	17	R417A
5	R410A	18	R427A
6	R507	19	R448A
7	R717 (NH_3)	20	R449A
8	R723	21	R450A
9	R744 (CO_2)	22	R452A
10	R22	23	R513A
11	R1234yf	24	R600
12	R1234ze	25	R600a

**Refrigerants 11 to 25 are only available with GMM EC from Version 046*

Register	Refrigerant															
Address (hex)	D00Ch															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Refrigerant (0-10)							

Example: Refrigerant R507 is used in the heat exchanger of the Modbus subscriber 1:

8.1.10 Status manual mode

Address: 53264 (decimal) / D010h (hexadecimal)

Format: 16 bit unsigned

Range: 0-1

Setting this register to the value "1" activates the manual mode. If the manual mode is active, it is possible via the register "control value manual mode" the control value of the controller to set in the range from 0% to 100%. After writing this register with a 0, the manual mode is de-activated.

Register	Status manual mode															
Address (hex)	D010h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Status manual mode (0-1)							

8.1.11 Control value Manual mode

Address: 53265 (decimal) / D011h (hexadecimal)

Format: 16 bit unsigned

Range: 0-100 [%]

This register indicates which control value the GMM controller displayed when the manual mode is active.

Register	Control value Manual mode															
Address (hex)	D011h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Control value Manual mode (0-100)							

8.1.12 Status nightsetback

Address: 53272 (decimal) / D018h (hexadecimal)

Format: 16 bit unsigned

Range: 0-1

With this register the nightsetback function can be activated. A "1" activates the function. A "0" deactivate it again.

Register	Status nightsetback															
Address (hex)	D018h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Status nightsetback (0-1)							

8.1.13 Nightsetback limit

Address: 53273 (decimal) / D019h (hexadecimal)

Format: 16 bit unsigned

Range: 0-100 [%]

About the Programming of this register the limit of the nightsetback is set.

Register	Nightsetback limit															
Address (hex)	D019h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Nightsetback limit (0-100)							

8.1.14 Manual inverse operation

Only available at GMM EC!

Address: 53274 (decimal) / D01Ah (hexadecimal)

Format: 16 bit unsigned

Value range: 0-1

While manual operation is active it is possible to cycle the fans in the opposite direction to their preferred direction. You can program this register to turn this function on (1) or off (0).

Register	Manual inverse operation															
Address (hex)	D01Ah															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Manual inverse operation (0-1)							

8.1.15 Fancycling ON/OFF

Only available at GMM step (minimum firmware version V004a/b)!

Address: 53376 (decimal) / D080h (hexadecimal)
Format: 16 bit unsigned
Range: 0-1

With this parameter, the function fancycling can be switched ON or OFF

Register	Fancycling															
Address (hex)	D080															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Fancycling ON = 1, OFF = 0							

8.1.16 Hysteresis OFF

Only available at GMM step (minimum firmware version V004a/b)!

Address: 53377 (decimal) / D081h (hexadecimal)

Format: 16 bit unsigned

Range: 1-50%

With this parameter, the Hysteresis OFF (switch off from higher step to lower step) can be programmed.

Register	Hysteresis OFF															
Address (hex)	D081															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Value Hysteresis OFF							

8.2 Input Register Overview

8.2.1 Number of motors, steps, VFD´s, output stage

Address:	53504 (decimal) / D100h (hexadecimal)
Format:	16 bit unsigned
Range:	0-16 (GMM EC) 1-9 (GMM sincon, GMM step, GMM phasecut)

This register contains, depending on the controller type the following contents:

-the number of fans (EC motors) used in the GMM EC
-the number of VFD´s used in GMM sincon
-the number of steps used in GMM step
-the number of phasecut units used in GMM phasecut

The type of Motor-Control can be read from Input Register: “Type of Motorcontrol”

Register	GMM number of motors															
Address (hex)	D100h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Number of motors 0-16)							

8.2.2 Status of the digital inputs of the Controller

Address: 53505 (decimal) / D101h (hexadecimal)

Format: 16 bit unsigned

Range: 0-7

This register contains the status (low or high) of the three digital inputs of the Controller. A 1 means high level, a 0 means low level.

Register	Status of the digital inputs															
Address (hex)	D101h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	DI3	DI2	DI1

DI1..DI3 : Digital inputs of the Controller.

Example: The status of the digital inputs will be read from modbus member 1.

GMM Inputs	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	k.f.	DI3	DI2.	DI1
conncected (High)														x		x
not connected (Low)															x	

Register	Status of the digital inputs															
Address (hex)	D101h															
	High Byte								Low Byte							
Status Inputs (bin)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	H
Status Inputs (hex)	0				0				0				5			

DI1 = connected, DI2 = not connected and DI3 = connected

8.2.3 Function current input AI1

(4..20 mA)

Address: 53506 (decimal) / D102h (hexadecimal)

Format: 16 bit unsigned

Range: 0-7

This register contains the value which represents the function of the current input AI1. This function can be set in the service menu.

Register	Function current input															
Address (hex)	D102h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Function current input (0-7)							

Value	Function	Value	Function
0	no function	3	Setpoint 1
1	Actual value 0..25 bar	4	Setpoint 2
2	Control value slave	7	Actual value 0..40 bar

8.2.4 Raw value AI1

Address: 53507 (decimal) / D103h (hexadecimal)

Format: 16 bit unsigned

Range: 0-230

This register contains the raw value from analog inputAI1 . The analog input has a value of 0 and 23mA. The value is multiplied by 10 for reasons of precision.

Register	Raw value AI1															
Address (hex)	D103h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Raw value AI1 (0-230, multiplied by 10)							

8.2.5 Scaled value AI1

(depending on refrigerant)

Address:	53508 (decimal) / D104h (hexadecimal)
Format:	16 bit signed
Range:	-500 - 1000

This register contains the value of the analog input AI1. The interpretation of this value is controlled by the settings in the service menu.

The value range is as follows:

Pressure:	1.0 .. 50.0 bar (only if the used refrigerant is set to „bar“)
Temperature:	-50.0 .. 100.0°C

The value is multiplied by 10 for precision purposes.

Register	Scaled value AI1															
Address (hex)	D104h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value AI1 (-500 - 1000)															

8.2.6 Function current input AI2

(4..20 mA / KTY)

Address:	53509 (decimal) / D105h (hexadecimal)
Format:	16 bit unsigned
Range:	0-9

This register contains the value which represents the function of the current input AI2. This function can be set in the service menu.

Register	GMM function current input AI2															
Address (hex)	D105h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Function current input AI2 (0-9)							

Value	Function	Value	Function
0	no function	5	Ambient temperature -50..+50 °C [4..20 mA]
1	Actual value 0..25 bar [4..20 mA]	7	Actual value 0..40 bar [4..20 mA]

Value	Function	Value	Function
2	Control value slave [4..20 mA]	8	Actual value Temp -30..+70 °C [4..20 mA]
3	Setpoint 1 [4..20 mA]	9	Actual value GTF210 [KTY]
4	Setpoint 2 [4..20 mA]		

8.2.7 Raw value AI2

Address: 53510 (decimal) / D106h (hexadecimal)

Format: 16 bit unsigned

Range: 0-230

This register contains the raw value of the analog input AI2 of the GMM. The analog input has a value range of 0..23mA. The value is multiplied by 10 for precision purposes.

Register	GMM raw value AI2															
Address (hex)	D106h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Raw value AI2 (0-230)							

8.2.8 Scaled value AI2

(depending on refrigerant)

Address: 53511 (decimal) / D107h (hexadecimal)

Format: 16 bit signed

Range: -500 - 1000

This register contains the scaled value of the analog input AI2. The interpretation of this value is controlled by the settings in the service menu.

The value range is as follows:

Pressure: 1.0 .. 50.0 bar (only if the used refrigerant is set to „bar“)

Temperature: -50.0 .. 100.0°C

The value is multiplied by 10 for precision purposes.

Register	GMM scaled value AI2															
Address (hex)	D107h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value AI2 (-500 - 1000)															

8.2.9 Function Resistor Input AI3

Address: 53512 (decimal) / D108h (hexadecimal)

Format: 16 bit unsigned

Range: 0-9

This register contains the value which represents the function of the analog input AI3. This function can be changed in the service menu of the GMM.

Register	GMM Function Resistor Input AI3															
Address (hex)	D108h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Function Resistor Input AI3 (0-9)							

Value	Function
0	no function
5	Ambient temperature
9	Actual value GTF210

8.2.10 Scaled value AI3

(GTF210)

Address: 53513 (decimal) / D109h (hexadecimal)

Format: 16 bit signed

Range: -580 - 2120

This register contains the scaled value (using the temperature sensor GTF210) of the analog input AI3. The interpretation of this value is controlled by the settings in the service menu (Celsius or Fahrenheit). The temperature sensor measures in a range of -30 ° C to + 100 ° C. The value is multiplied by 10 for precision purposes.

Register	GMM scaled value AI3															
Address (hex)	D109h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value AI3 (-580 - 2120)															

8.2.11 Function Voltage Input AI4

(0..10 V)

Address: 53514 (decimal) / D10Ah (hexadecimal)

Format: 16 bit unsigned

Range: 0-6

This register contains the value which represents the function of the analog input AI4. This function can be changed in the service menu of the GMM.

Register	GMM Function Voltage Input AI4															
Address (hex)	D10Ah															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Function Voltage Input AI4 (0-6)							

Value	Function	Value	Function
0	no function	4	Setpoint 2
2	Control value slave	6	Actual value 0..10 V
3	Setpoint 1		

8.2.12 Raw value / Voltage input AI4

(0..10 V)

Address: 53515 (decimal) / D10Bh (hexadecimal)

Format: 16 bit unsigned

Range: 0-120

This register contains the raw value of the analog input AI4 . The value range of the analog input is 0..10V. The value is multiplied by 10 for precision purposes.

Register	Raw value AI4															
Address (hex)	D10Bh															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Raw value AI4 (0-120)							

8.2.13 Scaled value of AI4

Register address: 4106 (decimal) / 100Ah (hexadecimal)

Data type: 16 bit signed integer

The following table depicts possible measurements and their characteristics of the AI4 input.

Measurement	Unit		Value range SI input	Division factor	
	SI	IP		SI unit	IP unit
Humidity sensor	%	%	0-100	1	1
Pressure sensor down-stream of pump	bar	psig	0-6	10	1

This register contains the scaled value of the AI4 analogue input.

Register	Scaled value of AI4															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value of AI4															

8.2.14 Status manual mode

Address: 53517 (decimal) / D10Dh (hexadecimal)

Format: 16 bit unsigned

Range: 0-1

This register contains the status info of the manual mode.

Register	Status manual mode															
Address (hex)	D10Dh															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Status manual mode (0-1)							

Value	Function
1	Manual mode ON
0	Manual mode OFF

8.2.15 Control value manual mode

Address: 53518 (decimal) / D10Eh (hexadecimal)

Format: 16 bit unsigned

Range: 0-100

This register contains the control value of the manual mode in percent.

Register	Control value for manual operation															
Address (hex)	D10Eh															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Control value manual mode (0-100)							

8.2.16 Current Energie Consuption of one or all VFD

Address: 53520..53529 (decimal) / D110h..D119 (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 65535

These registers contain the current energy consumption of the fans of one Frequency converter (VFD) or of all.

D110h: Total energy consumption [W]

D111h..D119h: Single energy consumption [W], mit D111h = FU 1 .. D119h = FU 9

The register range depends on the number of connected fans.

Register	Current Energie Consuption of one or all VFD															
Address (hex)	D110h..D119h															
Value Format	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Current Energie Consuption (0..65535)															

8.2.17 Current Energie Consumption of one Motor or in total

Address: 53520..53536 (decimal) / D110h..D120 (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 65535

These registers include the performance of individual motor or the total performance of the GMM EC

D110h: Total energy consumption [W]

D111h..D120h: Performance of motor X [W], where applies D111 = motor 1 .. D120 = motor 16

The register range depends on the number of connected fans.

Register	Current Energie Consumption of one Motor or in total															
Address (hex)	D110 h..D120 h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Current Energie Consumption (0..65535)															

8.2.18 Current fanspeed

(in rpm)

Address: 53585..53600 (decimal) / D151h..D160h (hexadecimal)

Format: 16 bit unsigned

Range: 0-65535

These registers contain the current fan speed of the connected fans in rpm.

D151h = motor 1 .. D160h = motor 16

The register range depends on the number of connected fans.

Register	GMM current fanspeed															
Address (hex)	D151..D160															
'Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Current fanspeed															

8.2.19 Faults / alarms from GMM

Address: 53616 (decimal) / D170h (hexadecimal)

Format: 16 bit unsigned

Value range: 0-65535

This register contains information about the status of the GMM.

Error AI1: Fault at current input AI1

Error AI2: Fault at current input AI2

Error AI3: Fault at resistance input AI3

Error AI4: Fault at voltage input AI4

n.s. No sensor selected

HardwareErr: Device fault, ALL faulty

ECC Err No status word from EC controller

r.* Reserved for internal use

n.f. No function/free

Register	GMM faults/alarms															
Address (hex)	D170h															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	HW Err	ECC Err	r.*	n.f.	n.f.	n.f.	n.f.	n.f.	n.s.	n.f.	r.*	r.*	Err AI4	Err AI3	Err AI2	Err AI1

8.2.20 Errors/Alerts of EC Motors

Address : 53617..53632 (decimal) / D171h..D180h (hexadecimal)

Format. 16 bit unsigned

Range: 0-65535

These registers contain status information of the individual motors.

D171h : Motor 1 ... D180h : Motor 16

The depth of the register arrays depends on the number of connected motors.

Register	GMM Errors/Alerts GMM EC							
Adresse (hex)	D171 h..D180 h							
Wert (Format)	High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
GMM Fehler 0 = keinFehler 1 = Fehler	X	InputOV	InputUV	SKF	Under-Volt	OverVolt	Brake	IntTemp

Register	GMM Errors/Alerts GMM EC							
Address (hex)	D171 h..D180 h							
Value (Format)	Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
GMM Error 0 = no error 1 = error	Hallsen-sor	Wrong-Fan	MotBlock	CableBrk	FanFail	PowSup	ElecTemp	Mo-torTemp

InputOV: Input voltage too high

InputUV: Input voltage too low

SKF: Communication error between master and slave controller in the motor (power failure?)

UnderVolt: DC link undervoltage

OverVolt: DC link overvoltage

Brake: activated at external drive in reverse direction

IntTemp: internal temperature is too high

WrongFan: wrong fan or the VT-Number does not correspond to the system

MotBlock:	motor is blocked
CableBrk:	RS485 cable interrupted
FanFail:	General error, this bit is set at every error
PowSup:	power supply failure
ElecTemp:	electronic circuit temperature is too high
MotorTemp:	motor temperature is too high

8.2.21 Current Fanspeed as percentage of the maximum Speed

Address:	53633..53648 (decimal) / D181h..D190h (hexadecimal)
Format:	16 bit unsigned
Range:	0-100

These registers contain the current fan speed as percentage of the maximum speed.

D181h =	fan 1 ..
D190h =	fan 16

The register range depends on the number of connected motors.

Register	GMM Current Fanspeed as percentage of the Maximum Speed															
Address (hex)	D181 h..D190 h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Current Fanspeed as percentage							

8.2.22 Errors / Alarms / IO-state of the VFD

Address:	53644..53672 (decimal) / D1A0h..D1A8h (hexadecimal)
Format:	16 bit unsigned
Range:	0-65535

These registers contain information about the current status of the frequency converter.

D1A0h: VFD1
D1A1h: VFD2
D1A2h: VFD3
D1A3h: VFD4
D1A4h: VFD5
D1A5h: VFD6
D1A6h: VFD7
D1A7h: VFD8
D1A8h: VFD9

Register	Errors / Alarms / IO-state of the VFD															
Address (hex)	D1A0h..D1A8h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	ISD00	ISD01	ISD02	ISD03	OSD02	OSD01	OSD00	EN-PO	Errorcode of the FQ							

The Lowbyte contains the errorcode of the VFD.

Error Code	Description
01h	Collective Fault
02h	undervoltage, voltage off
03h	overcurrent
04h	overvoltage
05h	Ixlxt power of motor
06h	Ixt power of FQ
07h	overtemperature of FQ
08h	Error CAN-Bus in FQ detected
09h	CAN-Bus line break to FQ detected, FQ does not answer or has no power connection

The Highbyte contains the information of the digital inputs/outputs of the VFD.

High byte	Status of digital IO of VFD
Bit	Descriptino
0	State of digital input ENPO (Release) 1 = high level (+24 V) on input, VFD Release OK 0 = low level (0 V or open) on input, VFD not released
1	State of digital output OSD00 (VFD Operation) 1 = output level = +24 V, VFD in operation 0 = output level = 0 V, VFD not in operation
2	State of digital output OSD01 (VFD Thermal Protection Reset) 1 = output level = +24 V, Thermal Protection Reset active 0 = output level = 0 V, Thermal Protection Reset not active (on this output a short reset impulse will be given out)
3	State of digital output OSD02 (Threshold) 1 = output “normaly open” is closed 0 = output “normaly closed” is closed
4	State of the digital input ISD03 (not used) 1 = high level (+24 V) on input 0 = low level (0V or open) on input
5	State of the digital input ISD02 (Protection Devices) 1 = high level (+24 V) on input, Protection OK 0 = low level (0V or open) on input, Protection NOK

High byte	Status of digital IO of VFD
Bit	Descriptino
6	State of the digital input ISD01 (Thermal Monitoring Fan) 1 = high level (+24 V) on input, Thermal Protection OK 0 = low level (0V or open) on input, Thermal Protection NOK
7	State of the digital input ISD00 (Clockwise Rotating Field) 1 = high level (+24 V) on input, Rotating Field is Clockwise, OK 0 = low level (0V or open) on input, Rotating Field is not Clockwise, NOK

8.2.23 Operating hours per fan

Address: 53673..53688 (decimal) / D1A9h..D1B8h (hexadecimal)

Format: 16 bit unsigned

Range: 0-65535 [h]

These registers includes the operating hours of the EC fans.

D1A9h = fan 1 .. D1B8h = fan 16

The depth of the register arrays depends on the number of connected motors.

Register	Operating hours per fan															
Address (hex)	D1A9 h..D1B8 h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Operating hours per fan (0-65535)															

8.2.24 Current Setpoint (Info)

Address: 53696 (decimal) / D1C0h (hexadecimal)

Format: 16 bit

Rankge: 0...FFFFh, see details

Additional information on the "Current Setpoint" register can be found in this register.

Register	Current Setpoint (Info)															
Address (hex)	D1C0h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Fixpoint info / Division factor							

Low Byte: Fixpoint info / Division factor

Value with which the scaled value is multiplied, ie. Which is the value to divide the scaled value for the display.

Example:

Scaled value =	125 (see register Current Setpoint)
Division factor=	10
real value =	12.5

High Byte:

Bit 0:	Value configured/available: 0=NO, 1= YES
Bit 1:	Value in the valid range: 0=NO, 1=YES
Bit 2:	free
Bit 3:	free
Bit 7654:	Unit for display
0010 =	%
0011 =	bar
0100 =	psig
0101 =	°C
0110 =	°F
0111 =	mA
1000 =	V

8.2.25 Current Setponit (scaled)

Address:	53697 (decimal) / D1C1h (hexadecimal)
Format:	16 bit signed
Range:	-32768... 32767

In this register, the current scaled "Setpoint" is displayed. Additional information, e.g. Divisional factor or unit and validity can be found in the tab "Current Setpoint (Info)".

Register	Current Setpoint															
Address (hex)	D1C1h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Current Setpoint															

8.2.26 Current air volume as a percentage of the maximum air volume

Address:	53760 (decimal) / D200h (hexadecimal)
Format:	16 bit unsigned
Range:	0-100

Dieses Register beinhaltet das Luftvolumen in Prozent des Maximalluftvolumen.

Register	GMM air volume in % of maximum air volume															
Address (hex)	D200h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	current air volume							

8.2.27 Status of digital outputs of GMM

Address: 53761 (decimal) / D201h (hexadecimal)

Format: 16 bit unsigned

Range: bitwise

These registers include the status of the digital outputs of the GMM.

Register	Status of digital outputs of GMM															
Address (hex)	D201h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	D04	D03	D02	D01

DO1..DO4 : the digital outputs of the GMM

Example: The status of the digital outputs of the GMM is read from Modbus member 1.

GMM digital output (n.F. = no function)	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	D04	D03	D02	D01
contact x1/x2 connected (normaly closed)(L)													x	x		x
contact x1/x4 connected (normaly open) (H)															x	

Register	Status of digital outputs of GMM															
Address (hex)	D201															
	High byte								Low byte							
Status digital outputs (bin)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L
Status digital outputs (hex)	0				0				0				2			

8.2.28 Status of digital outputs of GIOD

(only available at GMM step!)

Address: 53764 (decimal) / D204h (hexadecimal)

Format: 16 bit unsigned

Range: bitwise

This register contains the status of the outputs of GIOD.

Register	Status of digital outputs of GIOD															
Address (hex)	D204h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	n.F.	D08	D07	D06	D05	D04	D03	D02	D01

DO1..DO8 : the digital outputs of the GIOD

Example: The state of the digital outputs will be read from modbus member 1.

GIOD outputs (n.F. = no function)	n.F	n.F	n.F	n.F	n.F	n.F	n.F	n.F	D08	D07	D06	D05	D04	D03	D02	D01
contact x3/x4 not connected (normaly open) (L)									x	x		x		x		
contact x3/x4 connected (H)											x		x		x	x

Register	Status of digital outputs of GIOD															
Address (hex)	D204h															
	High byte								Low byte							
Status outputs (bin)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	L	L	L	L	L	L	L	L	L	L	H	L	H	L	H	H
Status outputs (hex)	0				0				2				B			

8.2.29 Status of the digital inputs of GIOD

(only available at GMM step!)

Address: 53765 (decimal) / D205h (hexadecimal)

Format: 16 bit unsigned

Range: 0h-FFFFh

This register contains the state of the digital inputs of the GIOD.

Register	Status of the digital inputs of GIOD															
Address (hex)	D205h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
GIOD input	DI16	DI15	DI14	DI13	DI12	DI11	DI10	DI9	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1

DI1..DI16 : the digital inputs of the GIOD

Example: The state of the digital inputs will be read from modbus member 1.

GIOD input	DI16	DI15	DI14	DI13	DI12	DI11	DI10	DI9	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1
Input-voltage = +24V (H)								x					x	x	x	x
Input-voltage = 0 V or open (L)	x	x	x	x	x	x	x		x	x	x	x				

Register	Status of the digital inputs of GIOD															
Address (hex)	D205h															
	High byte								Low byte							

Register	Status of the digital inputs of GIOD															
Status input (bin)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	L	L	L	L	L	L	L	H	L	L	L	L	H	H	H	H
Status input (hex)	0				1				0				F			

8.2.30 Status Info GMM

Address: 53766 (decimal) / D206h (hexadecimal)

Format: 16 bit unsigned

Range: 0h-FFFFh

This register contains status information of the GMM controller. The following table represents an allocation of the bits of this register to the functions / messages of GMM controller.

Bit No.	Status Info GMM (High Byte)	Status Info GMM (Low Byte)
0	1 = setpoint 2 active	1 = emergency value is put out
1	1 = nightsetback active	1 = External bus module has logged on
2	0 = cooling, 1 = heating	1 = Operating message
3	1 = offset setpoint positive active	1 = Error message (PRIO 1 or PRIO 2)
4	1 = Maintenance run active	frei
5	1 = Invers operation active (only GMM EC)	frei
6	1 = fan from external active (only GMM EC)	frei
7	1 = threshold value exceeded (from GMM EC V042)	frei

Register	Status Info															
Address (hex)	D206h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Status Info (0h-FFFFh)															

9 Register GHM spray

9.1 Holding Register Overview

The following table provides an overview of all available Holding Register. These are explained in detail in the following chapters.

9.1.1 Control Value

Address: 53248 (decimal) / D000h (hexadecimal)

Format: 16 bit unsigned

Range: 0-100

With this parameter the control value can be set. The control value is the speed of the fans in the range from 0 – 100%. This parameter will only be processed, if the operating mode 4 (Slave Extern Bus) is used (see Operating mode, page 15).

Register	GMM Control value															
Address (hex)	D000h															
Value (format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Controls value (0-100)							

9.1.2 Operating mode

Address: 53249 (decimal) / D001h (hexadecimal)

Format: 16 bit unsigned

Range: 0-4

With this parameter the operating mode of the GMM will be programmed.
Following operating modes may be used, which can be set in the service menu.

⚠ CAUTION

The manual mode overrides the operating mode.

9.1.2.1 Automatic Internal

In this mode, control is determined automatically on the basis of the setpoint defined internally. This setpoint is entered in the setpoints menu option.

9.1.2.2 Automatic External analog

In this mode is automatically set to the externally signaled command value from the analog input. Which input delivers the setpoint and which input delivers the actual value is set in the IO configuration.

9.1.2.3 Automatic External Bus

In this mode, the setpoint is written via the Modbus. The controller uses the last setpoint transmitted if communication problems arise. The external setpoint is written to the controller's setpoint register. If the mode is changed in the service menu, the setpoint can be changed in the controller.

9.1.2.4 Slave external analogue

In this mode, there is no internal control. Instead the control value on the slave input is scaled and forwarded to the individual spraying steps. The particular analog input to be used as the slave input is defined in the I/O configuration.

9.1.2.5 Slave External Bus

In this mode the internal control is deactivated. All parameters can be changed, but only the external control value will be used for setting the motor speed.
If the external communication is interrupted, the control will use the programmed setpoint (only if the watchdog is activated).

The following modes are available:

Value	Operating mode
0	Automatic Internal
1	Automatic External analog
2	Automatic External BUS
3	Slave External analog
4	Slave External BUS

Register	Mode of operation															
Address (hex)	D001h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Operating mode (0-4)							

9.1.3 Refrigerant

Address: 53253 (decimal) / D005h (hexadecimal)
Format: 16 bit unsigned
Range: 0-10

By writing to the register, the refrigerant is changed in the GHM spray menu.

The following refrigerant are available:

Value	Refrigerant	Value	Refrigerant
0	bar (no refrigerant)	6	R507
1	R134a	7	R717 (NH3)
2	R290	8	R723
3	R404A	9	R744 (CO^2)
4	R407C	10	R22
5	R410A		

Register	Refrigerant															
Address (hex)	D005h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Refrigerant (0-10)							

9.1.4 Setpoint 1

Address: 53257 (decimal) / D009h (hexadecimal)
Format: 16 bit signed
Range: 0-1000

With this register the setpoint 1 will be programmed, which is used for the internal regulation of the GMM. The interpretation of this value can be set in the service menu (pressure or temperature). Following data ranges are permitted:

Pressure: 0.0 ... 50.0 bar / 0....725 psig (only if the used refrigerant is set to „bar“)
Temperature: -30.0 .... 100.0 °C / -22.0 °F ... 212.0 °F

The value has to be multiplied by 10 for precision purposes.

Register	Setpoint 1															
Address (hex)	D009h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Setpoint 1 (0-1000)															

9.1.5 Setpoint 2

Address:	53258 (decimal) / D00Ah (hexadecimal)
Format:	16 bit signed
Range:	0-1000

With this register the setpoint 2 will be programmed, which is used for the internal control of the GMM. The interpretation of this value can be set in the service menu (pressure or temperature). Following data ranges are allowed:

Pressure:	0.0 ... 50.0 bar / 0....725 psig (only if the used refrigerant is set to „bar“)
Temperature:	-30.0 .... 100.0 °C / -22.0 °F ... 212.0 °F

The value has to be multiplied by 10 for precision purposes.

Register	Setpoint 2															
Address (hex)	D00Ah															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Setpoint 2 (0-1000)															

9.1.6 Frost drain temperature

Address: 53273 (decimal) / D019h (hexadecimal)

Format: 16 bit unsigned

Value range: 5°C – 8°C if the SI system of units is specified
41°F – 46°Fif the IP system of units is specified

Writing to this register modifies the frost drain temperature.

Register	Frost drain temperature															
Address (hex)	D019h															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Frost drain temperature							

9.1.7 Ambient temperature threshold

Address: 53274 (decimal) / D01Ah (hexadecimal)

Format: 16 bit unsigned

Value range: 10.0°C – 45.0°C if the SI system of units is specified
48.0°F – 113.0°Fif the IP system of units is specified

Writing to this register modifies the threshold value for the ambient temperature. The value is multiplied by 10 for reasons of precision.

Register	Ambient temperature threshold															
Address (hex)	D01Ah															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Ambient temperature threshold * 10															

9.1.8 Hysteresis of the external temperature threshold

Address: 53275 (decimal) / D01Bh (hexadecimal)

Format: 16 bit unsigned

Value range: 0.1 K – 3.0 K if the SI system of units is specified
0.1°F – 5.4°Fif the IP system of units is specified

Writing to this register modifies the hysteresis of the external temperature threshold. The value is multiplied by 10 for reasons of precision.

Register	Hysteresis of the external temperature threshold															
Address (hex)	D01Bh															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Hysteresis *10							

9.1.9 Downtime

Address: 53276 (decimal) / D01Ch (hexadecimal)

Format: 16 bit unsigned

Range: 1 Std. - 150 Std.

By writing in the register, the downtime is changed.

Register	Downtime															
Address (hex)	D01Ch															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Downtime (1-150)							

9.1.10 Manual mode

Address: 53289 (decimal) / D029h (hexadecimal)

Format: 16 bit unsigned

Range: see following table

Value	Description	Value	Description
Value range in professional system:			
0	Manual mode OFF	4	Manual mode valve draining
2	Manual mode control value:	5	Manual mode valve switching
3	Manual mode section		
Value range in basic system:			
0	Manual mode OFF	4	Manual mode draining
1	Manual mode spraying	5	Manual mode valve switching

By writing in the register of the manual mode is changed.

Register	Manual mode															
Address (hex)	D029h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Manual mode							

9.1.11 Manual mode control value

Only available in the professional system.

Address: 53290 (decimal) / D02Ah (hexadecimal)

Format: 16 bit unsigned

Value range: 0-100

Writing to this register modifies the control value for manual operation. This allows you to enable spraying for the various stages. This setting can take effect only if manual mode is programmed for “manual mode via control value”.

Register	Manual mode control value															
Address (hex)	D02Ah															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Manual mode control value							

9.1.12 Manual mode spraying:

(only in the basic system)

Address: 53295 (decimal) / D02Fh (hexadecimal)

Format: 16 bit unsigned

Value range: 0 – Spraying off, 1 – Spraying on

By writing to this register you can switch spraying on or off. Spraying is controlled by DO3 on the GHM spray controller. This setting can take effect only if manual mode is programmed for “manual mode spraying”.

Register	Manual mode spraying:															
Address (hex)	D02Fh															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Manual mode spraying (0, 1)							

9.1.13 Manual mode draining

Address: 53296 (decimal) / D030h (hexadecimal)

Format: 16 bit unsigned

Value range: 0 – Draining off, 3 – Draining on

By writing to this register you can switch draining on or off. This setting can take effect only if manual mode is programmed for “manual mode draining”.

Register	Manual mode draining															
Address (hex)	D030h															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Manual mode draining (0, 3)							

9.1.14 Speed threshold

Address: 53297 (decimal) / D031h (hexadecimal)

Format: 16 bit unsigned

Value range: 1-100

By writing to this register you can set up the fan speed from which spraying is enabled. This function is available only in combination with a GMM. If there is currently no bus communication to a GMM, the GHM is enabled by setting a high level on DI2.

Register	Speed threshold															
Address (hex)	D031h															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Speed threshold (1-100)							

9.1.15 Speed hysteresis

Address: 53298 (decimal) / D032h (hexadecimal)

Format: 16 bit unsigned

Value range: 1-80

By writing to this register you set up the hysteresis that is responsible for enabling spraying according to the fan speed. This function is available only in combination with a GMM.

Register	Speed hysteresis															
Address (hex)	D032h															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Speed hysteresis (1-80)							

9.2 Input Register Overview

9.2.1 Status of digital inputs

Address: 53530 (decimal) / D11Ah (hexadecimal)
Format: 16 bit unsigned
Range: 0,1

Allocation table			
Bit - number	0	1	2
DI - number	1	2	3
Bit = High → DI = High			

This register contains the information concerning the status of the digital inputs at GHM.

Register	Status of digital inputs															
Address (hex)	D11Ah															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Status of digital inputs (0-1)							

9.2.2 Status of digital outputs

Address: 53531 (decimal) / D11Bh (hexadecimal)
Format: 16 bit unsigned
Range: 0,1

Allocation table				
Bit - number	0	1	2	4
DO - number	1	2	3	4
Bit = High → DO = High				

Dieses Register beinhaltet die Information über den Zustand der digitalen Ausgänge

Register	Status of digital outputs															
Address (hex)	D11Bh															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Status of digital outputs (0-1)							

9.2.3 Raw value analog input AI1

Address: 53532 (decimal) / D11Ch (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 200

This register contains information about the raw value of the analog input AI1. The value is multiplied for accuracy by 10.

Register	Raw value analog input AI1															
Address (hex)	D11Ch															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Raw value AI1 (0-200)							

9.2.4 Scaled value of analog input AI1

Address: 53533 (decimal) / D11Dh (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 100

This register contains the information on the scaled value of the analog input AI1.

Register	Scaled value AI1															
Address (hex)	D11Dh															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Scaled value AI1 (0-100)							

9.2.5 Raw value analog input AI2

Address: 53534 (decimal) / D11Eh (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 200

This register contains information about the raw value of the analog input AI2. The value is multiplied for accuracy by 10.

Register	Raw value analog input AI2															
Address (hex)	D11Eh															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Raw value AI2 (0-200)							

9.2.6 Scaled value of analog input AI2

Address: 53535 (decimal) / D11Fh (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 2100

This register contains the information on the scaled value of the analog input AI2.

Register	Scaled value AI2															
Address (hex)	D11Fh															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value AI2 (0-2100)															

9.2.7 Scaled value of the analogue input AI3

Address: 53537 (decimal) / D121h (hexadecimal)

Format: 16 bit unsigned

Value range: From -300 to +700

This register contains the scaled value of input AI3 calculated according to the characteristic curve of the temperature sensor GTF210. The interpretation of the value is affected by the settings in the Service menu (Celsius or Fahrenheit). The temperature sensor measures over the range -30°C to +100°C. The value is multiplied by 10 for reasons of precision.

Register	Scaled value of AI3															
Address (hex)	D121h															
Value (Format)	Low byte								High byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value of AI3 (from -300 to 700)															

9.2.8 Raw value analog input AI4

Address: 53538 (decimal) / D122h (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 120

This register contains information about the raw value of the analog input AI4. The value is multiplied for accuracy by 10.

Register	Raw value analog input AI4															
Address (hex)	D122h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Raw value AI4 (0-120)							

9.2.9 Scaled value of the analogue input AI4

Address: 53539 (decimal) / D123h (hexadecimal)

Format: 16 bit unsigned

Value range: From -300 to +780, if AI4 records the external temperature
0 – 100, if AI4 is configured as a slave control value

This register contains information about the scaled value of the analogue input AI4. When AI4 records the external temperature the value is multiplied by 10 for reasons of precision.

Register	Scaled value of AI4															
Address (hex)	D123h															
Value (Format)	Low byte								High byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value of AI4 (-300 to +780), (0-100)															

9.2.10 Raw value analog output AO1

Address: 53540 (decimal) / D124h (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 100

This register contains information about the raw value of the analog output AO1. The value is multiplied for accuracy by 10.

Register	Raw value analog output AO1															
Address (hex)	D124h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Raw value AO1 (0-100)							

9.2.11 Raw value analog output AO2

Address: 53541 (decimal) / D125h (hexadecimal)

Format: 16 bit unsigned

Range: 0-100

This register contains information about the raw value of the analog output AO2. The value is multiplied for accuracy by 10.

Register	Raw value analog output AO2															
Address (hex)	D125h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Raw value AO2 (0-100)							

9.2.12 GHM control value

Address: 53542 (decimal) / D126h (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 100

This register contains the information concerning the GHM control value.

Register	GHM control value															
Address (hex)	D126h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	GHM control value (0-100)							

9.2.13 Actual values

Address: 53552 (decimal) / D130h (hexadecimal)

Format: 16 bit signed

Range: -32768... 32767

This register shows the current actual value.
The value is multiplied by 10 for accuracy.

Register	Actual values															
Address (hex)	D130h															
Value (Format)	High Byte								Low Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Actual values															

10 Register GHM pad

10.1 Holding Register Overview

The following table provides an overview of all available Holding Register. These are explained in detail in the following chapters.

10.1.1 Storage period

Address: 53251 (decimal) / D003h (hexadecimal)

Format: 16 bit unsigned

Value range: 1-40

Writing to this register modifies the “storage period” on the GHM pad. After the specified storage period, the drain valve is opened automatically and the system is drained.

Register	Storage period															
Address (hex)	D003h															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Storage period (1-40)							

10.1.2 Draining – external temperature

Address: 53252 (decimal) / D004h (hexadecimal)

Format: 16 bit unsigned

Value range: 5 – 15 if the SI system of units is specified
41 – 59 if the IP system of units is specified

Writing to this register modifies the parameter “external temperature” on the GHM pad. If the temperature falls below the specified temperature the system is drained to prevent freezing.

Register	External temperature															
Address (hex)	D004h															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	External temperature (5-15) External temperature (41-59)							

10.1.3 Wetting – ambient temperature

Address: 53253 (decimal) / D005h (hexadecimal)

Format: 16 bit unsigned

Value range: 15 – 45 if the SI system of units is specified
59 – 113 if the IP system of units is specified

Writing to this register modifies the parameter “external temperature” on the GHM pad. When the specified temperature is exceed the system will begin humidification.

Register	External temperature															
Address (hex)	D005h															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	External temperature (15-45) External temperature (59-113)							

10.1.4 Fan control value for starting humidification

Address: 53256 (decimal) / D008h (hexadecimal)

Format: 16 bit unsigned

Value range: 20-98

This parameter defines the fan control value threshold for starting humidification. Humidification of the pads starts as soon as the fan control value has reached this threshold and the external temperature is sufficiently high.

Register	Fan control value for starting humidification															
Address (hex)	D008h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Fan control value for starting humidification (20-98)															

10.1.5 Fan control value for stopping humidification

Address: 53257 (decimal) / D009h (hexadecimal)

Format: 16 bit unsigned

Value range: 10- (fan control value for starting humidification – 10)

This parameter defines the fan control value threshold for stopping humidification. As soon as the fan control value falls below this threshold, humidification of the pads stops.

Register	Fan control value for stopping humidification															
Address (hex)	D009h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Fan control value for stopping humidification (see value range)															

10.1.6 Water costs

Address: 53263 (decimal) / D00Fh (hexadecimal)
Format: 16 bit unsigned
Value range: 1-5000
Division factor: 100

If efficiency mode is activated, the water costs are required for calculating the cost efficiency. The water costs can be defined via this register.

Register	Water costs															
Address (hex)	D00Fh															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Water costs (1-5000)															

10.1.7 Electricity costs

Address: 53264 (decimal) / D010h (hexadecimal)
Format: 16 bit unsigned
Value range: 1-5000
Division factor: 100

If efficiency mode is activated, the electricity costs are required for calculating the cost efficiency. The electricity costs can be defined via this register.

Register	Electricity costs															
Address (hex)	D010h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Electricity costs (1-5000)															

10.1.8 Efficiency mode

Address: 53269 (decimal) / D015h (hexadecimal)
Format: 8 bit unsigned
Value range: see below

Efficiency mode is enabled and disabled via this register.

Value	Meaning
0	Efficiency mode disabled
1	Efficiency mode enabled

Register	Efficiency mode															
Address (hex)	D015h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Efficiency mode (0,1)							

10.1.9 Fan control value for transition to full load mode

Address: 53270 (decimal) / D016h (hexadecimal)

Format: 16 bit unsigned

Value range: 40-100

The fan control value threshold from which the system transitions to full load mode is defined via this register.

Register	Fan control value for transition to full load mode															
Address (hex)	D016h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Fan control value for transition to full load mode (40-100)															

10.1.10 Manual mode: Mode

Address: 53271 (decimal) / D017h (hexadecimal)

Format: 8 bit unsigned

Value range: see below

Manual operation mode is enabled and disabled via this register.

Value	Meaning
0	Manual mode disabled
1	Manual mode enabled

Register	Manual mode: Mode															
Address (hex)	D017h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Manual mode (0,1)							

10.1.11 Manual mode: Control value for humidification valve

Address: 53272 (decimal) / D018h (hexadecimal)
Format: 16 bit unsigned
Value range: 0-100
Division factor: 10

When manual mode is activated, the control value for the humidification valve can be defined via this register.

Register	Manual mode: Control value for humidification valve															
Address (hex)	D018h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Manual mode: Control value for humidification valve (0-100)															

10.1.12 Manual mode: Drain

Address: 53273 (decimal) / D019h (hexadecimal)
Format: 16 bit unsigned
Value range: see below

When manual mode is activated, drainage can be activated or deactivated via this register.

Register	Manual mode: Drain															
Address (hex)	D019h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Manual mode drainage (0,1)															

10.2 Input Register Overview

10.2.1 Status of digital inputs

Address: 53520 (decimal) / D110h (hexadecimal)
Format: 16 bit unsigned
Range: 0,1

Allocation table			
Bit - number	0	1	2
DI - number	1	2	3
Bit = High → DI = High			

This register contains the information concerning the status of the digital inputs at GHM.

Register	Status of digital inputs															
Address (hex)	D110h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Status of digital inputs (0-1)							

Example: the status of digital inputs is read.

10.2.2 Status of digital outputs

Address: 53521 (decimal) / D111h (hexadecimal)
Format: 16 bit unsigned
Range: 0,1

Allocation table				
Bit - number	0	1	2	4
DO - number	1	2	3	4
Bit = High → DO = High				

Dieses Register beinhaltet die Information über den Zustand der digitalen Ausgänge

Register	Status of digital outputs															
Address (hex)	D111h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Status of digital outputs (0-1)							

10.2.3 Raw value analog input AI1

Address: 53522 (decimal) / D112h (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 200

This register contains information about the raw value of the analog input AI1. The value is multiplied for accuracy by 10.

Register	Raw value analog input AI1															
Address (hex)	D112h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Raw value AI1 (0-200)															

10.2.4 Raw value analog input AI2

Address: 53523 (decimal) / D113h (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 200

This register contains information about the raw value of the analog input AI2. The value is multiplied for accuracy by 10.

Register	Raw value analog input AI2															
Address (hex)	D113h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Raw value AI2 (0-200)															

10.2.5 Raw value analog input AI4

Address: 53524 (decimal) / D114h (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 120

This register contains information about the raw value of the analog input AI4. The value is multiplied for accuracy by 10.

Register	Raw value analog input AI4															
Address (hex)	D114h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Raw value AI4 (0-120)															

10.2.6 Scale value analog input AI1

Address : 53525 (decimal) / D115h (hexadecimal)

Format: 16 bit unsigned

Range: from -350 to +750 bei eingestelltem Einheitensystem SI
from -310 to +1670 bei eingestelltem Einheitensystem IP

This register contains the information on the scaled value of the analog input AI1. The value is multiplied for accuracy by 10.

Register	Scaled value AI1															
Address (hex)	D115h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value AI1 (from -350 to +750) or (from -310 to +1670)															

10.2.7 Scale value analog input AI2

Address: 53526 (decimal) / D116h (hexadecimal)

Format: 16 bit unsigned

Range: 0 - 100

This register contains the information on the scaled value of the analog input AI2.

Register	Scaled value AI2															
Address (hex)	D116h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value AI2 (0-100)															

10.2.8 Scale value analog input AI3

Address:	53527 (decimal) / D117h (hexadecimal)
Format:	16 bit unsigned
Range:	no function

The input AI3 is currently without function.

10.2.9 Scale value analog input AI4

Address: 53528 (decimal) / D118h (hexadecimal)
Format: 16 bit unsigned
Range: 0-100

This register contains the information on the scaled value of the analog input AI2.

Register	Scaled value AI4															
Address (hex)	D118h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value AI4 (0-100)															

10.2.10 Raw value analog output AO1

Address: 53529 (decimal) / D119h (hexadecimal)
Format: 16 bit unsigned
Range: 0 - 100

This register contains information about the raw value of the analog output AO1. The value is multiplied for accuracy by 10.

Register	Raw value analog output AO1															
Address (hex)	D119h															
Value (Format)	Low Byte								High Byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Raw value AO1 (0-100)															

10.2.11 Raw value analog output AO2

Address: 53530 (decimal) / D11Ah (hexadecimal)
Format: 16 bit unsigned
Range: no function

The output AO2 is currently without function.

10.2.12 Calculated water volume

Address: 53536 (decimal) / D120h (hexadecimal)
Format: 16 bit unsigned
Value range: 0-65535
Division factor: 10

The register represents the current water volume calculated by the controller.

Register	Calculated water volume															
Address (hex)	D120h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Calculated water volume (0-65535)															

10.2.13 Recorded water flow

Address: 53537 (decimal) / D121h (hexadecimal)
Format: 16 bit unsigned
Value range: 0-65535
Division factor: 10

The register represents the currently recorded water flow for the system.

Register	Recorded water flow															
Address (hex)	D121h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Calculated water volume (0-65535)															

10.2.14 Status info 1

Address: 53538 (decimal) / D122h (hexadecimal)
Format: 16 bit bit field
Value range: see below

This parameter contains the current status information for the GHM pad. The information in this register is defined in bits. This means that an event or error is assigned to every bit in this register. The assignment is depicted in the next table. If a bit switches its status from 0 to 1, this indicates that an event or error exists. If the error is eliminated or if the event no longer exists, the associated bit is reset to 0.

Bit No.	Meaning	Bit No.	Meaning
0	Humidification is active	8	Error sensor AI1
1	Drainage is active	9	Error sensor AI2
2	Frost protection is active	10	Error sensor AI3 *(not possible at present)*
3	H2O base value not reached	11	Error sensor AI4
4	Manual mode active	12	Hydraulics NOK
5	Free	13	Air supply NOK
6	Warning (PRIO 2 error)	14	Free
7	Fault (PRIO 1 error)	15	Free

Register	Status info 1															
Address (hex)	D122h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Status info 1															

10.2.15 Status info 2

Address: 53539 (decimal) / D123h (hexadecimal)

Format: 8 bit bit field

Value range: see below

This parameter contains the current status information for the GHM pad. The information in this register is defined in bits. This means that an event or error is assigned to every bit in this register. The assignment is depicted in the next table. If a bit switches its status from 0 to 1, this indicates that an event or error exists. If the error is eliminated or if the event no longer exists, the associated bit is reset to 0.

Bit No.	Meaning
0	Maximum number of humidification hours exceeded
1	Maximum number of humidification months exceeded
2	Pre-warning: A service call-out is required after xx hours or xx months
3	Free
4	Free
5	Free
6	Free
7	Free

Register	Status info 2															
Address (hex)	D123h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Status info 2															

10.2.16 Absolute operating hours

Address: 53540 (decimal) / D124h (hexadecimal)

Format: 16 bit unsigned

Value range: 0 – 65535

This register contains the absolute number of operating hours for the system in a humidification state since initial commissioning.

Register	Absolute Operating hours															
Address (hex)	D124h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Absolute operating hours (0-65535)															

10.2.17 Relative operating hours

Address: 53542 (decimal) / D126h (hexadecimal)

Format: 16 bit unsigned

Value range: 0 – 65535

This register contains the relative number of operating hours for the system in a humidification state. Relative operating hours can be reset via the menu of the GHM pad controller.

Register	Relative Operating hours															
Address (hex)	D126h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Relative operating hours (0-65535)															

10.2.18 Counter status for water consumption

Address: 53544 (decimal) / D128h (hexadecimal)

Format: 16 bit unsigned

Value range: 0 – 65535

This register contains the counter status for the water consumed by the system.

Register	Counter status Water consumption															
Address (hex)	D128h															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Counter status for water consumption (0-65535)															

10.2.19 Basic water value

Address:	53546 (decimal) / D12Ah (hexadecimal)
Format:	16 bit unsigned
Value range:	0 – 65535
Division factor:	10

This register contains the basic water value. The basic water value forms one basis for determining the calculated water volume.

Register	Water basic value															
Address (hex)	D12Ah															
Value (format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Basic water value (0-65535)															

11 Register GHM pump

11.1 Holding Register Overview

The following table provides an overview of all available Holding Register. These are explained in detail in the following chapters.

11.1.1 Fan control value pump 1 start

Register address:	13 (decimal) / 0Dh (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	%
Value range:	0-100
Division factor:	1

This parameter defines the threshold for the fan control value. As soon as the fan control value has reached this threshold, the first pump starts.

Register	Fan control value pump 1 start															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Fan control value pump 1 start							

11.1.2 Fan control value pump 2 start

Register address:	14 (decimal) / 0Eh (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	%
Value range:	0-100
Division factor:	1

This parameter defines the threshold for the fan control value. As soon as the fan control value has reached this threshold, the second pump starts.

Register	Fan control value pump 2 start															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Fan control value pump 2 start							

11.1.3 Fan control value pump 1 stop

Register address:	15 (decimal) / 0Fh (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	%
Value range:	0-100
Division factor:	1

This parameter defines the threshold for the fan control value. As soon as the fan control value does not reach this threshold, the first pump stops.

Register	Fan control value pump 1 stop															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Fan control value pump 1 stop							

11.1.4 Fan control value pump 2 stop

Register address:	16 (decimal) / 10h (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	%
Value range:	0-100
Division factor:	1

This parameter defines the threshold for the fan control value. As soon as the fan control value does not reach this threshold, the second pump stops.

Register	Fan control value pump 2 stop															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Fan control value pump 2 stop							

11.1.5 Setpoint deviation pump 1 start

Register address:	17 (decimal) / 11h (hexadecimal)
Data type:	16 bit signed integer
Unit:	SI unit: K / bar; IP unit: °F / psig
Value range:	-25 K / -10 bar – 25 K / 10 bar
Division factor:	1 for IP unit psig, otherwise 10

The setpoint deviation is the deviation between the currently defined setpoint and the temperature or pressure of the medium. The first pump is activated as soon as the following criterion is fulfilled: “Actual value ≥ Setpoint + Setpoint deviation“.

Register	Setpoint deviation pump 1 start															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Setpoint deviation pump 1 start															

11.1.6 Setpoint deviation pump 2 start

Register address:	18 (decimal) / 12h (hexadecimal)
Data type:	16 bit signed integer
Unit:	SI unit: K / bar; IP unit: °F / psig
Value range:	-25 K / -10 bar – 25 K / 10 bar
Division factor:	1 for IP unit psig, otherwise 10

The setpoint deviation is the deviation between the currently defined setpoint and the temperature or pressure of the medium. The second pump is activated as soon as the following criterion is fulfilled: “Actual value ≥ Setpoint + Setpoint deviation“.

Register	Setpoint deviation pump 2 start															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Setpoint deviation pump 2 start															

11.1.7 Setpoint deviation pump 1 stop

Register address:	19 (decimal) / 13h (hexadecimal)
Data type:	16 bit signed integer
Unit:	SI unit: K / bar; IP unit: °F / psig
Value range:	-25 K / -10 bar – 25 K / 10 bar
Division factor:	1 for IP unit psig, otherwise 10

The setpoint deviation is the deviation between the currently defined setpoint and the temperature or pressure of the medium. The second pump is deactivated as soon as the following criterion is fulfilled: “Actual value ≤ Setpoint + Setpoint deviation“.

Register	Setpoint deviation pump 1 stop															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Setpoint deviation pump 1 stop															

11.1.8 Setpoint deviation pump 2 stop

Register address:	20 (decimal) / 14h (hexadecimal)
Data type:	16 bit signed integer
Unit:	SI unit: K / bar; IP unit: °F / psig
Value range:	-25 K / -10 bar – 25 K / 10 bar
Division factor:	1 for IP unit psig, otherwise 10

The setpoint deviation is the deviation between the currently defined setpoint and the temperature or pressure of the medium. The second pump is deactivated as soon as the following criterion is fulfilled: “Actual value ≤ Setpoint + Setpoint deviation“.

Register	Setpoint deviation pump 2 stop															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Setpoint deviation pump 2 stop															

11.1.9 Frost drain ambient temperature

Register address:	21 (decimal) / 15h (hexadecimal)
Data type:	16 bit signed integer
Unit:	SI unit: °C; IP unit: °F
Value range:	-20 – 40 [°C]
Division factor:	10

The frost drain ambient temperature represents the threshold for the external temperature. When the ambient temperature drops to the threshold defined here, the tray is drained.

Register	Frost drain ambient temperature															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Frost drain ambient temperature															

11.1.10 Filling ambient temperature

Register address:	22 (decimal) / 16h (hexadecimal)
Data type:	16 bit signed integer
Unit:	SI unit: °C; IP unit: °F
Value range:	-20 – 40 [°C]
Division factor:	10

To switch from dry to wet operation and to fill the tray with water, the filling threshold defined here should be reached by the ambient temperature.

Register	Filling ambient temperature															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Filling ambient temperature															

11.1.11 Filling fan control value

Register address:	23 (decimal) / 17h (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	%
Value range:	0-100
Division factor:	1

To switch from dry to wet operation and to fill the tray with water, the filling threshold defined here should be reached by the fan control value.

Register	Filling fan control value															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Filling fan control value															

11.1.12 Manual mode

Register address:	24 (decimal) / 18h (hexadecimal)
Data type:	8 bit enum
Unit:	n/a
Value range:	see below
Division factor:	n/a

The parameter defines the mode for manual operation. The following manual modes are available.

Value	Meaning
0	Manual mode is deactivated
1	Direct access Specific components of the GHM pump can be activated independently of the control panel in “direct access” manual mode. When direct access is activated, all ongoing processes are stopped.
2	Function Different commands can be delegated to the GHM in "function” manual mode. A command received is executed as quickly as possible by the controller, with normal controlled operation not being interrupted.

Register	Manual mode															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Manual mode							

11.1.13 Manual mode Feedwater valve

Register address:	25 (decimal) / 19h (hexadecimal)
Data type:	bool
Unit:	n/a
Value range:	see below
Division factor:	n/a

The manual mode parameter for the Feedwater valve allows the water inlet valve to be controlled in direct manual mode independently of the control system.

Value	Meaning
0	Feedwater valve closed
1	Feedwater valve open

Register	Manual mode Feedwater valve															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.14 Manual mode make-up water valve

Register address:	26 (decimal) / 1Ah (hexadecimal)
Data type:	bool
Unit:	n/a
Value range:	see below
Division factor:	n/a

The manual mode parameter for the make-up water valve allows the make-up water valve to be controlled in direct manual mode independently of the control system.

Value	Meaning
0	Make-up water valve closed
1	Make-up water valve open

Register	Manual mode make-up water valve															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.15 Manual mode blowdown valve

Register address:	27 (decimal) / 1Bh (hexadecimal)
Data type:	bool
Unit:	n/a
Value range:	see below
Division factor:	n/a

The manual mode parameter for the blowdown valve allows the blowdown valve to be controlled in direct manual mode independently of the control system.

Value	Meaning
0	Blowdown valve closed
1	Blowdown valve open

Register	Manual mode blowdown valve															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.16 Manual mode pump 1 uncontrolled

Register address:	28 (decimal) / 1Ch (hexadecimal)
Data type:	bool
Unit:	n/a
Value range:	see below
Division factor:	n/a

The parameter 'manual mode pump 1 uncontrolled' allows the first pump to be controlled in direct manual mode independently of the control system.

Value	Meaning
0	Pump 1 switched off
1	Pump 1 switched on

Register	Manual mode pump 1 uncontrolled															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.17 Manual mode pump 2 uncontrolled

Register address:	29 (decimal) / 1Dh (hexadecimal)
Data type:	bool
Unit:	n/a
Value range:	see below
Division factor:	n/a

The parameter 'manual mode pump 2 uncontrolled' allows the second pump to be controlled in direct manual mode independently of the control system.

Value	Meaning
0	Pump 2 switched off
1	Pump 2 switched on

Register	Manual mode pump 2 uncontrolled															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.18 Manual mode pump controlled

Register address:	30 (decimal) / 1Eh (hexadecimal)
Data type:	bool
Unit:	%
Value range:	0-100
Division factor:	n/a

The parameter 'manual mode pump controlled' allows the control value for the controlled pump to be pre-set in direct mode.

Register	Manual mode pump controlled															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Manual mode pump controlled							

11.1.19 Manual mode Basin heater

Register address:	31 (decimal) / 1Fh (hexadecimal)
Data type:	bool
Unit:	n/a
Value range:	see below
Division factor:	n/a

The manual mode parameter for Basin heater allows the tray heating to be controlled in direct manual mode independently of the control system.

Value	Meaning
0	Basin heater switched off
1	Basin heater switched on

Register	Manual mode Basin heater															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.20 Manual mode Trace heater

Register address:	32 (decimal) / 20h (hexadecimal)
Data type:	bool
Unit:	n/a
Value range:	see below
Division factor:	n/a

The manual mode parameter for Trace heater allows the Trace heater to be controlled in direct manual mode independently of the control system.

Value	Meaning
0	Trace heater switched off
1	Trace heater switched on

Register	Manual mode Trace heater															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.21 Manual mode biocide unit

Register address:	33 (decimal) / 21h (hexadecimal)
Data type:	bool
Unit:	n/a
Value range:	see below
Division factor:	n/a

The manual mode parameter for the biocide unit allows the biocide unit to be controlled in direct manual mode independently of the control system.

Value	Meaning
0	Biocide unit switched off
1	Biocide unit switched on

Register	Manual mode biocide unit															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.22 Manual mode UV sterilisation lamps

Register address:	34 (decimal) / 22h (hexadecimal)
Data type:	bool
Unit:	n/a
Value range:	see below
Division factor:	n/a

The manual mode parameter for UV lamps allows the UV lamps to be controlled in direct manual mode independently of the control system.

Value	Meaning
0	UV lamps switched off
1	UV lamps switched on

Register	Manual mode UV sterilisation lamps															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.23 External pump control

Register address:	35 (decimal) / 23h (hexadecimal)
Data type:	bool
Unit:	n/a
Value range:	see below
Division factor:	n/a

The Modbus interface of the GHM pump allows control of the pump to be taken over via Modbus. Pump control is enabled via the external pump control parameter so that the pump output can be pre-set via Modbus. The pump output pre-set via Modbus is only transferred to the GHM pump however if it is ready for wetting.

Value	Meaning
0	External pump control deactivated
1	External pump control activated

Register	External pump control															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.24 External pump activation

Register address:	36 (decimal) / 24h (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	n/a
Value range:	0-2
Division factor:	n/a

The number of uncontrolled pumps that are switched on when external pump control is activated is defined with the external pump activation parameter. The pumps are only switched on if readiness for wetting exists.

Value	Meaning
0	No pump activity
1	A pump is active
2	Two pumps are active

Register	External pump activation															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	External pump activation							

11.1.25 External pump control value

Register address:	37 (decimal) / 25h (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	%
Value range:	0-100
Division factor:	n/a

The control value of the controlled pump transferred from the pump when external pump control is activated is defined by the external pump control value parameter. The pump is only switched on however if readiness for wetting exists.

Register	External pump control value															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	External pump control value							

11.1.26 External control command

Register address: 38 (decimal) / 26h (hexadecimal)
Data type: 8 bit unsigned integer
Unit: n/a
Value range: see below
Division factor: n/a

NOTICE

This parameter can only be written.

The external control command parameter allows a control step to be performed on the GHM pump. A response to a control command is only issued during active GHM pump control, with the result that a command issued when the GHM pump is in manual mode is not executed.

Value	Meaning
0	Request to fill the tray
1	Request to blow down the tray
2	Request to drain the tray
3	Request for biocidal supply
4	Request to perform defrosting

Register	External control command															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	External control command							

11.1.27 Pump control via “function” manual mode

Register address: 39 (decimal) / 27h (hexadecimal)
Data type: bool
Unit: n/a
Value range: see below
Division factor: n/a

The requirements for pump control can be pre-set via Modbus when the GHM pump is in control mode and “function” manual mode is active. Either the number of pumps to be activated or the control value of the controlled pump can be pre-set.

Value	Meaning
0	Pump control via “function” manual mode switched off
1	Pump control via “function” manual mode switched on

Register	Pump control via “function” manual mode															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1

11.1.28 Pump activation via “function” manual mode

Register address:	40 (decimal) / 28h (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	n/a
Value range:	0-2
Division factor:	n/a

The number of uncontrolled pumps that are switched on via “function” manual mode when external pump control is activated is defined with the parameter.

Value	Meaning
0	No pump activity
1	One pump is active
2	Two pumps are active

Register	Pump activation via “function” manual mode															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Pump activation via “function” manual mode							

11.1.29 Pump control value via “function” manual mode

Register address:	41 (decimal) / 29h (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	%
Value range:	0-100
Division factor:	n/a

The control value of the controlled pump transferred from the pump when pump control is activated via “function” manual mode is defined by the parameter.

Register	Pump control value via “function” manual mode															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Pump control value via “function” manual mode							

11.2 Input Register Overview

11.2.1 Status of the GRC pump’s digital inputs

Register address: 4096 (decimal) / 1000h (hexadecimal)
Data type: 8 bit unsigned integer
Unit: n/a
Value range: 0/1
Division factor: n/a

The status of the GRC pump’s digital inputs is read from the parameter.

Bit value	Meaning
0	There is no power at the digital input (low status)
1	There is power at the digital input (high status)

The assignment of the GRC pump’s digital inputs to the parameter bits is shown in the next table.

Register	Status of the GRC pump’s digital inputs															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	DI3	DI2	DI1

11.2.2 Status of the GRC pump’s digital outputs

Register address: 4097 (decimal) / 1001h (hexadecimal)
Data type: 8 bit unsigned integer
Unit: n/a
Value range: 0/1
Division factor: n/a

The status of the GRC pump’s digital outputs is read from the parameter.

Value	Meaning
0	The x1/x4 relay contacts assigned to the digital output are open (x1/x2 closed).
1	The x1/x4 relay contacts assigned to the digital output are closed (x1/x2 open).

The assignment of relay contacts to the GRC pump's outputs is shown in the next table.

Relay contacts	Number of the digital outputs
11/14	DO1
21/24	DO2
31/34	DO3
41/44	DO4

The assignment of the GRC pump controller's digital outputs to the parameter bits is shown in the next table.

Register	Status of the GRC pump's digital outputs															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	0	0	0	0	DO4	DO3	DO2	DO1

11.2.3 Status of the GIOD's digital inputs

Register address:	4098 (decimal) / 1002h (hexadecimal)
Data type:	16 bit unsigned integer
Unit:	n/a
Value range:	0/1
Division factor:	n/a

The status of the GIOD expansion module's digital inputs is read from the parameter.

Bit value	Meaning
0	There is no power at the digital input (low status)
1	There is power at the digital input (high status)

The assignment of the GIOD's digital inputs to the parameter bits is shown in the next table.

Register	Status of the GIOD's digital inputs															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	DI16	DI15	DI14	DI13	DI12	DI11	DI10	DI9	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1

11.2.4 Status of the GIOD's digital outputs

Register address:	4099 (decimal) / 1003h (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	n/a
Value range:	0/1
Division factor:	n/a

The status of the GIOD expansion module's digital outputs is read from the parameter.

Bit value	Meaning
0	The x3/x4 relay contacts assigned to the digital output are open.
1	The x3/x4 relay contacts assigned to the digital output are closed.

The assignment of the GIOD's digital outputs to the parameter bits is shown in the next table.

Register	Status of the GIOD's digital outputs															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	DO8	DO7	DO6	DO5	DO4	DO3	DO2	DO1

11.2.5 Raw value of AI1

Register address: 4100 (decimal) / 1004h (hexadecimal)
Data type: 16 bit signed integer
Unit: mA
Value range: 0 – 20
Division factor: 10

This register contains the raw value of the AI1 analogue input.

Register	Raw value of AI1															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Raw value of AI1															

11.2.6 Raw value of AI2

Register address: 4101 (decimal) / 1005h (hexadecimal)
Data type: 16 bit signed integer
Unit: mA
Value range: 0 – 20
Division factor: 10

This register contains the raw value of the AI2 analogue input.

Register	Raw value of AI2															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Raw value of AI2															

11.2.7 Raw value of AI4

Register address: 4102 (decimal) / 1006h (hexadecimal)
Data type: 16 bit signed integer
Unit: mA
Value range: 0 – 10
Division factor: 10

This register contains the raw value of the AI4 analogue input.

Register	Raw value of AI4															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Raw value of AI4															

11.2.8 Scaled value of AI1

Register address: 4103 (decimal) / 1007h (hexadecimal)
Data type: 16 bit signed integer

The following table depicts possible measurements and their characteristics of the AI1 input.

Measurement	Unit		Value range SI input	Division factor	
	SI	IP		SI unit	IP unit
Water level sensor	mm	inch	50-800	1	10
Conductivity sensor	µS/cm	µS/cm	0-7000	1	1
Humidity sensor	%	%	0-100	1	1

This register contains the scaled value of the AI1 analogue input.

Register	Scaled value of AI1															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value of AI1															

11.2.9 Scaled value of AI2

Register address: 4104 (decimal) / 1008h (hexadecimal)
Data type: 16 bit signed integer

The following table depicts possible measurements and their characteristics of the AI2 input.

Measurement	Unit		Value range SI input	Division factor	
	SI	IP		SI unit	IP unit
Water level sensor	mm	inch	50-800	1	10
Conductivity sensor	µS/cm	µS/cm	0-7000	1	1
Humidity sensor	%	%	0-100	1	1

This register contains the scaled value of the AI2 analogue input.

Register	Scaled value of AI2															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value of AI2															

11.2.10 Scaled value of AI3

Register address: 4105 (decimal) / 1009h (hexadecimal)

Data type: 16 bit signed integer

The following table depicts possible measurements and their characteristics of the AI3 input.

Measurement	Unit		Value range SI input	Division factor	
	SI	IP		SI unit	IP unit
Water temperature in wetting tray	°C	°F	-40 – 100	10	10

This register contains the scaled value of the AI3 analogue input.

Register	Scaled value of AI3															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value of AI3															

11.2.11 Scaled value of AI4

Register address: 4106 (decimal) / 100Ah (hexadecimal)

Data type: 16 bit signed integer

The following table depicts possible measurements and their characteristics of the AI4 input.

Measurement	Unit		Value range SI input	Division factor	
	SI	IP		SI unit	IP unit
Humidity sensor	%	%	0-100	1	1
Pressure sensor downstream of pump	bar	psig	0-6	10	1

This register contains the scaled value of the AI4 analogue input.

Register	Scaled value of AI4															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Scaled value of AI4															

11.2.12 Raw value of AO1

Register address: 4107 (decimal) / 100Bh (hexadecimal)
Data type: 16 bit signed integer
Unit: V
Value range: 0 – 10
Division factor: 10

This register contains the raw value of the AO1 analogue output.

Register	Raw value of AO1															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Raw value of AO1															

11.2.13 Raw value of AO2

Register address: 4108 (decimal) / 100Ch (hexadecimal)
Data type: 16 bit signed integer
Unit: V
Value range: 0 – 10
Division factor: 10

This register contains the raw value of the AO2 analogue output.

Register	Raw value of AO2															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Raw value of AO2															

11.2.14 Concentration

Register address: 4109 (decimal) / 100Dh (hexadecimal)
Data type: 8 bit unsigned integer
Unit: n/a
Value range: 0 – 25
Division factor: 10

This register contains the current concentration of the tray water.

Register	Concentration															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Concentration							

11.2.15 Wet bulb temperature

Register address: 4110 (decimal) / 100Eh (hexadecimal)
Data type: 16 bit signed integer
Unit: SI unit: °C, IP unit: °F
Value range: -55 – 90 [°C]
Division factor: 10

This register contains the current wet bulb temperature.

Register	Wet bulb temperature															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Wet bulb temperature															

11.2.16 Water level (discrete)

Register address: 4111 (decimal) / 100Fh (hexadecimal)
Data type: 8 bit enum
Unit: n/a
Value range: see below
Division factor: n/a

This register contains the discrete fill level of the tray water.

Value	Meaning
0	Reserved
1	Dry run limit
2	Heating limit
3	Lower limit
4	Average limit
5	Upper limit

Register	Water level (discrete)															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Water level (discrete)							

11.2.17 Water level (continuous)

Register address:	4112 (decimal) / 1010h (hexadecimal)
Data type:	16 bit unsigned integer
Unit:	SI unit: mm, IP unit: inch
Value range:	50 – 800
Division factor:	SI unit: 1, IP unit: 10

This register contains the continuous fill level of the tray water.

Register	Water level (continuous)															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Water level (continuous)															

11.2.18 Status of feedwater valve

Register address:	4113 (decimal) / 1011h (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	n/a
Value range:	see below
Division factor:	n/a

The register contains the status information for the feedwater valve. The table below provides an overview of the available status information and the associated bit assignment.

Bit No.	Meaning	High for (bit x = 1)
Bit 0	Valve control active?	Active
Bit 1	Valve open?	open
Bit 2	Valve closed?	Closed
Bit 3	Has a fault occurred?	Fault
Bit 4	Is the dig. input for recording the position “open” configured?	configured
Bit 5	Is the dig. input for recording the position “closed” configured?	configured
Bit 6	Reserved	
Bit 7	Reserved	

Register	Status of feedwater valve															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Status of feedwater valve							

11.2.19 Status of make-up water valve

Register address:	4114 (decimal) / 1012h (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	n/a
Value range:	see below
Division factor:	n/a

The register contains the status information for the make-up water valve. The table below provides an overview of the available status information and the associated bit assignment.

Bit No.	Meaning	High for (bit x = 1)
Bit 0	Valve monitoring active?	Active
Bit 1	Valve open?	open
Bit 2	Valve closed?	Closed
Bit 3	Has a fault occurred?	Fault
Bit 4	Is the dig. input for recording the position “open” configured?	configured
Bit 5	Is the dig. input for recording the position “closed” configured?	configured
Bit 6	Reserved	
Bit 7	Reserved	

Register	Status of make-up water valve															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Status of make-up water valve							

11.2.20 Status of blowdown valve

Register address:	4115 (decimal) / 1013h (hexadecimal)
Data type:	8 bit unsigned integer
Unit:	n/a
Value range:	see below
Division factor:	n/a

The register contains the status information for the blowdown valve. The table below provides an overview of the available status information and the associated bit assignment.

Bit No.	Meaning	High for (bit x = 1)
Bit 0	Valve monitoring active?	Active
Bit 1	Valve open?	open
Bit 2	Valve closed?	Closed
Bit 3	Has a fault occurred?	Fault
Bit 4	Is the dig. input for recording the position “open” configured?	configured

Bit No.	Meaning	High for (bit x = 1)
Bit 5	Is the dig. input for recording the position “closed” configured?	configured
Bit 6	Reserved	
Bit 7	Reserved	

Register	Status of blowdown valve															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	0	0	0	0	0	0	0	0	Status of blowdown valve							

11.2.21 Operating hours of UV sterilisation lamps

Register address: 4116 (decimal) / 1014h (hexadecimal)
Data type: 16 bit unsigned integer
Unit: h
Value range: 0 – 65535
Division factor: n/a

This register contains the current operating hours of the UV sterilisation lamps.

Register	Operating hours of UV sterilisation lamps															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Operating hours of UV sterilisation lamps															

11.2.22 Meter reading: Water inflow (MSW), (LSW)

Register address: Most significant word:4117 (decimal) / 1015h (hexadecimal)
Least significant word:4118 (decimal) / 1016h (hexadecimal)
Data type: 16 bit unsigned integer per register
Unit: SI unit: m^3, IP unit: ft^3
Value range: 0 – 65535 per register
Division factor: 10

The registers depicted in this section together form a uint32 parameter. The table below shows the composition of the two registers for an unsigned 32-bit integer value.

Register 4117	Register 4118
16 bit MSW	16 bit LSW
32 bit unsigned integer value	

The parameter contains the count for the water inflow volume in the tray.

Register	Meter reading: Water inflow (MSW), (LSW)															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Meter reading: Water inflow (MSW), (LSW)															

11.2.23 Meter reading: Water outflow (MSW), (LSW)

Register address:	Most significant word:4119 (decimal) / 1017h (hexadecimal) Least significant word:4120 (decimal) / 1018h (hexadecimal)
Data type:	16 bit unsigned integer per register
Unit:	SI unit: m^3, IP unit: ft^3
Value range:	0 – 65535 per register
Division factor:	10

The registers depicted in this section together form a uint32 parameter. The table below shows the composition of the two registers for an unsigned 32-bit integer value.

Register 4119	Register 4120
16 bit MSW	16 bit LSW
32 bit unsigned integer value	

The parameter contains the count for the water outflow volume from the tray.

Register	Meter reading: Water outflow (MSW), (LSW)															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Meter reading: Water outflow (MSW), (LSW)															

11.2.24 Operating hours pump 1 (MSW), (LSW)

Register address:	Most significant word:4121 (decimal) / 1019h (hexadecimal) Least significant word:4122 (decimal) / 101Ah (hexadecimal)
Data type:	16 bit unsigned integer per register
Unit:	h
Value range:	0 – 65535 per register
Division factor:	1

The registers depicted in this section together form a uint32 parameter. The table below shows the composition of the two registers for an unsigned 32-bit integer value.

Register 4121	Register 4122
16 bit MSW	16 bit LSW
32 bit unsigned integer value	

The parameter contains the accumulated operating hours of the first pump.

Register	Operating hours pump 1 (MSW), (LSW)															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Operating hours pump 1 (MSW), (LSW)															

11.2.25 Operating hours pump 2 (MSW), (LSW)

Register address:	Most significant word:4123 (decimal) / 101Bh (hexadecimal) Least significant word:4124 (decimal) / 101Ch (hexadecimal)
Data type:	16 bit unsigned integer per register
Unit:	h
Value range:	0 – 65535 per register
Division factor:	1

The registers depicted in this section together form a uint32 parameter. The table below shows the composition of the two registers for an unsigned 32-bit integer value.

Register 4123	Register 4124
16 bit MSW	16 bit LSW
32 bit unsigned integer value	

The parameter contains the accumulated operating hours of the second pump.

Register	Operating hours pump 2 (MSW), (LSW)															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Operating hours pump 2 (MSW), (LSW)															

11.2.26 Errors/alarms (MSW), (LSW)

Register address:	Most significant word:4125 (decimal) / 101Dh (hexadecimal) Least significant word:4126 (decimal) / 101Eh (hexadecimal)
Data type:	16 bit unsigned integer per register
Unit:	n/a
Value range:	0 – 65535 per register
Division factor:	n/a

The registers depicted in this section together form a uint32 parameter. The table below shows the composition of the two registers for an unsigned 32-bit integer value.

Register 4125	Register 4126
16 bit MSW	16 bit LSW
32 bit unsigned integer value	

This parameter contains current errors and alarms for the GHM pump. The information in this register is defined in bits. This means that an error or alarm is assigned to every bit in this register. The assignment is depicted in the next table. If a bit switches its status from 0 to 1, this indicates that an error or alarm exists. Once an error/alarm has been eliminated, the associated bit is reset to 0.

Bit No. in LSW	Meaning	Bit No. in MSW	Meaning
Bit 0	PRIO 1 errors	Bit 0	Conductivity limit reached
Bit 1	PRIO 2 warnings	Bit 1	Circuit breaker chain disrupted
Bit 2	Communication with GMM interrupted	Bit 2	Tray heating error
Bit 3	Communication with GIOD interrupted	Bit 3	Biocidal station error
Bit 4	Pump minimum error	Bit 4	UV sterilisation lamp error
Bit 5	Error with first pump	Bit 5	Operating hours threshold for UV sterilisation lamps exceeded
Bit 6	Error with second pump	Bit 6	Operating hours threshold for pumps exceeded
Bit 7	Reserved	Bit 7	Reserved
Bit 8	Water inlet valve error	Bit 8	Reserved
Bit 9	Make-up water valve error	Bit 9	Reserved
Bit 10	Blowdown valve error	Bit 10	Reserved
Bit 11	Dry run limit reached	Bit 11	Reserved
Bit 12	AI1 sensor error	Bit 12	Reserved
Bit 13	AI2 sensor error	Bit 13	Reserved
Bit 14	AI3 sensor error	Bit 14	Reserved
Bit 15	AI4 sensor error	Bit 15	Reserved

Register	Errors/alarms (MSW), (LSW)															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Errors/alarms (MSW), (LSW)															

11.2.27 Status information (MSW), (LSW)

Register address:	Most significant word:4127 (decimal) / 101Fh (hexadecimal) Least significant word:4128 (decimal) / 1020h (hexadecimal)
Data type:	16 bit unsigned integer per register
Unit:	n/a
Value range:	0 – 65535 per register
Division factor:	n/a

The registers depicted in this section together form a uint32 parameter. The table below shows the composition of the two registers for an unsigned 32-bit integer value, whereby the register 4128 is not used at present.

Register 4127	Register 4128
16 bit MSW	16 bit LSW
32 bit unsigned integer value	

This parameter contains the current status information for the GHM pump. The information in this register is defined in bits. This means that a specific GHM pump status is assigned to every bit in this register. This assignment is depicted in the next table. If a status event occurs, the associated bit changes its status from 0 to 1.

Bit number in LSW	Meaning
Bit 0	External enabling
Bit 1	Readiness for wetting
Bit 2	Wetting
Bit 3	Make-up water requirement
Bit 4 - Bit 15	Reserved

Register	Status information (MSW), (LSW)															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Status information (MSW), (LSW)															

11.2.28 Current events

Register address:	4129 (decimal) / 1021h (hexadecimal)
Data type:	16 bit unsigned integer per register
Unit:	n/a
Value range:	0 – 65535
Division factor:	n/a

This parameter contains the current events for the GHM pump. The information in this register is defined in bits. This means that a specific GHM pump event is assigned to every bit in this register. This assignment is depicted in the next table. If an event occurs, the associated bit changes its status from 0 to 1. When an event has concluded, the associated bit is reset by the GHM pump to 0.

Bit number	Meaning
Bit 0	Filling active
Bit 1	Blowdown active
Bit 2	Draining is active
Bit 3	Biocidal process active
Bit 4 - Bit 15	Reserved

Register	Current events															
Value (Format)	High byte								Low byte							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value	Current events															

12 References

Modbus Organization Inc., The. (2006, October 24). Modbus Messaging on TCP/IP Implementation Guide. Retrieved from Modbus: http://www.modbus.org/docs/Modbus_Messaging_Implementation_Guide_V1_0b.pdf

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