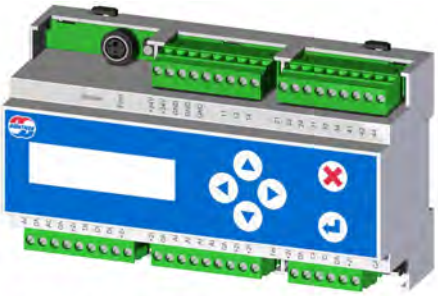
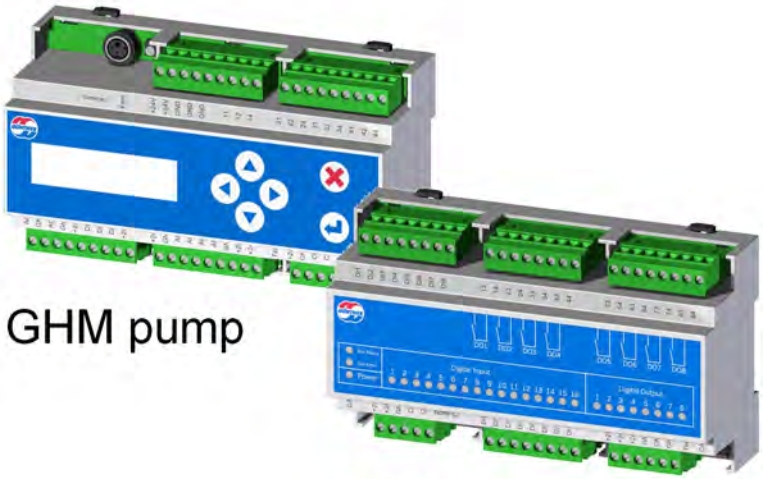
Operating instructions
Güntner Hydro Management GHM pump



GMM EC



GHM pump

GIOD

www.guentner.de

Contents

1 General notes

1.1 Safety instructions

In order to prevent serious physical injuries or major material damage, work on or with the unit may be performed only by authorised persons with appropriate training and qualifications who are familiar with the set-up, installation, commissioning and operation of electronic controllers. These persons must read the operating instructions carefully before the installation and commissioning. In addition to the operating instructions and national accident prevention regulations, all recognised technical rules (safety and professional work under UVV, VBG, VDE etc.) must be followed.

Repairs to the device may only be made by the manufacturer or a repair centre authorised by the manufacturer.

UNAUTHORISED AND IMPROPER INTERVENTIONS WILL INVALIDATE THE WARRANTY!

The applicable national accident prevention regulations must be followed when working on control units under voltage.

1.2 Proper intended use

The unit is intended only for the purposes agreed in the order confirmation. Any other application or use for any additional purpose, is not a proper intended use. The manufacturer accepts no liability for any injury or damage arising from unintended use. Proper intended use is also contingent on compliance with the installation, operating and maintenance procedures described in these operating instructions. The technical data and the details of the connection assignments can be found on the type plate and in the instructions, and must be complied with.

Electronic equipment is not fundamentally failsafe! The user must therefore ensure that his system reverts to a safe condition in the event of failure of the equipment. The manufacturer accepts no responsibility for any damage to life and limb or to material goods and assets in the event of failure to comply with this provision and in the event of improper use.

The electrical installation must be performed in accordance with the relevant regulations (e.g. cable cross-sections, fuses, earth conductor connections, etc.). Additional information is included in the documentation. If the control unit is used in a particular area of application, the required standards and regulations must be complied with.

1.3 Transport and storage, copyright notice

The controllers are packaged appropriately for transport and may only be transported in their original packaging. Avoid any impacts and collisions. Unless otherwise noted on the packaging, the maximum stacking height is 4 packs. When you receive the equipment, check for any damage to the packaging or the controller.

Store the equipment in its original packaging and protected from the weather, and avoid extremes of heat and cold.

Subject to technical changes in the interests of further development. Therefore no claims may be derived from information, images and drawings; errors excepted!

1.4 Warranty and liability

The current General Terms and Conditions of Sales and Delivery of Güntner AG & Co. KG apply.

See the homepage at http://www.guentner.com

1.5 Manufacturer and supplier address

Should you have a problem with any of our equipment, or any questions, suggestions or special requests, simply contact

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Hans-Güntner-Strasse 2-6
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1.6 EMC-compliant installation

Controllers in the GHM pump series fulfil the requirements of EN 61000-6-2 as regards resistance to EMC interference and those of EN 61000-6-3 as regards emissions.

In order to guarantee EM compatibility, the following points must be noted:

All measurement and signalling lines must be connected via shielded cables.

• The shielding of measuring, signal and bus lines must be earthed at one end only.

• Suitable shielding and routing measures must be taken to ensure that mains cables and motor cables do not give rise to any interference in signal and control lines.

NOTICE

If the equipment is installed in a switch cabinet, **proper attention must be given to the** temperature inside the cabinet. Güntner switch cabinets are provided with sufficient ventilation.

2 Short description of GHM pump

Together with the GMM EC, the GHM pump forms a coordinated control engineering solution for controlling cooling towers, evaporative condensers and hybrid dry coolers. The GMM EC assumes all control tasks for controlling the fans while the GHM pump is intended to control all water-related control tasks.

The condensing/return temperature of the cooler can be controlled flexibly in various operating modes by the GMM EC and GHM pump controller. The setpoint can be defined on the GMM EC or pre-set by means of an external signal. Likewise, the setpoint can be moved depending on the ambient temperature or the wet bulb temperature (with optionally available humidity sensor). Slave mode likewise offers the possibility to have the fan speed pre-set by a controller on the customer side or by another device configured as the master.

The GHM pump activates the pump in accordance with the performance requirement and the GMM EC controls the fan speed so that the setpoint defined on the controller is reached for the condensing/return temperature.

The water quality can be regulated in the GHM pump by calculating the concentration internally. The GHM pump can be fitted optionally with a conductivity sensor to allow more precise regulation of the water quality. The circulating water is drained automatically from the tray depending on the concentration and the tray is supplied with fresh water. The inflowing and outflowing water volume can be recorded by means of optional water meters in the controller, evaluated and transmitted by bus to a higher-level controller.

The GHM pump furthermore offers the possibility to integrate biocide metering systems in the controller on the customer side. Alternatively, UV lamps can be activated by the GHM pump to minimise biological growth. Hygiene-related parameters in accordance with the Ashrae standard 188-2015 are stored in the controller by means of the logbook functionality of the GHM pump.

The tray fill level is regulated automatically by the GHM pump. The water level is recorded by a continuous fill level sensor. Fresh water is replenished automatically by means of the replenishment valve.

Optionally available bus modules are provided for further processing the measured data and control parameters.

3 Commissioning GHM pump

The GHM pump has to be set in accordance with the deign of the heat exchanger. The performance features of the GHM pump, such as pump type/number, valve configuration and blow-down method, are defined by the commissioning.

The GHM pump automatically detects whether commissioning has been carried out when it is switched on. If it has, it continues with controlled operation.

If the GHM pump detects that this has not yet been done, it initiates a commissioning procedure. When this procedure has been completed, all the specified parameters are saved.

NOTICE

Commissioning is also necessary if the GHM pump has been reset to delivery settings from the Service menu.

3.1 The initial commissioning procedure

If it is detected when starting the controller that no commissioning has taken place, the commissioning menu will be displayed.

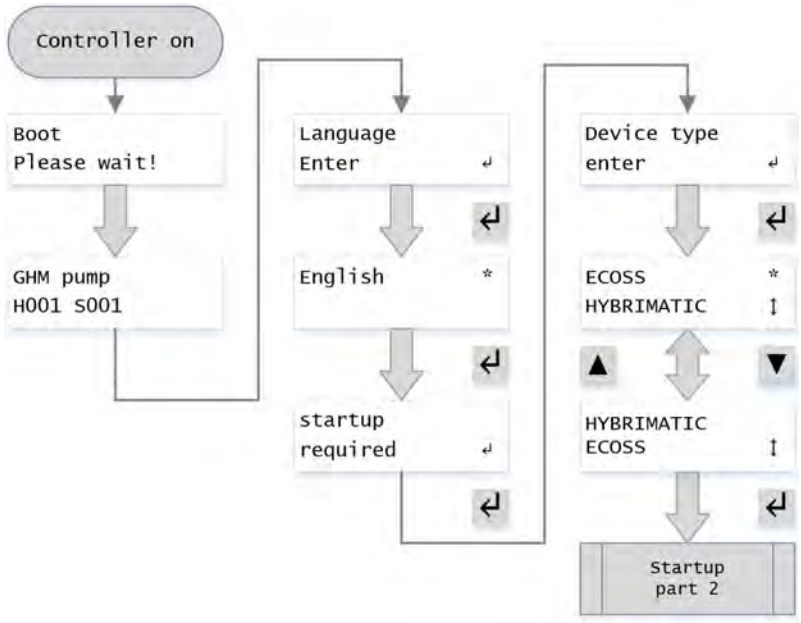
The commissioning menu can be navigated as follows:

Switch to the next commissioning entry or to EDIT mode for a commissioning entry

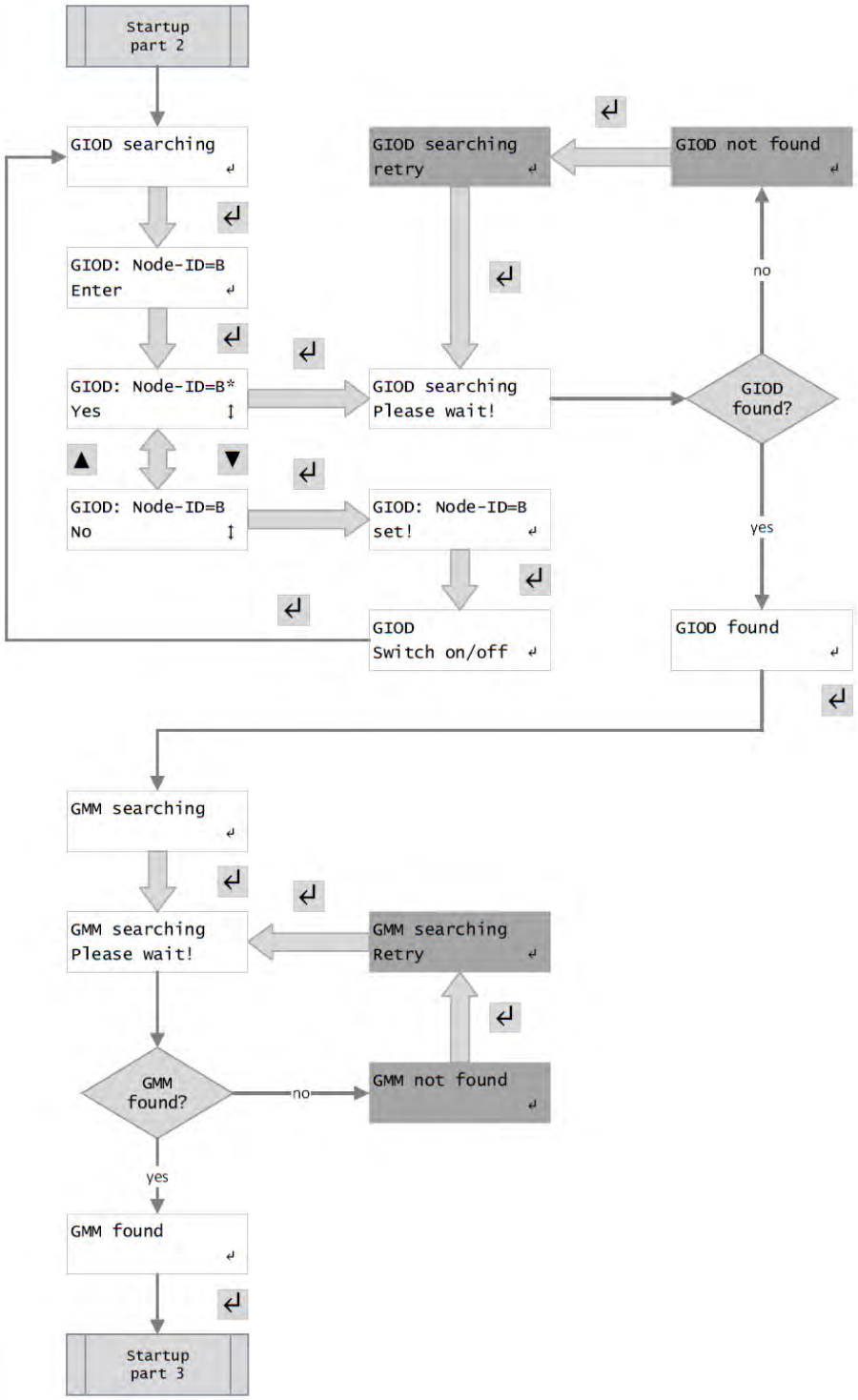

Switch to the previous commissioning entry


Switch to the first commissioning entry

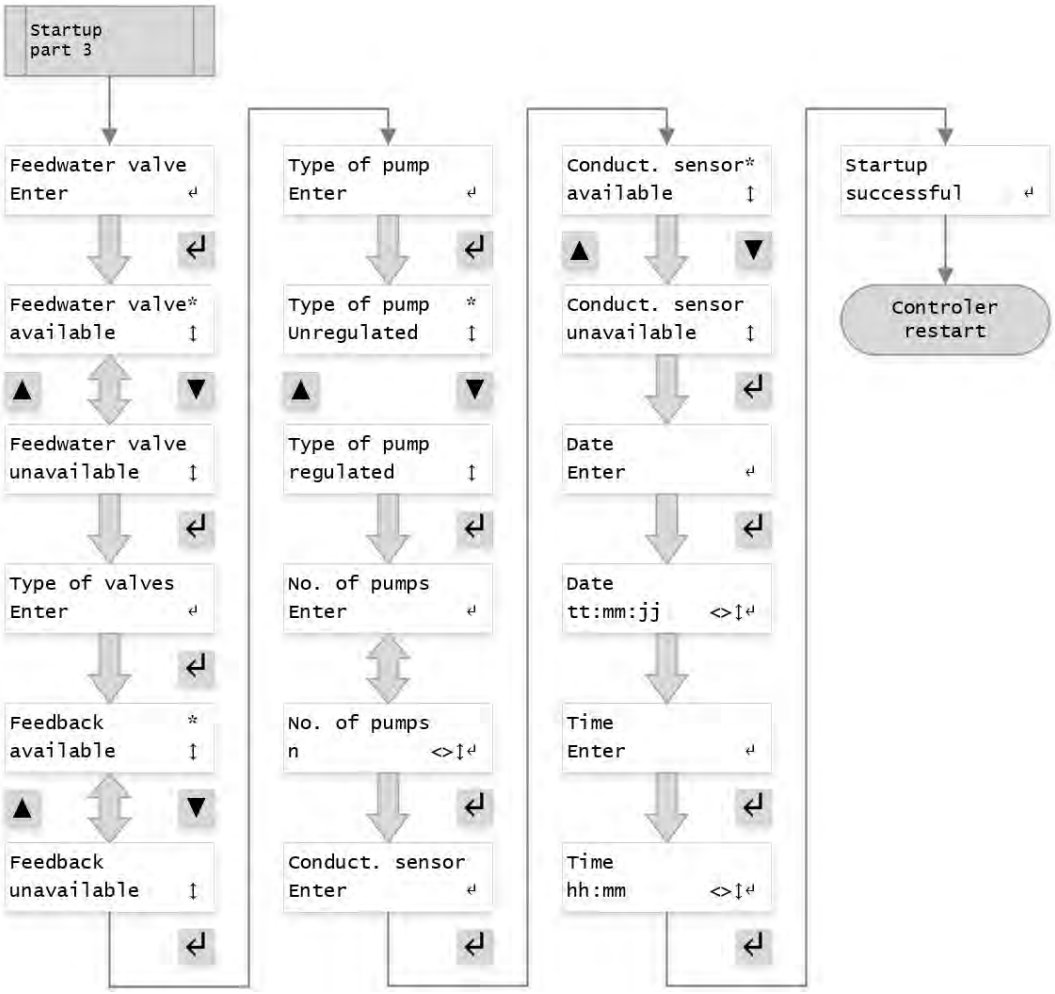
The language for the commissioning process is defined in the first part of the commissioning and the device type specified.



Communication between the required CAN bus subscribers is verified in the second part of the commissioning. The bus connections between GHM and GIOD and/or GHM and GMM are checked in this context. Searches for GIOD and GMM are repeated until the verification is successful.



The basic configuration of the system is defined in the final part of the commissioning. These parameters on one hand influence the resulting IO configuration and on the other hand the control functions of the GHM pump.



The impact on the configuration is outlined below:

Feedwater valve: If a feedwater valve is available, the corresponding function is configured for the GRC pump's digital output DO1. Otherwise DO1 remains free.

Type of valve: If the valve has integrated limit switches, the associated "Valve open/closed" functions will be pre-set at the GIOD's digital inputs DI1 to DI6 for all available valves. Otherwise, the corresponding DIs remain free.

Type of pump: If an adjustable pump is available, the "Control value for adjustable pump" function is pre-configured at the GRC pump's analogue output AO1. Otherwise AO1 remains free.

Number of pumps: The number of pumps connected is queried here. If uncontrolled pumps have been selected, the "Pump 1" and "Pump 2" functions are pre-configured at the GIOD's digital outputs DO1 and DO2 in accordance with the number of pumps. Otherwise, the corresponding DOs remain free.

Conductivity sensor: If a conductivity sensor is available, the GRC pump's analogue input AI1 is pre-configured with the appropriate function. The sensor is absolutely essential for a conductivity-based blowdown. Otherwise the blowdown is performed based on the concentration.

Once successfully commissioned, the defined parameters are saved and the controller is restarted.

4 Construction of the GHM pump

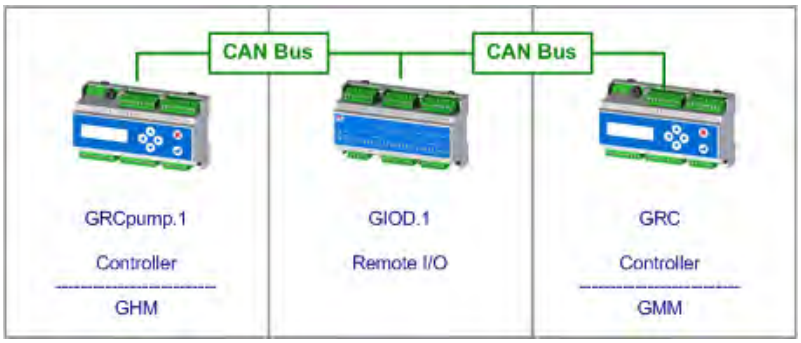
4.1 Controller

4.1.1 Functional description

Functional description of GRCpump.1

The GRCpump.1 provides hydro management for hybrid dry coolers and evaporative cooling systems and is used together with a GMM EC speed controller with bus communication.

The GRCpump.1 needs to be combined with a GIOD.1 expansion module, ERP no. 5204183.



GHM pump with GMM

In order to ensure controlled operation, the controller must have a power supply and must be enabled via digital input DI1. If the DI1 input is configured for an alternative function, the external enable is regarded as being implicitly issued. If it is not enabled the heat exchanger coil will not be wetted at all.

The unit has an internal power control whose parameters (fan control value, setpoint deviation) can be configured either from the menu or via an external bus module. The control mode for wetting can be pre-set from the internal menu.

The controller can control one or two wetting pumps. The relay outputs that control the wetting pumps are operated as directed by the control parameters and the operating mode. The switch-on threshold for each pump can be configured individually.

A humidity sensor displaces the setpoint in response to the wet bulb temperature.

The hydro management uses a conductivity sensor to monitor the quality of the wetting water, where necessary initiating a reduction in its conductivity as specified in the pre-set values. The GHM also uses a sensor to regulate the water level in the tray, taking into account the current operating state.

The digital inputs are designed as potential-free contacts that must be connected to +24V. Wetting is only approved if external enabling is issued and the criteria for starting the pumps are fulfilled (control value for fans and/or setpoint deviation).

In addition to this external enable, other digital inputs are also used to monitor various external status notifications, fault messages and measurements.

Digital inputs or the external bus communication can be used to activate system functions (such as blowdown, pump on/off, etc.) via a higher-level controller.

Impulse water meters can be connected to digital inputs DI2 and DI3 of the GRCpump.1 to record the volumes of water for inlet and outlet.

NOTICE

Please note that connecting the wrong voltage (e.g. 230V) may seriously damage the controller.

The relay outputs on GRCpump.1 are used to control valves (DO1-DO3) and a general fault message (DO4).

The expansion module GIOD.1 can be used to control the disinfection unit, the basin heating and heat tracing systems and to signal readiness for wetting.

The CAN interface of GRCpump.1 is an internal interface for communication with other Güntner units (e.g. the expansion module GIOD.1).

The following communications modules are available for external bus connections: for Modbus RTU (GCM MOD GHMpump Rail.2, ERP No.: 5206759) or Modbus TCP/IP and BACnet (GCM (W)LAN Rail.1, ERP No: 5206123).

Functional description of GIOD.1

The GIOD.1 is controlled via CAN by a Güntner controller. The GIOD.1 possesses 16 digital inputs with a rated voltage of 24V DC and 8 relay outputs. The bus address of the GIOD.1 (node ID) is set up using a rotary encoding switch. The address 0xF may not be used for this.

You determine the address by adding the base value 0x40 (hexadecimal) or 64 (decimal) to the value that is set up.

NOTICE

To operate the GIOD on GHM , the rotary switch must always be set to address B.

The GIOD reads this address only when first switched on.

To ensure the bus connection between the controller and one or more other units works correctly, bus termination must be activated at the beginning and end of the bus connection by setting the units' DIP switches labelled "Term". They must be placed in the "ON" position to activate the termination. Units that are in the middle of the bus and therefore permitted to transfer the bus signal may not have bus termination activated.

The status of the inputs and outputs is indicated by LEDs on the front of the casing. A lit LED against the digital inputs signifies that the corresponding input is receiving a "high" signal. A lit LED against the relay outputs signifies that the closer contact is closed. A power LED signifies that the internal electronic components are receiving power.
There is also a status display for the bus connection that involves two LEDs.

Bus status LED	Description
On	The GIOD.1 is in operation
Flashing 50:50	The GIOD.1 can be taken into operation
Brief single flash	The GIOD.1 is currently stopped
Three flashes with error LED	The software is attempting to overrun the stack on the GIOD.1
Alternate flashing with error LED	A “layer setting service” is being performed on the GIOD.1
Synchronous fast flashing with error LED	Reset to default has been selected on the rotary coding switch (setting “F”)

Bus error LED	Description
Off	Unit is operating correctly
On	There is a static fault on the CAN bus
Brief single flash	The warning limit has been reached in the CAN controller
Double flashing	A fault was detected in the lifeguard, nodeguard or heart-beat
Three flashes with the bus status LED	The software is attempting to overrun the stack on the GIOD.1
Alternate flashing with the bus status LED	A “layer setting service” is being performed on the GIOD.1
Synchronous fast flashing with error LED	Reset to default has been selected on the rotary coding switch (setting “F”)

Power LED	Description
On	The internal electronics are receiving power
Off	The unit is not powered or is reverse-poled

Digital input LED	Description
On	The digital input detects a “High” signal
Off	The digital input detects a “Low” signal

Digital output LED	Description
On	The digital output is closed
Off	The digital output is open

4.1.2 Installation / Operating conditions

Installation / Operating conditions GRCpump.1

- The module is designed for mounting on a top-hat rail.
- All measurement and signalling lines must be connected via shielded cables.
- The shielding of measuring, signal and bus lines must be earthed at one end only.
- Suitable shielding and routing measures must be taken to ensure that mains cables and motor cables do not give rise to any interference in signal and control lines.
- Temperature:

Storage, Transport:	-20°C ... +70°C
Operation:	-20°C ... +65°C

- Protection rating: IP 20
- Recommended cables: Belden 9841, Lapp 2170203, Lapp 2170803, Helukabel 81910

Installation / Operating conditions GIOD.1

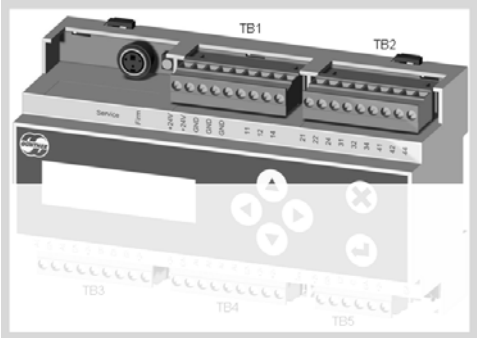
- The module is designed for mounting on a top-hat rail.
- Bus lines that are not wired via the supplied ribbon cable must be shielded.
- The shielding of bus lines must be earthed at one end only.
- Suitable shielding and routing measures must be taken to ensure that mains cables and motor cables do not give rise to any interference in signal and control lines.
- Temperature:

Storage location,	
Transport	-20°C .. +70°C
Operation:	-20°C .. +65°C

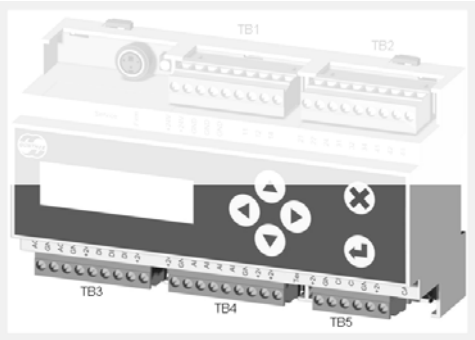
- Protection rating: IP 20

4.1.3 Connections

Connections GRCpump.1



Upper row of connections			
	Name	**Description**	
	Service	Service plug only for use by service personnel	
	Firm	Pushbutton only for use by service personnel	
TB1	+24V	External feed for power supply	
	+24V		
	GND	Contact ground for external power feed	
	GND		
	GND		
		Terminal not connected	
	11		relay DO1
	12		
	14		
TB2	21		relay DO2
	22		
	24		
	31		relay DO3
	32		
	34		
	41		relay DO4
	42		
	44		

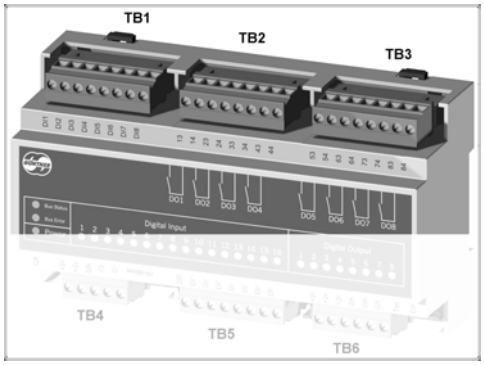


Lower row of connections		
	Name	**Description**
TB3	AO1	Analogue output 1, 0-10V
	GND	Ground
	AO2	Analogue output 2, 0-10V
	GND	Ground
	+24V	Voltage +24V
	DI1	Digital input +24V
	DI2	Digital input +24V
	DI3	Digital input +24V
	+24V	Voltage +24V
TB4	+24V	Voltage +24V
	GND	Ground
	AI1	Analogue output 4-20mA
	AI2	Analogue input 4-20mA or for temperature sensor GTF must be configured in the soft-ware
	AI3	Analogue input for temperature sensor GTF
	AI4	Analogue input 0-10V
	GND	Ground
	+24V	Voltage +24V
	+24V	
	Term	DIP switch for CAN bus termination (120Ω) / ON = termination activated
TB5	+24V	Voltage +24V
	GND	Ground
	CH	CAN high signal
	CL	CAN low signal

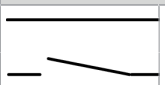
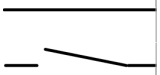
Lower row of connections		
	GND	Ground
	+24V	Voltage +24V
	CAN	CAN bus plug including power supply

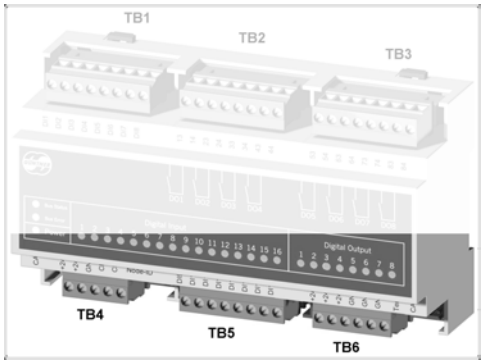
*TB: Terminal block

Connections GIOD.1



	Upper row of connections	
	Name	**Description**
TB1	DI1	Digital input 1
	DI2	Digital input 2
	DI3	Digital input 3
	DI4	Digital input 4
	DI5	Digital input 5
	DI6	Digital input 6
	DI7	Digital input 7
	DI8	Digital input 8
TB2	13	Relay contact 1 closer
	14	
	23	Relay contact 2 closer
	24	
	33	Relay contact 3 closer
	34	
	43	Relay contact 4 closer
	44	
TB3	53	Relay contact 5 closer
	54	
	63	Relay contact 6 closer
	64	

	Upper row of connections		
	Name	Description	
	73		Relay contact 7 closer
	74		
	83		Relay contact 8 closer
	84		



	Lower row of connections	
	Name	**Description**
	CAN	CAN bus plug including power supply
TB4	+24V	External feed for power supply
	+24V	
	GND	Contact ground for external power feed
	CH	CAN high signal
	CL	CAN low signal
	Node ID	Rotary switch for setting the bus node address (NodeID). The base value 0x40 (hexadecimal) or 64 (decimal) must be added to the value that is set up. 0= address 0x40 hex / 64 dec 1= address 0x41 hex / 65 dec ... E= address 0x4E hex / 78 dec F= reset the Canopen parameters to their default values
TB5	DI9	Digital input 9
	DI10	Digital input 10
	DI11	Digital input 11
	DI12	Digital input 12
	DI13	Digital input 13
	DI14	Digital input 14
	DI15	Digital input 15
	DI16	Digital input 16
TB6	+24V	Voltage +24V
	+24V	
	+24V	
	GND	Ground
	GND	

	Lower row of connections	
	Name	**Description**
	GND	
	Term	DIP switch for CAN bus termination (120Ω)
	CAN	CAN bus plug including power supply

5 Display and operation

Information and incident reports are shown on a two-line display. The controller is operated via a membrane keyboard.

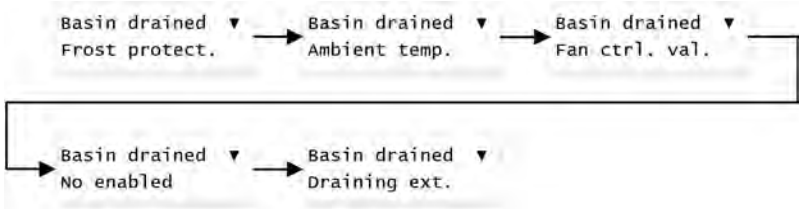
5.1 Info menu

The Info menu shows the current status messages and, if available, the incident reports for the controller. The individual entries are toggled automatically and in the following sequence:

1. Operating mode

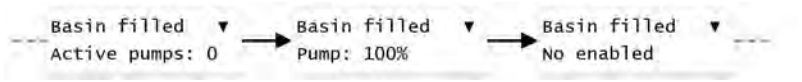
The current mode is displayed in the first line. Relevant additional information is shown in the second line.

The mode "**Tray drained**" is displayed when the tray has been drained or is currently being drained.



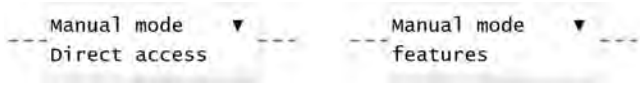
Frost protection	Ambient temperature has exceeded the frost drain threshold.
Ambient temperature	Ambient temperature has not reached the filling threshold.
Fan control value	GMM fan control value has not reached the filling threshold.
Disabled	No external enable was issued. Filling only takes place if an enable is issued.
Ext. draining	Tray is drained owing to external request.

The mode "**Tray filled**" is displayed when the tray has been filled or is currently being filled.



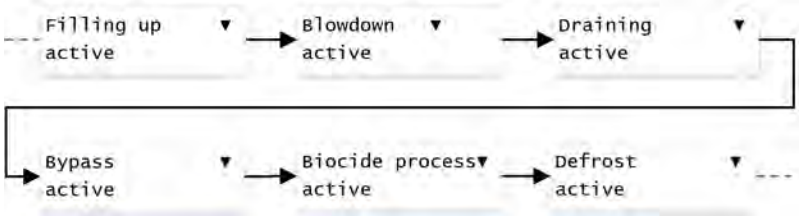
Active pumps: 1	Wetting takes place with the specified number of pumps (only for adjustable pumps).
Pump: 100%	Wetting takes place with the specified pump control value (only for adjustable pumps).
Disabled	No external enable was issued. Wetting only takes place if an enable is issued.

If **manual mode** is enabled, the mode set is shown additionally in the lower display line.



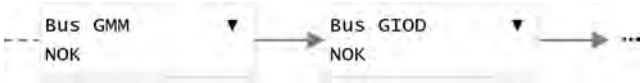
2. Events

If a number of events occur, these will be shown alternately on the display:



3. Incident reports

If a number of incidents occur, these will be shown alternately on the display:



Detailed information on the current incident reports as well as the alarm history can be viewed in the Alerts menu (see Alarms, page 56). Information concerning possible causes of errors and solution approaches can be referenced in the section on incident reports and warnings on page y.

5.2 Operation

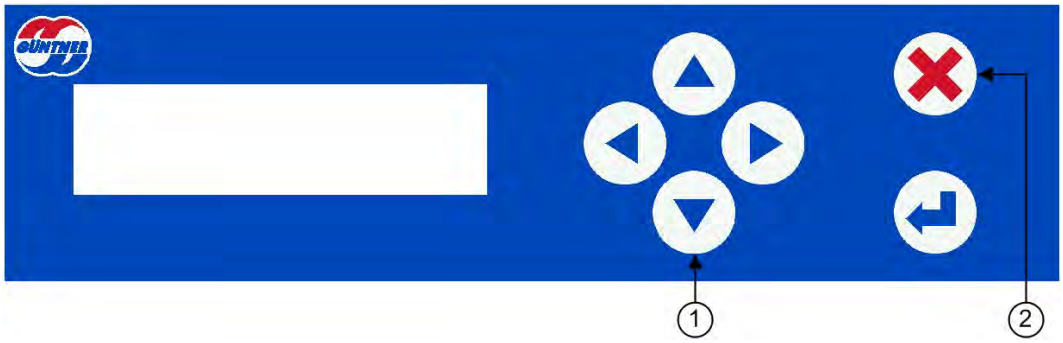
Cancel and return to INFO menu

Enter key for function selection; change to EDIT mode and value acceptance

Right arrow for moving to the next menu level.

Left arrow for moving to the previous menu level.

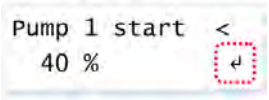
Up/down arrow for scrolling through the menu level.



1. Use this key to move from the **INFO** menu to the **Operating menu**.
2. Use this key to return to the **INFO** menu at any time.

5.3 Edit mode

This mode is required to change numeric values (setpoints, for example) and to select functions. All editable entries are highlighted accordingly in the Operating menu with the **ENTER-**symbol.

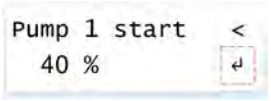


The currently defined value and the currently selected function are shown in display mode. Press the Enter key to switch to writing mode.

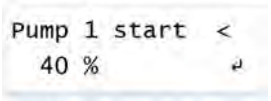
5.3.1 Changing numeric values

Numeric values can be edited in this mode, for example control values below the menu option “Service > Pumps > Parameter > Pump 1”:

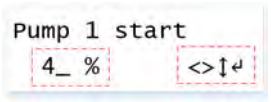
Select the required menu option
(e.g. fan control value for Pump 1 Start)



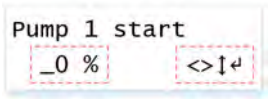
Change to the menu option



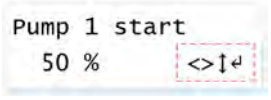
Change to writing mode
(cursor flashes)

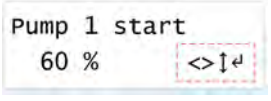


Decimal point selection
(cursor flashes)

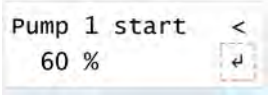


Change value

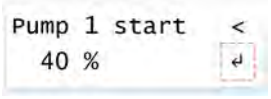




Adopt the new value and change to display mode



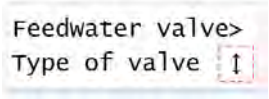
Reject changes and change to display mode



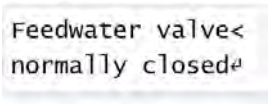
5.3.2 Selecting functions

This mode is required in order to select functions (for example valve type under the menu option "Service > Valve settings > Feedwater valve").

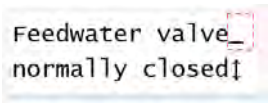
Select the required menu option
(e.g. valve type for feedwater valve)

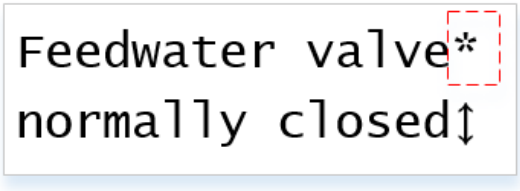


Change to the menu option

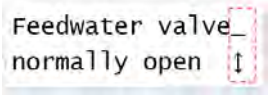


Change to writing mode (cursor flashes)
→ The currently selected function “normally closed” is indicated with a asterisk symbol (**indicated by**)

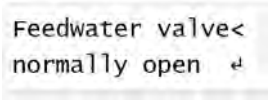




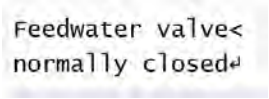
Scroll to select the desired function
(cursor flashes)



Adopt the new “normally open” function and change to display mode



Reject changes and change to display mode



5.4 Configuration

The GMM sinconThe GHM pump is configured with an appropriate number of potential-free contacts. Their assignments will differ depending on the configuration.

5.4.1 Configuration table

Configuration table GRCpump.1

NOTICE

The inputs and outputs on GRCpump.1 and GIOD.1 can be configured flexibly.

The table below shows a “standard configuration” with corresponding options for the GHM pump following commissioning.

	I/O	Signal	Function
GRCpump.1	DI1	24V	External enabling
	DI2	24V	Free
	DI3	24V	Free
	AI1	4..20mA	Water level sensor
	AI2	4..20mA/KTY	Conductivity sensor (4..20 mA) *1
	AI3	KTY	Water temperature in wetting basin
	AI4	0..10V	Free
	AO1	0..10V	Control value for adjustable pump *1
	AO2	0..10V	Tray fill level (symbolic)
	DO1	Relay	Feedwater valve (on site) *1
	DO2	Relay	Additional water valve (at the unit)
	DO3	Relay	Blowdown valve (at the unit)
	DO4	Relay	PRIO 1 and 2 fault messages
CAN BUS			Data from GMM: Pressure or return temperature / ambient temperature / setpoint / unit system Data to GMM: Wet bulb temperature / speed limitation / inverse operation of fans
GIOD.1	DO1	Relay	Pump 1 *1
	DO2	Relay	Pump 2 *1
	DO3	Relay	Free
	DO4	Relay	Free
	DO5	Relay	Free
	DO6	Relay	Free
	DO7	Relay	Free

Configuration table GRCpump.1 with GIOD.1

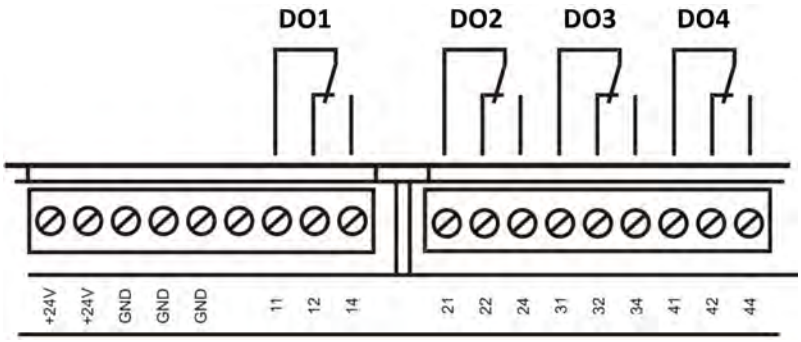
	I/O	Signal	Function
	DO8	Relay	Free
	DI1	24V	Feedwater valve is open (on site) *1
	DI2	24V	Feedwater valve is closed (on site) *1
	DI3	24V	Additional water valve is open (at the unit) *1
	DI4	24V	Additional water valve is closed (at the unit) *1
	DI5	24V	Blowdown valve is open (at the unit) *1
	DI6	24V	Blowdown valve is closed (at the unit) *1
	DI7	24V	Free
	DI8	24V	Free
	DI9	24V	Free
	DI10	24V	Free
	DI11	24V	Free
	DI12	24V	Free
	DI13	24V	Free
	DI14	24V	Free
	DI15	24V	Free
	DI16	24V	Free

Configuration table GRCpump.1 with GIOD.1

*1 Function is dependent on commissioning

5.4.2 Command outputs on GRCpump.1

The command outputs on GRCpump are implemented as relays with potential-free two-way contacts:



NOTICE

The load on the potential-free contacts DO1-DO4 on GRCpump must not exceed 250V/1A.

Digital output (DO1):
Digital output DO1 is used to control the on-site feedwater valve. Both NC (normally closed) and NO (normally open) valves can be connected (see Valve settings, page 112). The valve is powered when contact 11/14 is closed. If no feedwater valve is available, DO1 can be assigned an alternative function (see Digital outputs, page 107).

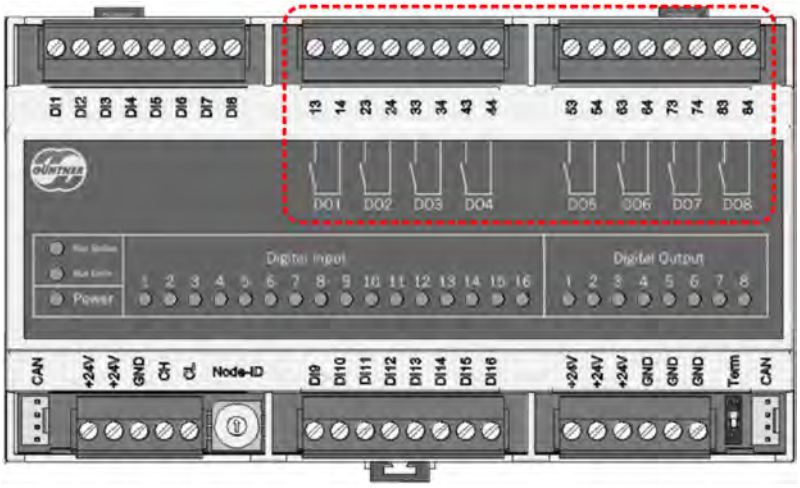
Digital output (DO2):
Digital output DO2 is used to control the additional water valve at the unit. Both NC (normally closed) and NO (normally open) valves can be connected (see Valve settings, page 112). The valve is powered when contact 21/24 is closed. The additional water valve is mandatory for proper operation of the system.

Digital output (DO3):
Digital output DO3 is used to control the blowdown valve at the unit. Both NC (normally closed) and NO (normally open) valves can be connected (see Valve settings, page 112). The valve is powered when contact 31/34 is closed. The blowdown valve is mandatory for proper operation of the system.

Digital output (DO4):
Digital output DO4 is used for the fault message. Either a combined fault message for PRIO 1 and 2 (default setting) or only PRIO 1 can be signalled. If a fault occurs, the relay is switched (drops out) i.e. the two-way contact 41/42 closes. As a result a fault is also reported when a fault causes the power to the GHM to be interrupted. If signalling of the fault messages is not required, DO4 can be assigned an alternative function (see Digital outputs, page 107).

5.4.3 Command outputs on GIOD.1

The command outputs on GIOD are implemented as relays with potential-free closer contacts:



NOTICE

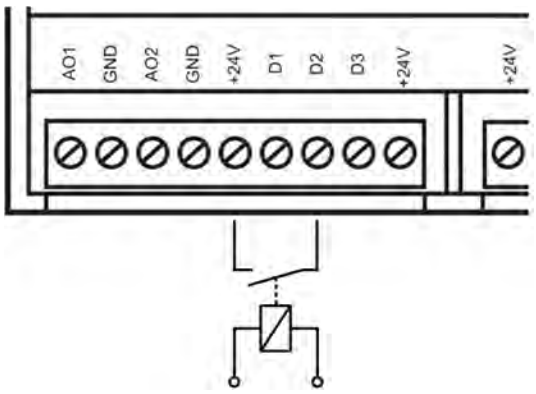
The load on the potential-free contacts DO1-DO8 on GIOD must not exceed 250V/1A.

Digital outputs (DO1 to DO8):
Functions are activated via the digital outputs DO1 to DO8. The functions can be assigned flexibly depending on the design of the system. All configuration options are explained in the section on service/IO configuration/digital outputs on page y.

5.5 Control inputs

The control inputs are designed as a **low-voltage connection** and are connected via a potential-free contact (relay, contactor contact, switch etc.).

The potential-free contact must be switched between the +24V terminal and the respective control input. If the contact is closed, the function is activated, for example relay on DI2 from GRCpump:

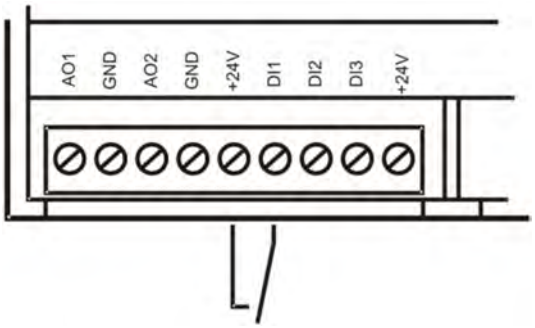


5.5.1 Enabling of GHM pump

The controller is enabled via terminal**DI1**(enable) on GRCpump.1. The enabling depends on the current mode of the GHM pump:

- The GHM remains in dry mode until the enable is issued and the filling criteria are observed.

- The humidification of the heat exchanger in wet mode remains blocked until the enable is issued and the humidification criteria are observed.



Connection of external enable contact on DI1/ +24V

If the enable does not take place externally, terminal DI1 must be switched by a wire bridge and removed accordingly from the IO configuration (see I/O configuration, page 94).

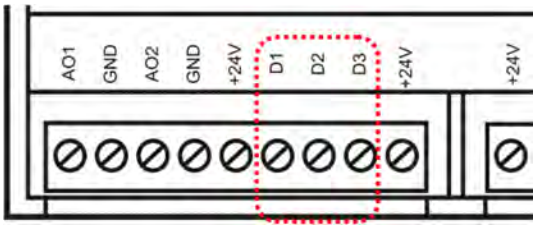
This enabling jumper is always installed in the factory.

NOTICE

Under no circumstances may the controller be disabled by interrupting the power supply! Continuously switching the supply voltage can damage the controller, and such damage is not covered by the warranty!

Enable is not required in "Manual mode".
See *Manual mode, page 66*

5.5.2 Control inputs on GRCpump.1



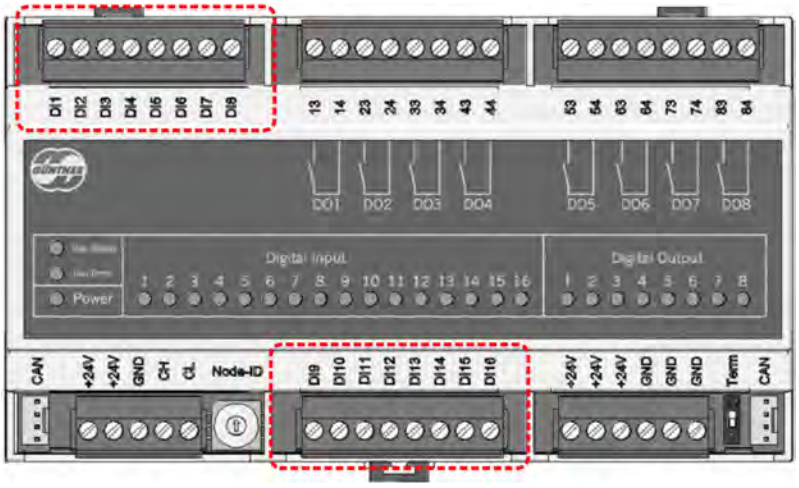
Digital inputs on GRCpump.1

Digital input (DI1):
The controller is enabled via digital input DI1 (see Enabling of GHM pump, page 37). If the external enable is not required, DI1 can be assigned an alternative function (see Digital inputs, page 101).

Digital input (DI2):
A water meter with pulse output for additional water can be connected to digital input DI2. The pulse rate and the unit can be configured individually in the service menu (see Water meter, page 111). If no water meter is available for the additional water, DI2 can be assigned an alternative function (see Digital inputs, page 101).

Digital input (DI3):
A water meter with pulse output for blowdown water can be connected to digital input DI3. The pulse rate and the unit can be configured individually in the Service menu (see Water meter, page 111). If no water meter is available for the blowdown water, DI3 can be assigned an alternative function (see Digital inputs, page 101).

5.5.3 Control inputs on GIOD.1

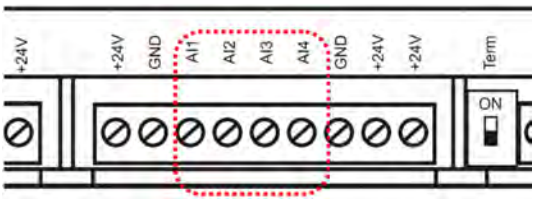


Digital inputs on GIOD.1

Digital inputs (DI1 to DI16):
Functions are activated via the digital inputs DI1 to DI16. The functions can be assigned flexibly depending on the design of the system. All possible digital input functions from GIOD.1 are explained in greater detail in the section on service/IO configuration/digital inputs.

5.6 Analogue inputs

The GRCpump.1 has four sensor inputs:



Input AI1	Current input	4-20mA
Input AI2	switchable	4-20mA or impedance sensor GTF210
Input AI3	Impedance sensor	GTF210
Input AI4	voltage input	0-10V DC

The various ways of using inputs and how to connect them in each case are described below.

5.6.1 Connecting a water level sensor on AI2 or AI2

A water level sensor with current signal (4-20 mA) must be configured on AI1 or AI2 to control the water level. The input signal 4...20mA is scaled in the defined measuring range (see Level sensor, page 114).

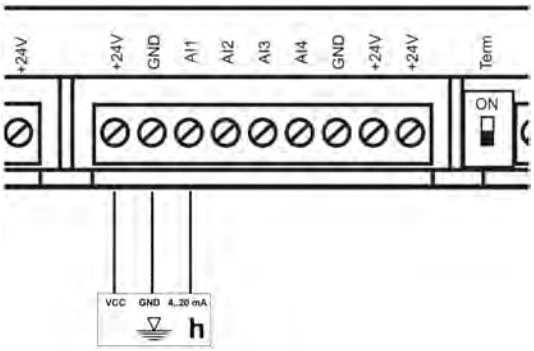
The fill level sensor is connected to the following terminals:

+24 V = Common supply voltage (+)

AI1 = Signal input 4...20 mA from sensor

or

AI2 = Signal input 4...20 mA from sensor



Connecting a fill level sensor

5.6.2 Connecting a conductivity sensor on AI1 or AI2

A conductivity sensor with current signal (4-20 mA) must be configured on AI1 or AI2 for conductivity-based blowdown. The input signal 4...20 mA is scaled in the defined measuring range (see Conductivity sensor, page 117).

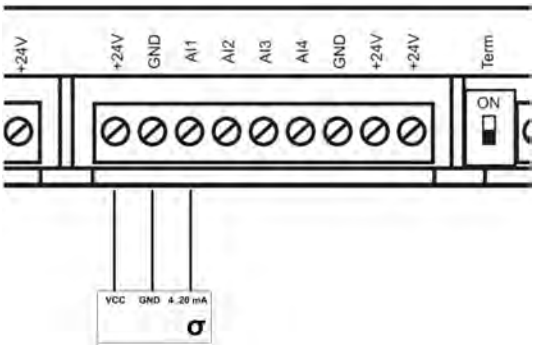
The conductivity sensor is connected to the following terminals:

+24 V = Common supply voltage (+)

AI1 = Signal input 4...20 mA from sensor

or

AI2 = Signal input 4...20 mA from sensor

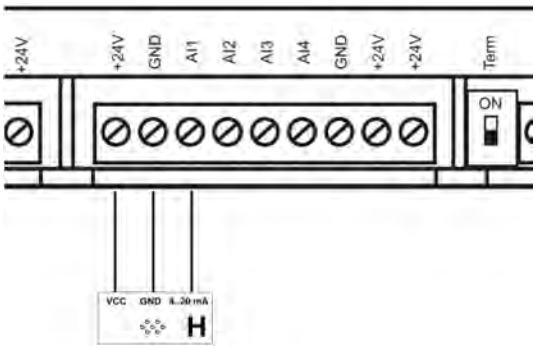


Connecting a conductivity sensor on AI1

5.6.3 Connecting a humidity sensor on AI1, AI2 or AI4

A humidity sensor can be connected to the analogue inputs AI1, AI2 or AI4 to record the relative humidity. The sensor is required for wet bulb-based setpoint displacement of the GMM control value. The 0-10 V input signal is scaled in the process in the measuring range 0-100 %.

The humidity sensor can either be configured with a current signal (4-20 mA) on AI1 or AI2 or voltage signal (0-10 V) on AI4.

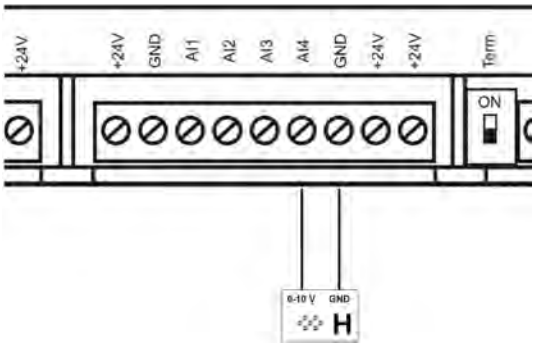


Connecting a humidity sensor on AI1

The humidity sensor is connected with the 0-10 V standard signal to the following terminals:

GND = Earth (-)

AI4 = Signal 0-10 V DC (+) from sensor (max. 12 V DC)



Connecting a humidity sensor on AI4

5.6.4 Connecting a temperature sensor on AI3

A temperature sensor can be connected on the analogue input AI3 to record the water temperature in the wetting basin.

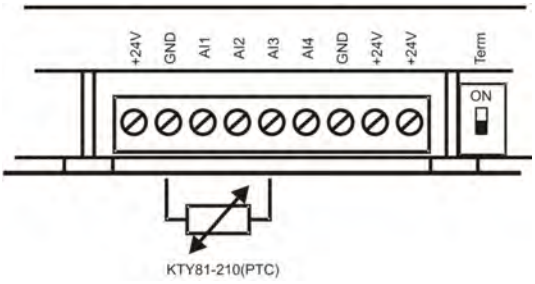
A temperature sensor is connected to the following terminals:

GND = Earth (-)

AI3 = Signal input

There is no particular sequence for the cores.

The Güntner GTF210 temperature sensor is used in the range #30°C to +70°C. Please contact us for other temperature ranges.



Connecting a temperature sensor on AI3

To test a temperature sensor that may be defective, disconnect it from the controller and then measure the impedance (with an ohmmeter or multimeter). On the GTF210, the impedance should be between 1.04 kΩ (-50 °C) and 3.27 kΩ (+100 °C). You can use the table below to check whether the sensor has the correct impedance at a known temperature.

Impedance Ω	Temperature (°C)	Impedance Ω	Temperature (°C)
1040	-50	2075	30
1095	-45	2152	35
1150	-40	2230	40
1207	-35	2309	45
1266	-30	2390	50
1325	-25	2472	55
1387	-20	2555	60
1449	-15	2640	65
1513	-10	2727	70
1579	-5	2814	75
1645	0	2903	80
1713	5	2994	85
1783	10	3086	90
1854	15	3179	95

Characteristic curve of the temperature sensor GTF210

Impedance Ω	Temperature (°C)	Impedance Ω	Temperature (°C)
1926	20	3274	100
2000	25	3370	105

Characteristic curve of the temperature sensor GTF210

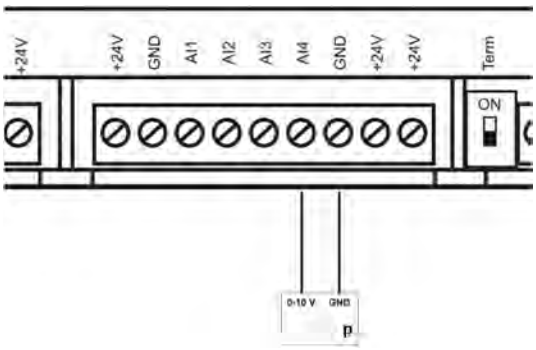
5.6.5 Connecting a pressure sensor on AI4

A pressure sensor can be connected on AI4 to record the nozzle pressure. The 0-10 V input signal is scaled in the process in the measuring range 0-6 bar.

The pressure sensor is connected with the 0-10 V standard signal to the following terminals:

GND = Earth (-)

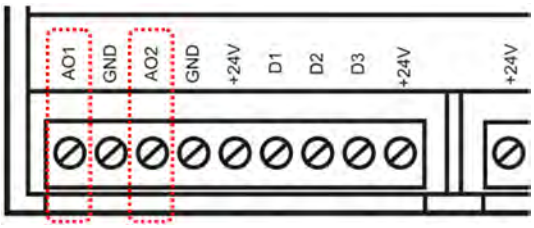
AI4 = Signal 0-10 V DC (+) from sensor (max. 12 V DC)



Connecting a pressure sensor on AI4

5.7 Analogue outputs

There are two outputs on GRCpump.1 for activating an adjustable pump and outputting different measured data:



Output AO1	Voltage output	0 - 10 V
Output AO2	Voltage output	0 – 10 V

The various ways of using outputs and how to connect them in each case are described below.

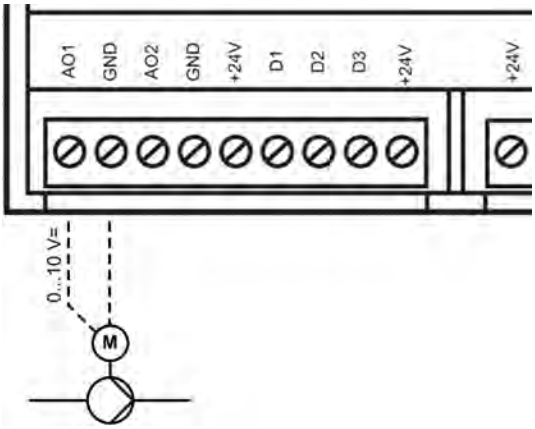
5.7.1 Controlling an adjustable pump via AO1 or AO2

If an adjustable pump is used, a control signal is output for pump control via the analogue output AO1 or AO2. The control value 0-100 % is scaled in the process to a voltage range of 0-10 V. If no adjustable pump is available, the corresponding output can be configured for outputting the measured data (see Outputting measured data via AO1 and AO2, page 44).

The pump control is connected with the 0-10 V standard signal to the following terminals:

GND = Earth (-)

AO1 = Signal output 0-10 V DC (+)
or
AO2 = Signal output 0-10 V DC (+)



Connecting an adjustable pump on AO1

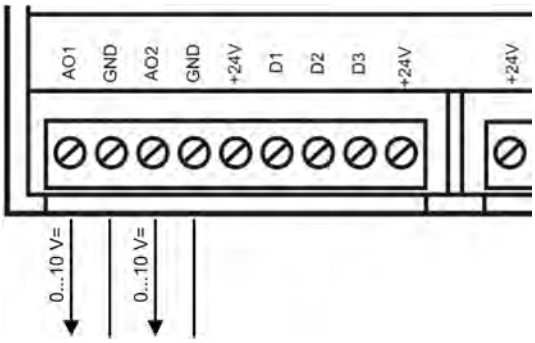
5.7.2 Outputting measured data via AO1 and AO2

Different sensor measured data can be output via the analogue outputs AO1 and AO2 in the form of a 0-10 V standard signal, which can be evaluated for example by a higher-level control. The measured variables for tray fill level (symbolic or continuous) and conductivity of the wetting water can be output in this way (see Analogue outputs, page 106).

A 0-10 V standard signal is connected to the following terminals:

GND = Earth (-)

AO1 = Signal output 0-10 V DC (+)
or
AO2 = Signal output 0-10 V DC (+)



Connecting a 0-10 V standard signal on AO1 or AO2

5.8 Operating menu

Structure of basic menu

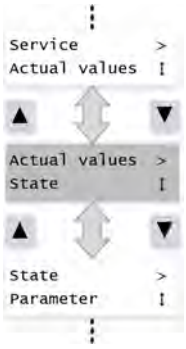
NOTICE

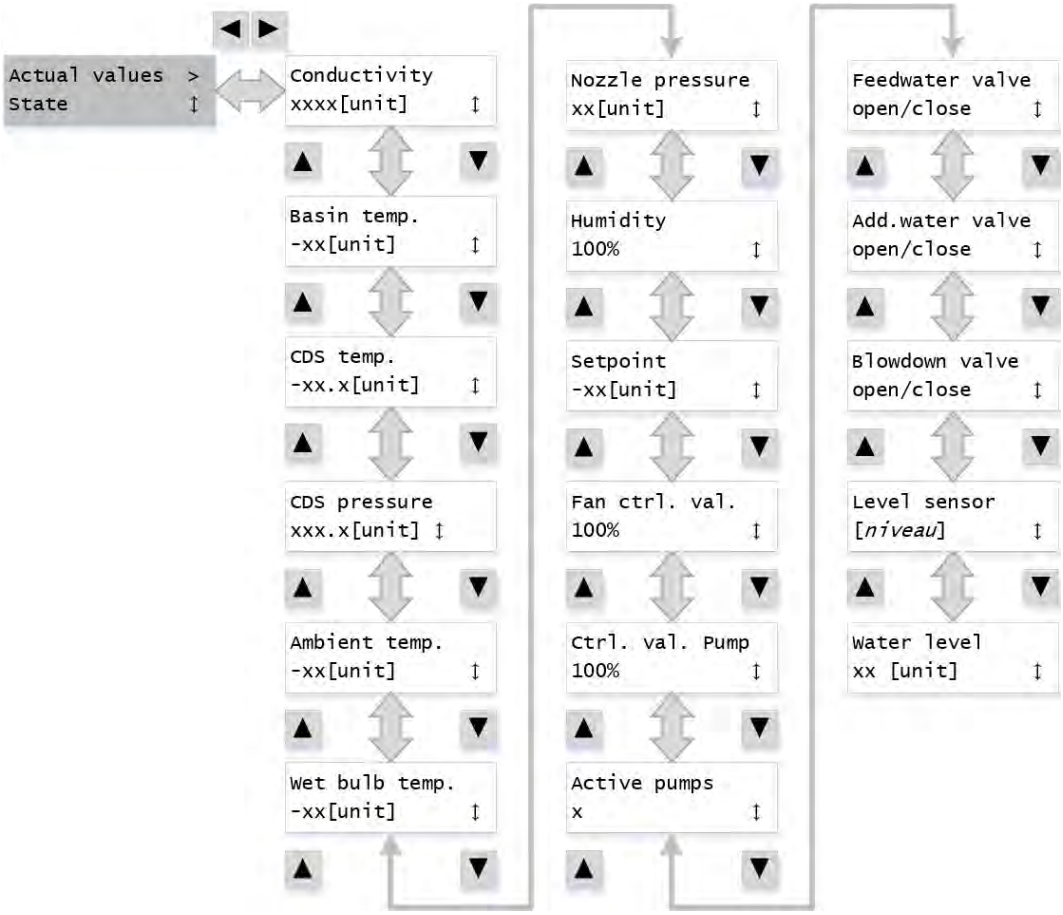
All values are displayed in the unit system currently defined in GMM. The unit system is defined on a one-time basis when the controller is started. This means that the controller then has to be restarted if the unit system is changed by GMM.

5.8.1 Actual values

The actual input signals and control values are shown here.

The number of entries displayed is dependent on the system configuration. For example, the tray temperature is only displayed when a corresponding temperature sensor is configured. The display of the actual value of the medium (condenser temperature/pressure or outlet temperature) is dependent on the type of cooler (condenser or dry cooler).

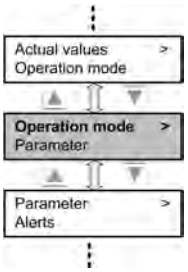




Display	Description
Conductivity	Conductivity of wetting water.
Basin temperature	Temperature of the water in the wetting basin.
Condenser temperature	Actual value of medium (condenser temperature) received from GMM.
Condenser pressure	Actual value of medium (condenser pressure) received from GMM.
Outlet temperature	Actual value of medium (dry cooler outlet temperature) received from GMM.
Ambient temperature	Ambient temperature received from GMM.
Wet bulb temperature	The wet bulb temperature is calculated based on the ambient temperature and humidity.
Nozzle pressure	Humidification nozzle inlet pressure or pressure downstream of the pump.
Air humidity	Relative humidity in the environment.
Setpoint	Setpoint of medium (pressure or temperature) received from GMM.
Fan control value	Fan control value received from GMM.
Control value pump	Control value of controlled pump.
Active pump	Number of active uncontrolled pumps.
Feedwater valve	Current command to the feedwater valve.
Additional water valve	Current command to the additional water valve.
Blowdown valve	Current command to the blowdown valve.
Level sensor	Current water level shown symbolically.
Fill level	Current water level measured in continuous height display.

5.8.2 Status

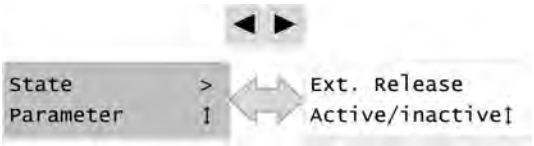
The Status menu provides information on the current operating modes. Moreover, the hardware and software version of the controller as well any connected bus module is displayed. The number of entries displayed is dependent on the system configuration. For example, the biocide process is only displayed if the corresponding “Biocide station” function is configured.



5.8.2.1 Hardware and software versions

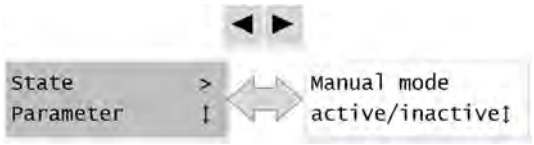
5.8.2.2 External enabling/release

It is shown here whether the external enable is issued**Active**or not**Inactive**



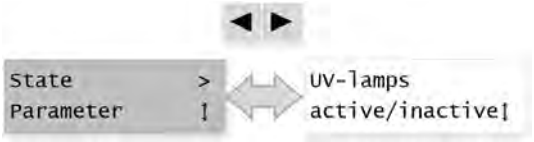
5.8.2.3 Manual mode

It is shown here whether direct manual mode is enabled**Active**or not**Inactive**



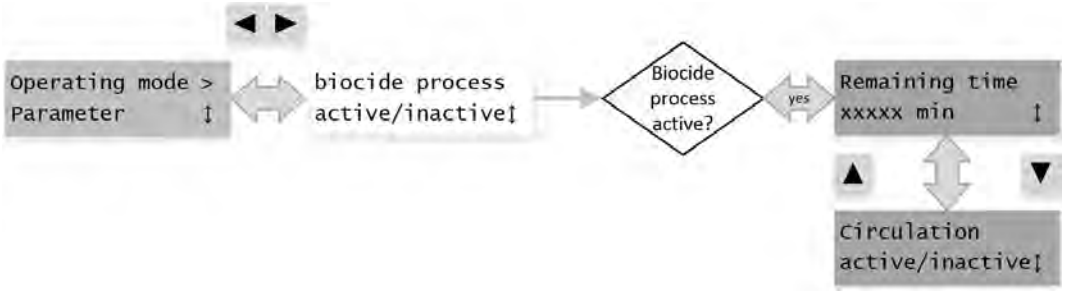
5.8.2.4 UV lamps

It is shown here whether the UV lamps in the wetting basin are switched on**Active**or not**Inactive**
This menu option is only displayed if the corresponding function is configured.



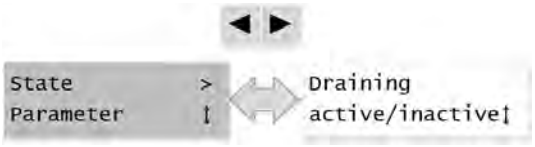
5.8.2.5 Biocide process

The status of biocide processing is shown in this sub-item. If the biocide process is**Active**the time remaining and the circulation status can be viewed in the associated sub-menu. This menu option is only displayed if the corresponding “Biocide station” function is configured.



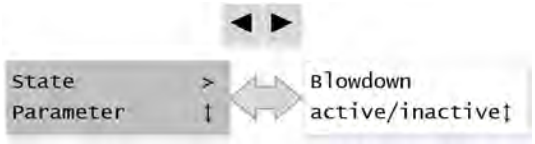
5.8.2.6 Draining

It is shown here whether the tray is currently being emptied**Active**or not**Inactive**



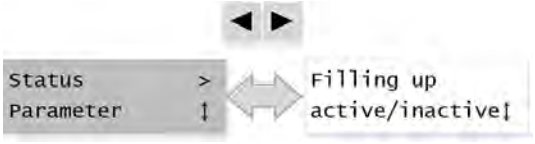
5.8.2.7 Blowdown

It is shown here if a blowdown process is currently taking place**Active**or not**Inactive**



5.8.2.8 Filling

It is shown here whether the tray is currently being filled with fresh water**Active**or not**Inactive**

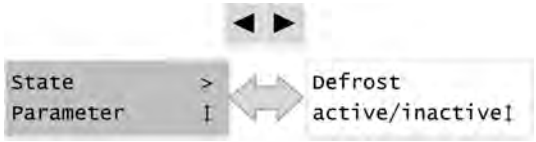


5.8.2.9 Feedwater valve

It is indicated here whether the valve provided by customer for feedwater is configured**Available**or not**Not available**

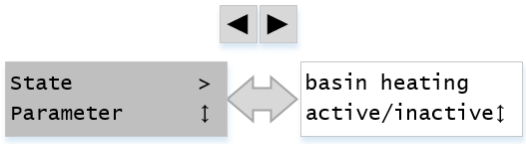
5.8.2.10 Defrosting

It is shown here whether a request for defrosting is currently being signalled to the GMM**Active**or not**Inactive**
The fans operate in inverse mode during defrosting.



5.8.2.11 Basin heating

It is shown here whether basin heating is currently enabled**Active**or not**Inactive**.
This menu option is only displayed if the corresponding function is configured.

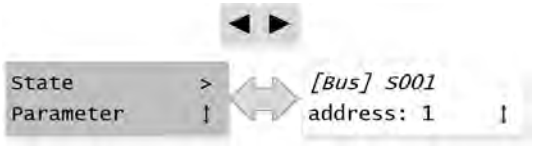


5.8.2.12 Heat tracing

It is shown here whether ancillary pipe heating is currently enabled**Active**or not**Inactive**
This menu option is only displayed if the corresponding function is configured.

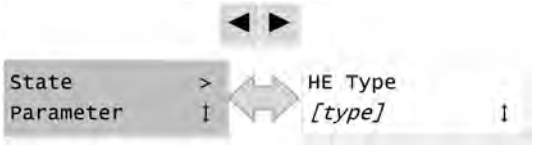
5.8.2.13 Bus module

This display provides information on the module type, firmware version and the address of the GCM bus module, when it is connected.



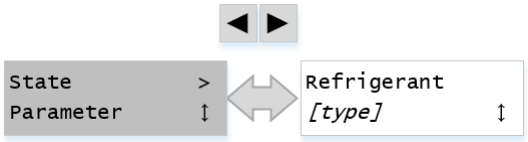
5.8.2.14 Heat exchanger

The heat exchanger type is displayed here. This information is provided by GMM.



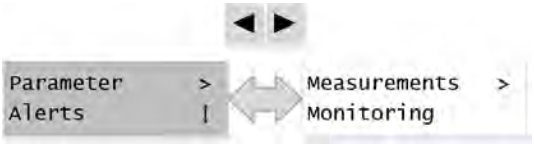
5.8.2.15 Refrigerant

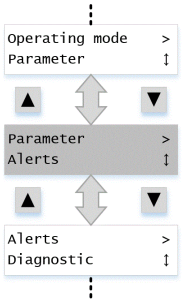
If a condenser has been selected as the heat exchanger, the selected refrigerant is displayed here. If no refrigerant has been selected, “bar” is displayed. This information is provided by GMM.



5.8.3 Parameters

The parameters for monitoring measurements can be defined in this menu.

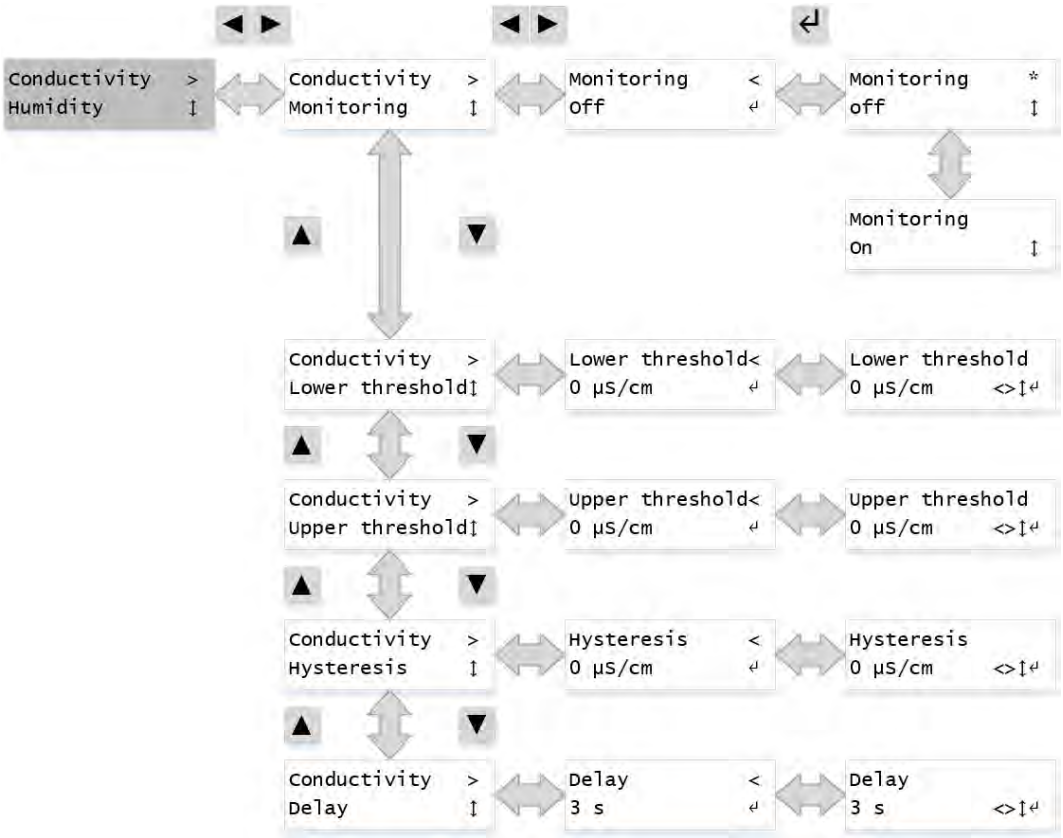




5.8.3.1 Measurement monitoring

The monitoring of measurements is configured in this menu option. Each measured variable is checked to determine whether its measurement is within a valid interval. If the measurements for a sensor lie outside its predefined interval over a longer period, an alarm entry is made and a PRIO 2 fault message is triggered, which can be picked up by default via the fault message output DO4.

Monitoring of measurements can be configured individually and switched on and off at any time for each measured variable. Monitoring can be defined as follows, for example for the measured variable “Conductivity”:

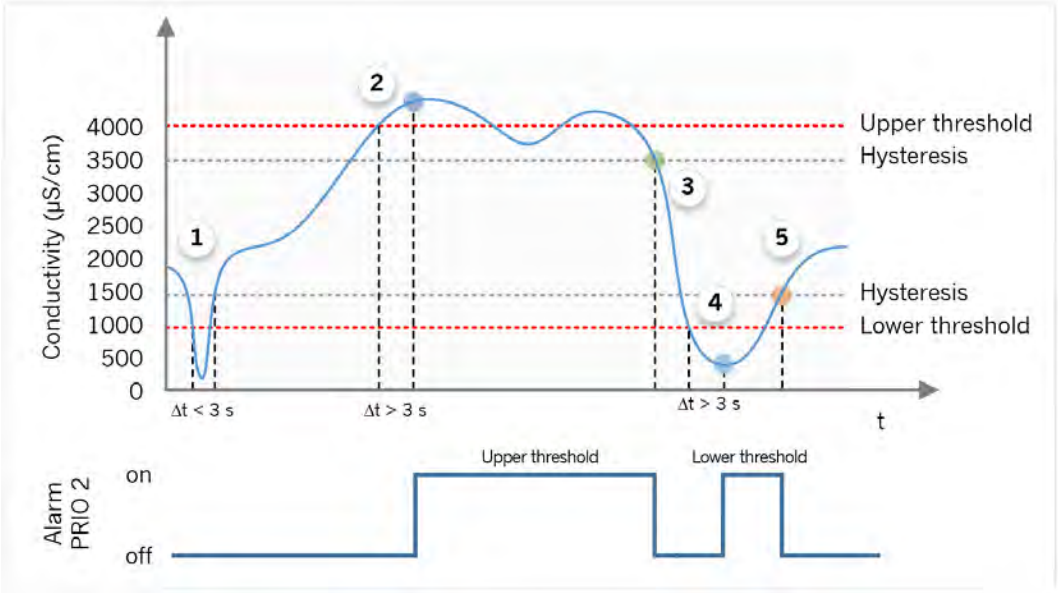


Parameter	Description	Default
Monitoring	Monitoring for selected measured variables and thus the corresponding alarm reports can be switched on and off.	Off
Upper threshold	The upper threshold for the permitted interval can be defined here for the selected measured variable.	0 (mm, µS/cm, %, °C, bar, °C)
Lower threshold	The lower threshold for the permitted interval can be defined here for the selected measured variable.	0 (mm, µS/cm, %, °C, bar, °C)
Hysteresis	The alarm threshold can be adjusted here additionally for the selected measured variable in order, for example, to prevent premature exiting of the alarm status in the case of heavily fluctuating measurements.	0 (mm, µS/cm, %, °C, bar, °C)
Delay	The time after which an alarm is triggered after the measured value is outside of the permitted interval can be defined here for the selected measured variable.	3 s

Example: The following parameters are configured for monitoring the measured variable “Conductivity”:

Monitoring:	On
Upper threshold:	4000 µS/cm
Lower threshold:	1000 µS/cm
Hysteresis:	500 µS/cm
Delay:	3 s

The following diagram shows the potential conductivity progression and the corresponding monitoring states of the measured variables.



Measurement monitoring

1. No alarm:
Conductivity falls below the lower threshold and rises again in less than three seconds above the “lower threshold + hysteresis”.

2. Alarm on:
Conductivity rises above the upper threshold and is maintained for more than three seconds. A PRIO 2 fault message is triggered after three seconds and an alarm entry “upper conductivity threshold” is generated.

3. Alarm off:
Conductivity falls below the “upper threshold - hysteresis” and the fault message is triggered.

4. Alarm on:
Conductivity falls below the lower threshold and is maintained for more than three seconds. A PRIO 2 fault message is triggered after three seconds and an alarm entry “lower conductivity threshold” is generated.

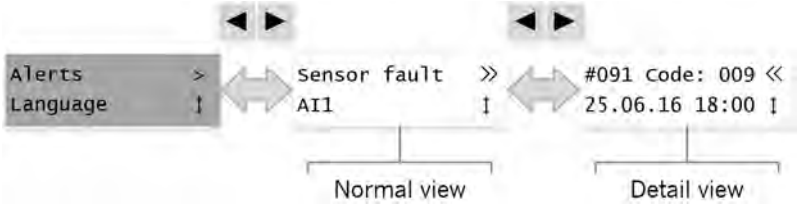
5. Alarm off:
Conductivity rises above the “lower threshold + hysteresis” and the fault message is triggered.

5.8.4 Alarms

The GHM has an alarm memory, which can store up to 100 messages (incident reports, warnings, starting and residual times). The generated messages are written continuously to the alarm memory (ring memory) together with an error code and time stamp (date and time).

A list of possible incident reports and warnings as well as additional information concerning possible sources of error and solution approaches can be referenced in the section on incident reports and warnings on page y.

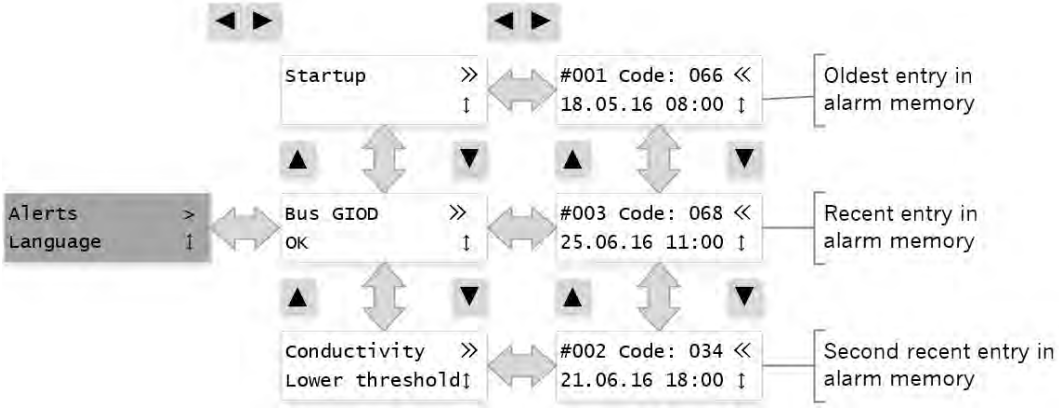
If there are entries in the alarm memory, the last message generated is displayed when the menu option is opened.



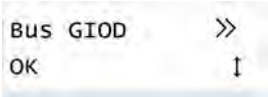
The **normal view** shows the two-line designation of the selected message.
The **detailed view** shows additional information on the selected entry.

- The upper line contains the serial number in the alarm memory (e.g. #091) and the error code (e.g. code: 009).
- The lower line contains the time stamp for the selected entry, consisting of the date and time of the alarm message.

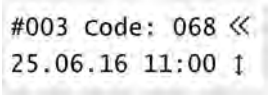
Navigation and operation of the Alerts menu is described below.



Scroll between alarm memory entries:
- “Down” arrow key: show older entries:
- “Up” arrow key: show latest entries



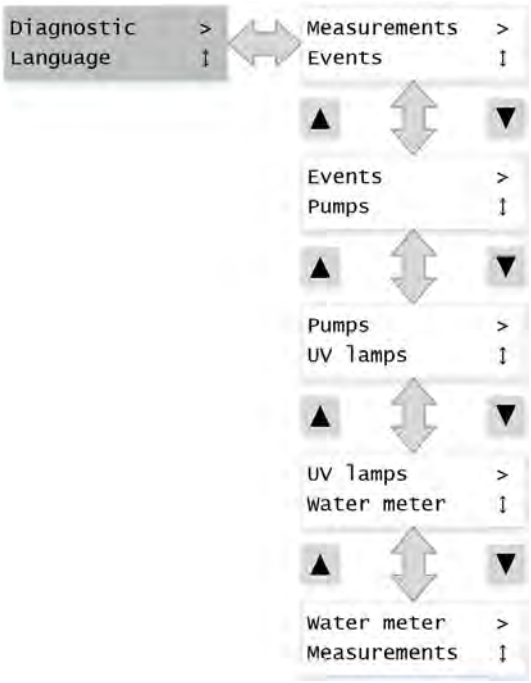
Switch to detailed view:
Line 1: Number in ring memory and error code
Line 2: Time stamp for entry



Switch from detailed to normal view and from normal view back to the main menu

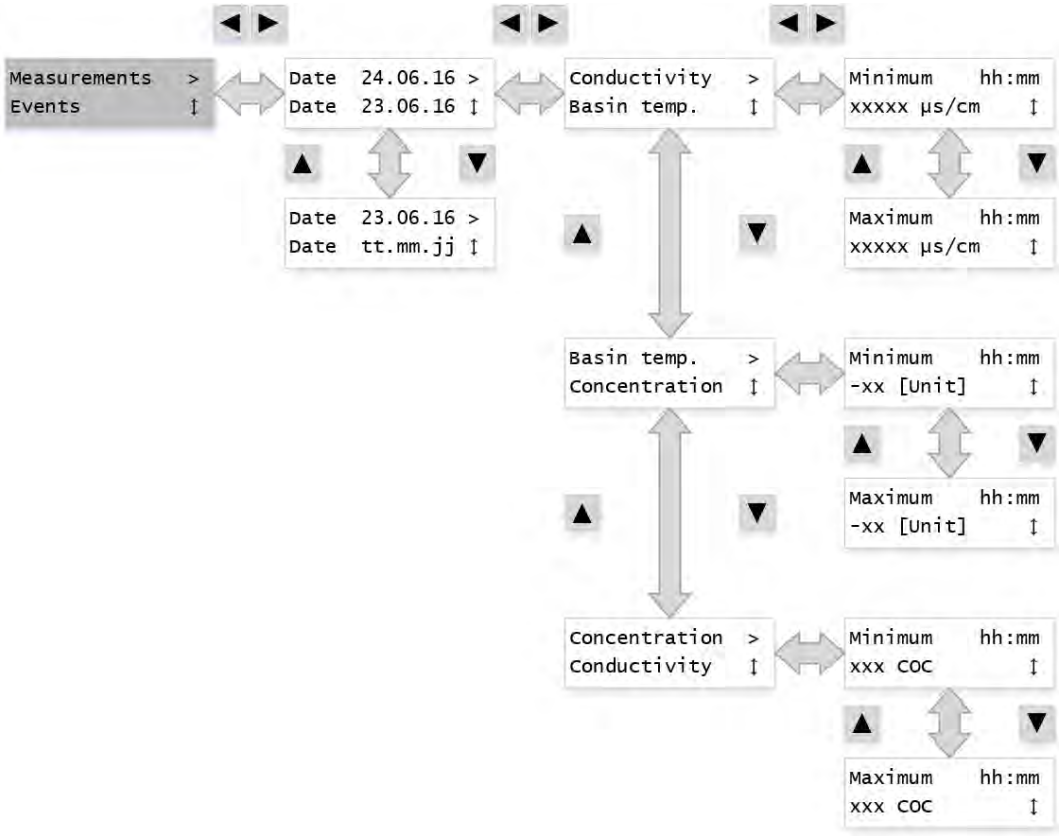
5.8.5 Diagnostics

The diagnostics menu is an important auxiliary means of monitoring, diagnosing and recording operating data on the system. The GHM pump has several diagnostic memories at its disposal. These memories store information concerning the current operating status as well as past events. Moreover a history of measurements is maintained for the last 64 days. The recorded data can be used for different monitoring, diagnostic and statistics purposes.



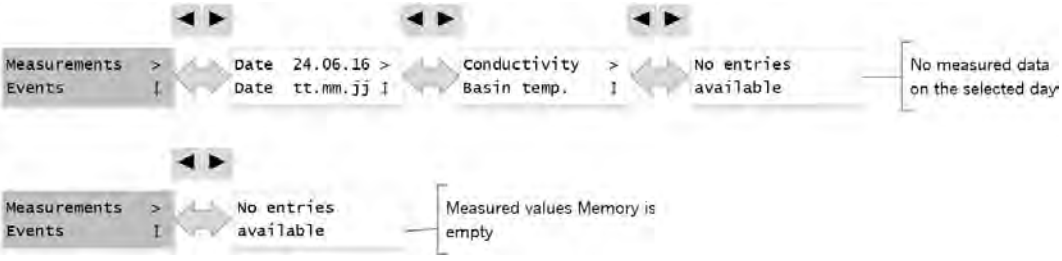
5.8.5.1 Measurements

The GHM pump's measurement memory can be viewed by selecting the "Measurements" sub-item. This memory includes statistical data for the last 64 days and is updated on a continuous basis (ring memory) with older entries being overwritten. Daily minimum and maximum values are recorded for the conductivity of the wetting water, the water temperature in the tray and the concentration.



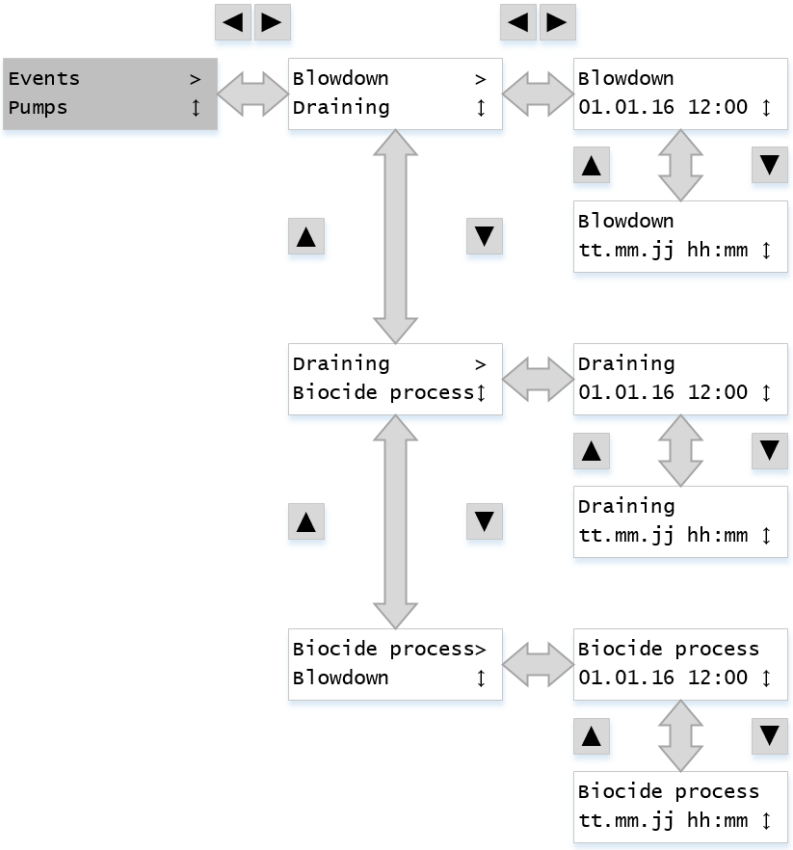
Conductivity	Minimum and maximum conductivity of the wetting water on the selected day.
Tray (basin) temperature	Minimum and maximum water temperature of the wetting basin on the selected day.
Concentration	Minimum and maximum concentration of the wetting water on the selected day.

If there is no data available for the selected day and the selected measured variable or if the measurement memory is blank, an appropriate message is displayed, such as:



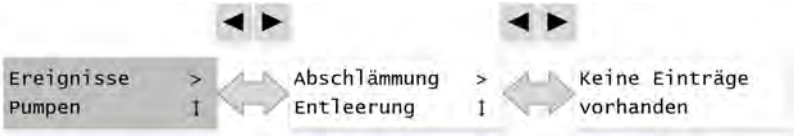
5.8.5.2 Events

The GHM pump's events memory can be viewed using the "Events" sub-item. This memory includes a history of especially important events. The individual events are saved continuously (ring memory) with older entries being overwritten. The events memory is structured as follows:



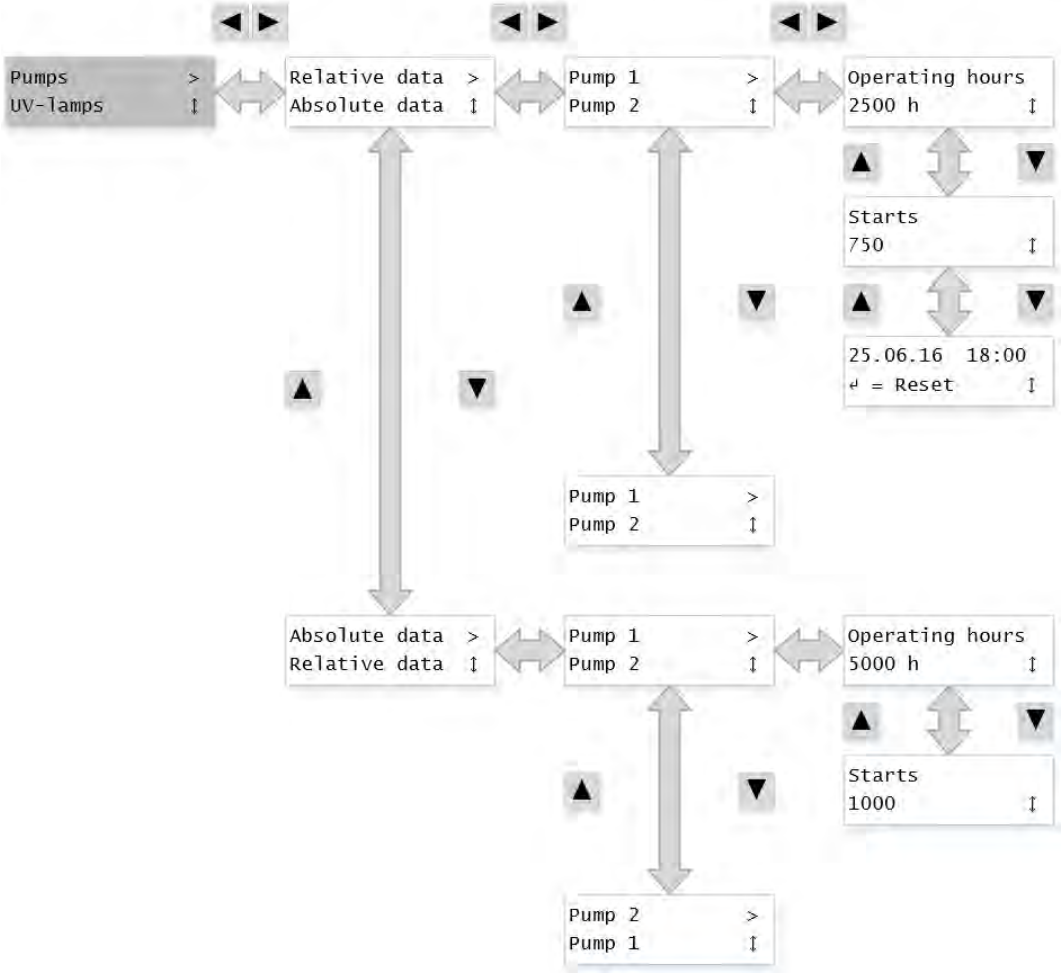
Blowdown	Last 10 blowdowns
Draining	Last 5 drainings
Biocide process	Last 30 biocide processes

If there is no data available for the selected event, an appropriate message is displayed, such as:



5.8.5.3 Pumps

The pump activity can be viewed in the “Pumps” sub-item. Both the operating hours and the number of pump starts can be queried. A distinction is made in this respect between relative and absolute data. In the case of relative data, the readings refer to the last counter reset time, while in the case of absolute data, they refer to the last commissioning time. Moreover, an option is provided for the relative data to reset the current pump statistics. The relevant data for the operating hours is deleted after a counter reset as well as the pump starts for all pumps and the reset time set to the current date and time.

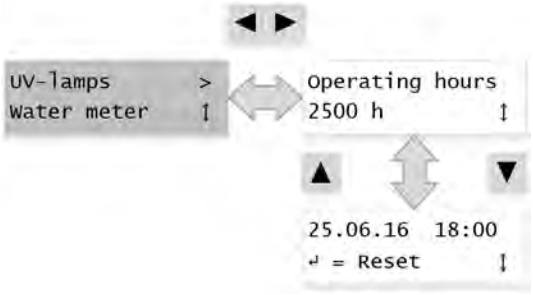


NOTICE

It is still possible to signal a warning message based on pump activity. An entry is written to the alarm memory if the threshold is exceeded and a PRIO 2 fault message is triggered. A maximum value for the operating hours can be configured in the “Service > Pumps > Pump 1/2 > Pump warning message” menu. Parameter, page 88).

5.8.5.4 UV lamps

The operating hours for the UV lamps and the last reset time can be viewed with the "UV lamps” menu option. Moreover, it is also possible to reset the current counter status, for example after replacing UV lamps. The statistics are deleted after a counter reset and the reset time is set to the current date and time.

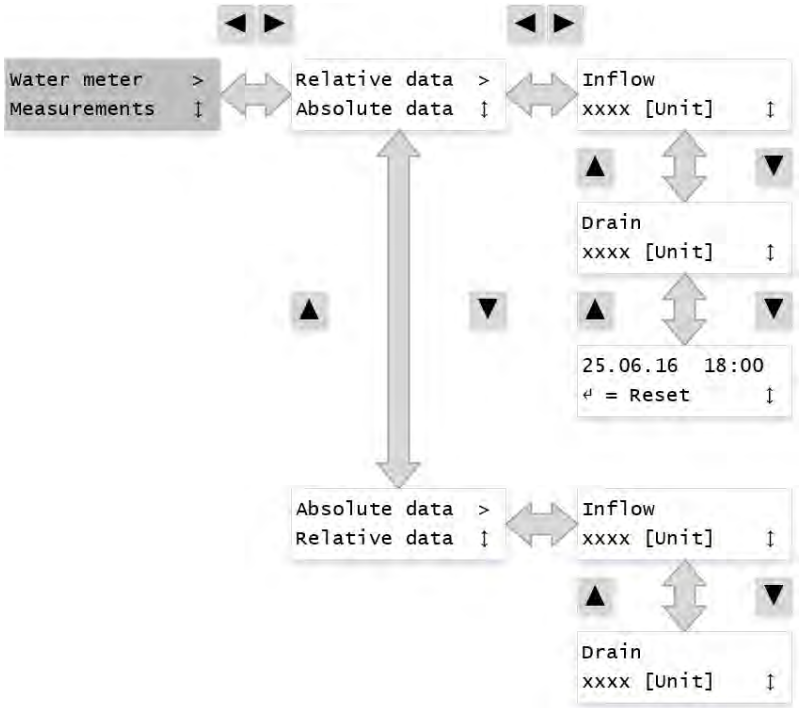


NOTICE

A maximum value can be set for the operating hours with the “Service > Functions > UV lamps > Change interval” menu option. An entry is written to the alarm memory if the threshold is exceeded and a PRIO 2 fault message is triggered.

5.8.5.5 Water meter

The water volumes flowing into and out of the tray can be viewed with the “Water meter” menu option. The recorded data can be used, for example, for accounting purposes or operating analysis. A distinction is made in this respect between relative and absolute data. In the case of relative data, the readings refer to the last counter reset time, while in the case of absolute data, they refer to the last commissioning time. Moreover, an option is provided for the relative data to reset the current counter status. The relevant statistics for the inflow as well as for the outflow are deleted after a counter reset and the reset time set to the current date and time.



5.8.6 Language

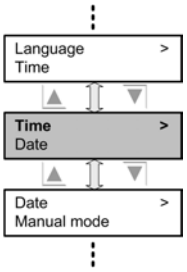
The menu language can be selected here.

5.8.6.1 Language selection

2 languages can be selected in the “Language selection” menu. The selected language is marked with an *asterisk*.

5.8.7 Time

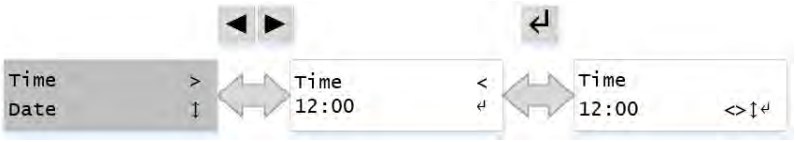
The time can be selected here.



5.8.7.1 Time setting

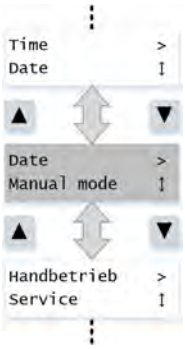
The set time is displayed and changed where required in the 24-hour clock.

The time is used for the timestamp for entries in the alarm and diagnostic memory as well as for all timer functions.



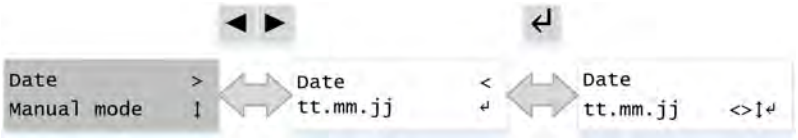
5.8.8 Date

The date can be set here. The date is displayed in the form DD.MM.YY and can be changed if necessary.



5.8.8.1 Set date

The date is used for the timestamp for entries in the alarm and diagnostic memory as well as for all timer functions.



5.8.9 Manual mode

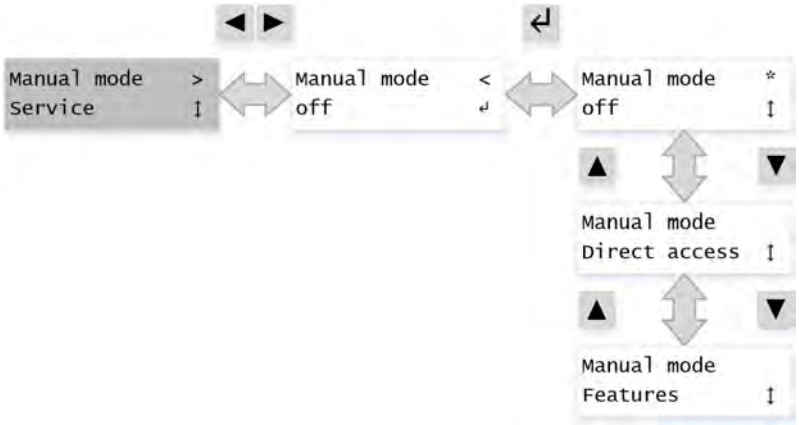
Manual mode is used to manually activate humidificationof the heat exchanger, draining or the individual valves.

Manual mode does not depend on DI1 enabling, has the highest priority and switches off all other control types.

Active manual mode is saved permanently, in other words it is active again even after switching off and on.

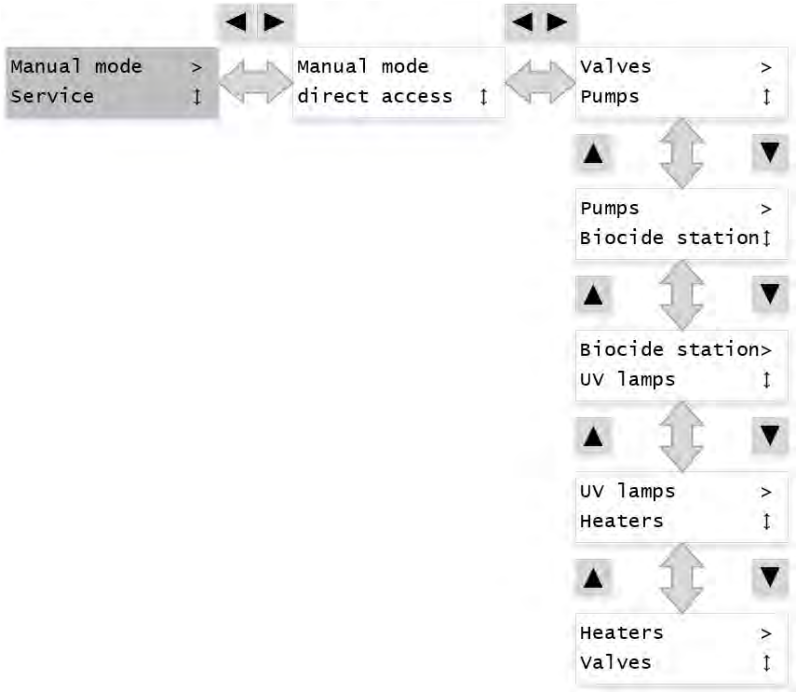
5.8.9.1 Manual mode

When the manual mode menu is opened, the currently defined mode is displayed first. To activate manual mode, the desired mode has to be set using the Enter key. The “Manual mode off” option has to be switched off in order to switch off manual mode again. Controlled operation is then resumed.



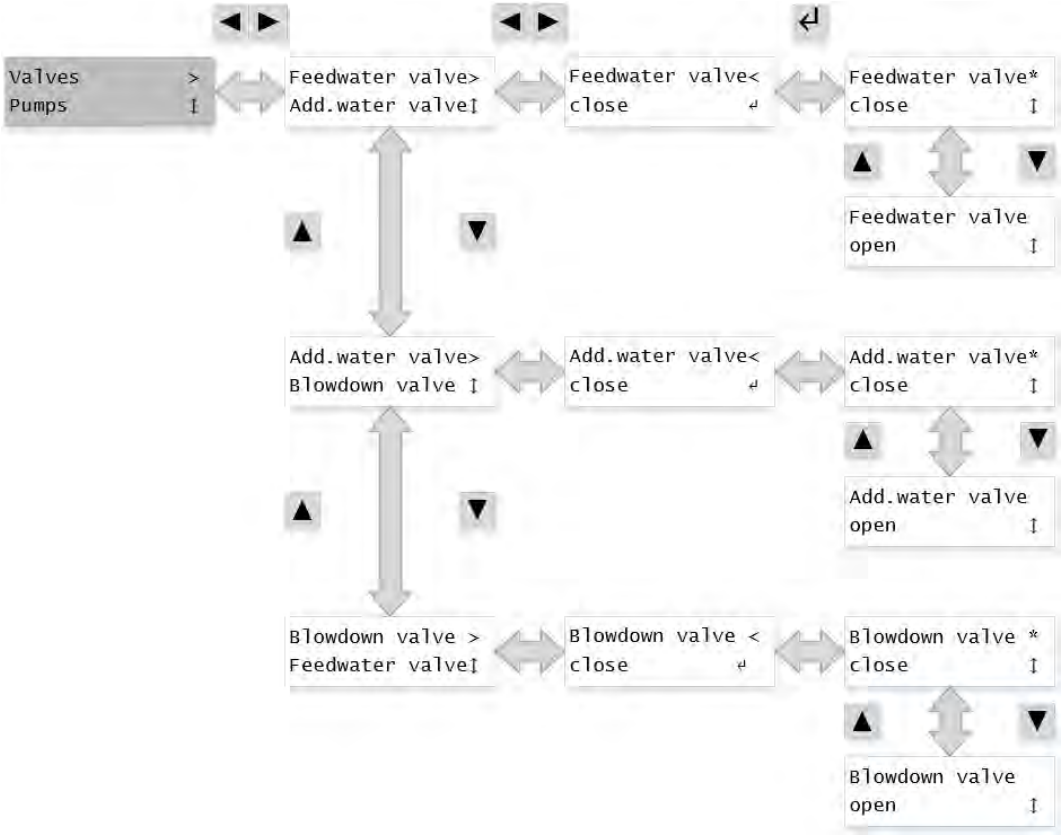
5.8.9.2 Direct access

Specific components of the GHM pump can be activated in “direct access” manual mode independently of the control system. When direct access is activated, all ongoing processes are stopped.



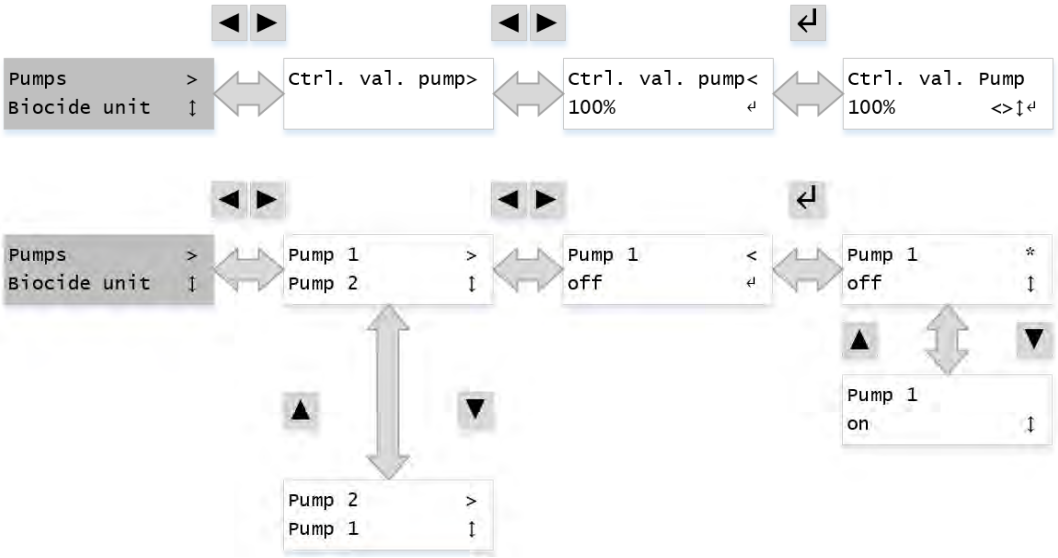
Valves

The feedwater, additional water and blowdown valves are activated separately here.



Pumps

This menu can be used in accordance with the pump type used (controlled or uncontrolled) to define the pump capacity by means of a control value or to activate the pumps individually.

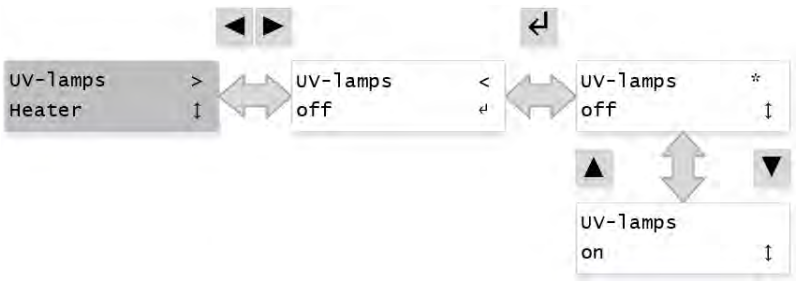


Biocide station

The supply of biocide can be switched on and off here.

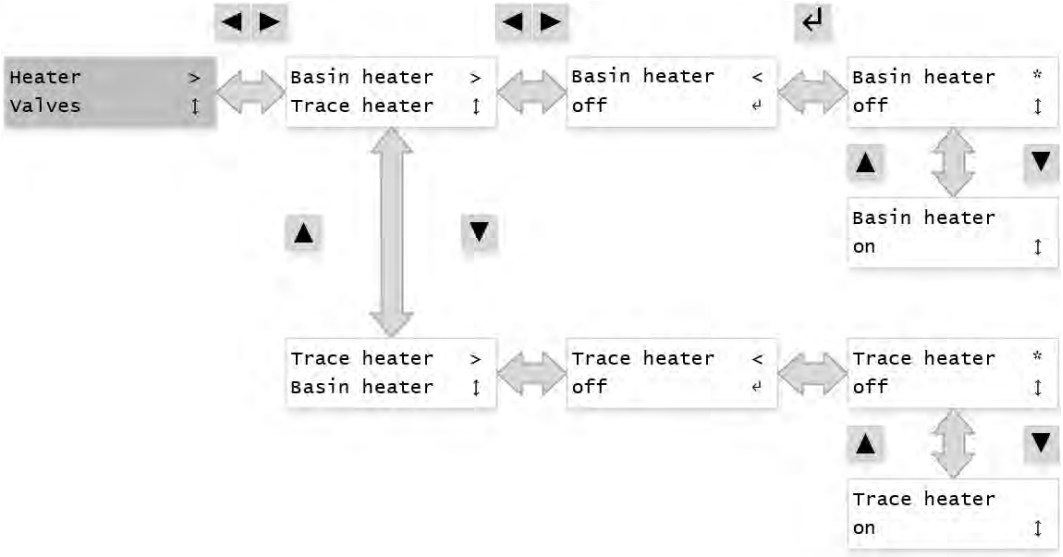
UV lamps

The UV lamps can be switched on and off here.



Heating

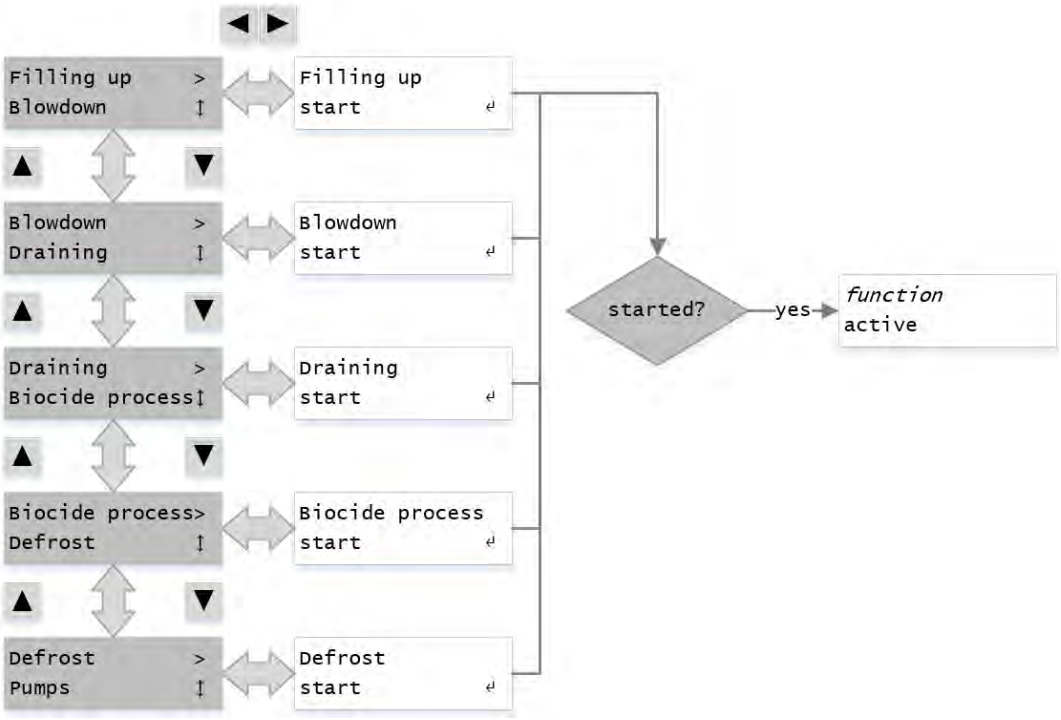
The basin and ancillary pipe heating can be switched on and off separately here.



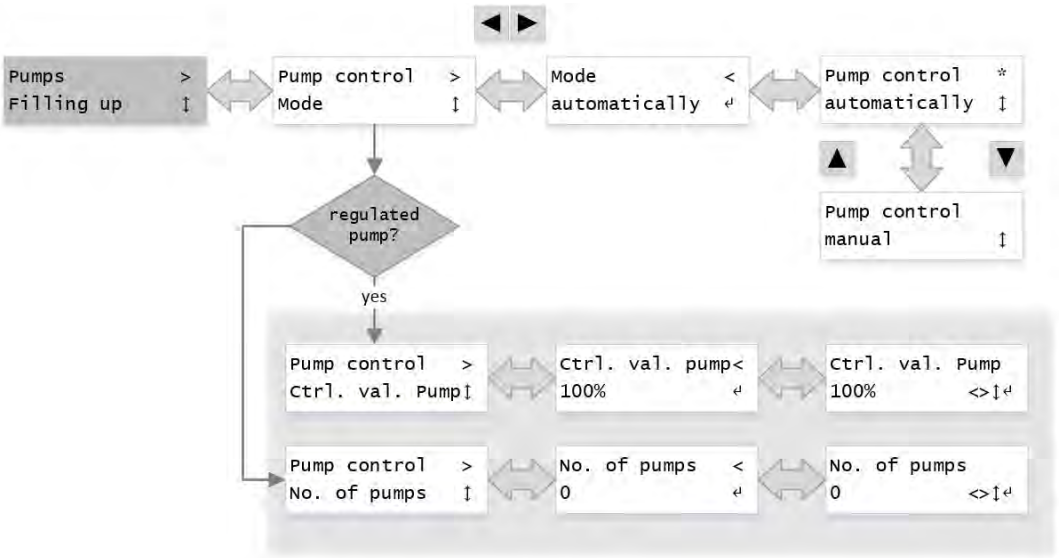
5.8.9.3 Features (functions)

Different commands can be delegated to the GHM in "Features" manual mode. A command received is executed as quickly as possible by the controller, with normal operation not being interrupted.

Processes such as filling, blowdown, draining, biocide process and defrosting can be initiated with the “Start” command. The respective function is selected in the menu and then started using the Enter key. If a process is active, a message is displayed and it can only be started again after it has ended.



Pump control can be influenced with the “Pumps” menu option. On one hand, pump control mode can be selected and on the other hand the pump capacity defined.



Mode:
- “automatic”: The defined user input is ignored in relation to the pump capacity in automatic mode, with the result that the capacity control continues working as usual.
- “manual”: Pump control is disabled in manual mode and the pumps are driven with the pump capacity defined by the user.

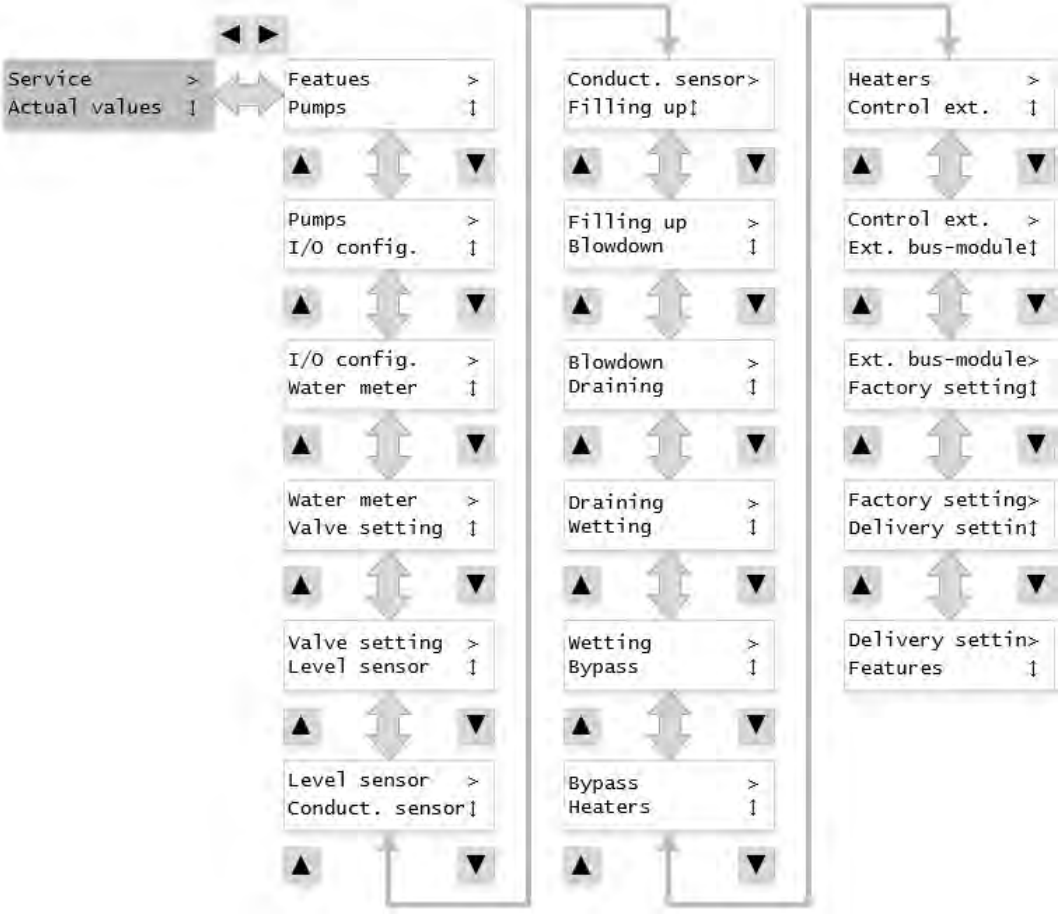
Pump capacity:
Depending on the pump type used (controlled or uncontrolled), the pump capacity can either be set with a control value or the number of pumps to be activated.

- “Pump control value”: The control value for the controlled pump can be set freely between 0 and 100%.
- “Number of pumps”: The number of pumps to be enabled can be defined here. If two pumps are configured in the system and the number is set to 1, the pump that indicates fewer operating hours after pump cycling is the one that is switched on.

5.9 Service

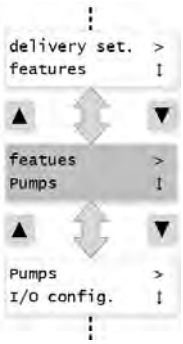
In the service menu you can set basic configurations, eg. IO-configuration, pump settings, also single features can be set.

Service menu set-up



5.9.1 Features (functions)

The special functions of the GHM pump can be defined with this Service menu option. Only the functions that are permitted in the current system configuration are displayed, for example “Pump Cycling” is only offered if two uncontrolled pumps exist.



5.9.1.1 Biocide station

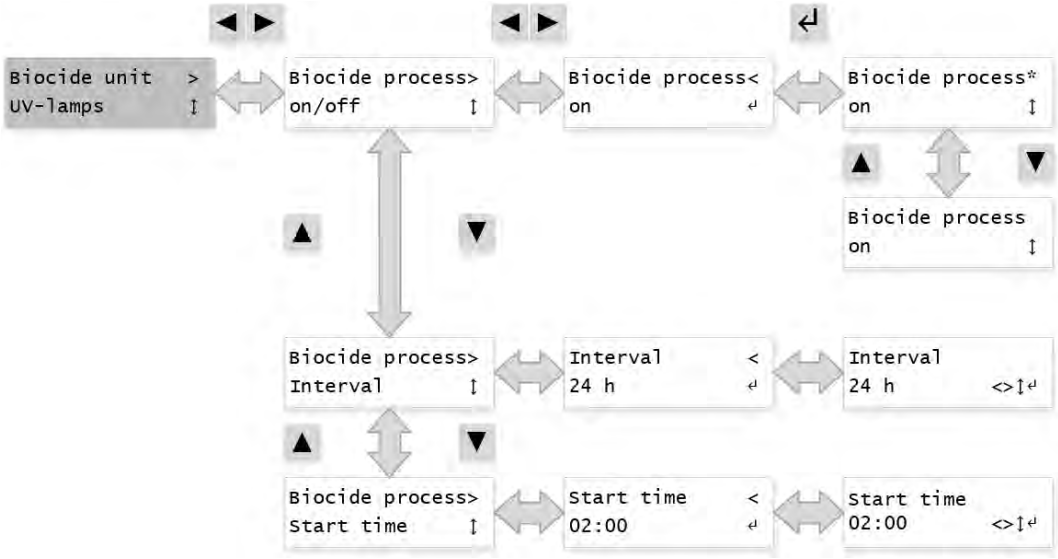
The functions relating to biocide processing are defined in this menu. The comprehensive setting options for the biocide station are explained in greater detail below.

NOTICE

Increased exposure of the system components to a high biological attack can lead to a reduction in the cooling capacity and cause damage to the system components. The biological load on the cooling water should be monitored regularly in accordance with the relevant guidelines.

5.9.1.1.1 Biocide process

The entire biocide process can be adapted individually depending on the system configuration and the ambient conditions. The biocide process can either be performed automatically on a regular basis or in response to an external requirement.



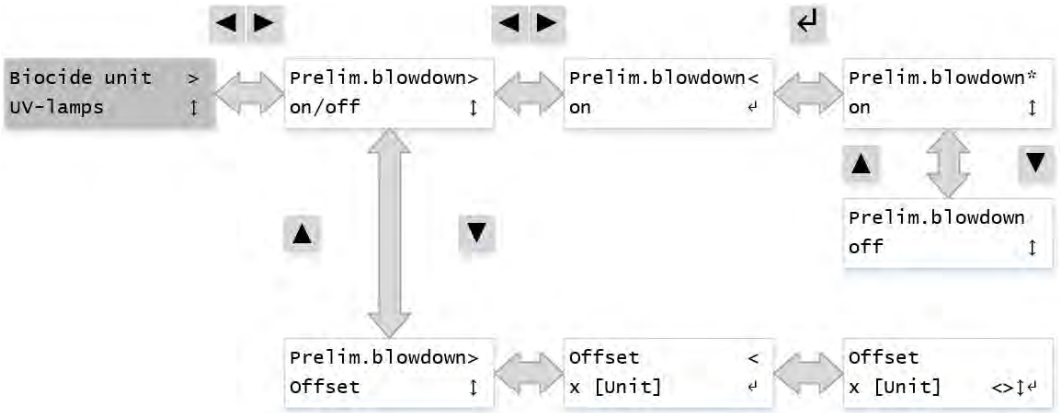
Parameter	Description	Default
Biocide process on/ off	Timed biocide processing can be switched on and off here.	Off
Biocide process in- terval	The amount of time that should pass between two consecutive biocide applications can be defined here.	24 h
Biocide process start time	The time at which the biocide process is to be started can be specified here.	02:00

NOTICE

If the biocide process is initiated by means of a corresponding external requirement (command or bus or digital signal), then the biocide process is executed at the next possible time. The “Biocide process on/off” and “Biocide process start time” parameters are not taken into account here.

5.9.1.1.2 Preliminary salting (blowdown)

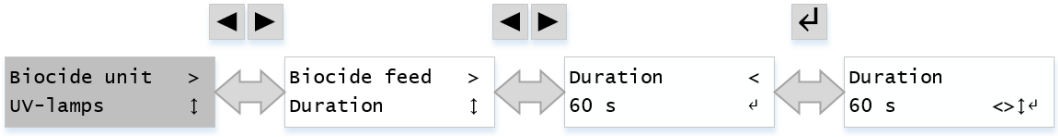
This is an optional step that can be performed prior to the actual biocide process. As the starting basis for the biocide process, the aim is to ensure the cleanest possible water in the wetting basin. A preliminary blowdown is performed with pre-salting up to a water level below the lower working point. This means that more water is drained in comparison with the regular blowdown process before the tray is filled with fresh water again.



Parameter	Description	Default
Pre-salting on/off	The pre-salting can be switched on and off here.	On
Pre-salting offset	A blowdown is performed up to an additionally defined offset compared with the lower working limit. **Example**: - “Limit below” is set to 351 mm - Pre-salting offset: 50 mm → The preliminary blowdown is performed up to a temporary limit of 301 mm	0 mm

5.9.1.1.3 Biocide feed duration

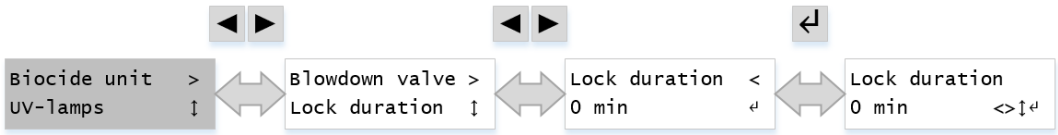
The duration of the biocide feed can be defined with this menu option. The feed duration is based on the system design and is performed by means of pulse dosing. The pumps remain switched off always during this time.



Parameter	Description	Default
Biocide feed duration	The duration of the biocide feed.	60 s

5.9.1.1.4 Blowdown valve lock duration

Once the biocide has been supplied, a certain time passes until the biocide has dissolved sufficiently and the wetting water can flow again. This time period is dependent both on the pesticide used and the dosing duration and can be defined with the following menu option:



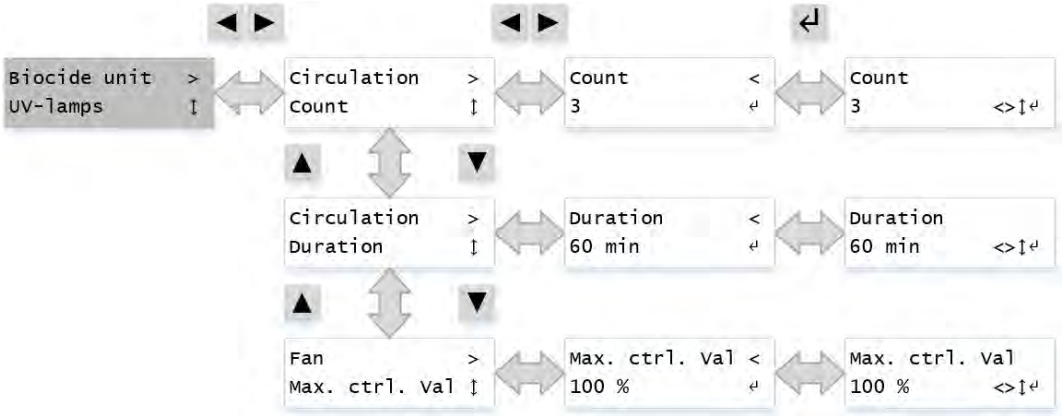
Parameter	Description	Default
Blowdown valve lock duration	The period of time from the start of biocide feeding until the blowdown valve is released again.	0 min

NOTICE

The cooling capacity may be impaired during the lock duration owing to possible restrictions in relation to pump activity and/or the fan speed. Any applicable restrictions are only overridden following expiry of the lock duration.

5.9.1.1.5 Circulation

The aim of circulation is to eliminate or reduce biological contamination both in the wetting basin and at the heat exchanger coil. The fan speed can be limited via the “Biocide station” menu to prevent biocide being emitted outside of the system.



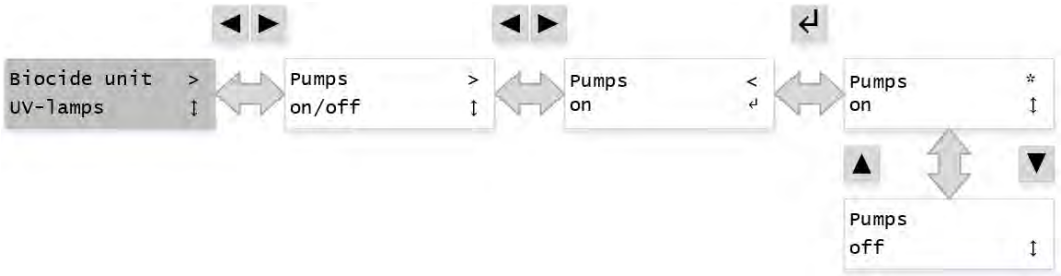
Parameter	Description	Default
Circulation count	The number of successive circulation processes to be executed within the entire **blowdown valve lock duration** can be defined here.	3
Circulation duration	The duration of an individual circulation period can be defined here. The pumps are switched on during this time so that the biocide circulation can take place.	60 min
Fan maximum control value	It can be specified here whether the control value for the fans is to be limited during circulation to a specific value “0 – 99 %” or not “100 %”.	100 % (no limitation)

NOTICE

The temporary limit for the maximum fan control value is conveyed to the GMM during biocide processing.

5.9.1.1.6 Pumps on/off

It can be defined here whether the pumps can be activated during biocide processing**On**or not**Off** This restriction only applies if no circulation is under way at present and the fan speed is not restricted. The effect of the biocide can be further optimised as a result.



Parameter	Description	Default
Circulation count	The number of successive circulation processes to be executed within the entire **blowdown valve lock duration** can be defined here.	3
Circulation duration	The duration of an individual circulation period can be defined here. The pumps are switched on during this time so that the biocide circulation can take place.	60 min
Fan maximum control value	It can be specified here whether the control value for the fans is to be limited during circulation to a specific value “0 – 99 %” or not “100 %”.	100 % (no limitation)

NOTICE

The temporary limit for the maximum fan control value is conveyed to the GMM during biocide processing.

5.9.1.2 UV lamps

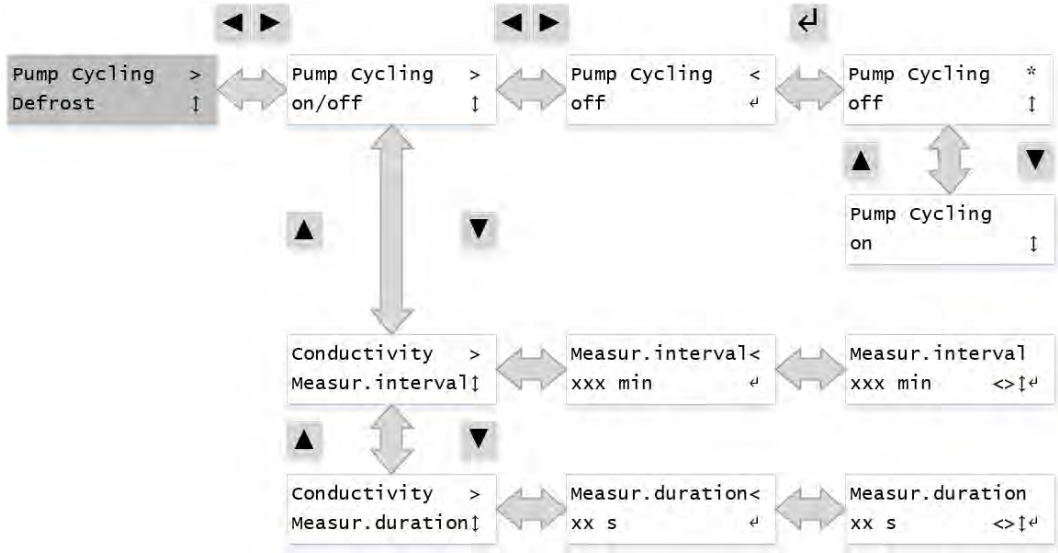
The change interval for the UV sterilisation lamps can be defined here. If the operating hours for the UV lamps are above the defined threshold, an alarm entry is made and a PRIO 2 fault message is triggered. Once the service work has been completed, the warning message can be cancelled by choosing the menu sequence “Diagnostics > UV lamps”.

Parameter	Description	Default
Change interval	Maximum number of operating hours until a fault message is signalled.	8760 h (365 days)

5.9.1.3 Pump cycling

If two pumps are used for capacity control, pump cycling can be used to balance the operating hours of the pumps. This increases the service life and thus the reliability of the heat exchanger. The pump that has worked the least to date is switched on in the starting phase.

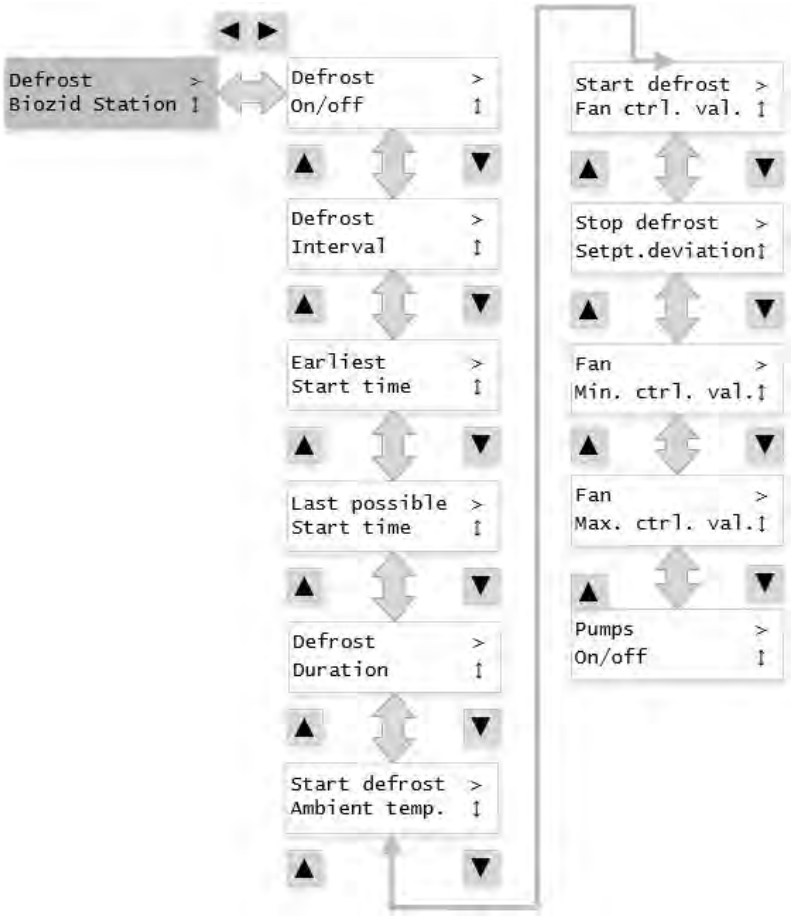
The first pump has to be switched on for a short period during pump cycling in order to measure the conductivity of the wetting water. This means that the first pump is switched on briefly at regular intervals during the runtime of the second pump.



Parameter	Description	Default
Pump cycling on/off	The pump cycling can be switched on and off here.	off
Conductivity measurement interval	Determines the time interval in which the conductivity is to be measured if only the second pump is activated.	2 min

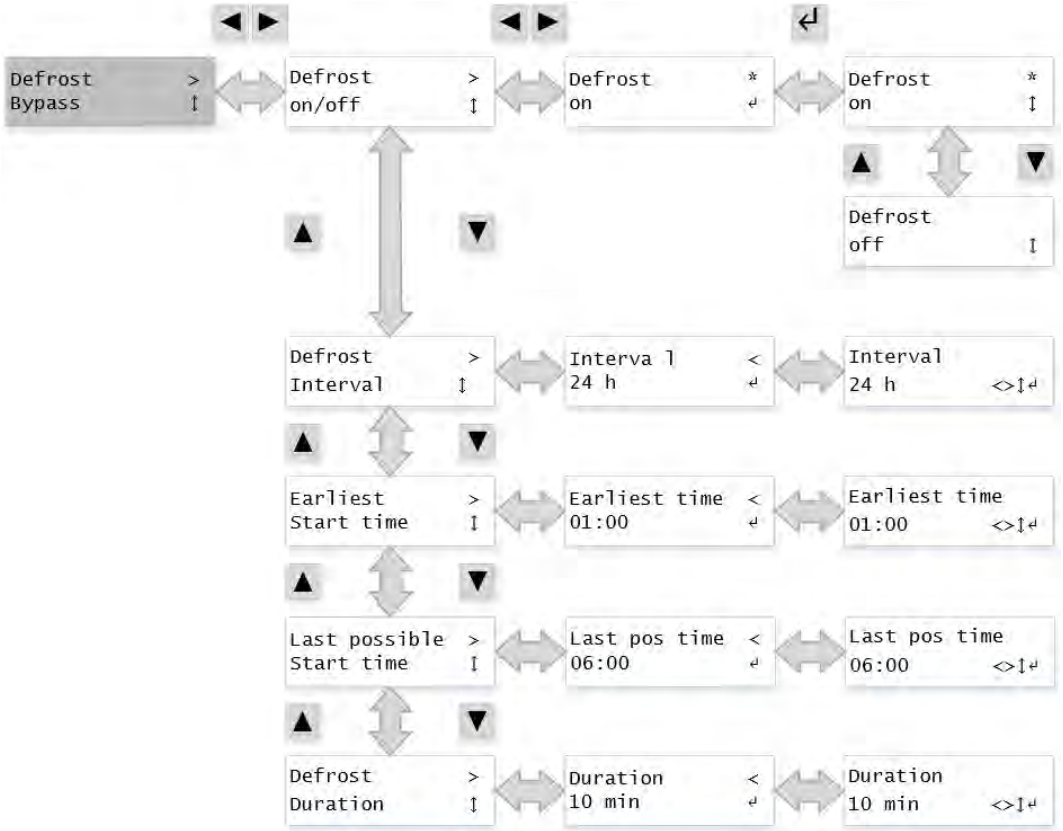
5.9.1.4 Defrosting

The defrosting function can be used in order to prevent frost forming on the air guide fins at low ambient temperatures. The fans are caused to move in the inverse direction, which warms up the air guide fins. The defrosting is generally used in the case of low capacity requirements and can either be started at regular intervals or by means of a corresponding external requirement (command or bus or digital signal). Moreover, the defrosting can be limited to a configurable time window. The comprehensive setting options for the defrosting function are explained in greater detail below.



5.9.1.4.1 Time-related criteria

The following parameters can be used to determine for how long, when and whether the defrosting process is to be started.



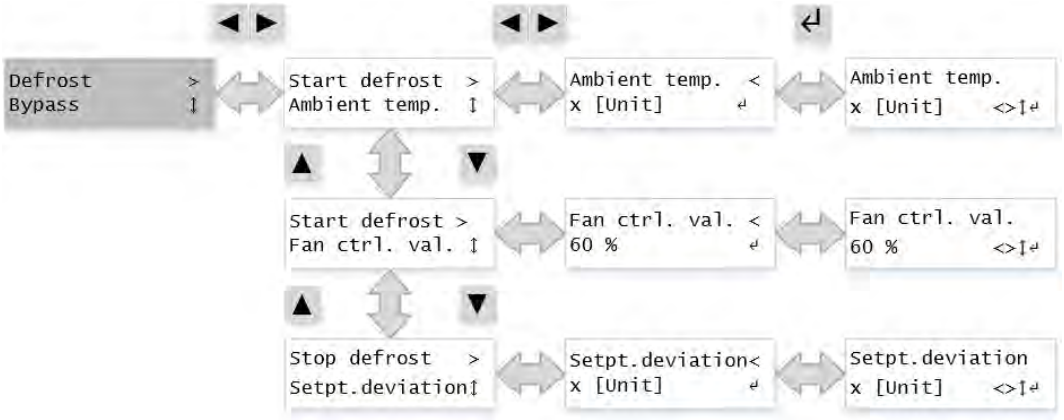
Parameter	Description	Default
Defrost on/off	The timed defrosting can be switched on and off here.	off
Defrost interval	The amount of time that should pass between two successive defrosting processes can be defined here.	24 h
Earliest starting time	The earliest time at which the defrosting process is to be started can be specified here.	01:00
Last possible starting time	The latest time at which the defrosting process can be started can be specified here.	06:00
Defrost duration	The defrosting duration can be defined here. Any restrictions in relation to pump activity and fan speed apply during this time.	10 min

NOTICE

If the defrosting process is initiated by means of a corresponding external requirement (command or bus or digital signal), then the defrosting is executed at the next possible time. The “Defrost on/off” and “Earliest and last defrost start time” parameters are not taken into account here.

5.9.1.4.2 External criteria

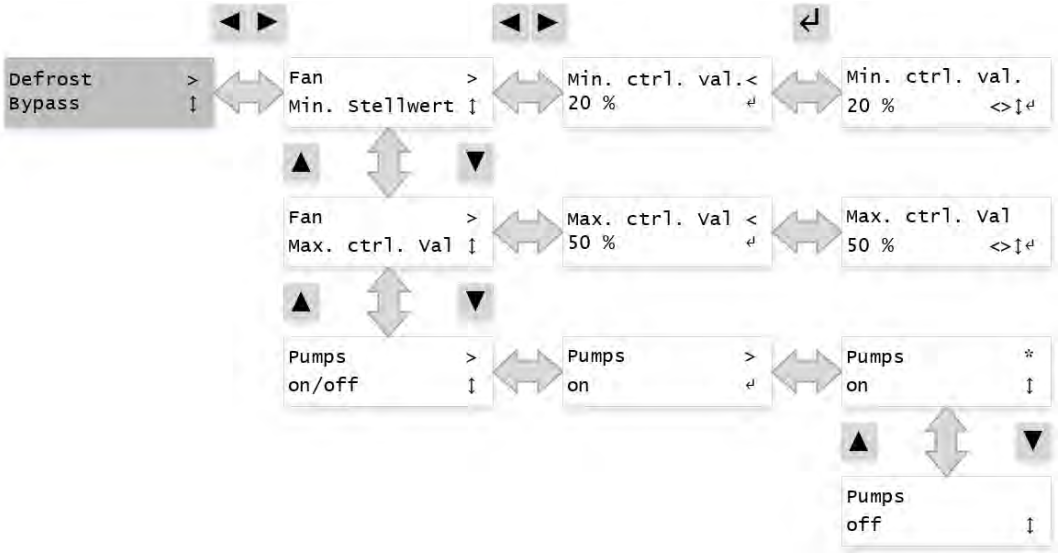
The following parameters can be used to define additional external conditions for starting and stopping defrosting.



Parameter	Description	Default
Start defrost: Ambient temperature	The ambient temperature must be less than or equal to the defined value in order to start the defrost sequence.	0.0 °C
Start defrost: Fan control value	The current fan control value must be less than or equal to the defined value in order to start the defrost sequence.	60 %
Stop defrost: Setpoint deviation	The defrosting process is not started or is aborted if necessary if the deviation between setpoint and actual value does not exceed the defined value. This means that the setpoint cannot be reached during defrosting. **Example**: - Setpoint is set to 30 °C - Setpoint deviation: 10 °C → Defrosting is ended if the actual value has exceeded 40 °C.	

5.9.1.4.3 Restrictions

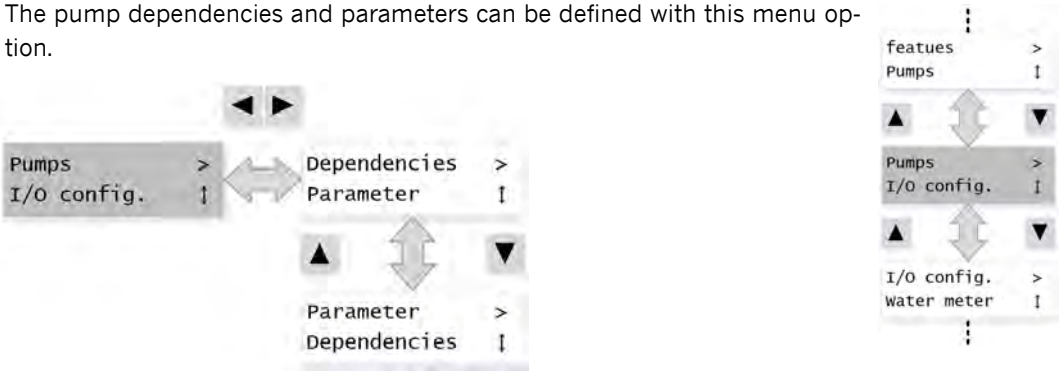
Restrictions can be defined here for the fan speed and the pump activity. The temporary limits for the fan control value are transmitted to the GMM during defrosting and inverse mode of the fans is activated.



Parameter	Description	Default
Fan minimum control value	The maximum fan control value is limited to the defined value during defrosting.	20 %
Fan maximum control value	The minimum fan control value is limited to the defined value during defrosting.	50 %
Pumps on/off	It can be defined here whether the pumps should be active during defrosting**On**or not**Off**	On

5.9.2 Pumps

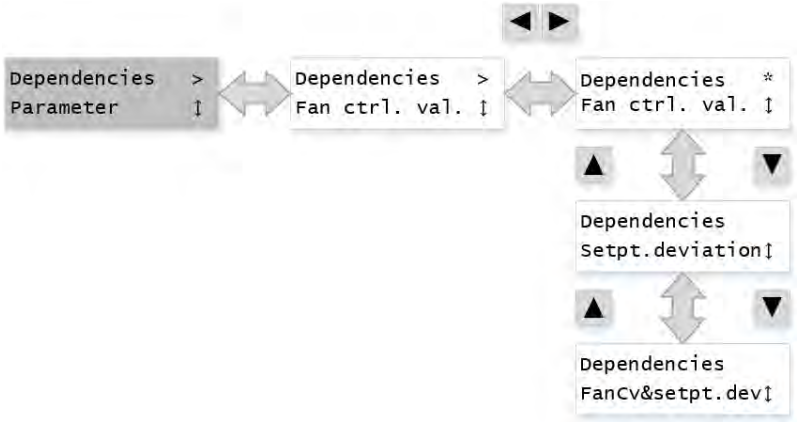
The pump dependencies and parameters can be defined with this menu option.



The wetting behaviour and consequently the effectiveness and efficiency of the system is coordinated with these settings.

5.9.2.1 Dependencies

Two criteria are offered for capacity control. Fan control value and setpoint deviation



Fan control value:
This method is based on the fan control value received from the GMM and can be used for both pump types (controlled and uncontrolled).

Setpoint deviation:
This method is based on the deviation between the medium temperature or pressure and the currently defined setpoint and can only be used for uncontrolled pumps.

Fan control value and setpoint deviation:
The pumps are started with this procedure when both start criteria (fan control value and setpoint deviation) are fulfilled, and stopped as soon as one of the stop criteria (fan control value or setpoint deviation) is fulfilled. This method can only be selected if uncontrolled pumps are used.

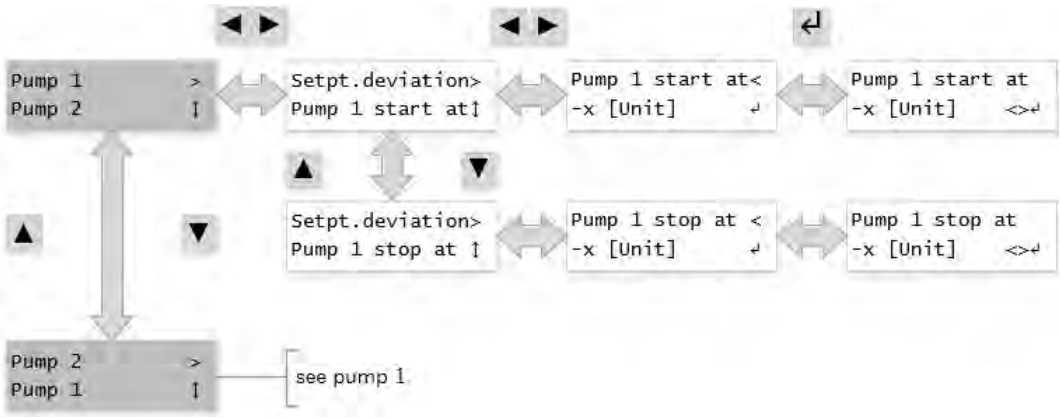
5.9.2.2 Parameter

The pump activity parameters can be configured in this menu. Only the menu options of relevance for the pump type used and the currently defined method are shown (see Dependencies, page 87):

5.9.2.2.1 Capacity control of pumps

The start/stop criteria for uncontrolled pumps and adjustable pumps can be defined here among other settings.

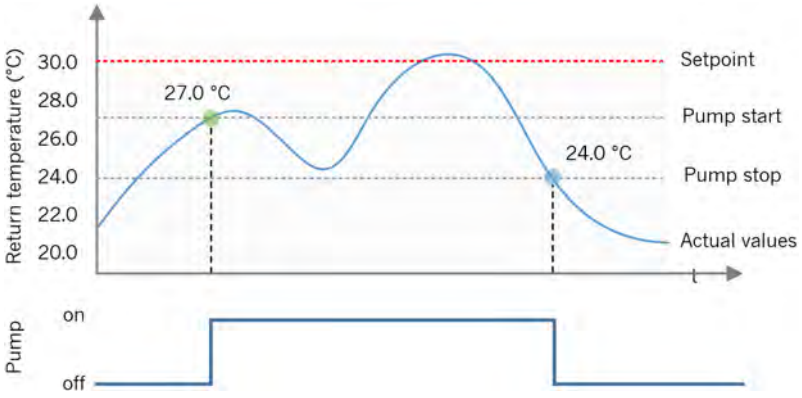
Settings relating to setpoint deviation:



Parameter	Description	Default
Setpoint deviation Pump 1/2 start	Deviation between setpoint and actual value for starting the respective pump.	-3.0 °C / -1.0 bar
Setpoint deviation Pump 1/2 stop	Deviation between setpoint and actual value for stopping the respective pump.	-6.0 °C / -2.0 bar

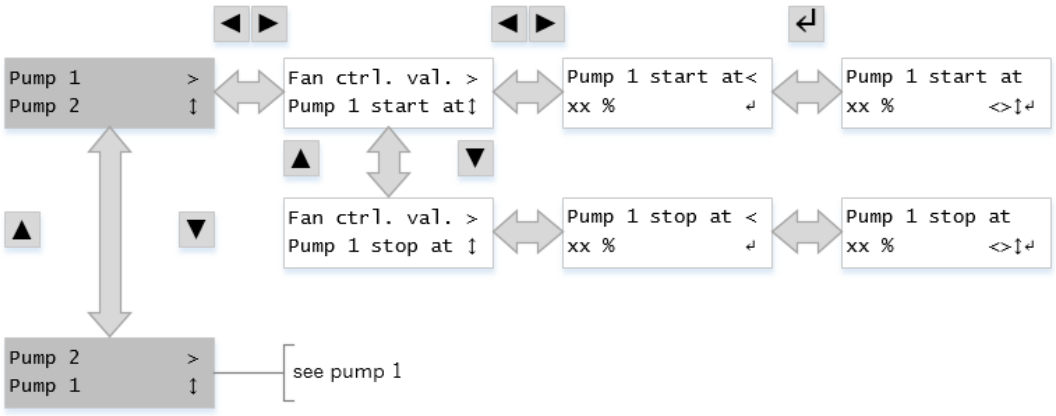
- The pumps are activated as soon as the following criterion is fulfilled: “Actual value ≥ Setpoint + Start criterion”.
- The pumps are deactivated as soon as the following criterion is fulfilled: “Actual value ≤ Setpoint + Stop criterion”.

Example:
The pump starts in accordance with the setpoint deviation before the fans are active.
- The setpoint is set to 30.0 °C
- Start criterion for the pump: Setpoint deviation -3.0 °C → 27.0 °C
- Stop criterion for pump: Setpoint deviation -6.0 °C → 24.0 °C



Capacity control based on setpoint deviation

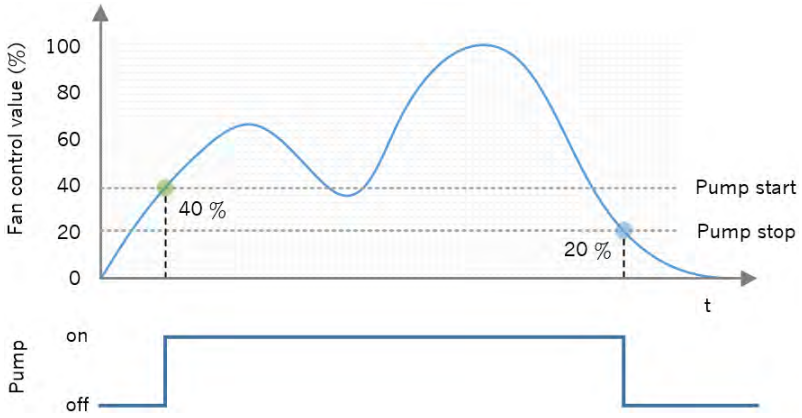
Setting in relation to the fan control value:



Parameter	Description	Default
Fan control value Pump 1/2 start	Threshold for starting the respective pump.	40 %
Fan control value Pump 1/2 stop	Threshold for stopping the respective pump.	20 %

- The pumps are activated as soon as the following criterion is fulfilled: “Control value ≥ Start criterion”.
- The pumps are deactivated as soon as the following criterion is fulfilled: “Control value ≥ Stop criterion”.

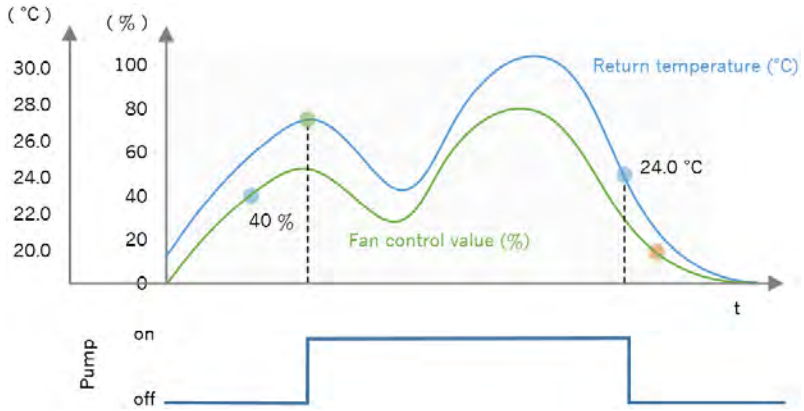
Example: The pump starts/stops depending on the fan speed.
- Start criterion for pump: 40 % → Pump is activated as soon as the GMM threshold is ≥ 40 %.
- Stop criterion for pump: 20 % → Pump is deactivated as soon as the GMM threshold is ≤ 20 %.



Capacity control based on fan control value

Combined criterion for starting/stopping wetting

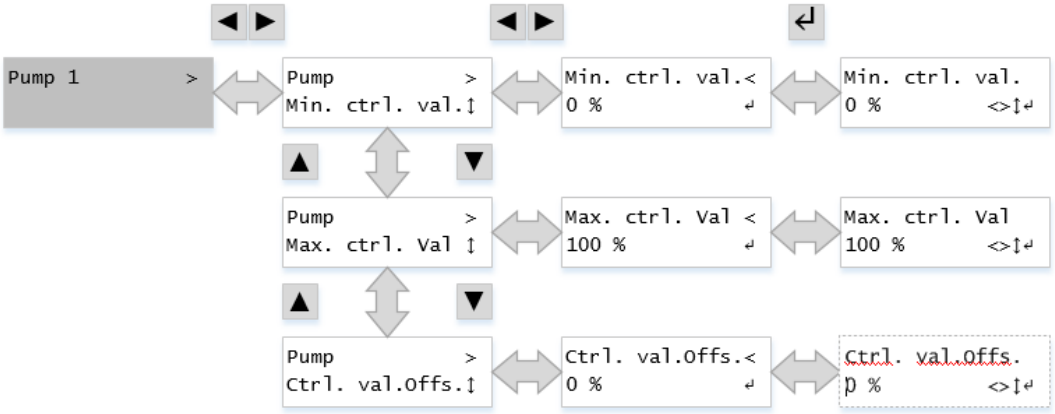
Example: The pump starts/stops depending on the fan speed and the setpoint deviation.
- The setpoint is set to 30.0 °C
- Start criterion for the pump: Control value 40 % and setpoint deviation -3.0 °C → Pump is activated if the control value from the GMM is ≥ 40 % and as soon as the actual value has reached 27 °C.
- Stop criterion for pump: Control value 20 % and setpoint deviation -6.0 °C → Pump is deactivated if the control value from the GMM is ≤ 20 % or the actual value falls below 24.0 °C.



Capacity control based on fan control value and setpoint deviation

5.9.2.2.2 Parameters for adjustable pump

The adjusting range can be adapted arbitrarily for the controlled pump, in other words the control value of the controller at which the pump is at minimum capacity and the control value at which the pump is at maximum capacity. Moreover, a control value offset can be configured for the fan control vale for optimum adjustment of the system.



Parameter	Description	Default
Pump minimum control value	Minimum control value at which the pump can operate.	0 %
Pump maximum control value	Maximum control value at which the pump can operate.	100 %
Pump control value offset	Relative deviation between the pump control value and the fan control value. This value is calculated based on the fan control value received from the GMM and can be both positive and negative. Example: - Fan control value received from GMM: 80 % - Control value offset: -10 % → gives rise to a pump control value of 70 %	0 %

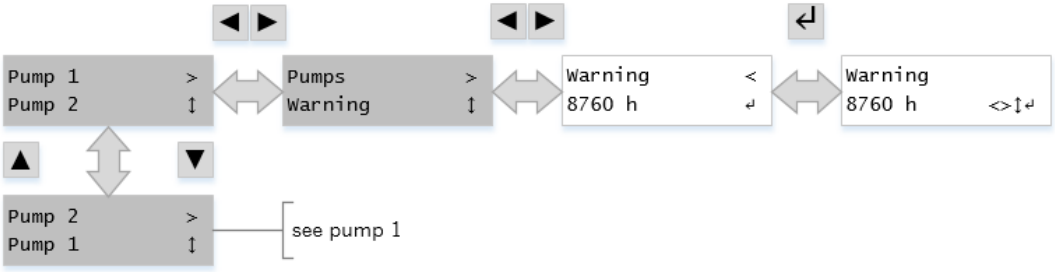
5.9.2.2.3 Minimum runtime

The minimum runtime is the minimum time that the pump remains in operation after it has been started. The actual duration depends on the system configuration and is defined as the time required after the activation process for the pumps until balanced wetting of the heat exchanger has taken place. If the value is set to “60 s” for example, this indicates that the wetting of the heat exchanger coil is balanced 60 seconds after the pump has started.

Parameter	Description	Default
Pump minimum runtime	Minimum runtime of the pump after the activation process.	60 s

5.9.2.2.4 Warning message

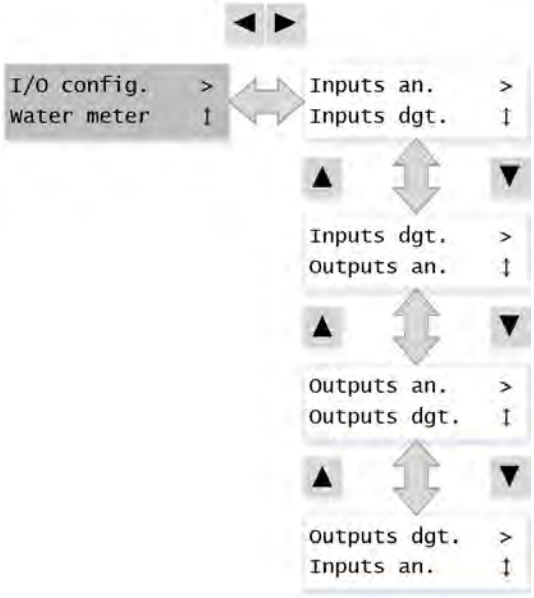
The warning message is used to inform the system operator of any pending maintenance and cleaning work. This warning message is based on the pump operating hours and is essentially dependent on operating conditions and the system configuration. A maximum value for the operating hours can be defined with this menu option. It is then checked for every pump if its operating hours are below the defined threshold. If the operating hours for a pump are above the threshold, an alarm entry is made and a PRIO 2 fault message is triggered. Once the service work has been completed, the warning message can be cancelled by choosing the menu sequence “Diagnostics > Pumps > Relative data” (see Pumps, page 60).



Parameter	Description	Default
Warning message	Maximum number of operating hours until a fault message is signalled.	8760 h (365 days)

5.9.3 I/O configuration

This menu option is used to configure the analogue and digital inputs and outputs.
Selected functions can be assigned to the inputs and outputs.

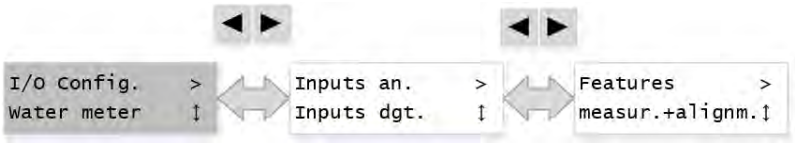


NOTICE

The IO configuration can be reset by switching the GHM to the delivery settings so that it has to be recommissioned. Depending on the options selected during commissioning, some functions are consequently pre-set at certain inputs and outputs (see Commissioning GHM pump, page 10).

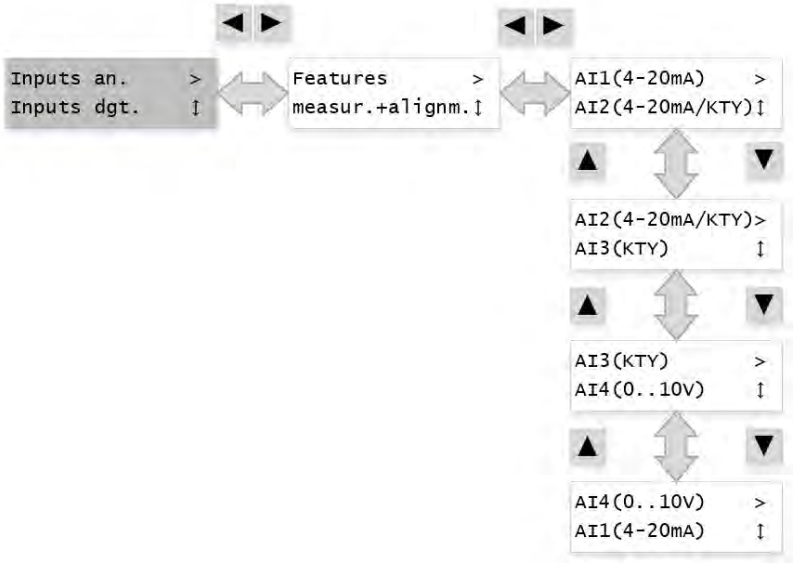
5.9.3.1 Analogue inputs

The analogue inputs AI1, AI2, AI3 and AI4 are measurement inputs for recording up to four different measured variables. Sensors with different signal types can be connected here to the GHM, in which case the different functions can different accordingly. Input AI1 is a 4...20 mA current input. The analogue input AI2 is a universal input, in other words the signal type (4...20 mA or KTY resistance input) is switched automatically in accordance with the selected function. The input AI3 is intended for the KTY type temperature probe. Sensors with a voltage output of 0...10 V DC can be connected to input AI4.



Appropriate functions can be assigned to the individual analogue inputs on GRCpump.1 in this menu and the current measurements view using the “Measurements and alignment” menu option. In addition, the temperature sensors (KTY) connected to AI2 and AI3 can be aligned by means of a user-defined temperature offset.

5.9.3.1.1 Assigning functions



The functions are assigned to the individual inputs here. The configuration options for the analogue inputs are explained below. The analogue input functions can only be configured on a free GRCpump.1 connection in each case, which means that a function cannot be assigned to several AIs. If an input is not to be active, the corresponding "No function” option can be selected.

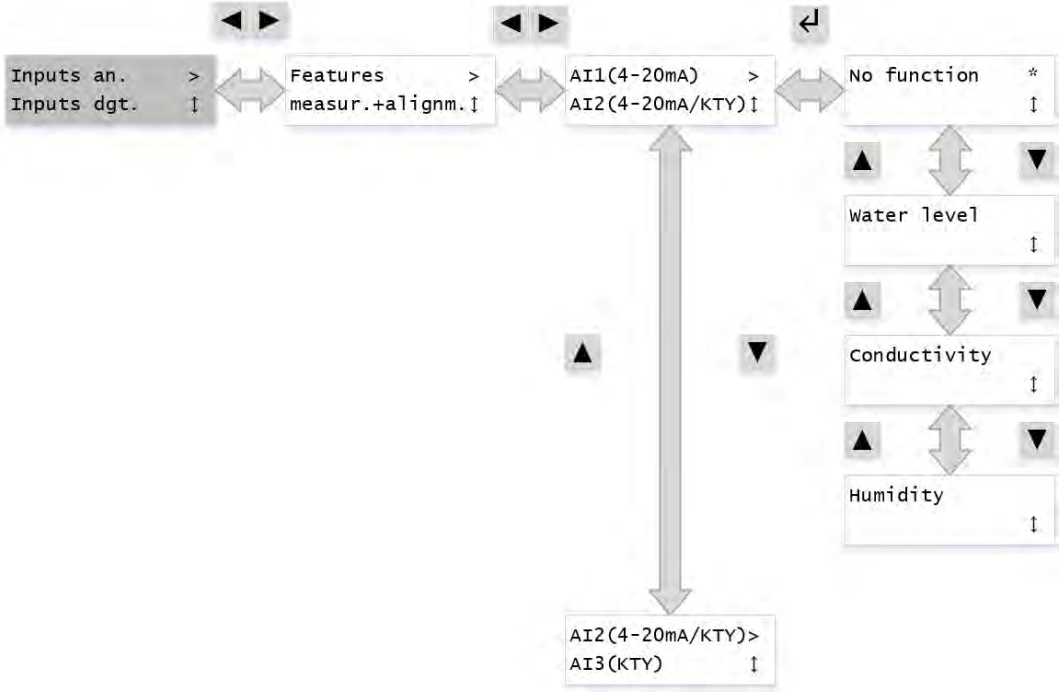
NOTICE

The input functions are configured flexibly depending on the design of the system. For example, a conductivity sensor is connected if a conductivity-based blowdown is used. The functions with corresponding dependencies are listed in the next table.

Function	Dependency
Fill level	Control of tray fill level
Conductivity	Blowdown based on electric conductivity
Air humidity	Setpoint displacement depending on the wet bulb temperature
Nozzle pressure	Monitoring of humidification nozzles and the pump
Tray temperature	Control of the basin heating

Inputs AI1 and AI2

Inputs AI1 and Ai2 can be configured for recording the following measured variables: fill level, conductivity and humidity A measured variable can only be configured on one analogue input at any one time. For example, if AI1 is defined for recording the conductivity and the same function is then defined on the input AI2, the “No function” option is defined automatically on AI1.



Function	Description
Fill level	Records the fill level of the water in the wetting basin. A corresponding sensor with the standard signal 4...20 mA has to be connected for this function (see Connecting a water level sensor on AI2 or AI2, page 39). **Note:** To ensure proper application of the water level control, make sure that the measuring range of the sensor and the individual fill level limits are defined correctly (see Level sensor, page 114).
Conductivity	Records the electric conductivity of the wetting water. The blowdown is performed based on the conductivity by activating this function. A corresponding sensor with the standard signal 4...20 mA has to be connected for this function (see Connecting a conductivity sensor on AI1 or AI2, page 40). **Note:** To ensure proper application of the blowdown control, make sure that both the measuring range of the sensor and the conductivity values for starting/stopping the blowdown are defined correctly (see Conductivity sensor, page 117 and Blowdown, page 119).

Function	Description
Air humidity	Records the relative humidity in the environment. This function is absolutely imperative for setpoint displacement in relation to the wet bulb temperature. A corresponding humidity sensor has to be connected to the GHM on one hand for this purpose (see Connecting a humidity sensor on AI1, AI2 or AI4, page 41). On the other hand, both an ambient temperature sensor and the “setpoint displacement” function must be configured on the GMM (see document GMM EC Operating instructions, Section “Setpoint displacement”). **Note:** Alternatively, a sensor can be used with a voltage signal of 0...10 V on the AI4 input (see Connecting a humidity sensor on AI1, AI2 or AI4, page 41).

NOTICE

The analogue input AI2 is a universal input. The signal type (4...20 mA or KTY) is switched automatically and depending on the selected function.

Input AI3

Input AI3 can be configured for recording the tray temperature using a temperature sensor.

Function	Description
Tray temperature	Records the temperature of the water in the wetting basin. This function is used to monitor the temperature of the water in the wetting basin. A corresponding sensor has to be connected for this function (see Connecting a temperature sensor on AI3, page 42) **Note:** If the water temperature has to be regulated, basin heating has to be configured additionally (see Basin heating, page 131).

Input AI4

Input AI4 can be configured for recording either the humidity or the nozzle pressure.

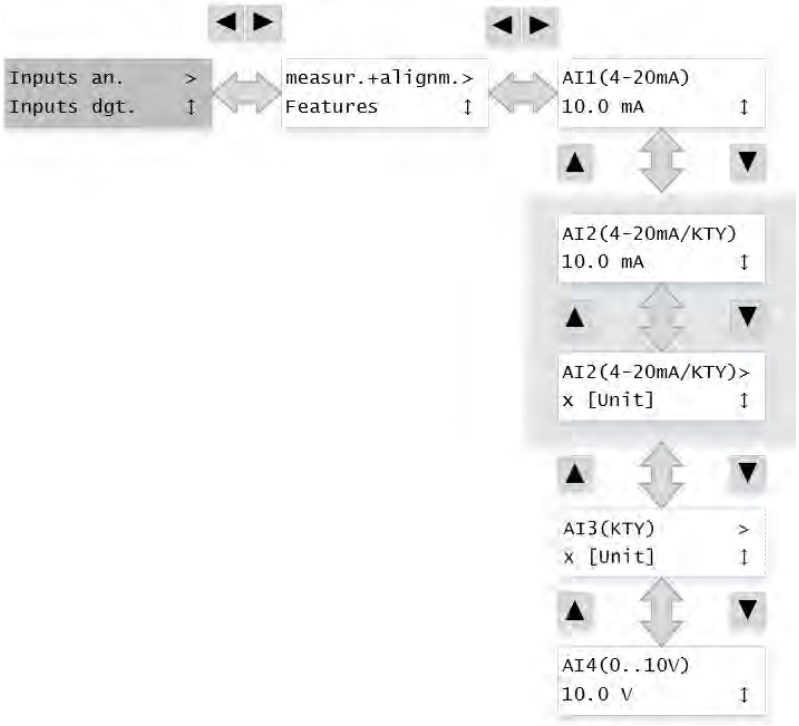
Function	Description
Tray temperature	Records the relative humidity in the environment. This function is absolutely imperative for setpoint displacement in relation to the wet bulb temperature. A corresponding humidity sensor has to be connected to the GHM on one hand for this purpose (see Connecting a humidity sensor on AI1, AI2 or AI4, page 41). On the other hand, both an ambient temperature sensor and the “setpoint displacement” function must be configured on the GMM (see document GMM EC Operating instructions, Section “Service/Setpoint displacement”). **Note:** Alternatively, a sensor with a current signal of 4...20 mA can be used (see Connecting a humidity sensor on AI1, AI2 or AI4, page 41).

5.9.3.1.2 Measurements and alignment

Both the current measurements and the alignment function are provided here for all analogue inputs

Measurements

The signal values currently applied at the inputs are displayed, among others, in this menu. The current measured is displayed for AI1 in the mA unit and the voltage measured is displayed for AI4 in the V unit. The converted value is depicted in °C or °F for AI3 depending on the unit system. Either the measured temperature or the current value is displayed for the universal input AI2, depending on the function assigned.

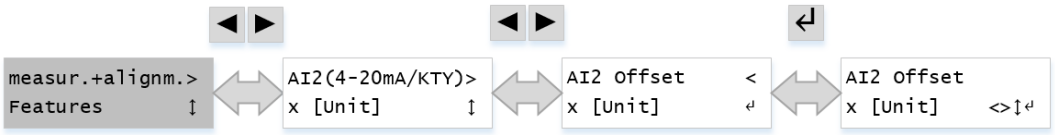


Alignment

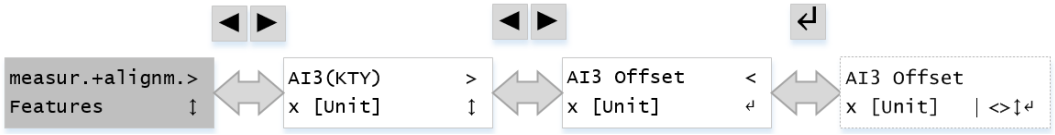
The alignment function can be configured for inputs AI2 and AI3 as soon as a relevant function is set on the respective input. The temperature difference with respect to the reference temperature can be configured here in the form of an offset.

Example:
The “Basin temperature” function and a GTF210 temperature sensor are configured on AI3.
Value displayed under “Measurements”: 31.5 °C
Reference temperature: 30.0 °C
Offset to be set for alignment: -1.5 K

AI2 is a switchable analogue input. An offset alignment can only be performed then for this reason if a suitable input function is defined on AI2. This means that if a function is defined on AI2 that uses a temperature sensor (KTY), then the corresponding sub-item “AI2 Offset” can be configured:



Input AI3 is an input exclusively for KTY temperature sensors, which means that an offset alignment can always be performed:

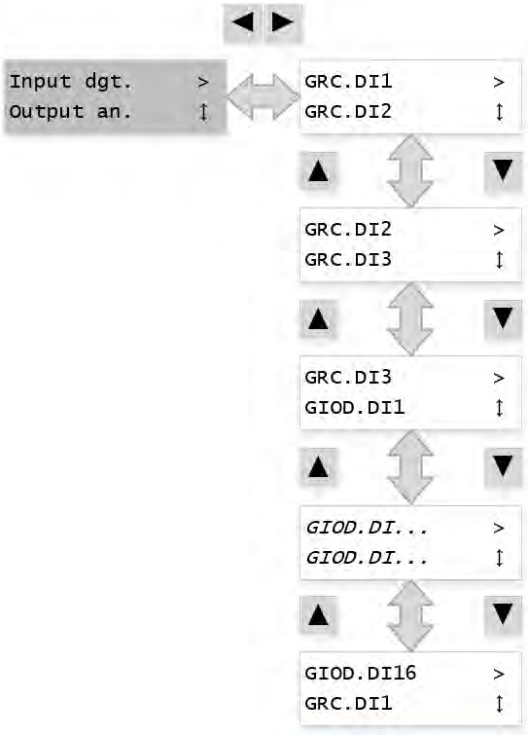


Parameter	Description	Default
AI2 Offset	An offset for aligning a temperature sensor configured on AI2.	0.0 K / 0.0 °F
AI3 Offset	An offset for aligning a temperature sensor configured on AI3.	0.0 K / 0.0 °F

5.9.3.2 Digital inputs

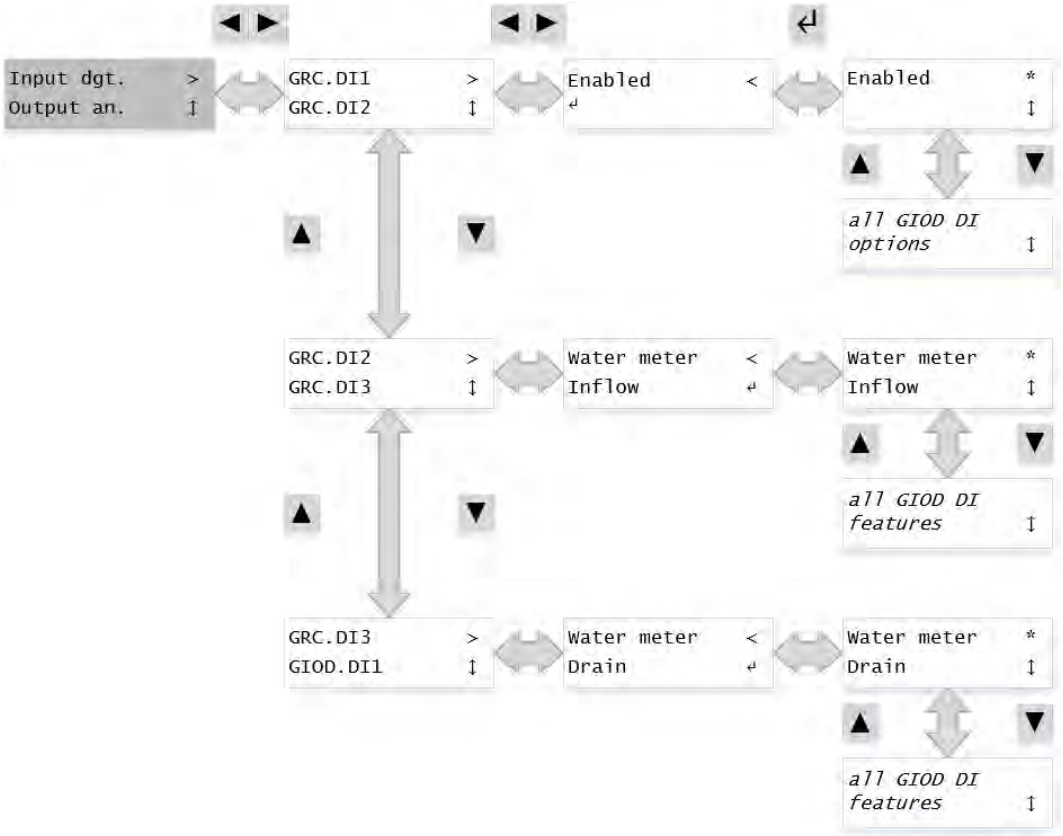
Appropriate functions can be assigned to the individual GRCpump.1 and GIOD.1 digital inputs in this menu. The GRCpump.1 digital inputs on the DI1 – DI3 terminals and the GIOD.1 digital inputs on the DI1 – DI16 terminals are control inputs. The inputs are active when they are connected to **+24V** . If an input is not to be active, the corresponding "No function" option can be selected.

The digital input functions can only be configured on a free connection in each case, which means that a function cannot be assigned to several DIs.



5.9.3.2.1 Digital inputs on GRCpump.1

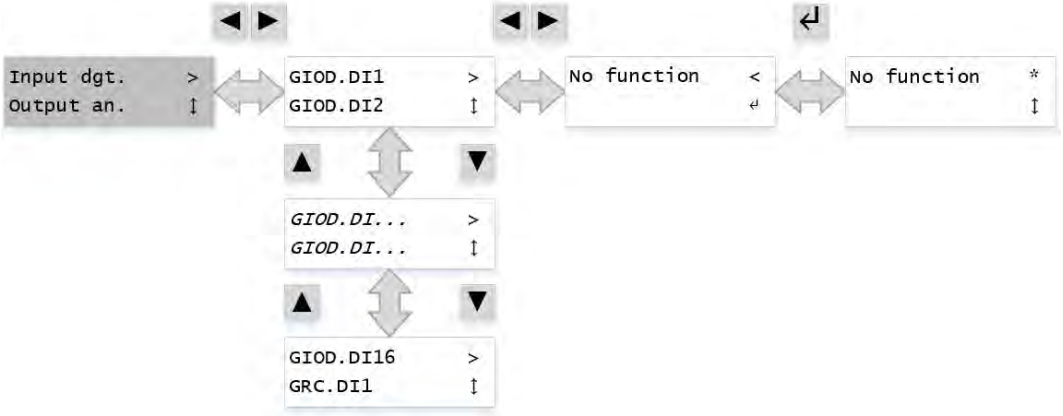
Specific functions are assigned to the GRCpump.1 digital inputs, which can be replaced by different alternative functions if they are not used. A total of up to three different functions can be assigned here based on the following schema.



Function	Description
External enabling	Can be configured exclusively on input DI1 in order to authorise the switch from dry to wet mode and the start of humidification (see External enabling/release, page 49).
Water meter inflow	Can be configured exclusively on input DI2 for recording the water inflow volume (see Water meter, page 111).
Water meter outflow	Can be configured exclusively on input DI2 for recording the water outflow volume (see Water meter, page 111).
All GIOD DI features	If one of the above-mentioned exclusive functions is not required, the corresponding input can be configured with an alternative function. All GIOD.1 digital input functions can be selected here (see Digital inputs on GIOD.1, page 103).

5.9.3.2.2 Digital inputs on GIOD.1

Up to 16 different functions can be configured on the GIOD.1 inputs. The valve feedback can be evaluated here. The operating status of individual subcomponents can be monitored with the protection functions.



The configuration options for GIOD.1 digital inputs are depicted in the next table.

Function	Description
Feedwater valve is open (on site)	Valve position feedback: Feedwater valve is fully opened
Feedwater valve is closed (on site)	Valve position feedback: Feedwater valve is fully closed
Additional water valve is open (at the unit)	Valve position feedback: Additional water valve is fully opened
Additional water valve is closed (at the unit)	Valve position feedback: Additional water valve is fully closed
Blowdown valve is open (at the unit)	Valve position feedback: Blowdown valve is fully opened
Blowdown valve is closed (at the unit)	Valve position feedback: Blowdown valve is fully closed
Biocide station OK	Protection function of biocide station
UV lamps OK	Protection function of UV lamps
Basin heating OK	Protection function of basin heating
All pumps OK	Protection function of pumps. An error state occurs if at least one pump reports an error.
Pump 1 OK	Protection function of first pump
Pump 2 OK	Protection function of second pump

Function	Description
Circuit breaker OK	Protection function of circuit breaker chain
External input water requirement	Function for system network: at least one systems still requires fresh water. For all systems in the network this means: - The feedwater valve remains open until at least one system still requires water. - The ancillary pipe heating remains enabled until at least one system still requires water.
External requirement: Activate all pumps	GHM is requested to switch to wet mode if necessary and to start humidification with all pumps.
External requirement: Start filling	GHM is requested to switch to wet mode and to fill the tray up to the upper limit.
External requirement: Start blowdown	GHM is requested to perform blowdown.
External requirement: Start drain	GHM is requested to drain the tray and to switch to dry mode.
External requirement: Start biocide process	GHM is requested to perform a biocide process.
External requirement: Start defrosting	GHM is requested to perform a defrosting process.

NOTICE

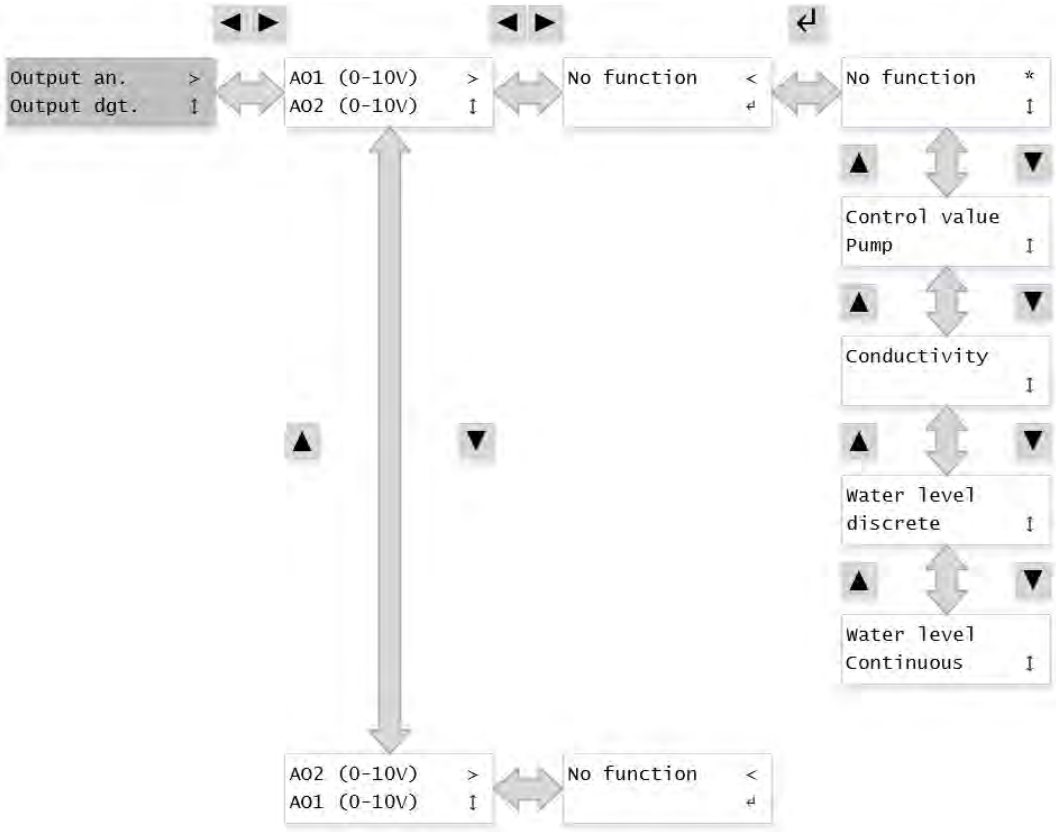
Some input functions can only be selected if a corresponding output function is configured. For example, the “Pump 2 OK” function can only be selected if the “Pump 2” function has been configured accordingly on a digital output. The functions with corresponding dependencies are listed in the next table.

Function	Dependency
Feedwater valve is open (on site)	Feedwater valve is available
Feedwater valve is closed (on site)	Feedwater valve is available
Additional water valve is open (at the unit)	Additional water valve is available
Additional water valve is closed (at the unit)	Additional water valve is available
Blowdown valve is open (at the unit)	Blowdown valve is available
Blowdown valve is closed (at the unit)	Blowdown valve is available
Biocide station OK	Biocide station is available
UV lamps OK	UV lamps are available

Function	Dependency
Basin heating OK	Basin heating is available
All pumps OK	Two discrete pumps are available
Pump 2 OK	Two discrete pumps are available

5.9.3.3 Analogue outputs

The analogue outputs can output a voltage of 0-10 V DC. Appropriate functions can be assigned to the individual GRCpump.1 digital outputs in this menu. The analogue output functions can be configured here both on a single free AO as well as several free AOs at the same time.



Function	Description
Control value pump	Indicates the control value 0...100 % for activating the controlled pump, scaled to the signal 0...10 V.
Conductivity	Outputs the last conductivity value measured. The signal 0...10 V is scaled in the process to the configured measuring range of the conductivity sensor (see Conductivity sensor, page 117).
Water level discrete	Outputs the last fill level measured according to the following schema: 0 V: Fill level < Dry run limit 2 V: Fill level ≥ Dry run limit 4 V: Fill level ≥ Heating limit 6 V: Fill level ≥ Lower limit 8 V: Fill level ≥ Median limit 10 V: Fill level ≥ Upper limit
Water level continuous	Outputs the last fill level measured. The signal 0...10 V is scaled in the process to the configured measuring range of the level sensor (see Level sensor, page 114).

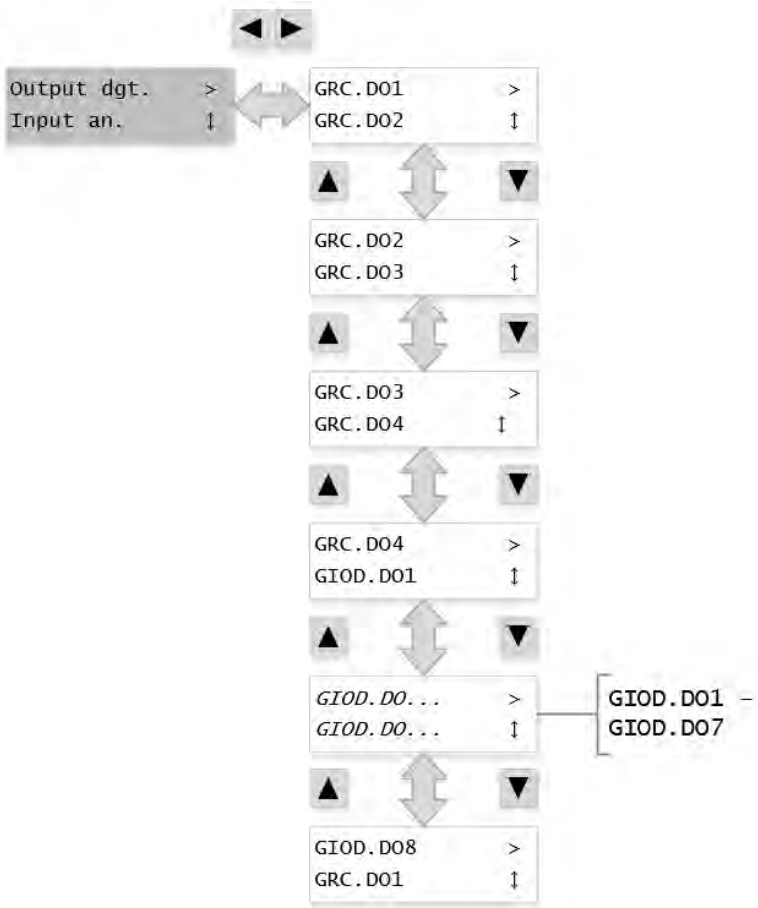
NOTICE

Some output functions can only be selected if the corresponding input function is configured. For example, the “Control value - Pump” function can only be selected if an adjustable pump was defined during commissioning. The functions with corresponding dependencies are listed in the next table.

Function	Description
Control value pump	Adjustable pump is available
Tray fill level (symbolic)	Fill level sensor is available
Tray fill level (continuous)	Fill level sensor is available
Conductivity of wetting water	Conductivity sensor is available

5.9.3.4 Digital outputs

Appropriate functions can be assigned to the individual GRCpump.1 and GIOD.1 digital outputs in this menu.



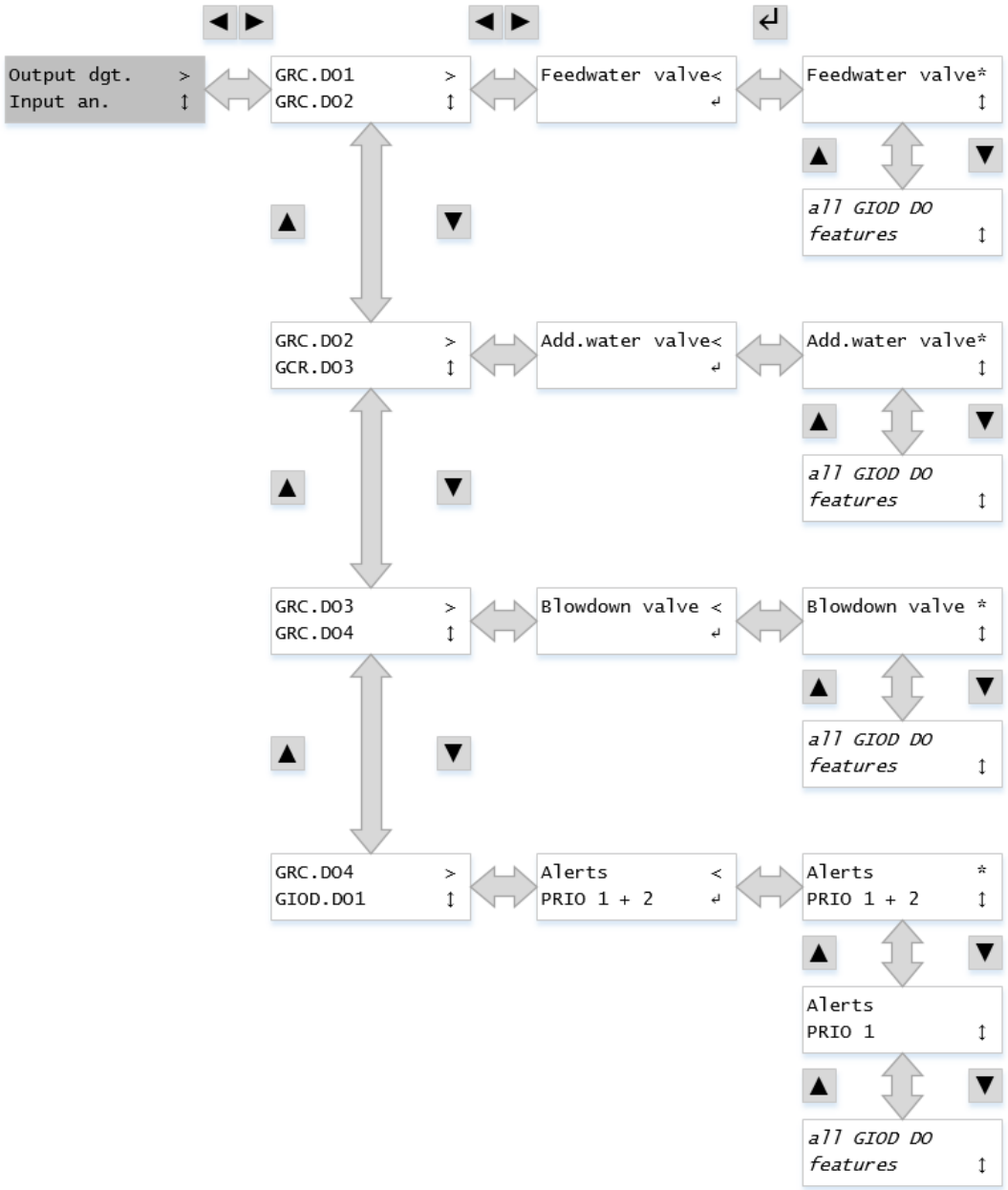
5.9.3.4.1 Digital outputs on GRCpump.1

The GRCpump.1 digital outputs on terminals DO1, DI2 and DI3 are relay contacts. Each output has a max. 250V/1A two-way contact. Specific functions are assigned to the GRCpump.1 inputs, which can be replaced by different alternative functions if they are not used.

The outputs DO1, DO2 and DO3 are used by default to activate valves, whereby the type of valve (normally open/closed) can be configured in the Service menu (see Valve settings, page 112).

Output DO4 is used by default to signal fault messages (PRIO 1 + 2) and is connected as a **failsafe** contact i.e. the contact is closed when there is no current.

A total of up to four functions can be assigned to the GRCpump.1 digital outputs based on the following schema.

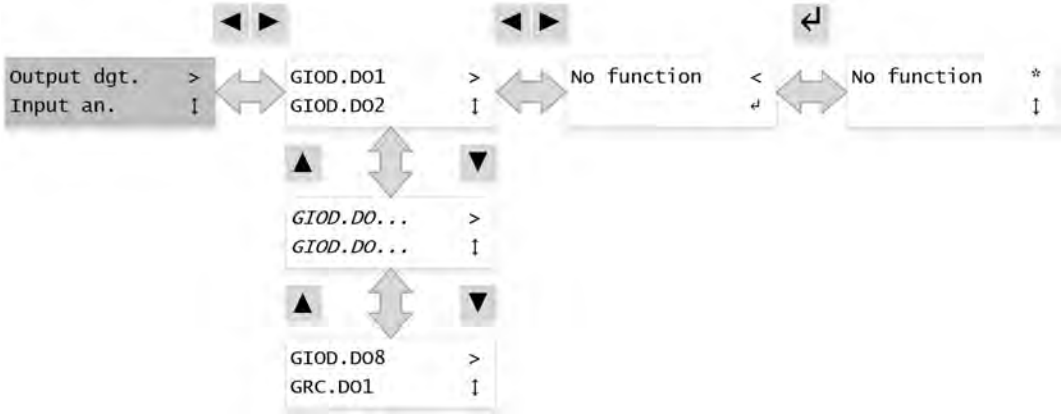


Functions	Description
Feedwater valve	Function can be configured exclusively on output **DO1** for activating the feedwater valve if an on-site feed valve is available (see Valve settings, page 112).
Additional water valve	Function can be configured exclusively on output **DO2** for activating the feed valve at the unit (see Valve settings, page 112). **Note**: The option is mandatory for proper operation of the system.
Blowdown valve	Function can be configured exclusively on output **DO3** for activating the outlet valve at the unit (see Valve settings, page 112). **Note**: The option is mandatory for proper operation of the system.
Alerts PRIO 1 + 2	Can be used exclusively at output **DO4** for the combined reporting of both PRIO 1 and PRIO 2 alarms and warnings. **Note**: Independently of this, the PRIO 2 fault message can be configured additionally on a free GRCpump.1 or GIOD.1 DO.
Alerts PRIO 1	Function can be used exclusively on output **DO4** for reporting PRIO 1 alarms. **Note**: Independently of this, the PRIO 2 fault message can be configured additionally on a free GRCpump.1 or GIOD.1 DO.
All GIOD DO features	If one of the above-mentioned exclusive functions is not required, the corresponding output can be configured with an alternative function. All GIOD.1 digital output functions can be selected here (see Digital outputs on GIOD.1, page 110). The alternative functions can be configured at the same time on several free DOs.

NOTICE

The “Additional water valve” and “Blowdown valve” options are essential for the system to operate properly.

5.9.3.4.2 Digital outputs on GIOD.1



The configuration options for the GIOD.1 digital outputs are depicted in the next table. All of the functions mentioned can also be configured on several free DOs

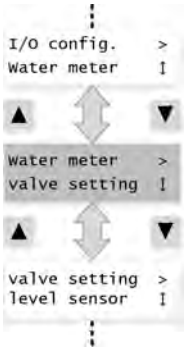
Functions	Description
Fault message PRIO 2	Message from PRIO 2 alarms and warnings.
Pump 1	The first uncontrolled pump is switched on.
Pump 2	The second uncontrolled pump is switched on.
Biocide station	Signal to biocide station to inject biocide into tray.
UV lamps	The UV lamps are switched on.
Ready for wetting	Ready message from GHM that humidification can take place.
Basin heating	The basin heating is switched on.
Ancillary pipe heating	The ancillary pipe heating is switched on.
Make-water requirement	Status message from GHM that the system still requires more additional water. **Note**: This function is important for operating several GHM in the system network. The corresponding mutual input function “External input water requirement” must also be configured here (see Digital inputs on GIOD.1, page 103).

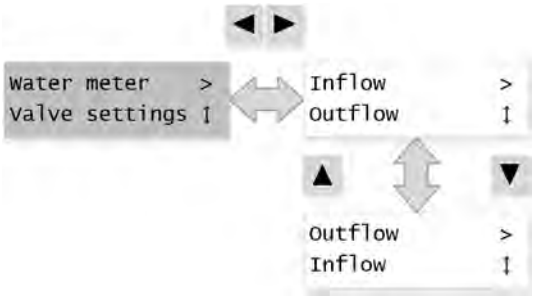
NOTICE

The “Additional water valve” and “Blowdown valve” options are essential for the system to operate properly.

5.9.4 Water meter

Up to two water meters can be configured with this menu option. The water meters are used to record the water volumes that flow into and out of the wetting basin. This also allows conclusions to be drawn as to how much water is used up during operation. The water meters can be configured independently of one another.

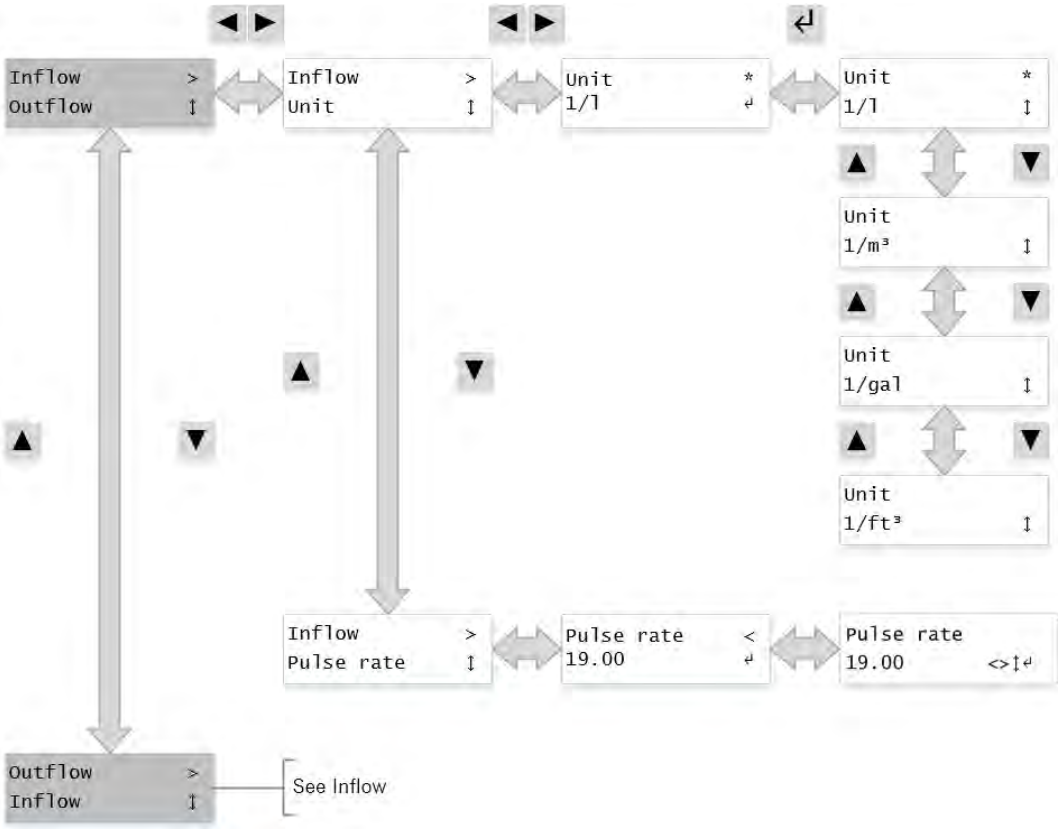




NOTICE

The current meter readings can be viewed in the Diagnostic menu (see Water meter, page 62).

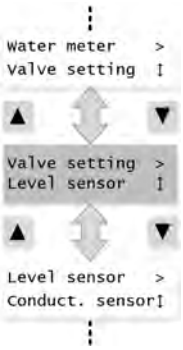
The GHM pump offers the possibility to set both the pulse rate and the unit for the water meter used independently of one another. This allows water meters with any relationship between the unit and pulse rate to be used. The water meter for the additional water can be configured in the “Inflow” sub-menu and the water meter for the blowdown water can be configured with the “Outflow” menu option.

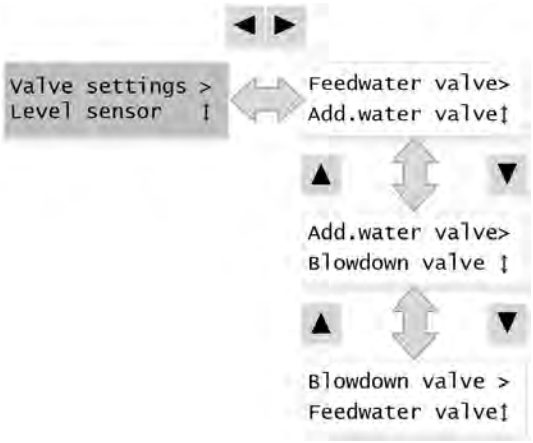


Parameter	Description	Default
Unit	The unit for the pulse rate can be defined here.	Inflow: 1/Litre Outflow: 1/Litre
Pulse rate	The number of pulses for the defined unit is set here.	Inflow: 19.00 Outflow: 10.00

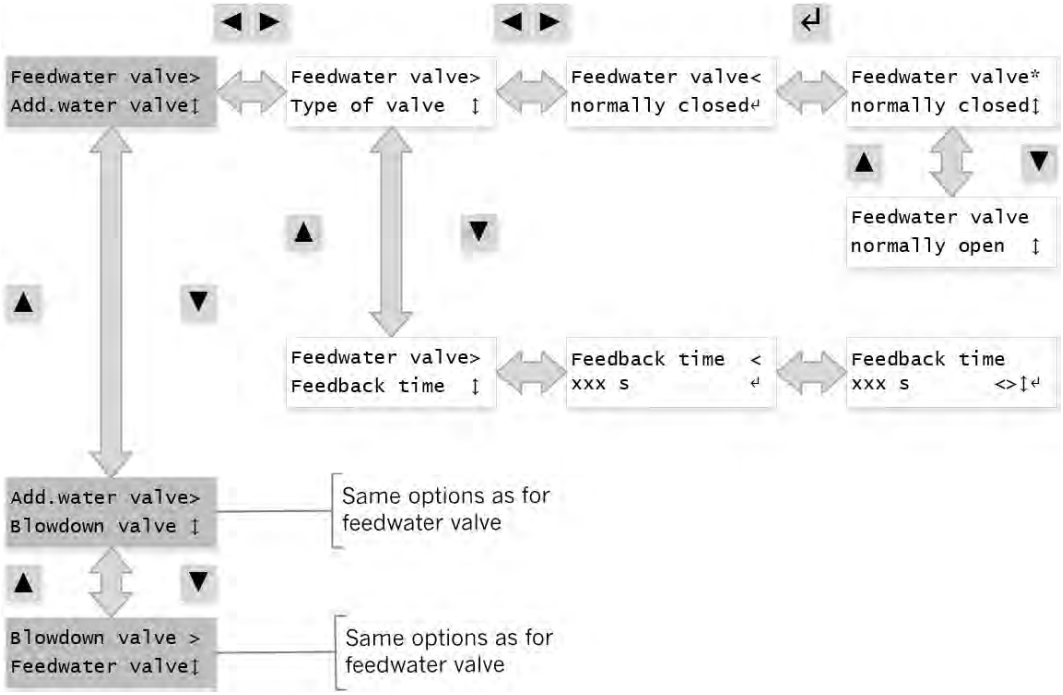
5.9.5 Valve settings

The valves can be configured with this menu option. Up to three valves can be connected to the GHM, namely the feedwater valve, additional water valve and the blowdown valve. Both the inflow and the outflow of fresh and blowdown water are regulated via the valves and the draining of the wetting dray ensured.





The valve parameters can be configured using the corresponding sub-menus. The valve type (normally closed or open) can be configured separately here for every valve. If position feedback is available for the valves, the feedback time can be defined here.

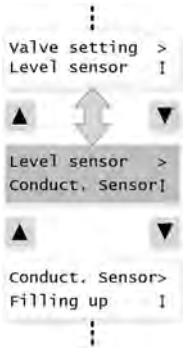


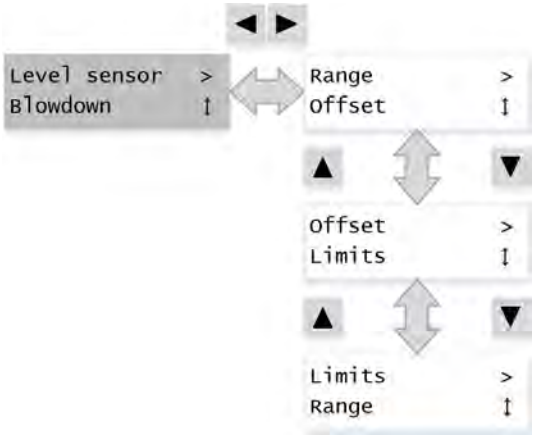
Parameter	Description	Default
Valve type	Setting of valve type: - Normally closed: If the valve is to be opened, the corresponding output (DO1, DO2 or DO3) is connected through. - Normally open: If the valve is to be opened, the corresponding output (DO1, DO2 or DO3) is de-energised.	Normally closed

Parameter	Description	Default
Feedback time	The maximum time a valve requires for an opening/closing process is defined here. **Note**: This parameter is defined collectively for all valves. The duration should always refer to the slowest valve for this reason.	30 s

5.9.6 Level sensor

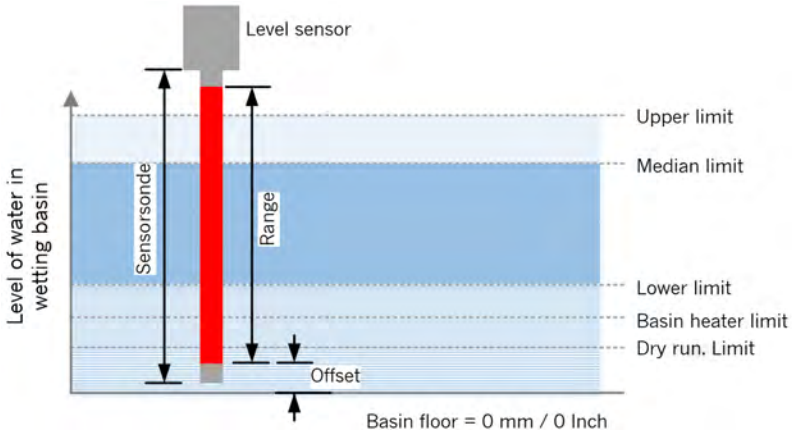
The parameters for the level sensor can be configured with this menu option.





5.9.6.1 Measuring range and offset

The GHM uses a sensor with a 4 to 20 mA current output and converts the signal to corresponding continuous values for the tray fill level. The GHM offers several parameters for adapting the level sensor optimally to the system configuration. The positioning can be adapted here relative to the tray floor and the measuring range of the level sensor can be adapted individually to the features of the wetting basin.

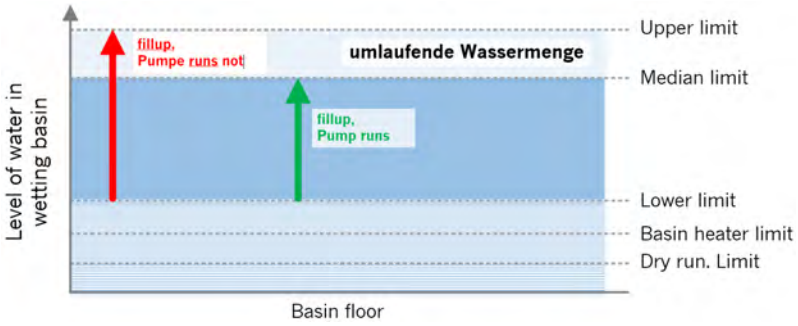


Features of the level sensor

Parameter	Description	Default
Measuring range	Active measuring range of sensor probe	500 mm
Offset	Relative distance from tray floor to start of measuring range.	10 mm

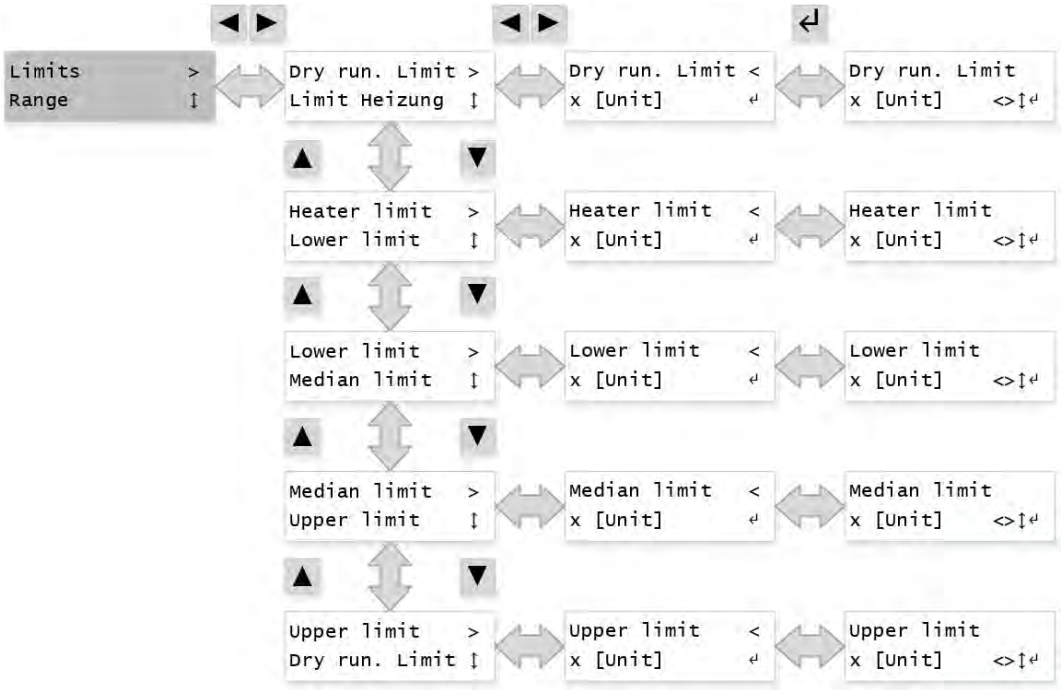
5.9.6.2 Limits

The GHM uses different discrete working points for the fill level control. The next diagram provides an overview of the possible discrete or symbolic tray fill levels.



Overview of symbolic tray fill levels

The discrete working points can be configured in the next menu. The height specifications are always specified relative to the tray floor.



Parameter	Description	Default
Upper limit	If the pump is not active, filling is up to this limit.	394 mm
Median limit	If the pump is active, filling is up to this limit.	363 mm
Lower limit	If this limit is not reached during wet operation, filling is started. The water is drained to this limit during a blowdown process.	351 mm
Heating limit	If this limit is not reached, the basin heating is switched off automatically.	229 mm
Dry run limit	If this limit is not reached, the pump is switched off automatically.	216 mm

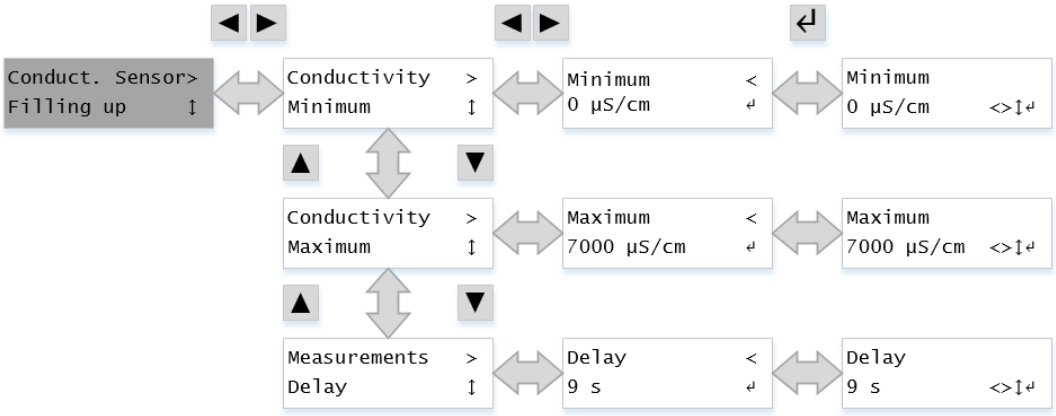
The current tray fill level (continuous and symbolic) can be viewed in the actual value menu (see Actual values, page 47).

NOTICE

To ensure proper operation of the system, the discrete working points have to be coordinated in relation to the system configuration as well as the tray and water pipe volume.

5.9.7 Conductivity sensor

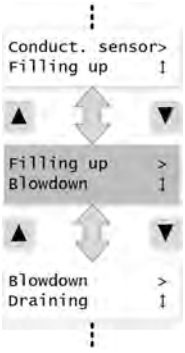
The parameters for the conductivity sensor can be configured with this menu option. A conductivity sensor can be used to monitor the quality of the wetting water and to initiate blowdown is necessary. The GHM uses a sensor with a 4 to 20 mA current output and converts the signal to the measured variable “electric conductivity”. A measurement delay as well as the measuring range of the conductivity sensor can be adapted individually here.

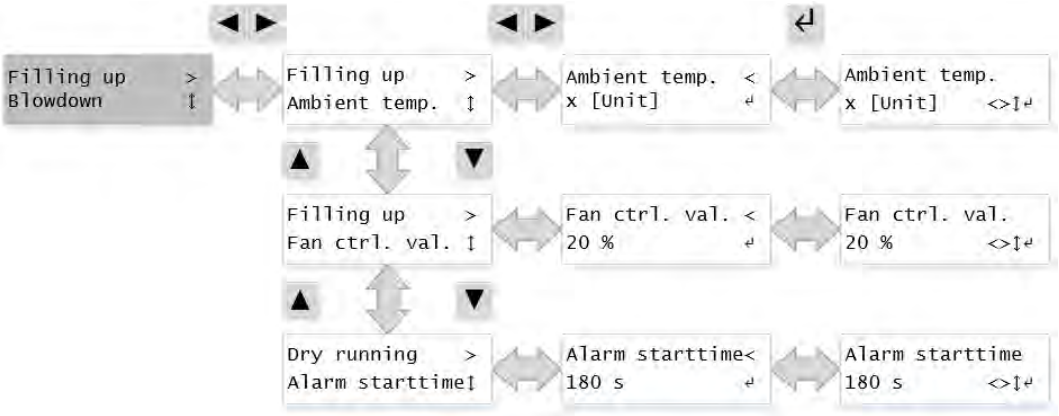


Parameter	Description	Default
Conductivity Minimum	The lower threshold of the measuring range specified by the sensor.	0 µS/cm
Conductivity Maximum	The upper threshold of the measuring range specified by the sensor.	7000 µS/cm
Measurements Delay	The time during which the first pump has to be active before the conductivity can be measured or updated.	9 s

5.9.8 Filling

The parameters for filling the wetting basin can be configured with this menu option. Filling is started for example when the system switches from dry to wet mode. Different criteria can be defined for automatic filling. Moreover, the filling process can be monitored by means of a configurable timer.



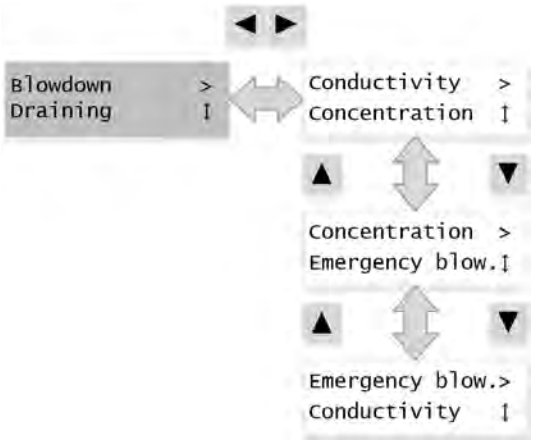


Parameter	Description	Default
Filling ambient temperature	The ambient temperature threshold to be exceeded to switch from dry to wet mode.	8.0 °C
Filling fan control value	The GMM fan control value to be exceeded to switch from dry to wet mode.	20 %
Dry running alarm start time	The period of time after filling starts until dry run protection is approved again. If this time expires without the dry run limit being reached, a corresponding PRIO 1 alarm message is triggered.	180 s

5.9.9 Blowdown

The blowdown parameters can be configured with this menu option. Blowdown is a process whereby the concentrated cooling water is drained from the wetting basin. Different contaminants in the heat exchanger, such as corrosion, deposits as well as microbiological growth, can be prevented in this way. The blowdown valve is opened first in order to allow concentrated water to flow off. As soon as the water fill level falls below the lower limit, the valve is closed again and the additional water valve is opened so that fresh water is added to the wetting basin. The tray is filled to the “Median limit” or “Upper limit”, depending on whether or not the pump is active.

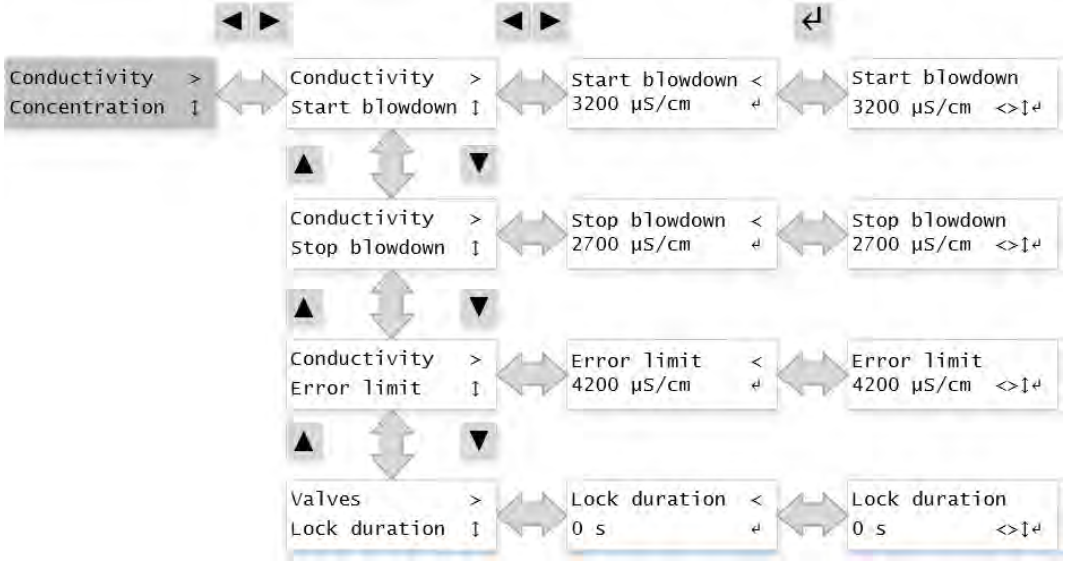
The GHM pump supports two different blowdown methods, namely blowdown based on conductivity or based on concentration. Moreover, emergency blowdown can also be configured. The criteria for starting and stopping the blowdown process may differ in this respect. Each method is configured by means of separate menu options.



The water quality is then checked. The blowdown process may be repeated if the water quality corresponds to the defined value.

5.9.9.1 Conductivity

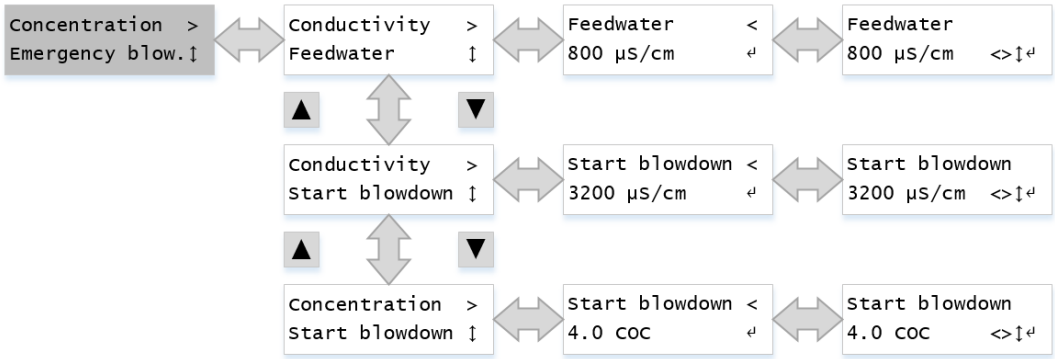
Conductivity-based blowdown is used if a conductivity sensor is configured. The quality of the wetting water is checked regularly with this method and a blowdown started if necessary. The process is concluded if the water quality after fresh water is added corresponds to the defined value. Otherwise the blowdown process is repeated until the conductivity of the wetting water corresponds to or falls below the defined value. The frequency and duration of the blowdown is essentially adapted with this method by means of the parameters “Conductivity - Start blowdown” and “Conductivity - Stop blowdown”.



Parameter	Description	Default
Conductivity start blowdown	A blowdown process is started if the conductivity of the wetting water exceeds this value.	3200 µS/cm
Conductivity stop blowdown	A blowdown process that has already started is only stopped if the conductivity of the wetting water falls below this value.	2700 µS/cm
Conductivity alarm limit	If the conductivity of the wetting water exceeds the defined value, a PRIO 2 fault message is triggered and a corresponding entry is made in the alarm memory and the GHM switches to dry mode. The pumps are stopped and the tray is emptied.	4200 µS/cm
Valves lock duration	The valves cannot switch their current status (opening/closing) for the specified duration during blowdown.	0 s

5.9.9.2 Concentration

Blowdown based on concentration is used if no conductivity sensor is available. The blowdown frequency can essentially be adapted with this method by means of the “Concentration - Start blowdown” parameter. The quality of the wetting water can be adapted based on the concentration count.



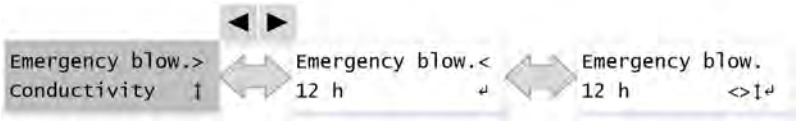
Parameter	Description	Default
Conductivity feedwater	Conductivity of tap water used for filling the tray. This value corresponds to a concentration count of “1.0”.	800 µS/cm
Conductivity start blowdown	See Conductivity, page 120	3200 µS/cm
Concentration start blowdown	Maximum number of concentration cycles before a blowdown is executed, also referred to as “Cycles of Concentration (COC)”. Higher COC figures tend to lead to more concentrated wetting water.	4.0 COC

NOTICE

The upper threshold for concentration depends essentially on the quality of the input water. To prevent any damage to system components owing to excessively concentrated wetting water, the recommended maximum water conductivity of 3200 µS/cm must be taken into account when defining the concentration count.

5.9.9.3 Emergency blowdown

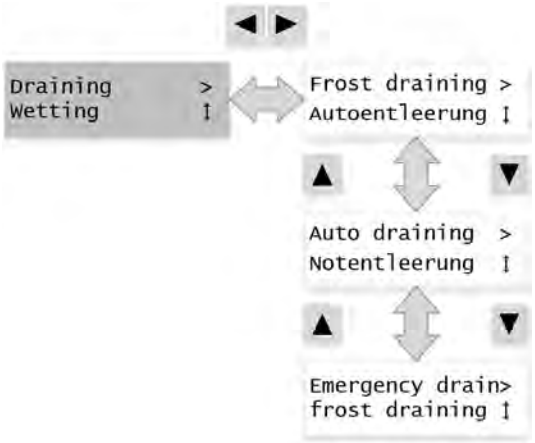
Emergency blowdown can be configured in this menu. If the defined blowdown method cannot be executed, for example because of a sensor error, an emergency blowdown can be performed at regular intervals. The tray is drained once following expiry of the defined time (to the “Lower limit”) and then refilled. This prevents the system components becoming damaged by any excessively concentrated water in case of faults.



Parameter	Description	Default
Emergency blowdown	Time period after which the periodic emergency blowdown is to be executed.	12 h

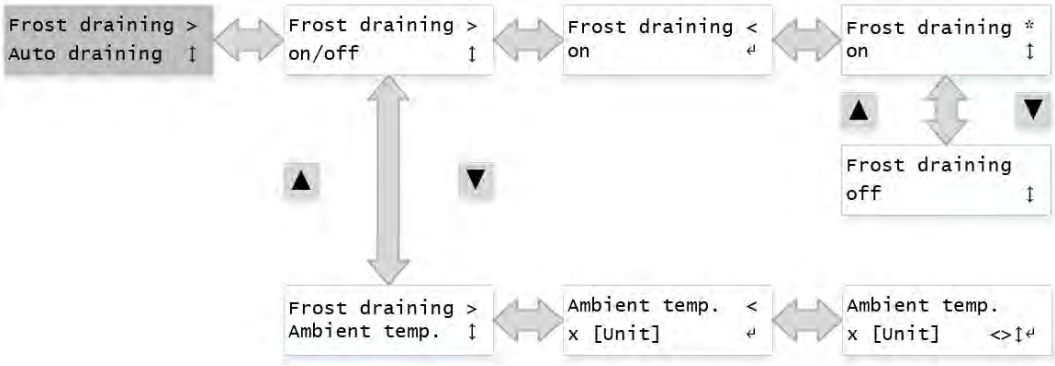
5.9.10 Draining

The draining process removes the water fully from the wetting basin. The GHM is then in dry mode. A distinction is made here between frost, auto and emergency draining.



5.9.10.1 Frost draining

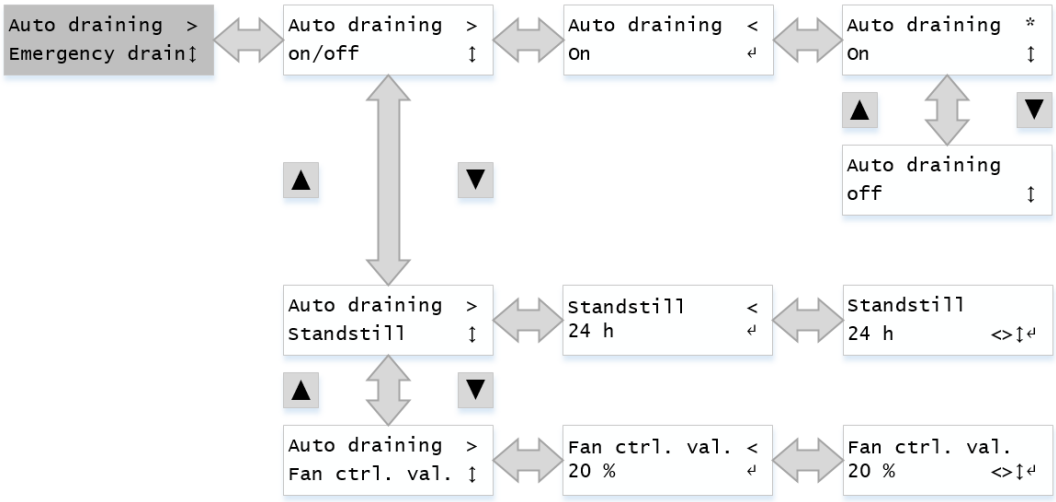
Frost draining aims to prevent the water in the wetting basin freezing at low ambient temperatures. The tray can be drained automatically in accordance with the ambient temperature.



Parameter	Description	Default
Frost draining on/off	The frost draining function can be activated here**On**or deactivated**Off**	Off
Frost draining ambient temperature	Ambient temperature threshold for performing draining.	4 °C

5.9.10.2 Automatic draining

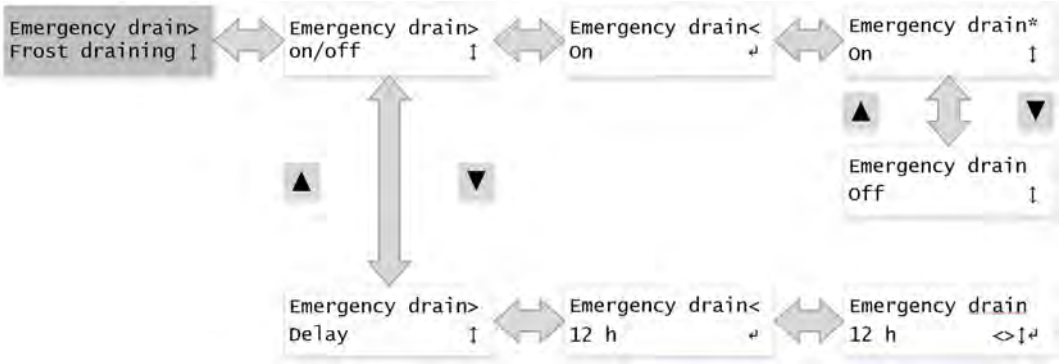
Automatic draining of the tray can be defined here. During longer downtimes, the GHM can perform an automatic switch to dry mode by means of automatic draining. Automatic draining is especially interesting if hygiene aspects also have to be considered, such as avoidance of legionella, when operating the system. Automatic draining is also referred to as “hygienic draining” for this reason.



Parameter	Description	Default
Auto-draining on/off	The automatic draining function can be activated here**On**or deactivated**Off**	Off
Auto-draining Downtime	The downtime that is to elapse to switch automatically to dry mode. The downtime starts immediately after the last pump has stopped and the GHM is still in wet mode.	24 h
Auto-draining Fan control value	The GMM fan control value must be larger than the defined value so that automatic draining can be started.	20 %

5.9.10.3 Emergency draining

The “Emergency draining” function can be configured here. The wetting basin can be drained automatically here if no measured data in relation to the ambient temperature is available for a specific time, for example in case of a sensor error.



Parameter	Description	Default
Emergency draining on/off	The emergency draining function can be activated here**On**or deactivated**Off**	Off
Emergency draining delay	The period that is to elapse after the wetting basin is drained if the ambient temperature remains unknown.	12 h

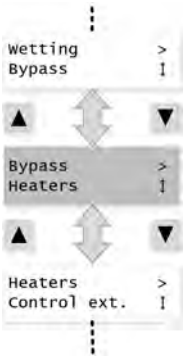
5.9.11 Wetting

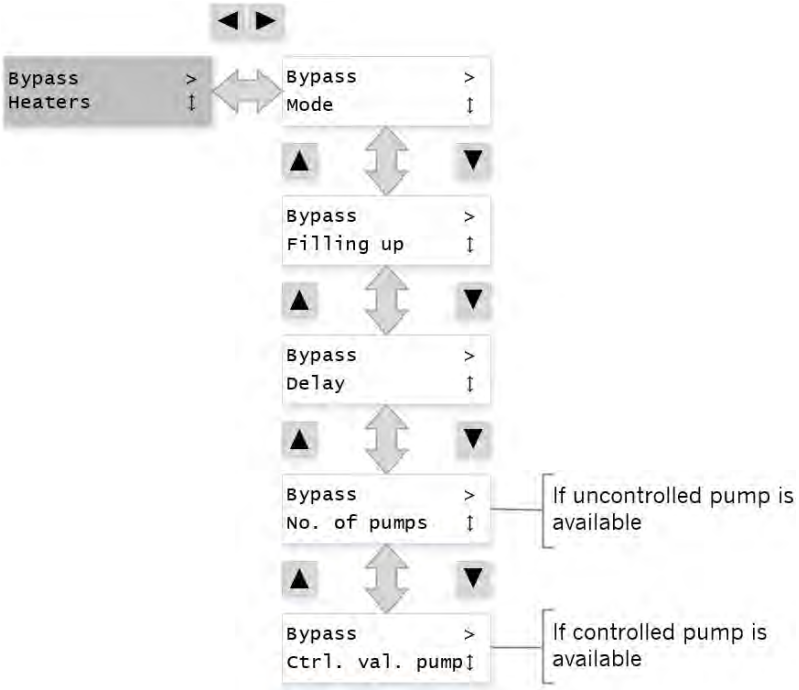
The GMM fan control value can be limited to the defined value with this menu option, while the GHM is in wetting mode. The cooling capacity can be adapted on one hand during wetting and on the other hand the emission of water drops and other particles reduced.

Parameter	Description	Default
Fan Maximum control value	The fan control value limitation to be communicated to the GMM. The limitation only applies for as long as the GHM is in wetting mode.	100 %

5.9.12 Bypass

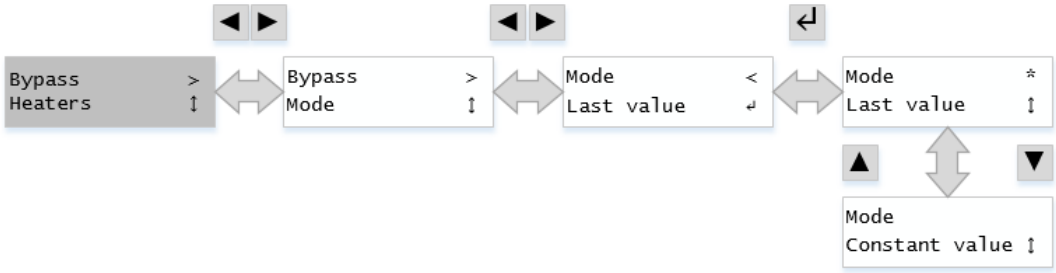
The GHM pump has a configurable bypass control. If the medium temperature or pressure, the fan control value or the ambient temperature are not known, for example communication errors with the GHM, bypass mode can be activated after a configurable time.





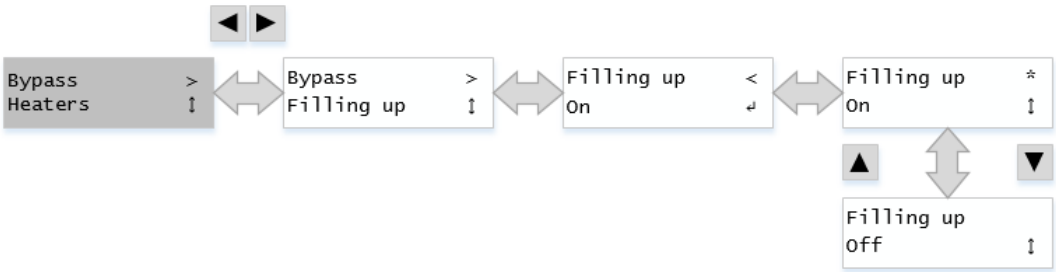
5.9.12.1 Mode

Bypass mode can be defined here.



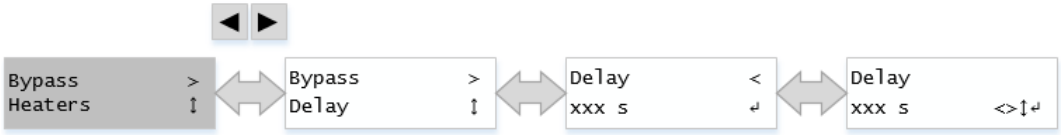
Parameter	Description	Default
Bypass mode	Determines which pump capacity should apply when the system is in bypass mode: “**Last value**” means that the same pump capacity is delivered as before the fault, in other words the number of pumps last active in the case of uncontrolled pumps and the last control value in the case of controlled pumps. “**Constant value**” means that the pumps should operate in the bypass in accordance with a defined principle. If a controlled pump is installed, it is activated with a configurable control value. If there are uncontrolled pumps, the defined number of pumps is activated.	Constant value

5.9.12.2 Filling



Parameter	Description	Default
Bypass filling	Defines whether the bypass is permitted to change the system from dry to wet mode.	ECOSS: On HYBRI-MATIC: Off

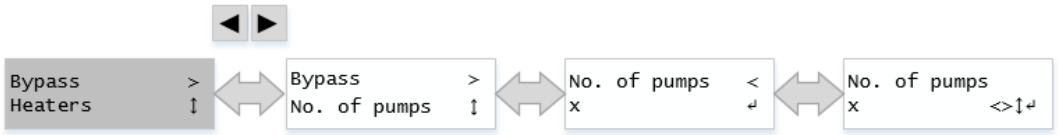
5.9.12.3 Delay



Parameter	Description	Default
Bypass delay	The period of time after which the bypass is activated if the cooling capacity cannot be controlled.	0 s

5.9.12.4 Number of pumps

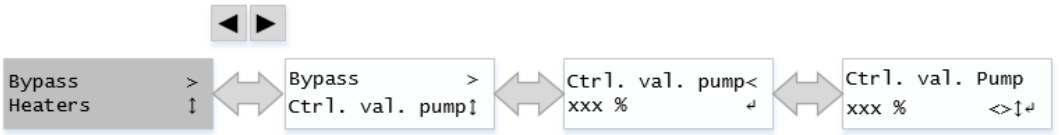
The number of uncontrolled pumps can be defined here. This parameter is only relevant if bypass mode is set to “constant value”.



Parameter	Description	Default
Bypass number of pumps	The number of uncontrolled pumps that are to be activated during the bypass.	1

5.9.12.5 Control value pump

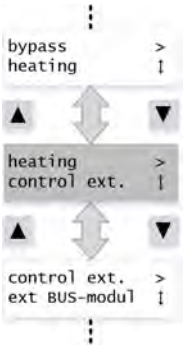
The control value for the controlled pump can be defined here. This parameter is only relevant if bypass mode is set to “constant value”.

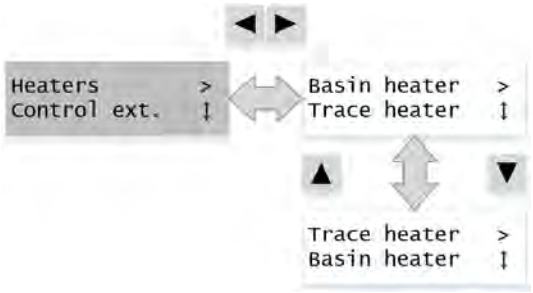


Parameter	Description	Default
Bypass control value pump	The control value for the controlled pump that is to be used during the bypass.	100 %

5.9.13 Heating

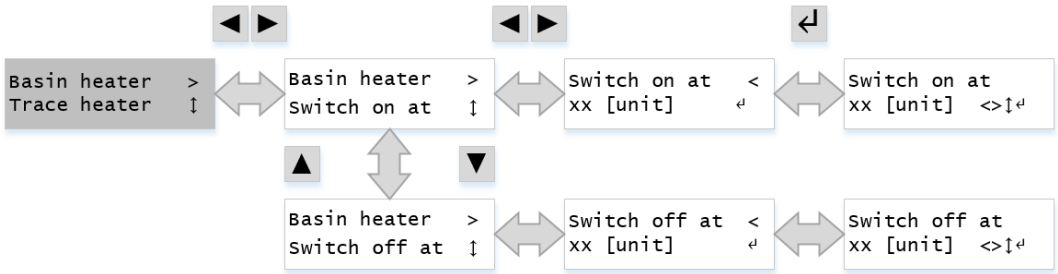
The heating is one of the frost protection functions of the GHM pump. Both basin heating and ancillary pipe heating can be connected to the GHM. The respective heating is configured by means of separate sub-menu options.





5.9.13.1 Basin heating

The basin heating is switched on and off according to the water temperature in the wetting basin. The starting and switch-off temperature can be defined in this menu.



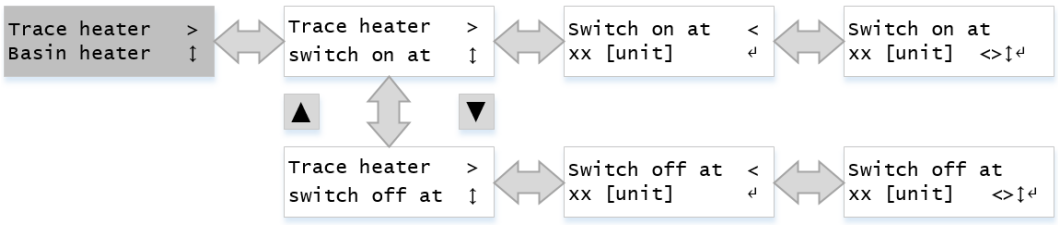
Parameter	Description	Default
Basin heating starting temperature	Lower threshold for the water temperature in the basin for activating basin heating.	3.0 °C
Basin heating switch-off temperature	Upper threshold for the water temperature in the basin for deactivating basin heating.	6.0 °C

NOTICE

To ensure proper operation of the basin heating, a temperature sensor has to be connected to GR-Cpump.1 and the “Basin temperature” function configured by means of the GHM IO configuration.

5.9.13.2 Heat tracing

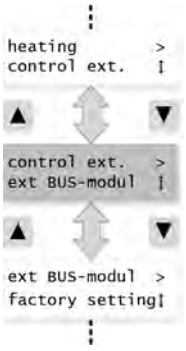
The ancillary pipe heating is switched on and off according to the ambient temperature. The starting and switch-off temperature can be defined in this menu.



Parameter	Description	Default
Heat tracing starting temperature	Lower threshold for the ambient temperature for activating heat tracing.	3.0 °C
Heat tracing switch-off temperature	Upper threshold for the ambient temperature for deactivating heat tracing.	6.0 °C

5.9.14 External control

The pre-set pump capacity for the GHM pump can be defined by means of a higher-level control. Pump control can be allowed or prevented via the bus with this menu option. If the external control system is used, the internal GHM pump control remains inactive. If pump control is permitted, the number of pumps to be activated (in the case of discrete pumps) or the control value for the adjustable pumps (in the case of adjustable pumps) can be pre-set by the higher-level control by means of bus communication with the GHM pump (see document *Interface specification for GCM MOD GHMpump*). Should it happen that the external control unit is not operating correctly, external control can be deactivated with this menu option as a remedy with the result that internal pump control is used automatically.



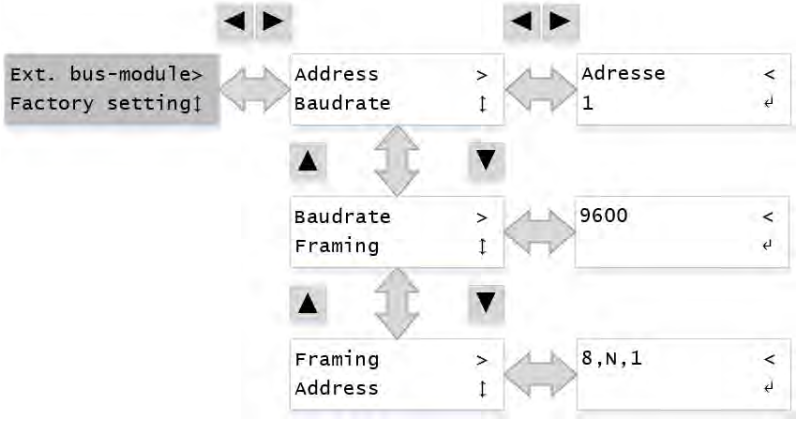
Parameter	Description	Default
Control via bus	Permits**On**or prevents**Off**control of the pumps via the bus.	off

5.9.15 External BUS module

The interface parameters of the connected bus module can be changed with this menu option.

5.9.15.1 Modbus RTU

The address, baud rate and framing parameters can be changed for a Modbus RTU module:



Parameter	Description	Default
Address	The address of the Modbus slave can be configured in the following value range: 1...247	1
Baud rate	Baud rate for communication with the Modbus master. The following values in baud are possible: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	9600
Framing	The transmission mode can be defined here. The following modes can be selected. 8,E,1 (8 bits, even parity, 1 stop bit) 8,N,1 (8 bits, no parity, 1 stop bit) 8,N,2 (8 bits, no parity, 2 stop bits) 8,O,1 (8 bits, odd parity, 1 stop bit)	8,N,1

5.9.15.2 Profibus

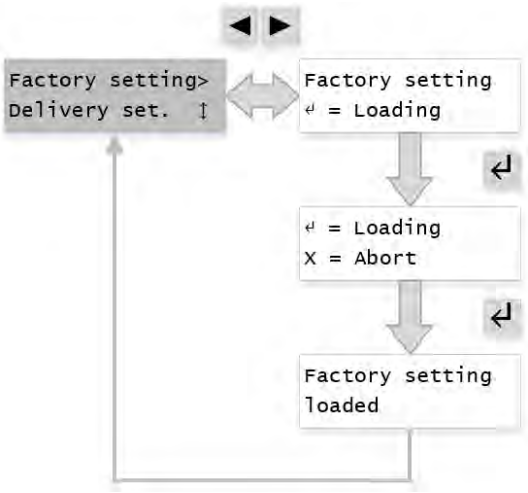
Only the fieldbus address can be changed for a Profibus module; the baud rate is set automatically.

Parameter	Description	Default
Address	The address of the Profibus slave can be configured in the following value range: 0...126	0

5.9.16 Factory setting

The control can be reset to factory settings here.

5.9.16.1 Control reset (factory setting)



NOTICE

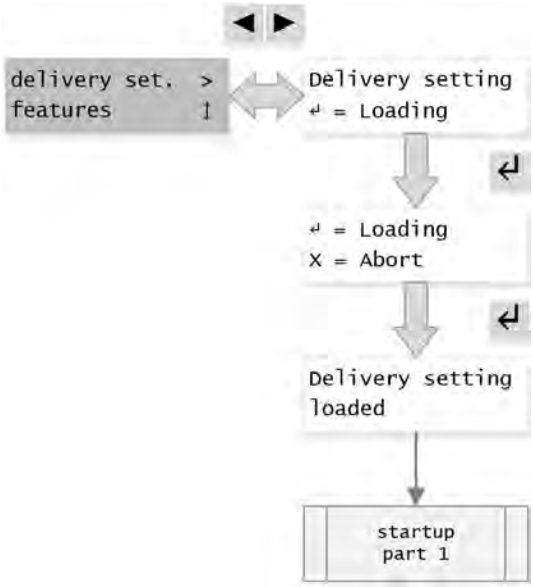
Any changes made locally will be deleted. Factory commissioning values will be retained. The control functions are reset to their default values.

See Parameters after commissioning - Factory setting, page

5.9.17 Delivery condition

The control can be reset to delivery condition here.
Commissioning is then necessary.

5.9.17.1 Control reset (delivery condition)



NOTICE

Any changes made locally and the **commissioning values** will be cleared. Once this function has been completed, a completely new factory commissioning must be carried out.

6 Faults and troubleshooting

6.1 General notes

Most faults that occur during commissioning are due to wiring faults or defective sensors. It is only in the rarest of cases that the GHM controller itself is defective. Check the following points before ordering a replacement:

Status info menu:

• Is a fault displayed in the info menu? (You can always return to the Info menu by pressing **X**).

• If **NO**, then go to **Test point 2.**

• For other incident reports, see Table Incident reports and warnings, page 143

TEST POINT 2:

Mains connection:

• Are all phases present?

Sensor connection:

• Is the sensor connected correctly? Cf "Sensor connection" section

• Sensor OK? (Measure! AI1 standard signal 4 - 20 mA, AI3 temp.: 1.2 - 2.7 kΩ, AI4 standard signal: 0 - 10 V, AI2 check function: 4 - 20 mA or temp. 1.2 - 2.7 kΩ)

• Are the sensor cables laid in the immediate vicinity of the mains or motor cable? Consider increasing the distance!

• Are the sensor cables shielded? If not – swap for shielded cables!

• Is the shielding applied unidirectionally on the controller?

Fuses:

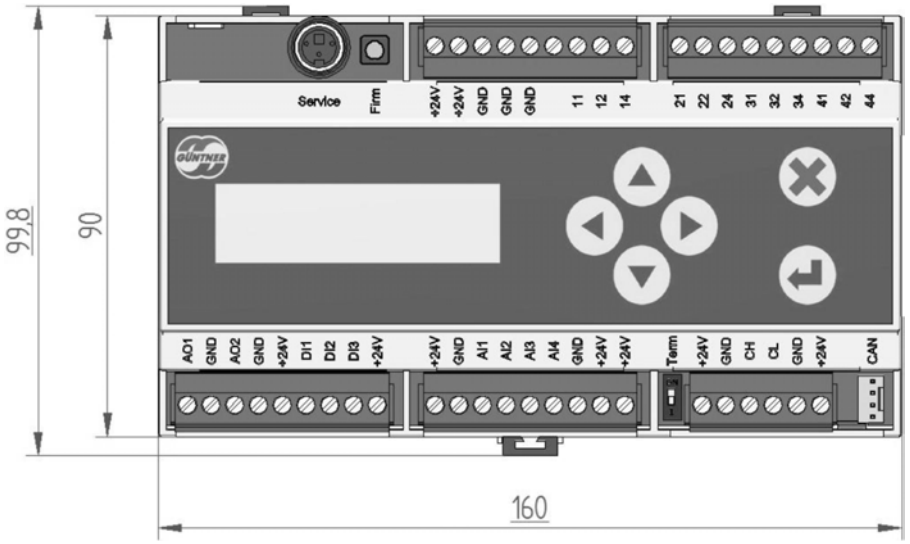
• Is the fuse on the controller supply OK?

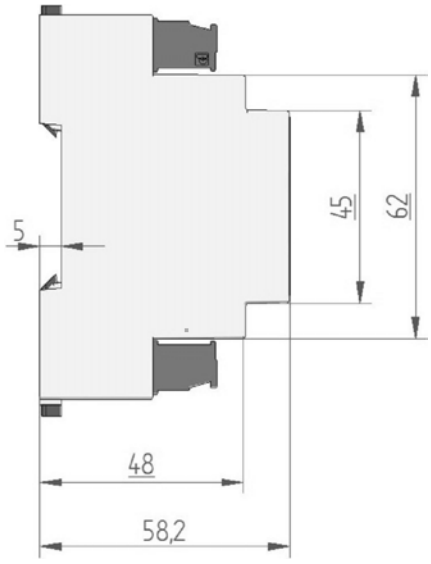
7 Technical data

7.1 Dimensions of component - Dimensions and weight

Dimensions of GRCpump.1

You will find the casing dimensions below. All dimensions are given in millimetres.



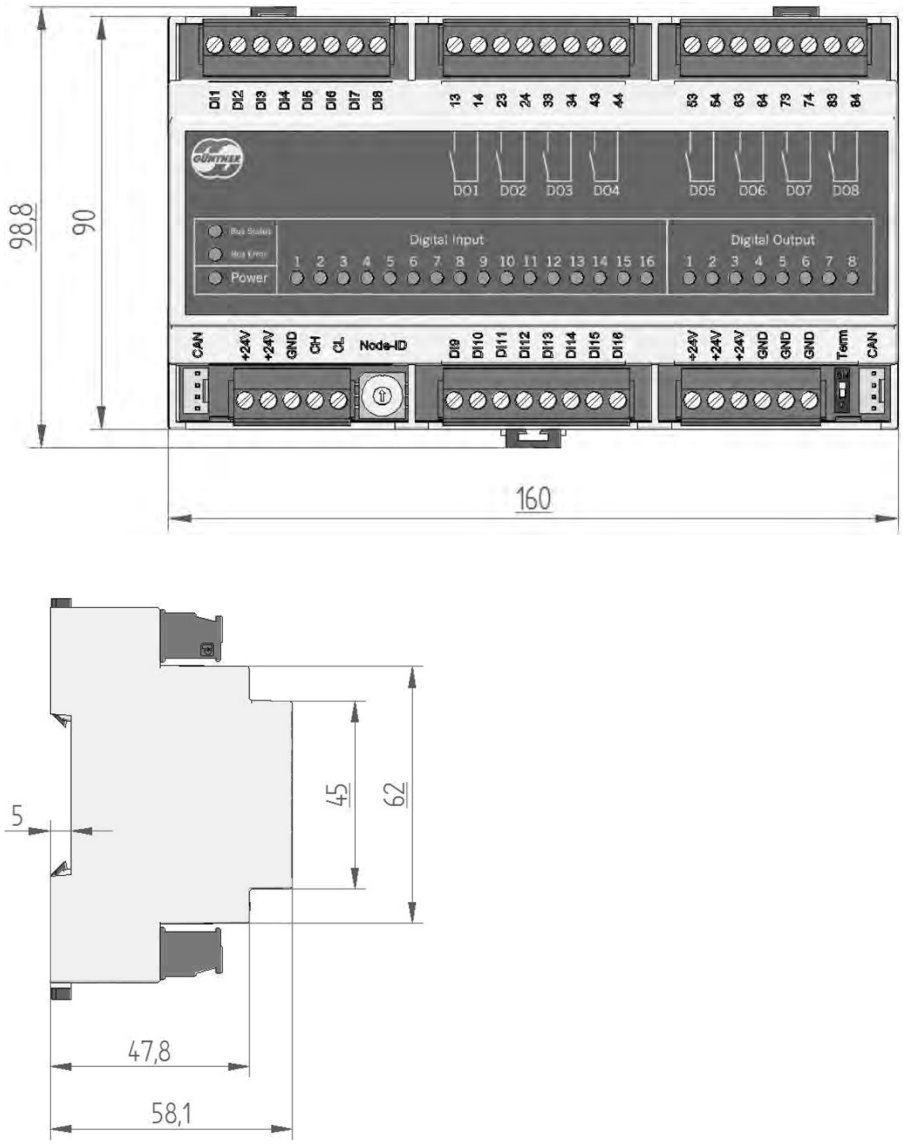


Casing dimensions of GRCpump.1

Weight:
approx. 340 g

Dimensions of GIOD.1

You will find the casing dimensions below. All dimensions are given in millimetres.



Dimensions of casing of GIOD.1

Weight:
approx. 340 g

8 Electrical properties of the components

Electrical properties of GRCpump.1				
	Min	**Type**	**Max**	**Unit**
Power supply	21	24	30	V
Current consumption		80	250[1]	mA
Digital inputs				
High level	15	24	30	V
Low level	-3	0	5	V
Relay outputs				
Voltage DC		24	30	V
Voltage AC			250	V
Current resistive load 24V DC/250V AC			1	A
Current inductive load 24V DC/250V AC			1	A
Switch cycles, mechanical	$1*10^6$			Hysteresis
Switch cycles, electrical	$1*10^5$			Hysteresis
Voltage input				
Dielectric strength	-24		30	V
Measuring range	0		12	V
Resolution			10	bit
Fault			1	%[2]
Input resistor:		230		kΩ
Current input				
Dielectric strength	-24		30	V
Measuring range	0		21	mA
Resolution			10	bit
Fault			1	%[2]
Input resistance (without protective circuit)		130		Ω

Electrical properties ofGRCpump.1

	Min	Type	Max	Unit
Voltage output				
Voltage range	0		10	V
Load resistance		>=100		kΩ
Resolution			10	bit
Fault			2.5	%[2]
Short protection			Yes	
Potential separation			No	
Temperature input				
Dielectric strength	-24		30	V
Measuring range	-30		100	°C
Resolution			10	bit
Precision			3	%[2]
CAN bus				
Dielectric strength	-24		24	V
Transmission rate		125		kbit/s
Galvanic separation			No	

Electrical properties ofGRCpump.1

1. The maximum current consumption includes supplying two attached pressure transponders and one attached temperature sensor.

2. Of the appropriate range

	Min	Type	Max	Unit
Power supply DC	21	24	30	V
Current consumption		100	250	mA
Digital inputs				
High level	15	24	30	V
Low level	-3	0	5	V
Relay outputs				
Power supply DC		24	30	V
Voltage AC			250	V
Current resistive load 24V DC/250V AC			1	A
Current inductive load 24V DC/250V AC			1	A
Switch cycles, mechanical	$1*10^6$			Hysteresis
Switch cycles, electrical	$1*10^5$			Hysteresis
CAN bus				
Dielectric strength	-24		24	V
Transmission rate		125		kbit/s

9 Incident reports and warnings

The table shows which signal relay (**PRIO 1** or **PRIO 2**) is tripped with which message on the display.

Message	Error code	Alarm prio	Description
Display dark, GMM pump OFF	n/a	1	**Explanation**: Supply voltage not available or display defective. **Possible causes**: Main switch off, power pack has no power supply, power pack defective, display defective. **Measures**: Check power supply and fuses. **Display**: n/a
Bus GMM NOK	0	1	**Explanation**: Communication error with GMM. **Possible causes**: CAN connection faulty (cable defective or not plugged in), GMM is without power or defective. **Measures**: Check supply voltage and CAN connection to GMM. **Display**: Info menu, alarm memory
Bus GIOD NOK	1	1	**Explanation**: Communication error with GIOD. **Possible causes**: CAN connection down (cable defective or not plugged in), GIOD without power or defective, the rotary code switch for address on the GIOD is not set correctly. **Measures**: Check supply voltage and CAN connection, set the rotary code switch on the GIOD correctly and then switch GIOD off and on again. **Display**: Info menu, alarm memory
Pump NOK	2	1	**Explanation**: At least one pump is reporting a fault. **Possible causes**: At least one pump is defective. **Measures**: Check the pump. **Display**: Info menu, alarm memory
Pump 1 NOK	3	1	Explanation: The first pump is reporting a fault. Possible causes: First pump is defective. **Measures**: Check the first pump. **Display**: Info menu, alarm memory
Pump 2 NOK	4	1	**Explanation**: The second pump is reporting a fault. **Possible causes**: Second pump is defective. **Measures**: Check the second pump. **Display**: Info menu, alarm memory
Feedw. valve Position NOK	5	1	**Explanation**: The feedwater valve has not reached its end position. **Possible causes**: Valve blocked, defined feedback time too short. **Measures**: Check valve, increase feedback duration under valve settings if necessary. **Display**: Info menu, alarm memory

Incident reports/warnings on the display

Message	Error code	Alarm prio	Description
Add. water valve Position NOK	6	1	**Explanation**: The additional water valve has not reached its end position. **Possible causes**: Valve blocked, defined feedback time too short. **Measures**: Check valve, increase feedback duration under valve settings if necessary. **Display**: Info menu, alarm memory
Blowdown valve Position NOK	7	1	**Explanation**: The blowdown valve has not reached its end position. **Possible causes**: Valve blocked, defined feedback time too short. **Measures**: Check valve, increase feedback duration under valve settings if necessary. **Display**: Info menu, alarm memory
Dry run	8	1	**Explanation**: The water level in the tray is insufficient to operate the pump. **Possible causes**: Tray cannot be filled or is losing water. **Measures**: Check valves, check pressure in supply, check tray for leakage. **Display**: Info menu, alarm memory
Sensor error AI1	9	1	**Explanation**: An invalid signal is measured at analogue input 1. **Possible causes**: Cable break, sensor defective, input configured incorrectly. **Measures**: Check I/O configuration, check sensor and replace if necessary. **Display**: Info menu, alarm memory
Sensor error AI2	10	1	**Explanation**: An invalid signal is measured at analogue input 2. **Possible causes**: Cable break, sensor defective, input configured incorrectly. **Measures**: Check I/O configuration, check sensor and replace if necessary. **Display**: Info menu, alarm memory
Sensor error AI3	11	1	**Explanation**: An invalid signal is measured at analogue input 3. **Possible causes**: Cable break, sensor defective, input configured incorrectly. **Measures**: Check I/O configuration, check sensor and replace if necessary. **Display**: Info menu, alarm memory

Incident reports/warnings on the display

Message	Error code	Alarm prio	Description
Sensor error AI4	12	1	**Explanation**: An invalid signal is measured at analogue input 4. **Possible causes**: Cable break, sensor defective, input configured incorrectly. **Measures**: Check I/O configuration, check sensor and replace if necessary. **Display**: Info menu, alarm memory
Conductivity alarm limit	13	1	**Explanation**: The conductivity of the tray water is too high. **Possible causes**: No blowdown performed, conductivity of feedwater too high. **Measures**: Check last blowdown in event memory, check conductivity of input water **Display**: Info menu, alarm memory
Circuit breaker NOK	14	2	**Explanation**: At least one subscriber in the circuit breaker chain is reporting a fault. **Possible causes**: Subscriber in circuit breaker chain defective. **Measures**: Locate faulty element in the chain. **Display**: Info menu, alarm memory
Basin heating NOK	15	2	**Explanation**: The basin heating is reporting a fault. **Possible causes**: Basin heating defective. **Measures**: Check basin heating. **Display**: Info menu, alarm memory
Biocide station NOK	16	2	**Explanation**: The biocide station is reporting a fault. **Possible causes**: Biocide station is not ready to use, biocide stock exhausted. **Measures**: Check biocide station and replenish biocide stock if necessary. **Display**: Info menu, alarm memory
UV lamps NOK	17	2	**Explanation**: The UV lamps are reporting a fault. **Possible causes**: One of the UV lamps is defective. **Measures**: Replace defective UV lamp. **Display**: Info menu, alarm memory
UV lamps Operating hours	18	2	**Explanation**: The set operating time of the UV lamps has been exceeded. **Measures**: Replace UV lamps and reset operating hours. **Display**: Info menu, alarm memory
Pump Operating hours	19	2	**Explanation**: The runtime of the pumps until the next system maintenance event has been exceeded. **Measures**: Perform maintenance work and reset operating hours. **Display**: Info menu, alarm memory

Incident reports/warnings on the display

Message	Error code	Alarm prio	Description
Fill level Lower threshold	32	2	**Explanation**: The water level in the tray is below the pre-set interval. **Display**: Info menu, alarm memory
Fill level Upper threshold	33	2	**Explanation**: The water level in the tray is above the pre-set interval. **Display**: Info menu, alarm memory
Conductivity lower threshold	34	2	**Explanation**: The conductivity of the tray water is below the pre-set interval. Display: Info menu, alarm memory **Display**
Conductivity Upper threshold	35	2	**Explanation**: The conductivity of the tray water is above the pre-set interval. **Display**: Info menu, alarm memory
Humidity Lower threshold	36	2	**Explanation**: The relative humidity is below the pre-set interval. **Display**: Info menu, alarm memory
Humidity Upper threshold	37	2	**Explanation**: The relative humidity is above the pre-set interval. **Display**: Info menu, alarm memory
Tray temperature Lower threshold	38	2	**Explanation**: The temperature of the tray water is below the pre-set interval. **Display**: Info menu, alarm memory
Tray temperature Upper threshold	39	2	**Explanation**: The temperature of the tray water is above the pre-set interval. **Display**: Info menu, alarm memory
Nozzle pressure Lower threshold	40	2	**Explanation**: The nozzle pressure is below the pre-set interval. **Display**: Info menu, alarm memory
Nozzle pressure Upper threshold	41	2	**Explanation**: The nozzle pressure is above the pre-set interval. **Display**: Info menu, alarm memory
Ambient temperature Lower threshold	42	2	**Explanation**: The ambient temperature is below the pre-set interval. **Display**: Info menu, alarm memory
Ambient temperature Upper threshold	43	2	**Explanation**: The ambient temperature is above the pre-set interval. **Display**: Info menu, alarm memory
Power On	64	n/a	**Explanation**: The GRCpump has performed a cold start. **Display**: Alarm memory
Reset	65	n/a	**Explanation**: The GRCpump has performed a warm start. **Display**: Alarm memory
Commissioning	66	n/a	**Explanation**: The GHM pump has been commissioned. **Display**: Alarm memory

Incident reports/warnings on the display

Message	Error code	Alarm prio	Description
Bus GMM OK	67	n/a	**Explanation**: Communication has been established with the GMM. **Display**: Alarm memory
Bus GIOD OK	68	n/a	**Explanation**: Communication has been established with the GIOD. **Display**: Alarm memory

Incident reports/warnings on the display

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