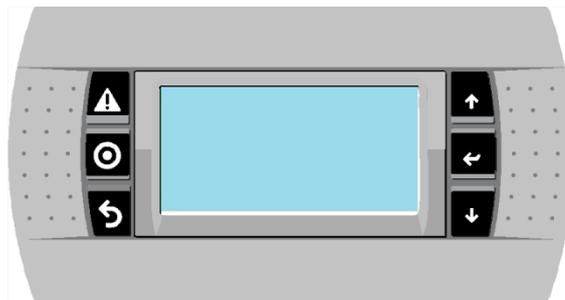


Operating instructions

Control for heat pumps



SmartHeat heat pump

date of commissioning / release code
(to enter during the commissioning)

machine number
(to enter during the commissioning)

Tel.

service partner
(to enter during the commissioning)

Caution

Please read before installation and use of the device the instructions carefully!

Non-compliance can cause damage to man and machine and void the warranty!
Keep the instructions at a safe place

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1 General information

The SmartHeat heat pump controller is used in SmartHeat heat pumps. While the user menu system is limited strictly to important functions, adapting the controller and its properties to the many optional use cases and usage conditions requires thorough examination of this manual. The successful operation of a heat pump system is substantially dependent on setting the right controller and system parameters.

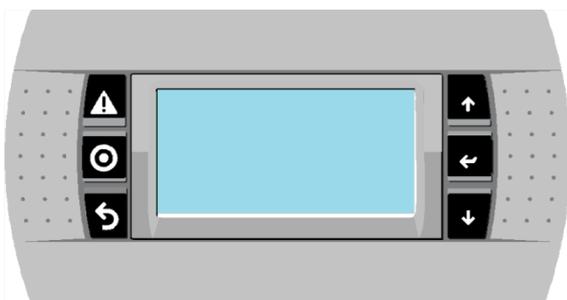
The control system is designed to supply power for four Generators. The sources could be either heat pumps, heating boilers or electric heaters. For special tariff shut-off, the separate switch-on and switch-off conditions must be noted.

The system consists of the following functional units (partly optional equipment):

- Water heating
- Heating
- Cooling
- Mixer control unit
- screed heating programme
- Solar system control
- Seasonal Performance Factor (optional)
- Service:
 - Logging of operating hours for all Generators
 - Access rights provided by different password levels
 - Fault input analysis
 - Energy-saving function
 - Flow monitoring on the source and sink side
 - Reference room temperature control
 - Expansion valve control

1.1 Operating unit

The user has a clearly-laid out operating unit for checking and adjusting the system parameters. The operating unit can also be operated remotely from the control unit. The maximum distance is 30m. The operating unit is connected to the RJ12 port.



Only disconnect or connect it in a de-energised state. Otherwise you will cause malfunctions to the operating and control units

Figure 1 Operating unit

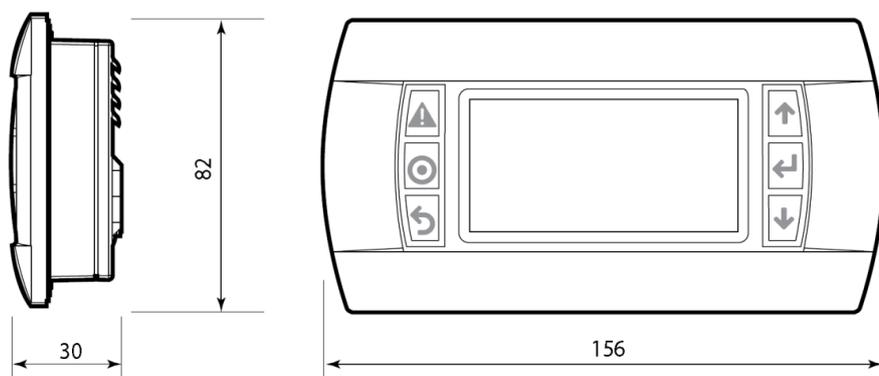


Figure 2 Operating unit dimensions

1.2 Control unit



Figure 3 Control unit

All ports use plug connectors with screwed connection.

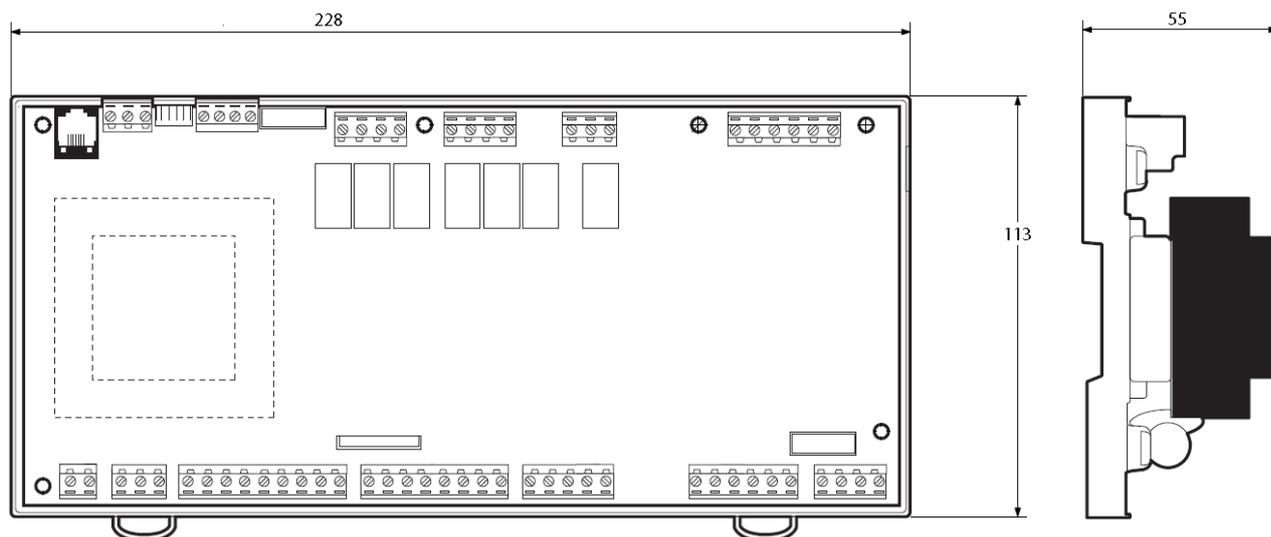


Figure 4 Control unit dimensions

2 Symbols and abbreviations

Explanation of the graphical symbols used in this operating manual:



Caution!

The symbol indicates possible hazards and faults.



Caution: 230V voltage!

The symbol indicates hazards due to life-threatening high voltages.



List



Information on operation / particular features

3 Safety instructions



All installation and wiring tasks on the controller may only be carried out when it is in a de-energised state. An external disconnection device must be provided.



Connection and commissioning of the SmartHeat controller may only be undertaken by specialist personnel, adhering to the applicable safety regulations, primarily VDE 0100.



Before carrying out installation or wiring work on the electrical equipment, always fully disconnect the device from the operating voltage.



Make sure you never confuse the SELV (safety extra low voltage) connectors (sensor, flow sensor) with the 230V connectors. The destruction of the device and life-threatening voltages are possible, on the device and on connected sensors and devices.



Heat pump systems can reach high temperatures. There is a risk of burns!



Install the controller in such a way that, for example, heat sources do not cause an impermissible operating temperature (below 0°C and above 50°C) or excessive humidity (80% non-condensing).



The system should not be put into operation if any damage can be discerned to the controller, cables or to the connected pumps and valves.



Check that the materials used for the piping, insulation and the pumps and valves are suitable for the temperatures which occur in the system.



Avoid water getting on any and all electrical and electronic components.



Do not allow conductive metallic objects to get on or inside electrical modules.

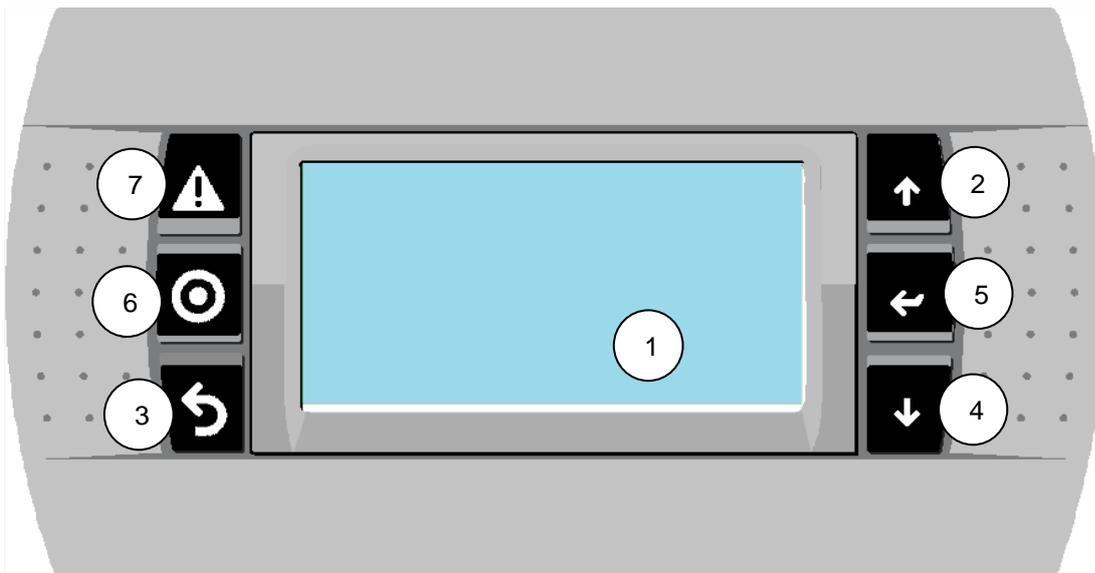


Connect the power supply cable according to the connection diagram. Note the phase sequence.

4 O
p

eration

4.1 Overview of the operating unit



| Number | Description |
|--------|---|
| 1 | Display, dims together with the LEDs in buttons 2 to 5 after 5 minutes with no interaction. |
| 2 | Scroll Up / + operating button |
| 3 | Exit / Cancel / ESC operating button |
| 4 | Scroll Down / - operating button |
| 5 | Select / Confirm / Enter operating button |
| 6 | On / Off function button |
| 7 | Alarm menu function button |

4.2 Button functions

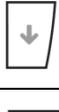
The controller can be operated simply and conveniently with four operating buttons and two function buttons.

The operating buttons are used to:

- call up display values
- configure device settings

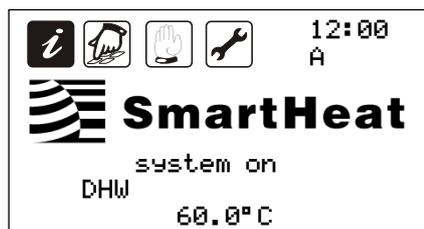
The graphical display easily guides you through the operating structure on screen and displays the current menu items, display values and parameters in a clear manner.

The operating and function buttons have the following functions:

| Button* | | Function | Description |
|---|---|---------------------------|--|
|  |  | Up + | <ul style="list-style-type: none"> • Scroll up in the menu • Change values: incrementally increase the displayed value • Pressing and holding the button raises the value continuously |
|  |  | Down - | <ul style="list-style-type: none"> • Scroll down in the menu • Change values: incrementally decrease the displayed value • Pressing and holding the button reduces the value continuously |
|  |  | Exit Cancel | <ul style="list-style-type: none"> • Exit a menu • Exit a menu item • Cancel a value change without saving |
|  |  | Select Confirm | <ul style="list-style-type: none"> • Select a menu item • Confirm a value change and save |
|  |  | Alarm message Reset | <ul style="list-style-type: none"> • LED flashes red when faults are pending • LED is permanently lit red for faults which have been viewed but not reset |
|  |  | On/Off | <ul style="list-style-type: none"> • Switches the control function on/off, not the device power supply • Button LED lights up when controller is switched off |

* Buttons as seen on the operating unit

4.3 Main screen



4.4 Explanation of graphical symbols

| Graphical symbol | Menü |
|---|----------------|
|  | Information |
|  | Programme |
|  | Manual mode |
|  | Basic settings |

To enable clear operation of the device, the device, operation and display functions are arranged into four menus. These menus are represented by the graphical symbols.

Depending on the configuration of the heat pump, the menus may contain submenus. The menus and submenus can display information or be used to change setting values.

The dark version of the symbol shows that this is the currently selected menu. Button 5 is used to open the menu. When a menu is open, the corresponding light version of the symbol is displayed.

| Menu | Overview of the functions contained (excerpt) |
|--|--|
| Information  | Main menu for automatic control of the heat pump system: <ul style="list-style-type: none"> • Display the current measured values • Display the system status • Display the history (system message memory) • Display the operating hours |
| Programm  | Change and adjust the programmable setting values (parameters): <ul style="list-style-type: none"> • Setpoint in heating, cooling, and hot water mode • Day/week programme for heating, cooling, exhaust air, hot water • Set date and time • Service information <p>Note: Changes can have an influence on system functions!</p> |
| Manual mode  | Switch the connected pump, valves and Generators on and off in manual mode. <p>Note: This should only be done by trained specialists, after entering a password! This will put all functions of the controller out of operation! See Chapter 13 Special applications!</p> |

Basic settings

Information on the basic settings for the functioning of the system

Without entering a password, certain parameters can be viewed but not modified.

Depending on the configuration, the following submenus are available:

- Options
- Generators
- Additional heating
- Mixer settings
- Pump operating hours
- Screed heating programme
- Various safety functions
- Save and restore settings

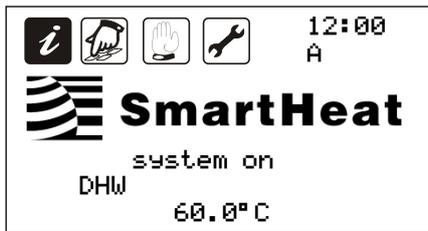
Note: Password-protected settings and changes may only be undertaken by specialist personnel!

5 Operation

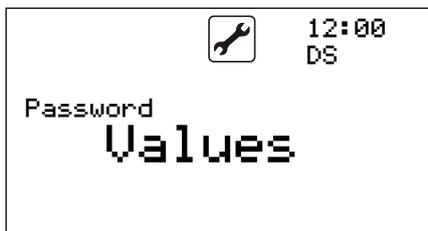
5.1 Password entry

Entering a password allows the device differentiate between users, who are then able to make adjustments to control parameters according to their competency. A distinction is made between Release, Maintenance, Installer and Manufacturer levels. When a password is entered, access is maintained for five minutes after the last button press, after which it is reset automatically.

Explanation based on the "Release" password:



Scroll with  until the dark version of the  symbol is shown, then confirm with .



Scroll with  until "Password values" appears on the display, then confirm with .



Scroll with  until "Release password" appears on the display, then confirm with .

(1000 is used here as an example release code. You can obtain the release code for the heat pump from the first page of this operating manual.)

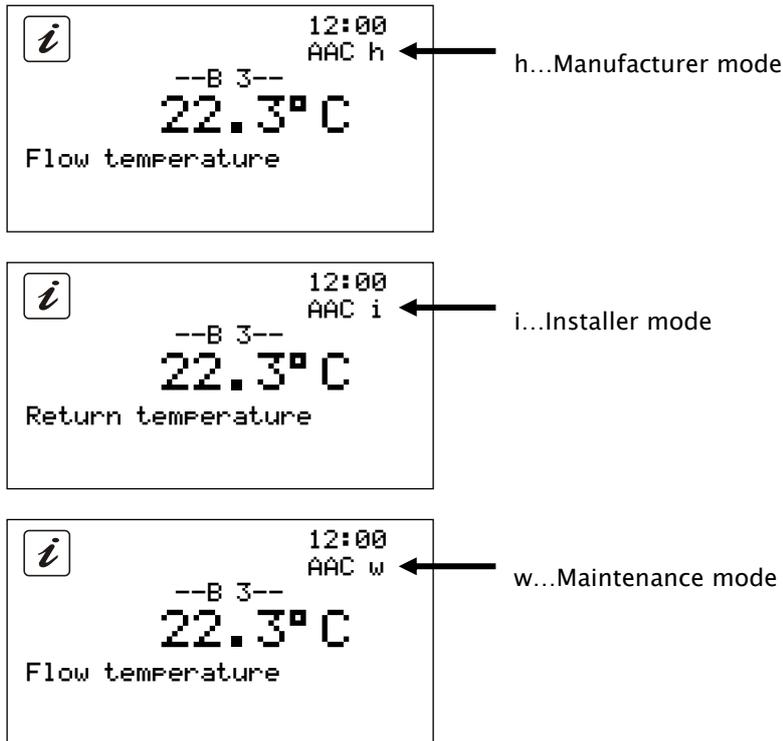


 causes the cursor to jump to the first numbers; you can enter an appropriate value using  and .  causes the cursor to jump to the next numbers; you can enter an appropriate value using  and . The remaining numbers must be entered accordingly.



Once all numbers have been entered and the password has been judged to be correct, "Password values" appears on the display.

A small letter under the time displays the current password mode. This affects the following passwords:



All three modes are activated by entering a password and may only be used by trained specialists, as the wrong settings could cause injury, and damage to the system. No separate character is displayed for the release code.

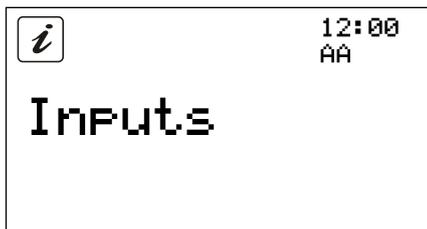
5.2 Information menu

The following steps are necessary to call up the Information menu:

In the main menu, press  or  until the dark version of the  symbol is shown, then confirm with .

 or  is used to select the appropriate submenu and then  to confirm. There are four submenus available: Inputs, Outputs, Generators and History

Inputs submenu:



The Inputs submenu shows the values for the analogue and digital inputs. Analogue values include temperatures and pressure values. Digital values include switching statuses of safety devices.

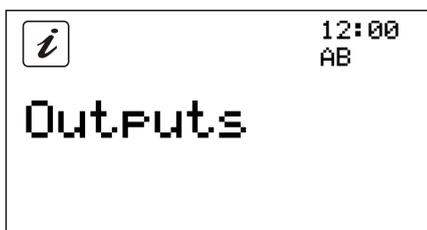
The arrow buttons ,  can be used in the submenu to access all of the active analogue and digital inputs:

- Analogue input B1, B2, B3,...,B12
- Digital input DI1, DI2, DI3,...,DI10

To exit the submenu or menu, press  until the main menu appears.

i Only values specific to the system and the values for activated additional functions are displayed!

Outputs submenu:



The Outputs submenu shows the values for the analogue and digital outputs. Analogue values include 0-10V or PWM. Digital values include control signals for the Generators (compressor).

The arrow buttons ,  can be used in the submenu to access all of the analogue and digital outputs:

- Analogue output Y1, Y2, Y3, Y4
- Digital output NO1, NO2, NO3,...,NO12

To exit the submenu or menu, press  until the main menu appears.

i Only values specific to the system and the values for activated additional functions are displayed!

Generator submenu:

The Generator submenu serves to display the statuses of the Generators. The appearance of this information differs depending on the type and number of Generators.

The arrow buttons ,  can be used in the submenu to access all information about the:

- Generator 1, 2, 3, 4

To exit the submenu or menu, press  until the main menu appears.

i Only values specific to the system and the values for activated additional functions are displayed!

History submenu:

The History submenu stores messages about safety shutdowns and other messages concerning fault statuses. It stores the last 50 messages.

The arrow buttons ,  can be used in the submenu to access up to 50 stored system messages:

- History (system message memory)

The messages are numbered according to the time they occurred. The most recent message is displayed first and has the highest message number. When the memory is full, the oldest message is overwritten. Various data on each message is also saved. The date and time that a message occurred can be seen at a glance. You

can bring up additional information on the individual messages by pressing . The arrow buttons ,  can be used to switch between messages.

To exit the submenu or menu, press  until the main menu appears.

Note: The message memory is used by installation and maintenance personnel to analyse the sequence of the programme.

5.3 Programme menu

The following steps are necessary to call up the Programme menu:

In the main menu, press  or  until the dark version of the  symbol is shown, then confirm with



 or  is used to select the appropriate submenu and then  to confirm.

These submenus are available:

- Heating
- Cooling (optional function)
- Hot water
- Mixer 1 (optional function)
- Mixer 2 (optional function)
- Data logging
- Date and time
- Service
- Source control
- Sink control

Examples of the procedure are described in Chapter 5.4!



The Heating submenu allows you to programme the functions for heating mode. Certain settings can only be modified if you have the appropriate rights. A password must be entered first. The scope of available settings is the same as for cooling.



takes you to the programming screen or  to additional functions



The setpoint relates to a reference value for the flow temperature and indirectly represents the room temperature.

Press , then  or  to set the desired value, and press  twice to confirm.

Heating

- Set the desired room temperature
- Usually 20–24°C
- *Default 22°C*

Cooling

- Set the desired room temperature
- Usually 18–20°C
- *Default 20°C*

Press  to proceed



The reduction specifies which room temperature is adopted between the time frames on the weekly schedule.

Press , then  or  to set the desired value, and press  twice to confirm.

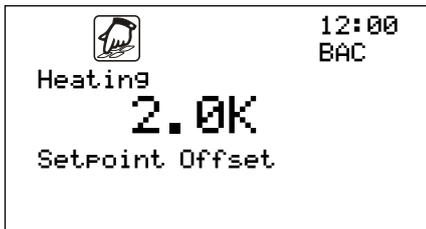
Heating

- Set the desired room temperature for the reduction
- Usually 3K below the desired room temperature
- *Default 19°C*

Cooling

- Set the desired room temperature for the reduction
- Usually 2K above the desired room temperature
- *Default 22°C*

Press  to proceed



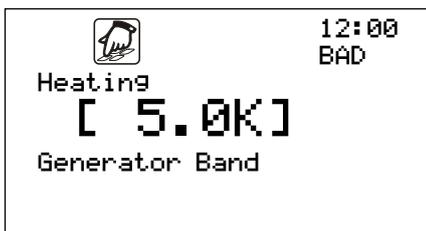
The Offset Setpoint is used to calculate the switch-on and switch-off point relating to a request for heating or cooling

A request is deemed to have been satisfied once the actual value is greater than or equal to the setpoint plus the offset setpoint.

A request is triggered once the actual value is less than or equal to the setpoint minus the offset setpoint.

Press , then  or  to set the desired value, and press  twice to confirm.

Press  to proceed



- Generator modulation specifies how soon the output should be reduced before the end of the request.
- This function is used on multi-stage and inverter-operated systems.

Press , then  or  to set the desired value, and press  twice to confirm.

Press  to proceed



The activation temperature specifies from what outdoor temperature the heating or cooling function is available, according to the activation period.

Press , then  or  to set the desired value, and press  twice to confirm.

Heating

- Set the outdoor temperature which the temperature must drop below to activate heating mode
- Usually 18–20°C

- *Default 18°C*

Cooling

- Set the outdoor temperature which the temperature must exceed to activate cooling mode
- Usually 22–24°C
- *Default 22°C*



Press  to proceed



The activation period specifies how long the outdoor temperature must be maintained to enable the heating or cooling function.



Press , then  or  to set the desired value, and press  twice to confirm.

Heating

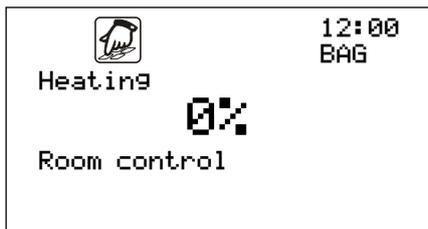
- Set the period
- The unit can be set in seconds, minutes, hours and days
- *Default 12 hours*

Cooling

- Set the period
- The unit can be set in seconds, minutes, hours and days
- *Default 12 hours*



Press  to proceed



The room control allows the control variable to be switched from outdoor temperature to a reference room temperature.



Press , then  or  to set the desired value, and press  twice to confirm.

Heating

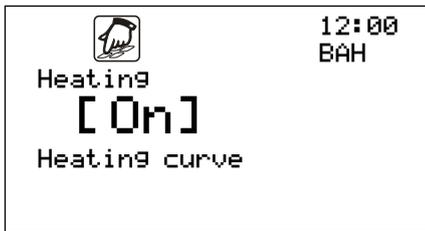
- 0% outdoor temperature-based control
- 50/50 outdoor and room temperature control
- 100% room temperature-based control
- *Default 0%*

Cooling

- 0% outdoor temperature-based control
- 50/50 outdoor and room temperature control
- 100% room temperature-based control
- *Default 0%*



Press  to proceed



The heating or cooling curve depicts the adaptation of the flow temperature to the current control temperature variable (outdoor temperature or reference room temperature). If the curve is deactivated, a fixed value is used.

Press , then  or  to set the desired value, and press  twice to confirm.

Heating

- On or Off

Cooling

- On or Off

Press  to proceed



The reference setpoint relates to the flow temperature for a setpoint of 20°C

Press , then  or  to set the desired value, and press  twice to confirm.

Heating

- Not shown when the heating curve is activated
- Direct assignment:
 - Room temperature or flow temperature dependent on the room control
- *Default 40°C*

Cooling

- Not shown when the cooling curve is activated
- Direct assignment:
 - Room temperature or flow temperature dependent on the room control
- *Default 10°C*

Press  to proceed



X1 outdoor temperature defines the first point of the heating or cooling curve as the outdoor temperature.*

Press , then  or  to set the desired value, and press  twice to confirm.

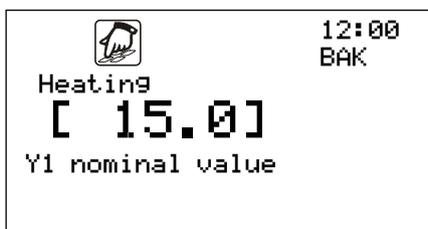
- Input value for calculation point X1 of the heating curve
- Only shown when the heating curve is activated

Cooling

- Input value for calculation point X1 of the cooling curve
- Only shown when the cooling curve is activated

Press  to proceed

*For further information, see point 12



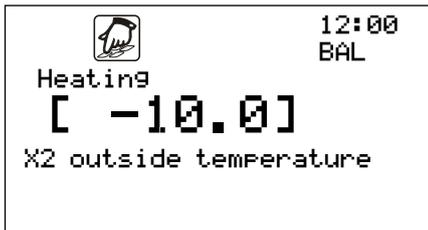
Y1 nominal value defines the first point of the heating or cooling curve as the flow temperature with reference to the setpoint or the reduction value.*

Press , then  or  to set the desired value, and press  twice to confirm.

- Output value for calculation point Y1 of the heating curve
Only shown when the heating curve is activated
- Output value for calculation point Y1 of the cooling curve
- Only shown when the cooling curve is activated

Press  to proceed

*For further information, see point 12



X2 outdoor temperature defines the second point of the heating or cooling curve as the outdoor temperature.*

Press , then  or  to set the desired value, and press  twice to confirm.

- Input value for calculation point X2 of the heating curve
- Only shown when the heating curve is activated

Cooling

- Input value for calculation point X2 of the cooling curve
- Only shown when the cooling curve is activated

Press  to proceed

*For further information, see point 12



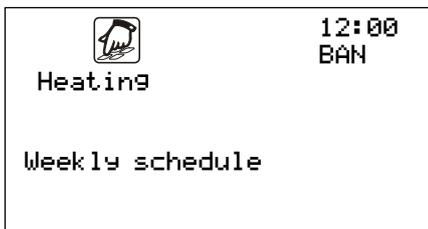
Y2 nominal value defines the first point of the heating or cooling curve as the flow temperature with reference to the setpoint or the reduction value.*

Press , then  or  to set the desired value, and press  twice to confirm.

- Output value for calculation point Y2 of the heating curve
- Only shown when the heating curve is activated
- CoolingOutput value for calculation point Y2 of the cooling curve
- Only shown when the cooling curve is activated

Press  to proceed

*For further information, see point 12



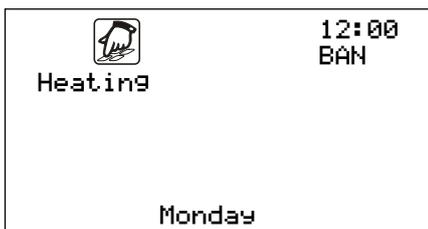
In the weekly schedule two time frames, to which the set target value applies, are defined for each day. Outside of these time frames, the reduction value is applied. The weekly schedule is available for heating, cooling, and hot water.

Heating

- Create the weekly schedule for heating cycles with two time frames
- A start time and stop time can be set for each time frame
- The master day overwrites all days of the week

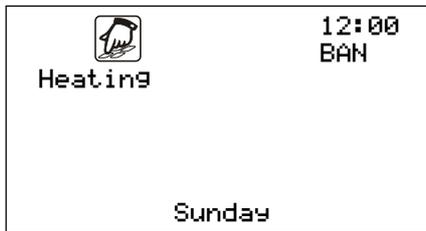
Cooling

- Create the weekly schedule for cooling cycles with two time frames
- A start time and stop time can be set for each time frame
- The master day overwrites all days of the week

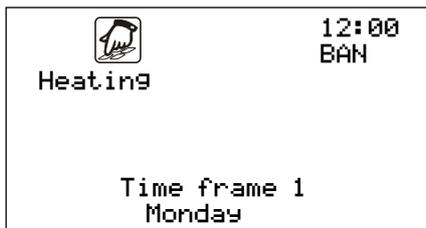
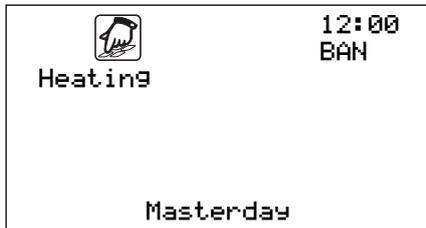


Proceed to select the day of the week by pressing .

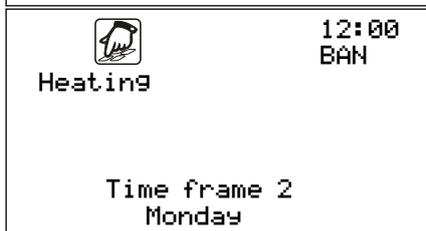
Select the day of the week by pressing  or .



Proceed to confirm the day of the week by pressing .



Select the time frame by pressing  or .
Proceed to confirm the time frame by pressing .



Select the start or stop time by pressing  or .
Proceed to confirm the start or stop time by pressing .



 is used to activate the cursor and  or  to set the desired value for the hours. Press  twice to confirm and  or  to set the desired value for the minutes. Press  twice to confirm. Press  once to set the stop time, for example, or  twice to set the next time frame or  three times to select the next day of the week, or  four times to exit the weekly schedule.

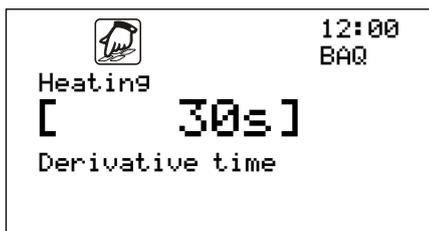


The control type defines the type of speed control for the compressor. The choice of control has a direct influence upon achieving the setpoint. This setting is also important for the cooling function. You can choose from P, PI, and PID.

Press , then  or  to set the desired value, and press  twice to confirm.



Press , then  or  to set the desired value, and press  twice to confirm.

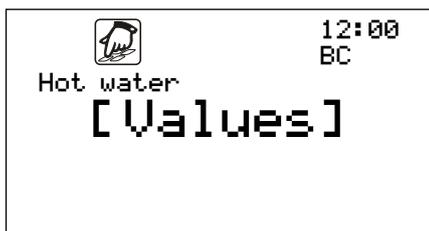


Press , then  or  to set the desired value, and press  twice to confirm.

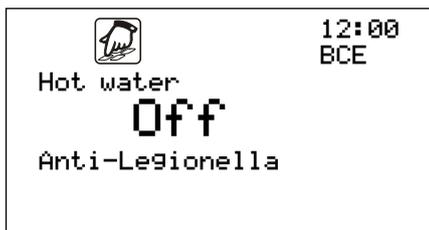


Inverter speed defines the maximum speed at which the function can be carried out. This also serves to limit the power.

Press , then  or  to set the desired value, and press  twice to confirm.



With the exception of the heating curve (since it is based on a fixed value), hot water is programmed in exactly the same way as heating or cooling.



An additional anti-legionella function can be activated.

Press , then  or  to set the desired value, and press  twice to confirm.

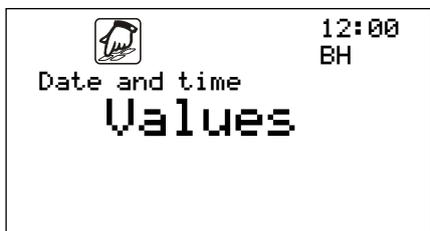


For an output-controlled charging pump, the speed can be adjusted using a continuous signal.

Press , then  or  to set the desired value, and press  twice to confirm.

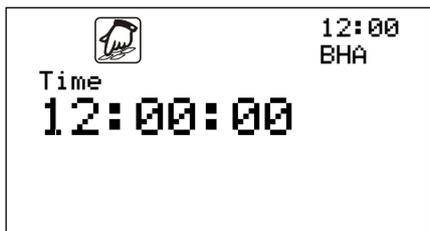


The Data logging function is not currently supported. The function can however be covered by an additional module.



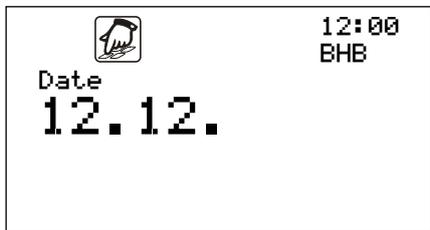
The date and time are entered in the format hh:mm:ss and dd/mm/20yy

Proceed to set the time by pressing  or 



To set the time, press ; the cursor is activated.

Then press  or  to set the hours, and press  twice to confirm. The cursor jumps to the minutes. Press  or  to set the minutes, and press  twice to confirm. It is not possible to set the



seconds. Press  to proceed

To set the day and month, press ; the cursor is activated.

Then press  or  to set the days, and press  twice to confirm. The cursor jumps to the month. Press  or  to set the month, and press  twice to confirm. Press  to proceed



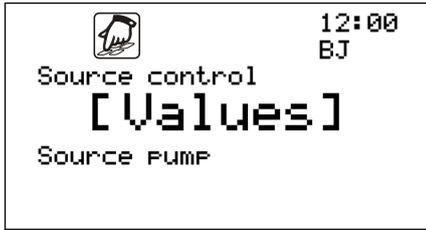
To set the year, press ; the cursor is activated.

Then press  or  to set the year, and press  twice to confirm.

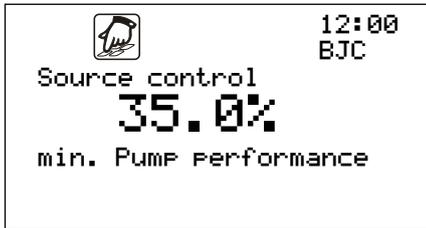
Press  twice to exit.



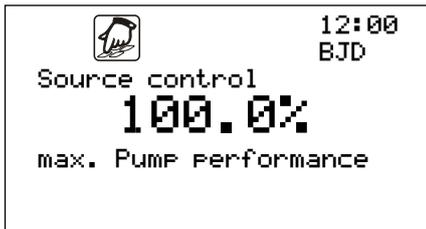
In the Service submenu you can store the telephone number for your service representative, which is shown on the main screen when a disabling message is displayed. This function is not yet available.



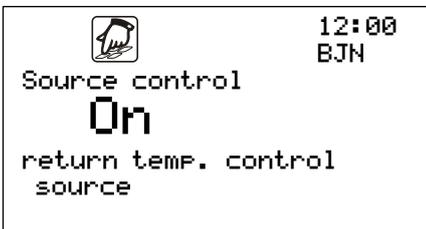
The source control is adjusted in accordance with the machine type and differentiates among different functions and working modes. In this case, Type 2 with pump.



Proceed to the submenus by pressing . The settings can only be configured once a password for the corresponding access level is entered.



If a heating / cooling / WW requirement is the source pump is actuated. The pump start for the "pump lead time + compressor minimum duration + 30s" with 100% (10V) output. During normal operation the unit is controlled in dependence of compressor output (inverter speed). This is the max. speed set for the operating mode (eg. WW = 90rps) equal to 100% pump output. If no heating / cooling / WW requirement longer exists, the control is set minimum pump performance (Bsp.35% = 3.5V). The maximum and minimum shared pump performance can be set in the software.

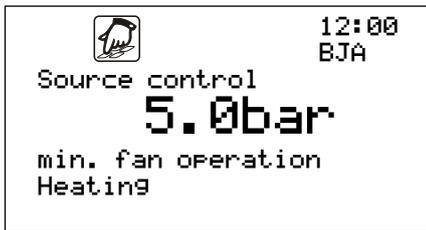


Alternatively, you can regulate the source pump by the source return temperature. This function must be switched on in the "BJN" mask. Then you can parameterize the PID parameters in the following masks and thus influence the control behavior of the pump. The controlled variable is the adjustable minimum source start temperature in the mask "BJA".

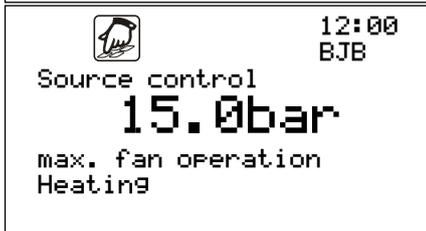
The minimum and maximum pump power continues to be the limits for pump speed control.



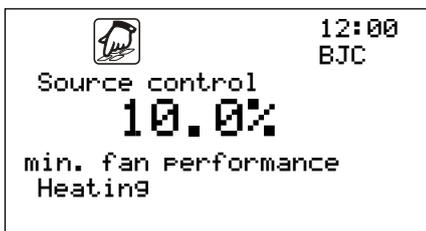
The source control is adjusted in accordance with the machine type and differentiates among different functions and working modes. In this case, Type 1 with fan.



Proceed to the submenus by pressing . The settings can only be configured once a password for the corresponding access level is entered.

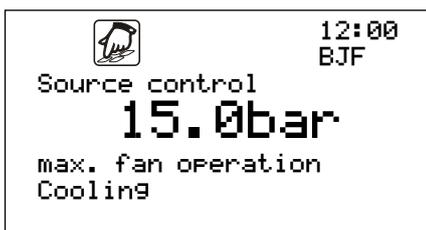
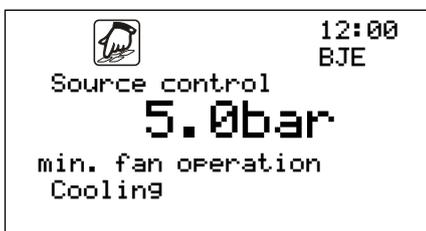
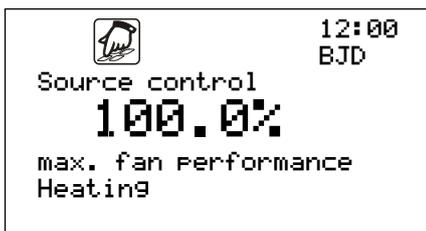


Defining four points establishes a characteristic curve, on the basis of which source control is performed. If the source unit is a pump, it is only possible to define one characteristic curve.



For a fan, heating, cooling, and defrosting differ.

Press , then  or  to set the desired value, and press  twice to confirm.



 12:00
BJG

Source control
0.0%
min. fan performance
Cooling

 12:00
BJH

Source control
100.0%
max. fan performance
Cooling

 12:00
BJI

Source control
15.0bar
min. fan operation
Defrost

 12:00
BJJ

Source control
20.0bar
max. fan operation
Defrost

 12:00
BJK

Source control
0.0%
min. fan performance
Defrost

 12:00
BJL

Source control
0.0%
max. fan performance
Defrost

 12:00
BJM

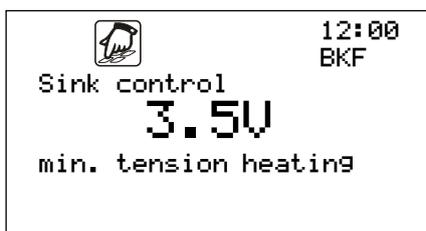
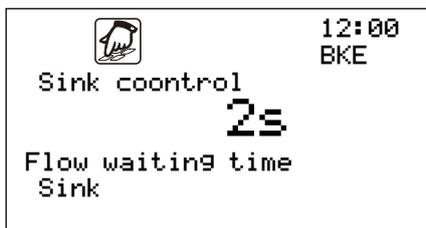
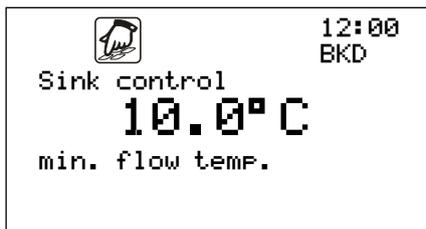
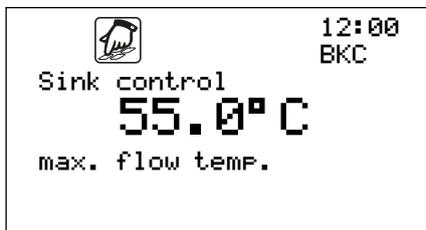
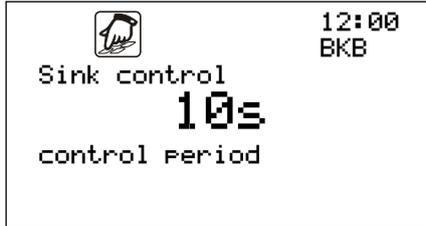
Source control
2s
Flow waiting time
Source

The Flow waiting time specifies how long monitoring of the flow rate can be interrupted once the source pump (for example) has been activated.

Press , then  or  to set the desired value, and press  twice to confirm.



Proceed to the submenus by pressing . The settings can only be configured once a password for the corresponding access level is entered.

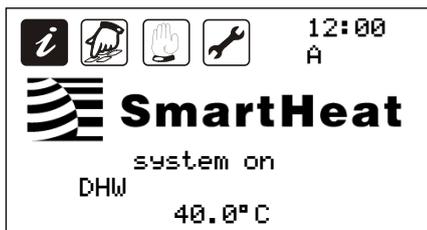


5.4 Example

Once you have familiarised yourself with the descriptions of the menus from this chapter and the preceding steps, you may perform some operating steps with the system as an exercise. An example operating procedure is illustrated below.

The starting position is the main menu.

Objective: Change the parameter "Hot water reduction value" from 40°C to 35°C in the Programme menu.

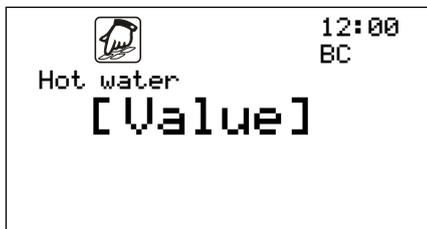


Scroll right as far as the Programme menu.



The dark version of the  symbol is shown.

Press Enter to proceed.



Scroll through the Programme menu until the Hot water submenu is displayed



to set the reduction



Scroll through the submenu until Reduction is displayed.



Select value: Reduction
The cursor then starts to flash



Reduce the value until the desired value is achieved. The value continues flashing.



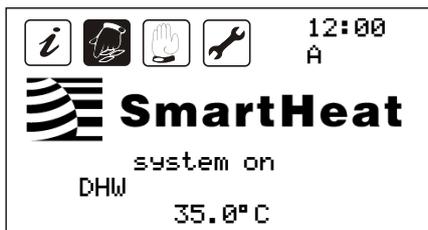
Select "Confirm value"



"OK?" is displayed
Confirm the change with Enter;
the change is accepted.



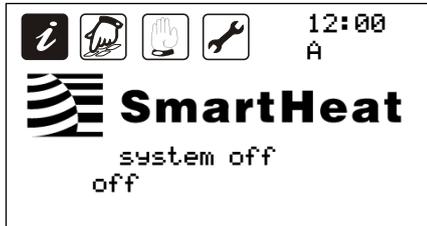
or
Exit with Esc:
the change is not accepted



2x
Exit the Hot water submenu
Exit the Programme menu
Return to the main menu

5.5 Statements on the main menu

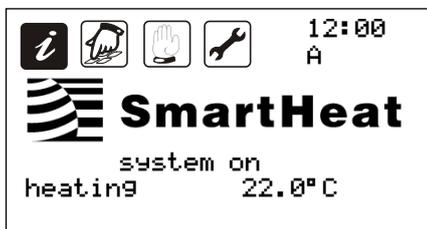
The following chapter shows possible statements on the main menu and describes their meanings for the heat pump controller.



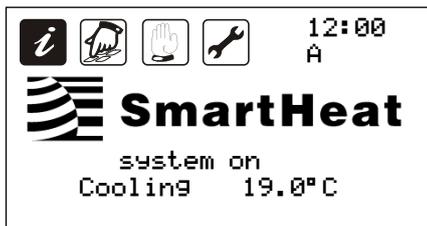
The system has been switched off via function button 6.



The system does not have a Generator available, possibly blocking time have not yet elapsed or temperature ranges have not yet been reached.



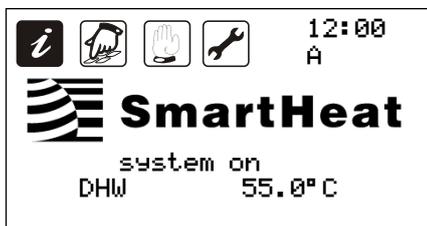
The system is in heating mode with a setpoint of 22°C.



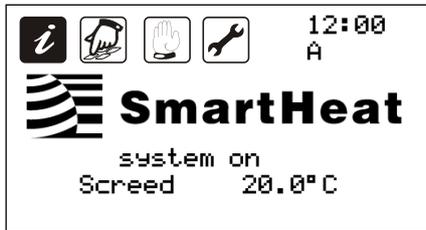
The system is in cooling mode with a setpoint of 19°C.



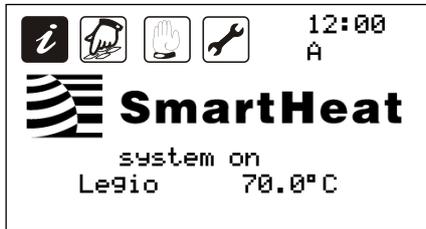
The system is in standby mode, as there is no request.



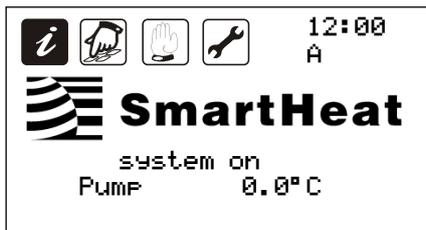
The system is in hot water mode with a setpoint of 55°C.



The system is running the screed heating programme, with a current target value of 20°C.



The system is running the anti-legionella programme, with a current target value of 70°C.



The pump protection system is off. There is no setpoint.



The system has detected a fault in Generator operation. The Generators are disabled by this fault.



The system has detected an operating fault. The system is disabled by this fault.

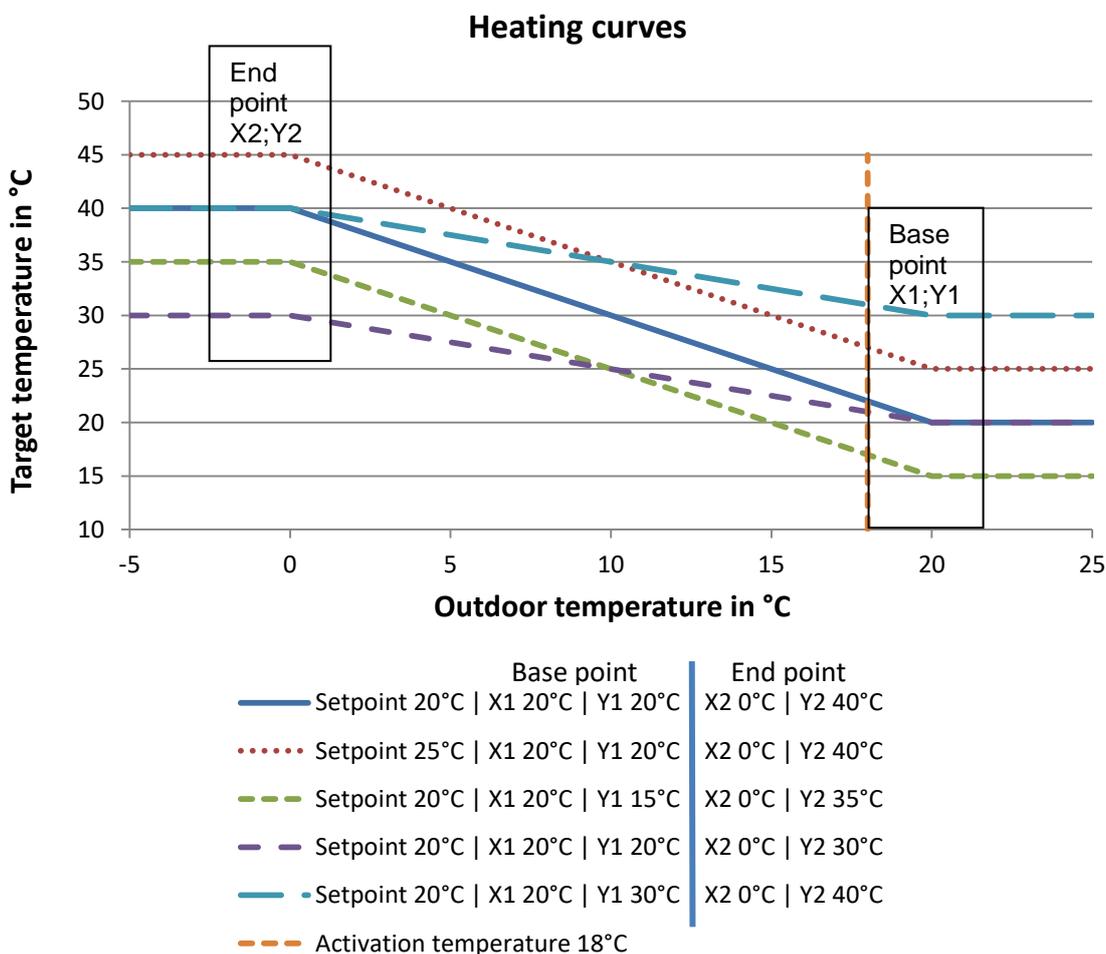
6 Heating curves

The default heating or cooling curve adapts the setpoint according to the outdoor temperature, in order to counteract unnecessary heat and energy loss. The characteristic values for adapting the curves are located under the Programme menu in the respective Heating or Cooling areas. Together, the fixed points form a linear function, a maximum and minimum limit. The linear function is defined by points X1 and the associated Y1, and X2 and the associated Y2. X1 and X2 serve as outdoor temperature values. Y1 and Y2 refer to the corresponding setpoints. Before and after the values of X1 and X2, the calculated values assume the set values of Y1 and Y2. This means outside of the range of Y1 and Y2 no further adaptation to the outdoor temperature occurs.

The setpoint and the reduction value should not be taken as the actual room temperature. Rather the should be set on a room thermostat. The setpoint rather serves to set the system temperatures. As a point of reference, for a setpoint of 20°C a system temperature of 40°C is stored. The serves in turn as a switch-on and switch-off criterion for the heat pump.

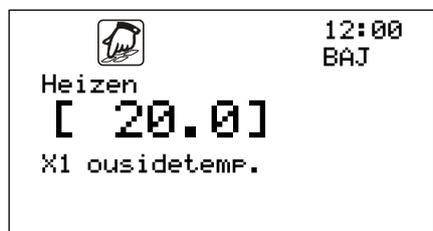
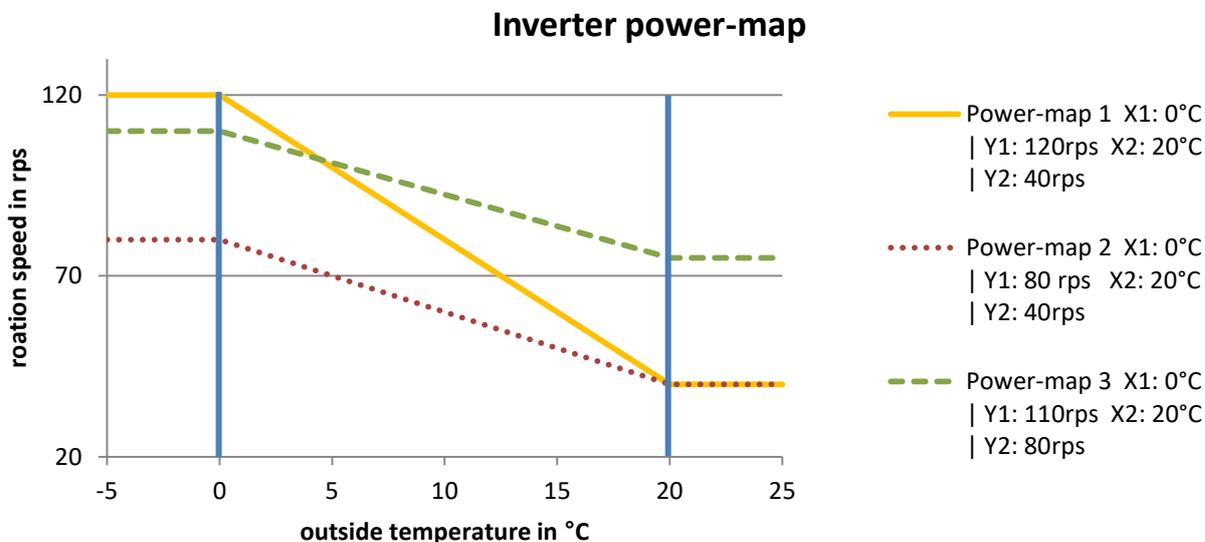
The calculation for cooling works in an equivalent manner to the diagram shown for the heating curve.

Modifications can only be made to the heating and cooling curve with Maintenance access rights and above.

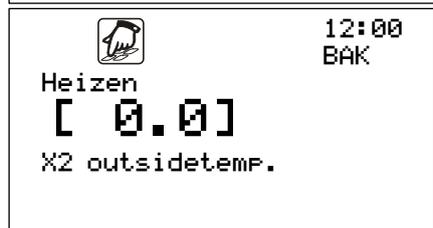


6.1 Inverter power-map

In dependence of the outside temperature is a power adaptation of the inverter over the min. or maximum rotation speed possible. The limit of the rotation speed is referring to the outside temperature (X1 / X2) settings in the heating curve. As an example you see in the followed diagram the dependence of outside temperature and rotation speed.



X1 outside temperature define the first point of the heating curve.



X2 outside temperature define the second point of the heating curve.



The values X1 and X2 are adapted to heating curve and Inverter power-map



7 Safety shutdowns/ faults during system operation

It is necessary to differentiate between two general categories of potential safety shutdowns/ faults:

- Faults which are detected by the heat pump controller itself and can therefore be reported

The LED behind the  button indicates that there is a safety shutdown because of differences, defects or incorrect settings in the system or in the heat pump.

- Faults which cannot be detected by the controller.

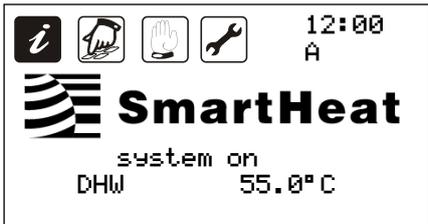
From this we can generally assume that the heat pump and its source system upstream, as well as the downstream heating surface system and all its elements are working properly. Their function is monitored by the heat pump controller depending on the connected sensor. However, it is never possible to completely rule out irregularities, such as a cable break on a sensor site or air in a fluid circuit, etc.

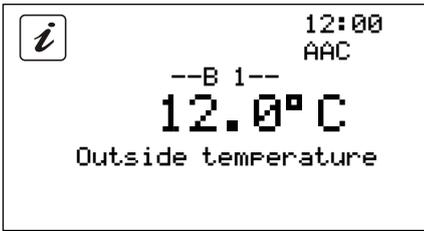
Permanent or repeated deviations from the standard operation of the system, including on the source and heating system as well as the heat pump, are indicated on the display of the controller. If a high-priority fault occurs, the system switches to an emergency function and attempts to carry out its heating role with the additional heating (generally an integrated electric heating element). If the fault is such that even this emergency operation is not possible, the system switches off. This would be the case, for instance, if the heating pump is faulty and the heat cannot be discharged. Faults which can be traced back to permanent errors in the system must be rectified with the help of the installer.



If there is a safety shutdown with a high priority, then this may be reset only once. If the same safety shutdown occurs again, is necessarily a specialized company to consult. Please note that the frequent resetting and the failure to correct the underlying cause can result in damage or even total loss by itself.

7.1 Screen for proper operation of the system

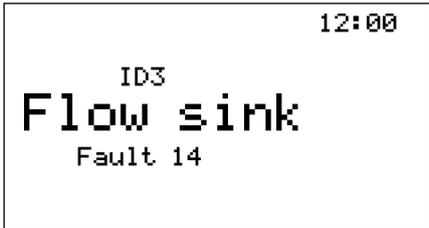
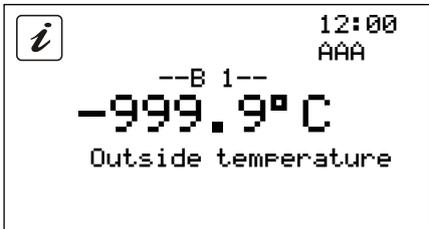
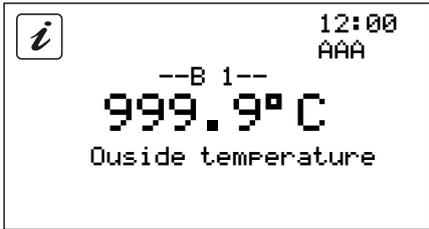
| Display | Possible cause |
|---|---|
|  | <p>Display on the main menu: The system is in hot water mode with a setpoint of 55°C.</p> |



Display in the Information menu:

Intact temperature sensor at an outdoor temperature by 12°C

7.2 Fault messages from the controller

| Display | Possible cause | Action ¹ |
|---|---|--|
|  | <p>Display on the main menu: There is a controller-detected fault.</p> <p>The  operating button flashes.</p> | <p>Press the  operating button.</p> |
|  | <p>When  is pressed, the precise information for the fault is displayed. In this case we can see that flow monitoring has been triggered</p> | <ul style="list-style-type: none"> • Check the flow switch • Check the cable |
|  | <p>Display in the Information menu: The activated outdoor temperature sensor is not connected, there is a cable break in the sensor line, or the sensor is below its measuring range.</p> | <ul style="list-style-type: none"> • Check sensor resistance • Check line • Replace sensor if necessary |
|  | <p>Display in the Information menu: The activated outdoor temperature sensor is above its measuring range.</p> | <ul style="list-style-type: none"> • Check sensor resistance • Check line • Replace sensor if necessary |

¹ The safety instructions and Chapter 3 must be followed!

7.3 Fault monitoring

The following table lists messages of the controller, describes reactions to these messages, and specifies possible causes. An audible signal is only present on certain operating units.

| Fault number | Fault | Reaction | Possible cause | Priority |
|----------------------|--|--|---|----------|
| Fault 1 – Alarm B1 | Outdoor temperature sensor | 0°C as a fixed outdoor temperature | Sensor not connected, sensor faulty | Low |
| Fault 2 – Alarm B2 | Hot water temperature sensor | Hot water deactivated | Sensor not connected, sensor faulty | Low |
| Fault 3 – Alarm B3 | Sink flow temperature sensor | Return temperature as flow temperature | Sensor not connected, sensor faulty | Low |
| Fault 4 – Alarm B4 | Sink return temperature fault | Flow temperature as return temperature | Sensor not connected, sensor faulty | Low |
| Fault 5 – Alarm B5 | Source return temperature sensor | | Sensor not connected, sensor faulty | Low |
| Fault 6 – Alarm B6 | Mixer circuit 1 temperature sensor | | Sensor not connected, sensor faulty | Low |
| Fault 7 – Alarm B7 | Mixer circuit 2 temperature sensor / collector temperature sensor | | Sensor not connected, sensor faulty | Low |
| Fault 8 – Alarm B8 | Limit temperature sensor / room temperature sensor / storage tank temperature sensor | | Sensor not connected, sensor faulty | Low |
| Fault 9 – Alarm B9 | Hot gas temperature sensor | | Sensor not connected, sensor faulty | Low |
| Fault 10 – Alarm B10 | Suction gas temperature sensor | | Sensor not connected, sensor faulty | Low |
| Fault 11 – Alarm B11 | High-pressure pressure sensor | System safety shutdown | Sensor not connected, sensor faulty | Low |
| Fault 12 – Alarm B12 | Low-pressure pressure sensor | System safety shutdown | Sensor not connected, sensor faulty | High |
| Fault 13 – Input ID1 | Safety chain | Compressor safety shutdown | Flow absent or low on the sink or source side, insufficient power decrease on the sink side | High |
| Fault 14 – Input ID3 | Sink fault | System safety shutdown | Flow absent or low on the sink side, drop in pressure in the connected pressure monitor | High |
| Fault 15 – Input ID6 | Actuator monitoring | System safety shutdown | Overload of the connected pumps by the fault message | High |
| Fault 16 – Input ID4 | Additional heating, safety temperature limiter | Additional heating safety shutdown | Air on the sink side or in the additional heating; no or insufficient flow on the sink side | Low |
| Fault 17 – Input ID5 | Compressor overload | Compressor safety shutdown | Internal / external motor protection triggered and reported via the fault contact | Low |
| Fault 18 – | Source fault | System safety shutdown | Flow absent or low on the source side, | High |

| | | | | |
|-----------|--------------------------|------------------------|---|-----|
| Input ID2 | | | drop in pressure in the connected pressure monitor | |
| Fault 19 | Heating request fault | | | Low |
| Fault 20 | Cooling request fault | | | Low |
| Fault 21 | Generator disabled fault | | | Low |
| Fault 22 | Hot gas maximum fault | System safety shutdown | System operation outside of the area of operation, Defrost setting inappropriate for air/water systems | Low |
| Fault 23 | Expansion valve fault | | General fault which occurs together with faults 33–50 | Low |
| Fault 24 | Constant fault | | | Low |
| Fault 25 | Hot gas delta fault | System safety shutdown | System operation outside of the area of operation | Low |
| Fault 26 | Modbus connection error | System safety shutdown | Connection to BMS lost | Low |
| Fault 27 | Inverter Alarm 1 | | | Low |
| Fault 28 | Inverter offline alarm | | Inverter is not being supplied at the tariff | Low |

| Fault number | Fault | Reaction | Possible cause | Priority |
|--------------|----------------------|----------------------------|--|----------|
| Fault 29 | High delta P | System safety shutdown | Inappropriate system conditions or inadequate expansion valve settings | Low |
| Fault 30 | Compressor off alarm | | | Low |
| Fault 31 | Envelope alarm | | System operation outside of the area of operation | Low |
| Fault 32 | Inverter start fault | | System operation outside of the area of operation | Low |
| Fault 33 | Alarm S1 | Compressor safety shutdown | System operation outside of the area of operation, sensor not connected, sensor faulty | Low |
| Fault 34 | Alarm S2 | Compressor safety shutdown | System operation outside of the area of operation, sensor not connected, sensor faulty | Low |
| Fault 35 | Alarm S3 | Compressor safety shutdown | System operation outside of the area of operation, sensor not connected, sensor faulty | Low |
| Fault 36 | Alarm S4 | Compressor safety shutdown | System operation outside of the area of operation, sensor not connected, sensor faulty | Low |
| Fault 37 | Control alarm A | Compressor safety shutdown | | Low |
| Fault 38 | Control alarm B | Compressor safety shutdown | | Low |
| Fault 39 | Low SH alarm A | Compressor safety shutdown | System operation outside of the area of operation, inappropriate system conditions | Low |
| Fault 40 | Low SH alarm B | Compressor safety shut- | System operation outside of the area of | Low |

| | | | | |
|----------|---------------------------------------|------------------------------------|--|---------|
| | | down | operation, inappropriate system conditions | |
| Fault 41 | System alarm | Compressor safety shutdown | | Low |
| Fault 42 | LOP alarm A | Compressor safety shutdown | System operation outside of the area of operation, inappropriate system conditions | Low |
| Fault 43 | LOP alarm B | Compressor safety shutdown | System operation outside of the area of operation, inappropriate system conditions | Low |
| Fault 44 | High pressure alarm A | Compressor safety shutdown | System operation outside of the area of operation, inappropriate system conditions | Low |
| Fault 45 | High pressure alarm B | Compressor safety shutdown | System operation outside of the area of operation, inappropriate system conditions | Low |
| Fault 46 | Low suct. alarm A | Compressor safety shutdown | System operation outside of the area of operation, inappropriate system conditions | Low |
| Fault 47 | Low suct. alarm B | Compressor safety shutdown | System operation outside of the area of operation, inappropriate system conditions | Low |
| Fault 48 | Evo tunes alarm A | Compressor safety shutdown | | Low |
| Fault 49 | Extensionboard | | pLAN connection lost | Low |
| Fault 50 | HiT cond. alarm | Compressor safety shutdown | | Low |
| Fault 51 | High pressure via transmitter | Compressor safety shutdown | System operation outside of the area of operation, inappropriate system conditions | High |
| Fault 52 | Low pressure via transmitter | Compressor safety shutdown | System operation outside of the area of operation, inappropriate system conditions | High |
| Fault 54 | Fault in other pLAN circuit | | Master reports an error in other circuit | Low |
| Fault 55 | Hot gas delta fault | System safety shutdown | System operation outside of the area of operation | Low |
| Fault 56 | High delta P | System safety shutdown | Inappropriate system conditions or inadequate expansion valve settings | Low |
| Fault 57 | Leakage warning | | Maybe a leakage is available, please check it | Low |
| Fault 58 | Leakage alarm | System safety shutdown | Leakage is occurred | High |
| Fault 59 | Maintenance Sensor | Deactivation of leakage monitoring | Leakage Sensor must be calibrated | Hoch |
| Fault 60 | Source temperature outside parameters | Compressor safety shutdown | Source temperature - to high - to low | Niedrig |



The audible signal can be acknowledged by pressing ! This also takes you to the Alarm menu, where alarms whose cause has been resolved can be reset



(cleared) with a long press on



In the case of serious alarms, it is necessary to reset them to resume operation of the system.



The audible signal will only sound in the period from 5:30am to 10:00pm.

If there is a safety shut down with a high priority, then this may be reset only once.



If the same safety shutdown occurs again, is necessarily a specialized company to consult.

Please note that the frequent resetting and the failure to correct the underlying cause can result in damage or even total loss by itself.

7.4 Faults with no fault message

Faults and malfunctions which are not indicated can be checked using the following table, to establish possible causes and the source of the fault. If the fault cannot be rectified using the description, contact the installer.



Faults pertaining to the 230V/AC mains power may only be repaired by qualified specialists!

| Fault | Possible causes | Action ² |
|--|--|--|
| Display no functioning | • No 230V mains power | • Switch on or connect the controller • Inspect the house fuse for the connection |
| | • Device faulty | • Consult the installer |
| Controller not working | • Controller in manual mode | • Exit "Manual" menu |
| | • Switch-on condition not fulfilled | • Wait until the switch-on condition is fulfilled |
| Displayed temperature fluctuates wildly at short intervals | • Sensor lines routed close to 230V cables | • Route sensor lines a different way, shield sensor lines |
| | • Long sensor lines extended without shielding | • Shield sensor lines |
| | • Device faulty | • Consult the installer |
| | • Loose line connection | • Retighten line connection |

² The safety instructions and Chapter 3 must be followed!

8 Electrical connection



Please observe the safety instructions in Chapter 3!

The device may only be opened when the mains voltage has been shut off and secure against reconnect!

8.1 General connection instructions



On all connection lines, strip the cable jacket to a length of approx. 6–8 cm and the ends of the wires to a length of approx. 10 mm.



In the case of flexible lines, a strain relief must be provided, either inside or outside of the device. The wire ends should be provided with ferrules.



All protective conductors must be secured to the terminals labelled "PE" (Protective Earth).

8.2 230V connections

There are max. twelve 230V/50Hz outputs (NO1, NO2, NO3,..., NO12). The exception is output NO7/NC7. This is used primarily as a potential-free fault message contact. Note the following points regarding the 230V connections:



It must be possible to disconnect the mains supply for the controller outside of the heat pump with a main switch.



The controllers are intended for operation on a 230V /50Hz grid. The pumps and valves which are connected must be designed for this voltage!



All protective conductors must be connected to the terminals labelled "PE"



Outputs may not be supplied with power from an external source, as this could cause damage to the board.

8.3 Connecting sensors

The controllers operate exclusively with temperature sensors of type NTC, NTC HT or ratiometric 0–5 V. The following inputs and outputs are available:

- 10 temperature inputs
- 2 pressure transducer inputs
- 4 analogue outputs

Installation/wiring of the temperature sensors

Install the sensors in their intended location on the heat pump, storage tank, external wall. When doing so, make sure there is good temperature transfer and if necessary use thermally conductive paste. If necessary, insulate the measuring points in order to avoid disrupting influences on the sensor.

The lines of the temperature sensors can be extended. Up to 15m in length, a cross-section of 2 x 0.5mm² is necessary, and up to 50m of 2 x 0.75 mm². In the case of long connections (e.g. collector) shielded extension cables must be used. On the sensor side, do not connect the shield if there is no shielding present, but rather trim and insulate!

The temperature sensors are connected in accordance with the system diagram. When it comes to temperature sensors, there is no need to observe the polarity of the two wires.



Sensor lines must be routed separately from 230V and 400V lines, because under unfavourable circumstances not doing so could result in interference. The distance between the two lines must be at least 15cm.

All electrical lines are connected to a module in the connection unit or the transfer terminals provided for the purpose.

8.4 Assignment of the analogue inputs

| I/O | Specification | Function |
|-----|--|---|
| B1 | NTC, -50°C...105°C | Outdoor temperature |
| B2 | NTC, -50°C...105°C | Hot water temperature |
| B3 | NTC, -50°C...105°C | Sink flow temperature |
| B4 | NTC, -50°C...105°C | Sink return temperature |
| B5 | NTC, -50°C...105°C | Source return temperature |
| B6 | NTC, -50°C...105°C | Mixer circuit temperature 1, Flow temperature Hot gas exchanger, Hot gas temperature Compressor 2 |
| B7 | NTC, -50°C...105°C | Mixer circuit temperature 2/ Collector temperature ³ |
| B8 | NTC, -50°C...105°C/ NTC HT 0°C...120°C | Limit, room or solar storage tank temperature ⁴ |
| B9 | NTC HT, 0°C...120°C | Hot gas temperature |
| B10 | NTC, -50°C...105°C | Suction gas temperature |
| B11 | 0-5V | High pressure transducer |
| B12 | 0-5V | Low pressure transducer |

8.5 Assignment of the digital inputs

| I/O | Specification | Function |
|------|--------------------------------------|------------------------------|
| DI1 | Digital input, potential free to GND | Safety chain LP/HP |
| DI 2 | Digital input, potential free to GND | Source flow/pressure monitor |
| DI 3 | Digital input, potential free to GND | Sink flow/pressure monitor |

^{3, 4} The controller is pre-configured in the respective heat pump by the factory for its intended function. This means, according to the configuration of the parameters, that other functions may apply to the analogue inputs.

| | | |
|-------|--------------------------------------|---|
| DI 4 | Digital input, potential free to GND | Additional heating / safety temperature limiter |
| DI 5 | Digital input, potential free to GND | Generator overload, e.g. motor circuit breaker |
| DI 6 | Digital input, potential free to GND | Actuator monitoring, e.g. pump overload |
| DI 7 | Digital input, potential free to GND | Reserve |
| DI 8 | Digital input, potential free to GND | Remote On/Off |
| DI 9 | Digital input, potential free to GND | Smart grid 1 / |
| DI 10 | Digital input, potential free to GND | Smart grid 2 / Möhlenhoff signal |

8.6 Assignment of the digital outputs

| I/O | Specification | Max. switching capacity | Function |
|------|--------------------|-------------------------|----------------------------------|
| NO1 | 230V/50Hz, max. 1A | Max. 3A in total | Source request |
| NO2 | 230V/50Hz, max. 1A | | Heating request |
| NO3 | 230V/50Hz, max. 1A | | Hot water request |
| NO4 | 230V/50Hz, max. 1A | Max. 3A in total | Cooling/heating contact |
| NO5 | 230V/50Hz, max. 1A | | Four-way valve |
| NO6 | 230V/50Hz, max. 1A | | Additioan heating |
| NC7 | 230V/50Hz, max. 1A | Max. 1A | Collective fault message |
| NO8 | 230V/50Hz, max. 1A | Max. 5A in total | Operation/ Storage tank charging |
| NO9 | 230V/50Hz, max. 1A | | Generator 1 |
| NO10 | 230V/50Hz, max. 1A | | Generator 2 |
| NO11 | 230V/50Hz, max. 1A | | Generator 3 |
| NO12 | 230V/50Hz, max. 1A | | Generator 4 / Solar pump |

8.7 Assignment of the analogue outputs

| I/O | Specification | Function |
|-----|----------------------------------|-------------------------------|
| Y1 | 0 - 10V, max. 5mA | Fan / Brine pump ⁵ |
| Y2 | 0 - 10V, max. 5mA | Heating pump |
| Y3 | 0 - 10V, max. 5mA, PWM max. 10mA | Mixer 1 activation |
| Y4 | 0 - 10V, max. 5mA, PWM max. 10mA | Mixer 2 activation |

9 Type key

The type key is used to activate typical functions for the machine or deactivate unnecessary ones.

Type1: SmartHeat aero-series air/water heat pumps

Type2: SmartHeat classic, bravour and Titan-series brine/water (BW) and water/water (WW) heat pumps

⁵ The controller is pre-configured in the respective heat pump by the factory for its intended function. This means, according to the configuration of the parameters, that other functions may apply to the analogue outputs.

10 Logic of particular control functions

10.1 Water heating

Inputs and outputs used

| Inputs | Name |
|--------|-----------------------|
| B2 | Hot water temperature |

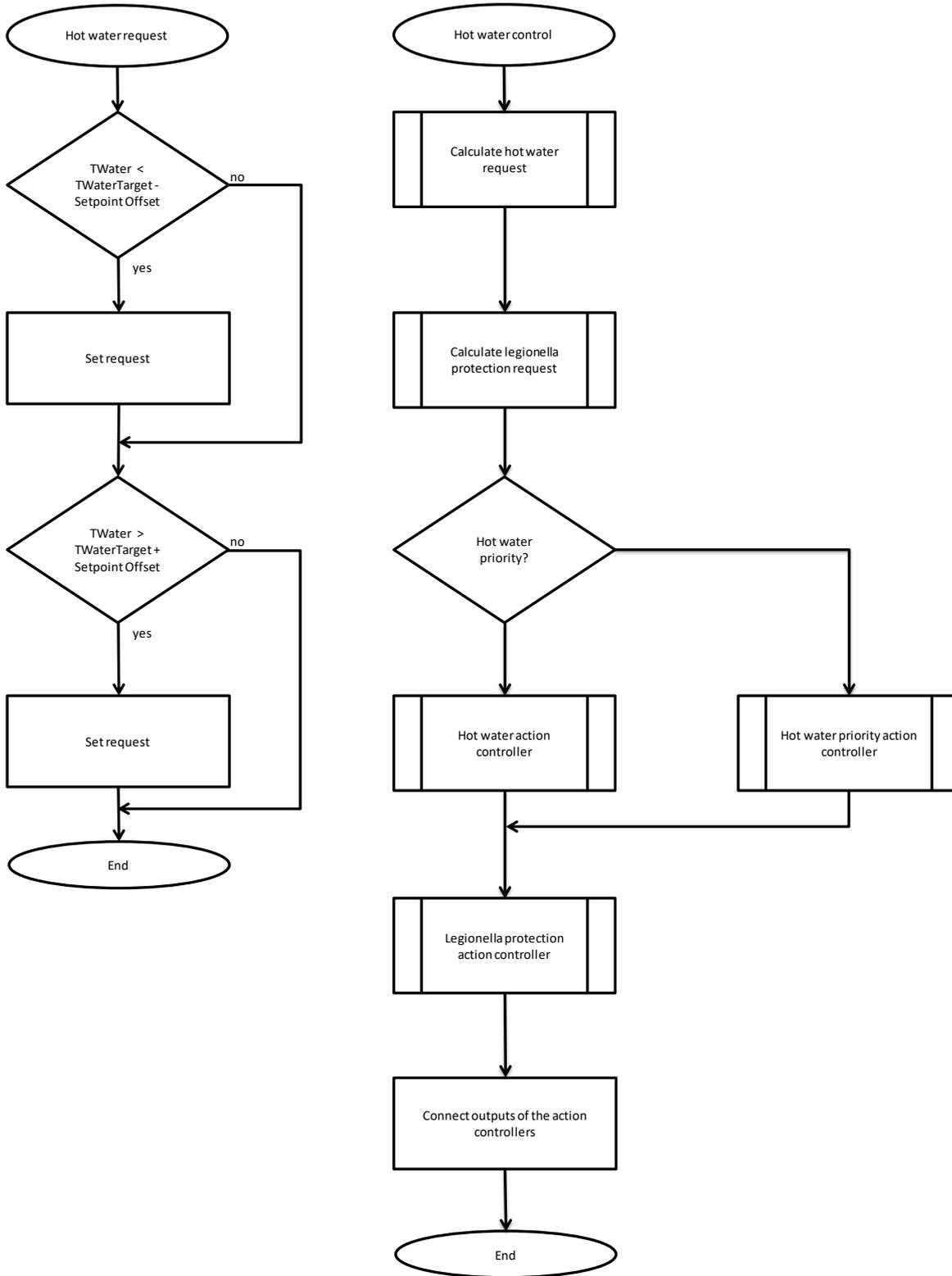
| Outputs | Name |
|---------|--|
| NO1 | Source pump |
| NO2 | Heating pump (only for WW valve, not for WW pump) |
| NO3 | Hot water valve or pump |

Parameters used

| Menu | Term | Description | Min | Max | Factory sett. |
|------|-----------------|--|-------|------|---------------|
| AAB | Hot water | Hot water temperature | - | - | |
| BCA | Setpoint | Hot water target value | -20°C | 90°C | 45°C |
| BCB | Reduction value | Hot water reduction target value | -20°C | 90°C | 40°C |
| DQB | WW pump/valve | Select between hot water pump and hot water valve | Valve | Pump | Valve |
| DOA | Priority | Hot water priority before heating | Off | On | Off |
| DQE | Lead time | Time between switching on the pump and switching on the Generator | 1 s | 300s | 30s |
| DQF | Shut-off delay | Time between switching off the Generator and switching off the pumps | 1 s | 300s | 30s |

Control algorithms

When the hot water temperature is below the setpoint, one or more energy sources starts up in order to achieve the setpoint. Using the weekly and daily programmes, you can define two time frames for operation for each day. Outside of these time frames the energy-saving programme with the reduced target values comes into effect.



Fault handling

| Fault | Description | Adoption for emergency operation | Display |
|-------|-------------|----------------------------------|---------|
|-------|-------------|----------------------------------|---------|

| | | | |
|--------------------------------|--------------------------------------|-----|--|
| Outdoor temperature | Outdoor temperature sensor defective | Yes | Short-circuit / cable break Information menu, temperature gauge |
| Water temperature | Water temperature sensor defective | No | Short-circuit / cable break Information menu, temperature gauge |
| Flow temperature | Flow sensor defective | Yes | Short-circuit / cable break Information menu, temperature gauge |
| Return temperature | Return sensor defective | Yes | Short-circuit / cable break Information menu, temperature gauge |
| LP HP Opt.safety circuit | Switch off the heat pump | Yes | Red. source Red. system Source |

10.2 Heating

Inputs / Outputs

| Inputs | Name |
|--------|---------------------|
| B1 | Outdoor temperature |
| B3 | Flow temperature |
| B4 | Return temperature |
| B8 | Room temperature |

| Outputs | Name |
|---------|--------------|
| NO1 | Source pump |
| NO2 | Heating pump |
| | |
| | |

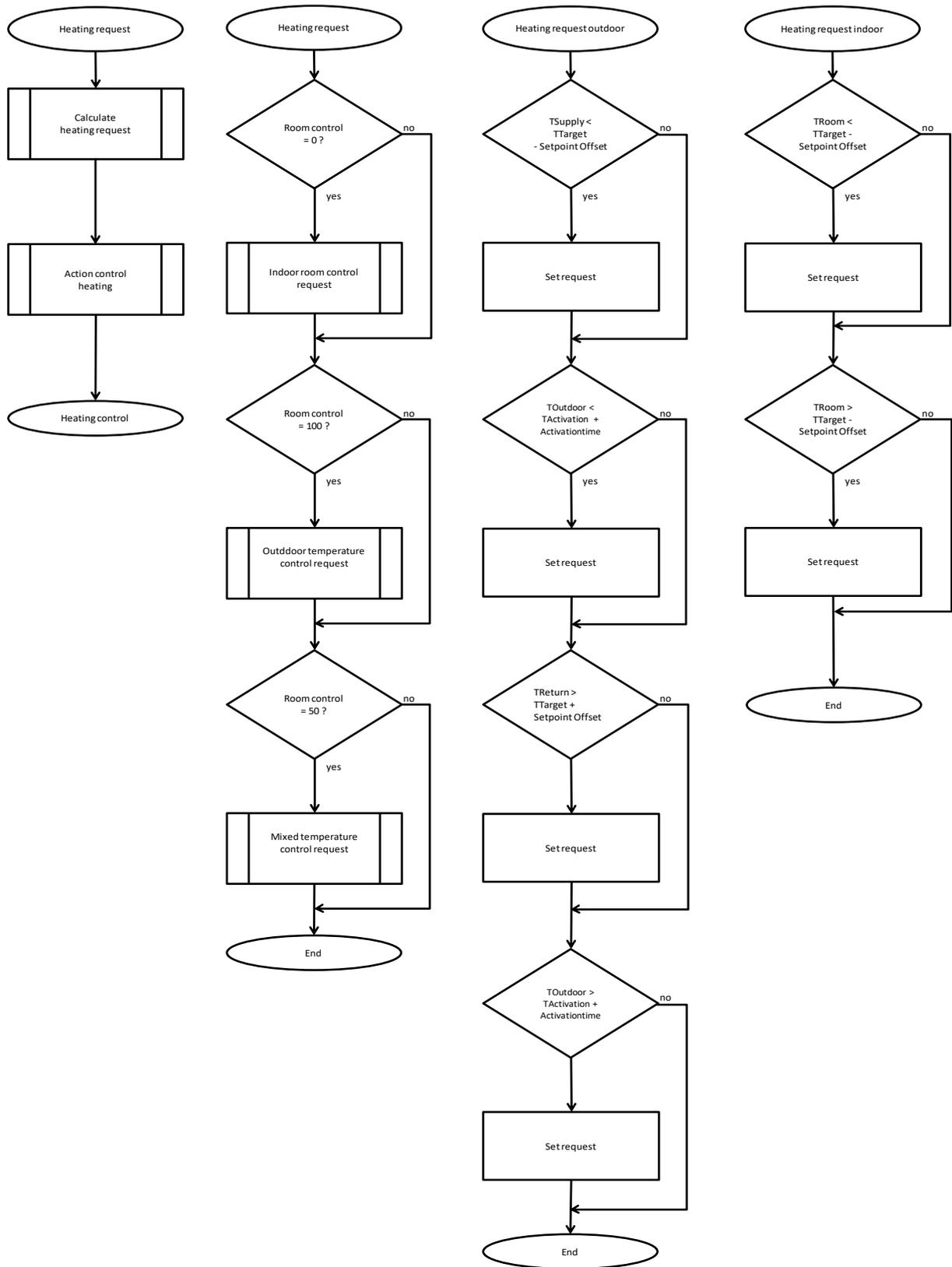
Parameters

| Menu | Term | Description | Min | Max | Factory sett. |
|------|-------------------------|--|-----|---------------------|---------------|
| AAA | Outdoor temperature | Display outdoor temperature | - | - | |
| AAC | Flow temperature | Display flow temperature | - | - | |
| AAD | Return temperature | Display return temperature | - | - | |
| AAH | Room temperature | Display room temperature | - | - | |
| BAA | Setpoint | Target value for heating | -20 | 90 | 22 |
| BAB | Reduction value | Target value for heating reduction time | -20 | 90 | 19 |
| BAE | Activation temp. | Activation temperature, below which heating control is switched on | 10 | Cooling activ.temp. | 18 |
| BAF | Activation period | Activation period if the temperature drops below the activation temperature | 1s | 60 days | 12 hrs |
| BAG | Room control | Room temperature control | 0 | 100 | 0 |
| BAH | heating curve | Dynamic setpoint calculation | Off | On | On |
| BAI | Flow reference setpoint | Fixed assignment between the flow target temperature and the reference room target temperature of 20°C | -20 | 90 | 40 |

| | | | | | |
|-----|------------------|--|-----|----|----|
| BAJ | X1 TOutdoor | Input value for the first fixed point of the target value characteristic curve | -20 | 90 | 20 |
| BAK | Y1 nominal value | Output value for the first fixed point of the target value characteristic curve | -20 | 90 | 20 |
| BAL | X2 TOutdoor | Input value for the second fixed point of the target value characteristic curve | -20 | 90 | 0 |
| BAM | Y2 nominal value | Output value for the second fixed point of the target value characteristic curve | -20 | 90 | 40 |
| BAN | Weekly schedule | | | | |

Control algorithms

If the outdoor temperature for the set activation period is below the activation temperature, the heating circuit is activated. Using the weekly and daily programmes, you can define two time frames for operation for each day. Outside of these time frames the energy-saving programme with the reduced target values comes into effect.



The heating is activated by TFlow, and deactivated again by TReturn.

Fault handling

| Fault | Description | Emergency operation | Display |
|---------------------------------|--------------------------------------|---------------------|--|
| Outdoor temperature | Outdoor temperature sensor defective | Yes | Short-circuit / cable break, Information menu, temperature gauge |
| Flow temperature | Flow sensor defective | Yes | Short-circuit / cable break, Information menu, temperature gauge |
| Return temperature | Return sensor defective | Yes | Short-circuit / cable break, Information menu, temperature gauge |
| LP HP Opt. safety circuit | Switch off the heat pump | Yes | Red. source Red. system Source |

Reference room temperature control (RRT) and outdoor temperature control

The explanation on adjustment can be found under point 5.2 "Room control".

| | |
|------|---|
| 0% | <p>If no room temperature sensor is active Heating control occurs normally, as before. Activation is triggered by the flow temperature. Deactivation is triggered by the return temperature.</p> <p>Outdoor temperature-based control</p> |
| 50% | <p>A target flow temperature is calculated by the controller. The Generator(s) run until the RRT is reached. Then the switch-off temperature is calculated from the flow temperature achieved at this point. When the room temperature is reached in the reference room, another reheating cycle occurs. The only limit is TSPmax.</p> <p>Outdoor temperature control and room temperature control are combined</p> |
| 100% | <p>Heating control occurs via a reference room temperature sensor. If the temperature drops below the reference value the Generator(s) is/are switched on, and then off again if it is exceeded. When the target room temperature is reached in the reference room, the Generators are switched off.</p> <p>Room temperature-based control</p> <p>Request occurs when $T_{Room} < T_{RoomTarget}$ Switch-off occurs when $T_{Room} > T_{RoomTarget}$ Only the min. and max/ flow temperature of Generator E1 is monitored.</p> |

10.3 Cooling

Inputs / Outputs

| Inputs | Name |
|--------|---------------------|
| B1 | Outdoor temperature |
| B3 | Flow temperature |
| B4 | Return temperature |
| B8 | Room temperature |

| Outputs | Name |
|---------|-------------------------|
| NO1 | Source pump |
| NO2 | Heating pump |
| NO4 | Cooling/heating contact |
| NO5 | Four-way valve |

Parameters

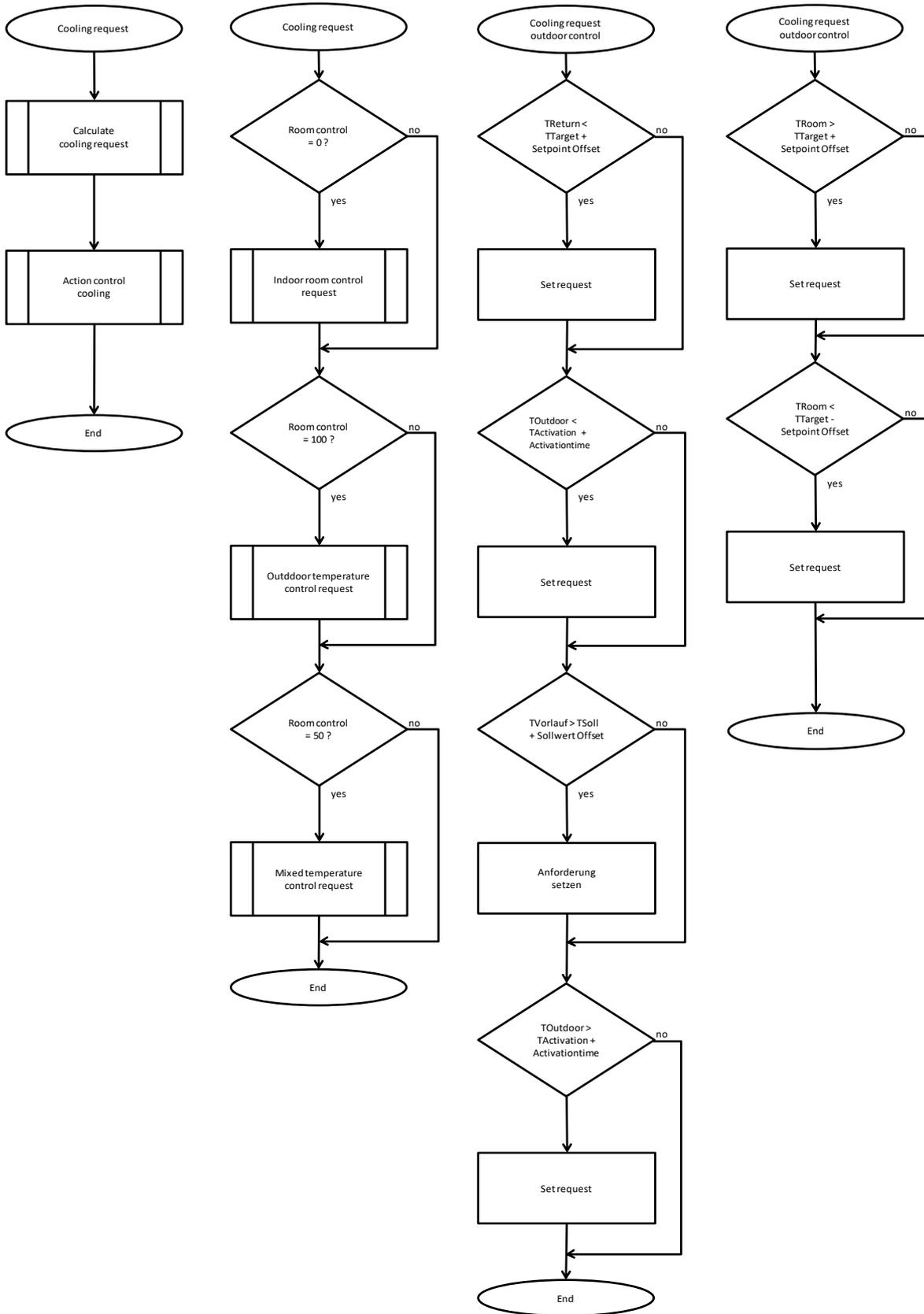
| Menu | Term | Description | Min | Max | Factory sett. |
|------|-----------------------------|--|--------------------------|--------|---------------|
| AAA | Outdoor temperature | Display outdoor temperature | - | - | |
| AAC | Flow temperature | Display flow temperature | - | - | |
| AAD | Return temperature | Display return temperature | - | - | |
| AAH | Room temperature | Display room temperature | - | - | |
| BBA | Setpoint | Target value for cooling | -20 | 90 | 22 |
| BBB | Reduction target value | Setpoint for cooling reduction | -20 | 90 | 24 |
| BBE | Activation temp. | Activation temperature, below which cooling control is switched on | Heating activation temp. | 30 | 22 |
| BBF | Activation period | Activation period if the temperature drops below the activation temperature | 1 s | 60 hrs | 12 hrs |
| BBG | Room control | Room temperature control | 0 | 100 | 0 |
| BBH | Cooling curve | Dynamic setpoint calculation | Off | On | On |
| BBI | Flow reference target value | Fixed assignment between the flow target temperature and the reference room target temperature of 20°C | -20 | 90 | 10 |
| BBJ | X1 TOutdoor | Input value for the first fixed point of the target value characteristic curve | -20 | 90 | 20 |
| BBK | Y1 nominal value | Output value for the first fixed point of the target value characteristic curve | -20 | 90 | 20 |
| BBL | X2 TOutdoor | Input value for the second fixed point of the target value characteristic curve | -20 | 90 | 40 |
| BBM | Y2 nominal value | Output value for the second fixed point of the target value characteristic curve | -20 | 90 | 0 |
| BBN | Weekly schedule | | | | |

| | Term | Description | Optional factory settings |
|--|------|-------------|---------------------------|
|--|------|-------------|---------------------------|

| | | | |
|----------------------|------------------|--------------------------------|--------------------|
| Basic setting | Optional cooling | Switch cooling function on/off | Active/Passive/Off |
|----------------------|------------------|--------------------------------|--------------------|

Control algorithms

If the outdoor temperature for the set activation period is above the activation temperature, the cooling circuit is activated. Using the weekly and daily programmes, you can define two time frames for operation for each day. Outside of these time frames the energy-saving programme with the reduction target values comes into effect.



Fault handling

| Fault | Description | Adoption for emergency operation | Display |
|-------|-------------|----------------------------------|---------|
|-------|-------------|----------------------------------|---------|

| | | | |
|---------------------------------|--------------------------------------|---------------------------------------|--|
| Outdoor temperature | Outdoor temperature sensor defective | Outdoor temperature 0°C | Short-circuit / cable break, Information menu, temperature gauge |
| Flow temperature | Flow sensor defective | Flow temperature = Return temperature | Short-circuit / cable break, Information menu, temperature gauge |
| Return temperature | Return sensor defective | Return temperature = Flow temperature | Short-circuit / cable break, Information menu, temperature gauge |
| LP HP Opt. safety circuit | Switch off the heat pump | Reduced cooling mode to approx. 75% | Red. source Red. system Source |



With no cooling mode, there must be a "Cooling off" option.

10.4 Mixer control

Inputs / Outputs

| Inputs | Name |
|--------|---------------|
| B6 | Mixer 1 TFlow |
| B7 | Mixer 2 TFlow |

| Outputs | Name |
|---------|---------|
| Y3 | Mixer 1 |
| Y4 | Mixer 2 |

Parameters

| Menu | Term | Description | Min | Max |
|------|-------------------|---|------|------|
| AAF | Flow Mixer 1 | Temperature Mixer 1 | - | - |
| AAG | Flow Mixer 2 | Temperature Mixer 2 | | |
| DLA | Mixer 1 | Switching on the mixer control for mixer 1 and activating further setting parameters in the mask "BE" | off | on |
| DLB | Control period | Minimum control time for adjusting the mixer control | 10s | 60s |
| DMA | Mixer 2 | Switching on the mixer control for mixer 1 and activating further setting parameters in the mask "BF" | off | on |
| DMB | Control period | Minimum control time for adjusting the mixer control | 10s | 60s |
| BEA | Mixer 1 activated | Refelxion of the "DLA" mask, if this parameter is switched off, the mixer can only be activated via the "DLA" | off | on |
| BEB | Increase heating | Raises the calculated setpoint value from the mixer's own heating curve by the set value (only activated and visible if the heating curve is switched on) | -3,0 | 10,0 |
| BEC | Heating Setpoint | Mixer setpoint independently of the outside temperature is always approached firmly. (Only activated and visible if heating curve is switched off) | 0 | 70,0 |
| BED | Heating curve | Activates the own heating curve for mixer 1. Operation is identical to the standard heating curve for heating mode. | off | on |

| | | | | |
|-----|---------------------------|--|-----------|----------------------------|
| BEE | X1-TOutside heating | Point1 (outdoor temperature) for heating setpoint calculation | -30,0 | 40,0 |
| BEF | Y1-flow Setpoint-heating | Point1 Desired flow setpoint at outside temperature X1 | -30,0 | 40,0 |
| BEG | X2- TOutside heating | Point2 (outdoor temperature) for heating setpoint calculation | -30,0 | 40,0 |
| BEH | Y2- flow Setpoint-heating | Point2 Desired flow setpoint at outside temperature X2 | -30,0 | 40,0 |
| BEI | Increasing cooling | Raises the calculated setpoint value from the mixer's own cooling curve by the set value (only activated and visible if the cooling curve is switched on) | -3,0 | 10,0 |
| BEJ | cooling Setpoint | Mixer setpoint independently of the outside temperature is always approached firmly. (Only activated and visible if cooling curve is switched off) | 0,0 | 70,0 |
| BEK | Cooling curve | Activates the own cooling curve for mixer 1. Operation is identical to the standard cooling curve for cooling mode. | off | on |
| BEL | X1- TOutside cooling | Point1 (outdoor temperature) for cooling setpoint calculation | -30,0 | 40,0 |
| BEM | Y1- flow Setpoint cooling | Point1 Desired flow setpoint at outside temperature X1 | -30,0 | 40,0 |
| BEN | X2- TOutside cooling | Point 2 (outdoor temperature) for cooling setpoint calculation | -30,0 | 40,0 |
| BEO | Y2- flow Setpoint cooling | Point2 Desired flow setpoint at outside temperature X2 | -30,0 | 40,0 |
| BEP | Mode | Desired operating mode for the mixer. Automatic switching of the heating and cooling modes based on the set values under "BA" and "BB" or permanently set mode: heating only / cooling only. | automatic | Only heating /only cooling |
| BEQ | Logic | Configure mixer logic 0V = open - 10V = closed or 0V = closed - 10V = open | default | reversed |
| BER | Consumer regulation | If activated, the higher setpoint of the heat pump is always set to the highest set value (for heating) and lowest value (for cooling). That If a mixer set point is above the set or calculated setpoint in, for example, "BAA", the setpoint is taken by the mixer as switch-on and switch-off condition (value applies to mixer 1, mixer 2 as well as heating and cooling). | off | on |
| BFA | Mixer 2 | Functions identical to mixer 1 | | |

Control algorithms

The mixer is activated when $T_{\text{Flow mixer}} < (\text{Setpoint heating value})$

The mixer is activated when $T_{\text{Flow mixer}} > (\text{Setpoint cooling value})$

$T_{\text{Flow mixer}}$ is monitored during the set control period.

Via the analogue output a mixer is activated according to a 0V - 10V signal. If the deviation is more than 7K, the adaptation occurs in 1V increments. If the deviation from the setpoint is less than this, the adaptation occurs in 0.5V increments.

Mixer setting

Set the Setpoint for the mixer control in the  menu



Switch on the mixer control and set the control period in the



10.5 Pump protection function

Inputs / Outputs

| Outputs | Name |
|---------|--------------------------------------|
| NO1 | Source pump |
| NO2 | Heating pump |
| NO3 | Hot water pump (if valve is not set) |

Parameters

| Menu | Term | Description | Min | Max | Factory sett. |
|------|-----------------|--|-----|-----|---------------|
| DD | Pump protection | Switch on the pump protection function | Off | On | Off |

Control algorithms

When pump protection is activated, every three days at 12:00am, the pumps are activated for one minute, to avoid seizing.

10.6 Anti-legionella function

Inputs / Outputs

| Inputs | Name |
|--------|-----------------------|
| B2 | Hot water temperature |

| Outputs | Name |
|---------|--|
| NO1 | Source pump |
| NO2 | Heating pump (only for WW valve, not for WW pump) |
| NO3 | Hot water valve or pump |

Parameters

| Menu | Term | Description | Min | Max | Factory sett. |
|------|-----------------------|--|-------|--------|---------------|
| DEA | Legionella protection | Switch on the legionella protection function | Off | On | Off |
| DEB | Duration | Maximum duration for the function | 0:00 | 2:00 | 1:30 |
| DEC | Temperature | Temperature to which the water is heated | 40 | 80 | 60 |
| DED | Interval | | Daily | Weekly | Weekly |

Control algorithms

Depending on the setting for "Interval", the hot water system is heated up once a day (at 12:00am) or once a week (on Mondays at 12:00am) to the set legionella protection temperature, provided that legionella protection is set to "On". The function is activated for no longer than the set duration.

10.7 Solar support

Inputs / Outputs

| Inputs | Name |
|--------|--------------------------------|
| B7 | Collector temperature |
| B8 | Lower storage tank temperature |

| Outputs | Name |
|---------|------------|
| NO12 | Solar pump |

Parameters

| Menu | Term | Description | Min | Max | Factory sett. |
|------|-----------|--------------------------------|-----|-----|---------------|
| AAG | Collector | Collector temperature | - | - | - |
| AAH | ↓ storage | Lower storage tank temperature | - | - | - |

| | | | | | |
|-----|---------|-----------------------------------|-----|----|-----|
| | tank | | | | |
| DNA | Solar | Activation of the solar circuit | Off | On | Off |
| DNB | Maximum | Storage tank maximum temperature | 15 | 90 | 60 |
| DNC | Start | Switch-on temperature difference | 3 | 40 | 7 |
| DND | Stop | Switch-off temperature difference | 2 | 39 | 3 |

Control algorithms

If the temperature of the collector is greater than the temperature of the storage tank by the factor of the switch-on temperature difference, the output for the solar pump (NO12) is activated. Provided that the temperature difference between storage tank and collector is less than the switch-off temperature difference, the output (NO12) is deactivated.

10.8 Screed heating programme

Inputs / Outputs

| Inputs | Name |
|--------|---------------------|
| B1 | Outdoor temperature |
| B3 | Flow temperature |
| B4 | Return temperature |

| Outputs | Name |
|---------|--|
| NO1 | Source pump |
| NO2 | Heating pump (only for WW valve, not for WW pump) |

Parameters

| Menu | Term | Description | Min | Max | Factory sett. |
|------|----------------|--|-----|-----|---------------|
| DPA | Screed heating | Switch on the floor heating programme | Off | On | Off |
| DPB | Start | Start temperature for the function | 10 | 40 | 20 |
| DPC | Stop | Stop temperature for the function | 10 | 40 | 30 |
| DPD | Delta T | Temperature level for the function | 1 | 10 | 1 |
| DPE | Duration | Duration of a temperature level in hours | 1 | 60 | 1 |

Control algorithms

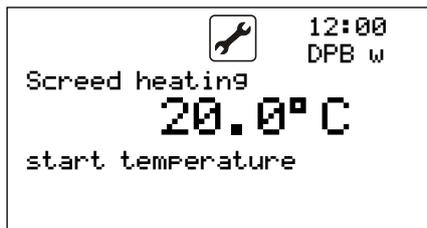
Based on the start temperature the heating setpoint is increased incrementally by amount Delta T, until the stop temperature is reached. Once the stop temperature is reached, the process is reversed, and the target temperature is reduced again incrementally to the start temperature. The duration for one level is defined by the parameter Duration.

Caution! The heating programme takes precedence over the other control programmes and must be set to "OFF" again after completion.

Floor heating programme settings



To activate the heating programme, the function is activated (after entering the password).



Set the start temperature.



Set the stop temperature, then the system heats back up to the start temperature in this same period.



Set the Delta T temperature levels for each step.



Set the duration of each step.



Once the heating programme has ended, set it to "Off" again here. Otherwise only a frost protection programme is running.

10.9 Generator control

Inputs / Outputs

| Inputs | Name |
|--------|---------------------|
| B1 | Outdoor temperature |
| B3 | Flow temperature |
| B4 | Return temperature |
| B8 | Limit temperature |

| Outputs | Name |
|---------|--------------------|
| NO6 | Additional heating |
| NO8 | Operation |
| NO9 | Generator1 |
| NO10 | Generator2 |
| NO11 | Generator3 |
| NO12 | Generator4 |

Parameters

| Menu | Term | Description | Generator 1 | | Generator 2 | | Generator 3 | | Generator 4 | |
|------|---------------------|---|-------------|-----|-------------|-----|-------------|-----|-------------|-----|
| | | | Min | Max | Min | Max | Min | Max | Min | Max |
| AAA | Outdoor temperature | Outdoor temperature | - | - | - | - | - | - | - | - |
| AAC | T flow | Flow temperature | - | - | - | - | - | - | - | - |
| AAD | T return | Return temperature | - | - | - | - | - | - | - | - |
| AAH | T limit | | - | - | - | - | - | - | - | - |
| ACA | Status | Current status of the controller and the Generators | - | - | - | - | - | - | - | - |
| | For each Generator | | | | | | | | | |
| *A | Generator x | Switch the Generator on/off | | | | | | | | |
| *D | T outdoor min. | Minimum outdoor temperature above which the Generator is switched on | -60 | 60 | -60 | 60 | -60 | 60 | -60 | 60 |
| *C | T outdoor max. | Maximum outdoor temperature below which the Generator is switched on | -60 | 60 | -60 | 60 | -60 | 60 | -60 | 60 |
| *E | Delay | Delay time until the system advances to the next Generator | 0 | 180 | 0 | 180 | 0 | 180 | 0 | 180 |
| *F | Blocking time | Off-period for the Generator after switch-off | 0 | 120 | | | | | | |
| *G | T flow min. | Minimum flow temperature | 5 | 80 | 10 | 80 | 10 | 80 | 10 | 80 |
| *H | T flow max. | Maximum flow temperature | 10 | 80 | 10 | 80 | 10 | 80 | 10 | 80 |
| *I | Min. runtime | Minimum runtime for the Generator | 0 | 120 | 0 | 120 | 0 | 120 | 0 | 120 |
| *L | Operating hours | Enter the old number after making changes to the hardware or software | | | | | | | | |

(*) Generator menu: Generator1: DF; Generator2: DG; Generator3: DH; Generator4: DI

Control algorithms

The energy sources are switched on in the sequence 1 - 4 as required. During this process, the switch-on conditions of the Generator are first checked (temperatures, faults, etc.). If demand has not been satisfied after the defined delay time, the respective following energy source is switched on. For each Generator, a minimum runtime and reactivation block are monitored.

All four Generators are also switched off for tariff shut-offs. If external energy sources are to be activated by the controller, this should be taken into account.

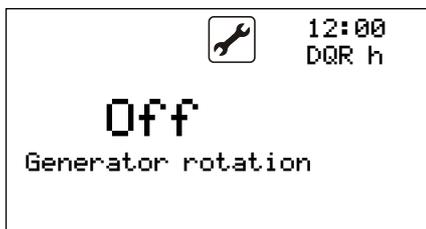
11 Special applications

11.1 Operation with electric heating element only

To deactivate the heat pump and establish operation using the electric heating element only, all Generators must be set to "Off". The additional heating must be activated. Moreover, additional heating automatically ensures use of emergency operation whenever an alarm occurs. It has two basic modes:

- Emergency operation: Heating circuit is heated up to a flow temperature of 25°C.
- Normal operation: Additional heating operates in hot water and heating mode and uses the setpoint setting.

11.2 Alternating Generator activation



If two, three or four compressors are working as Generators, you can release alternating activation. Then upon each activation, the operating hours are used to determine which Generator to switch on first.

The operating hours can be viewed in the Information menu.

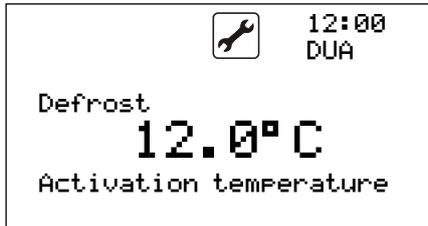
11.3 Defrost functions

Defrost function type 1



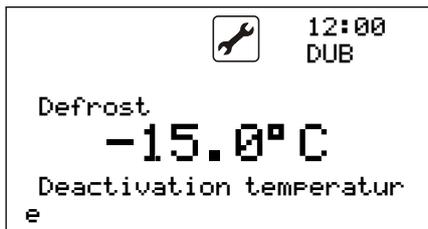
Under the Basic settings menu item you can configure the Defrost screen. The defrost function enables the register on an air/water machine to be defrosted.

The defrost function is controlled by the pressure and outdoor temperature. Depending on the outdoor temperature, the defrost cycle can be activated and completed according to the settings, using a low pressure value and/or a temperature difference between the suction gas temperature and the outdoor temperature. The defrost phase only ends once the high pressure setpoint is reached or the max. defrost period is exceeded.



The activation temperature is the outdoor temperature from which the defrost function can be used. The deactivation temperature is the outdoor temperature from which the defrost function can no longer be used. These temperatures define a range within which the defrost function is activated.

Press , then  or  to set the desired value, and press  twice to confirm.



The set low pressure value or temperature difference specifies the operating point from which defrosting should start. The operating point must be present at least for the set control time, in order to fulfil the defrost condition.

Press , then  or  to set the desired value, and press  twice to confirm.



The set high pressure value ends the defrost cycle once the value is reached, though not before the set time has elapsed.

Press , then  or  to set the desired value, and press  twice to confirm.

12:00
DUG

Defrost

300s

max. defrost time

12:00
DUH

Defrost

600s

Blocking time

12:00
DUI

Defrost Start

No

Generator off

12:00
DUJ

Defrost End

No

Generator off

12:00
DUK

Defrost

15s

Switch delay

12:00
DUL

Defrost

15s

pressure delay control

12:00
DUM

Defrost

90.0rps

Speed

The blocking time specifies how long the period of time between two defrost cycles should be. Within this off-period, no defrost cycles are started, even if the conditions are in place.

Press , then or to set the desired value, and press twice to confirm.

The defrost cycles can be started or ended by running Generator

Press , then or to set the desired value, and press twice to confirm.

The switching delay specifies how long the four-way valve will remain in its initial state before being switched, after "Generator off" or after the minimum speed is reached.

Press , then or to set the desired value, and press twice to confirm.

When initiating the defrost cycle, low pressure monitoring of the sensor can be suppressed for the set period of time.

Press , then or to set the desired value, and press twice to confirm.

This parameter is the max. speed at which the compressor can run in defrost cycle.

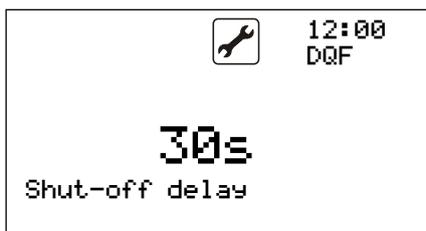
Press , then or to set the desired value, and press twice to confirm.

11.4 Lead time and shut-off delay

In the Basic settings, under "Options", you can set lead time and shut-off delay for the source and sink units.



Press , then  or  to set the desired value, and press  twice to confirm.



11.5 Serial number

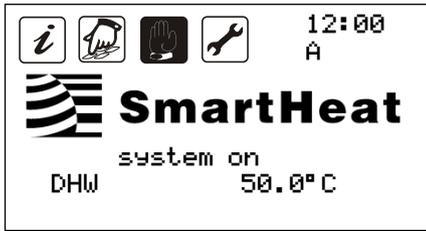


The serial number is entered in the factory and can be viewed in the Basic settings.

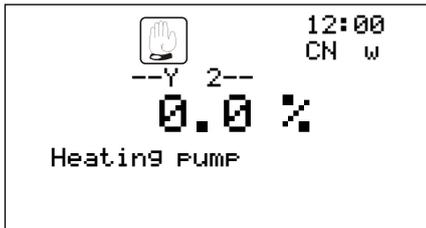
11.6 Manual mode

Manual mode is a function used exclusively for fault rectification and may only be employed by trained specialists. Activating manual mode bypasses or deactivates all control functions

Manual mode is activated by confirming selection of the  menu by pressing . All connected outputs can be switched on and off manually.



Activate by pressing . The outputs are all deactivated. Select the desired output with  or . Press  once to enable the cursor. Cancel with  or press  twice to confirm.



Press  to exit manual mode and reverse all manual settings.

11.7 Smart Grid

The control unit provides the option to connect with Smart Grid systems. Two inputs are provided for this purpose which, depending on the switching state, will cause a modification of the operating parameters.

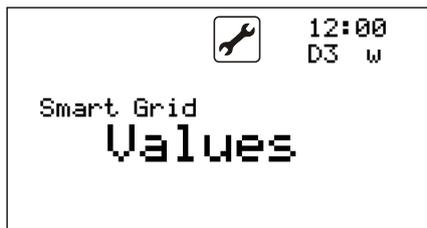
| Smart Grid 1 (DI 9) | Smart Grid 2 (DI10) | Effects on the operating parameters |
|---------------------|---------------------|--|
| 0 | 0 | The control operates without making changes to the set parameters. |
| 1 | 0 | The control disables the system. This state is used for an energy supplier shut-off. |
| 0 | 1 | The control operates with the first increase of the setpoints is stored in the Basic settings. |
| 1 | 1 | The control operates with the second increase of the setpoints is stored in the Basic settings. This operating state also makes it possible to distinguish whether the electric additional heating should be used to fulfil the demand. This option is defined in the Basic settings. |

0...Contact closed*

1...Contact open*

* Depending on the configuration of the digital inputs (masks: "DQOU" &

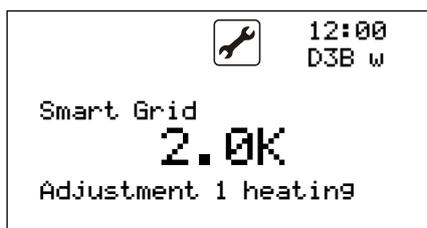
"DQOV")



Select the desired setting values by pressing and then or .



Press , then or to set the desired value, and press twice to confirm.



| | |
|---|----------------|
|  | 12:00 D3C w |
| Smart Grid | |
| 4.0K | |
| Adjustment 2 heating | |

| | |
|---|----------------|
|  | 12:00 D3D w |
| Smart Grid | |
| -2.0K | |
| Adjustment 2 cooling | |

| | |
|---|----------------|
|  | 12:00 D3E w |
| Smart Grid | |
| -4.0K | |
| Adjustment 2 cooling | |

| | |
|--|----------------|
|  | 12:00 D3F w |
| Smart Grid | |
| 2.0K | |
| Adjustment 1 Hot water | |

| | |
|---|----------------|
|  | 12:00 D3G w |
| Smart Grid | |
| 4.0K | |
| Adjustment 2 Hot water | |

11.8 Pump control with hot gas heat exchanger

If the heat pump is additionally equipped with a hot gas heat exchanger, then there is a possibility to charge the DHW tank with modulation 0-10V pump.

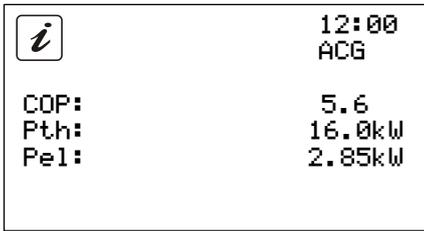
If the function in the controller is activated then the additional "hot gas heat exchanger" - pump will start at a settable hot gas temperature with minimum rotation speed. If the hot gas flow temperature exceeds the configured hot gas flow temperature setpoint, then the pump will speed up all "x" seconds and increase by 0,5V. Falls the hot gas flow temperature below the hot gas flow temperature setpoint, then the pump speed will decrease until the minimum allowed pump speed is reached. If the flow temperature of hot gas temperature is lower than setpoint of "hot gas flow temperature" or the setpoint of the heat pump is reached or the heat pump will be disabled then the controlling of the pump will be disabled with a "pump shut off time".

This function works in heat, cooling and hot water mode. If this function will be used, then the function mixer1 will be disabled.

To parametrize this function see mask "DK".

11.9 Seasonal Performance Factor (optional)

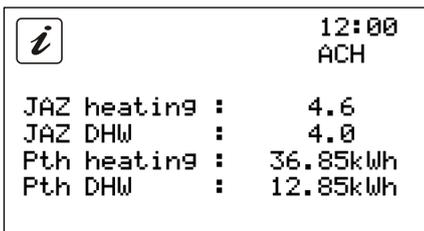
There are optional possibilities to display the different Power-maps about the heat pump. This are showed, if they are activated in the information mask "ACG" and "ACH"



This function will be activated in the manufactory or by a specific release code.

You can activate it in the mask „DSA“ if you got the code

For release you need to contact manufacturer.



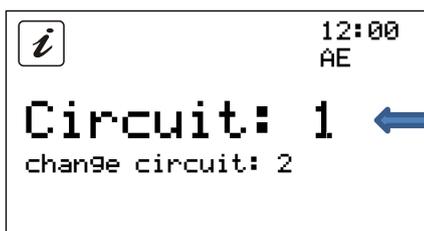
11.10 Machines compound

The controller offers the function of operating several controllers in the network via the native bus system. This makes it possible to transfer values of the sensor inputs from the master to the following controllers. The controller with the pLAN address 1 is automatically the master. Each controller can be configured as a master, but there may only be one per bus system.



C1 means Unit 1 / Circuit 1

C2 means Unit 2 / Circuit 2



You can change the channel in the information menu on the "AE" screen

Here, the circle currently activated in the view is displayed.

To change press the "Enter" button:

Value = 1 circle1

Value = 2 circle2

Value = 3 circle3 ...

Values transfer:

If a combination of machines with the same software version exists, it is possible to transfer the sensor inputs. The sensor values are only transferred from the master (pLAN address1) to the other controllers. It is not possible to transfer "slave" machines (pLAN address> 1) to the master.



To do this, the pLAN transfer must be switched on in the Options menu under Configuration Inputs.



If the pLAN connection is disconnected, the controller's own input is automatically evaluated.

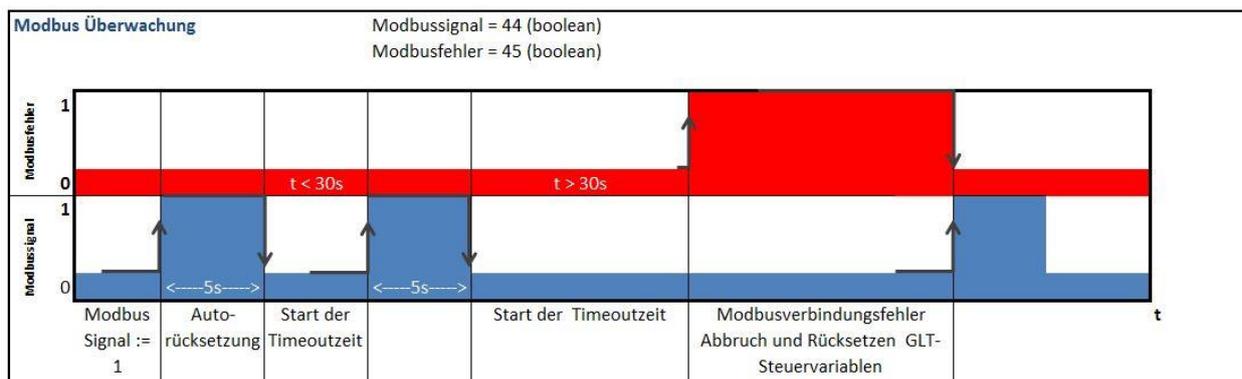
11.11 Modbus monitoring



You can integrate the heatpump controller in a Building Management System (BMS) and because of this; you need maybe a Modbus connection monitoring.



That the monitoring function works, you need to activate it in mask "DAL". After this, the BMS must set all 5-6second a modbus check variable to value true. (see supervisor list). The value will automatically reset to false to check the Modbus connection. Will the Modbus check variable set not set back to "true" then it will occurred a alarm message auf a Alarm delay (Mask "DAM")



11.12 Extensionboard

The Extensionboard allow to use a lot of additional function. To use this you must connect both controllers with the pLAN connection.

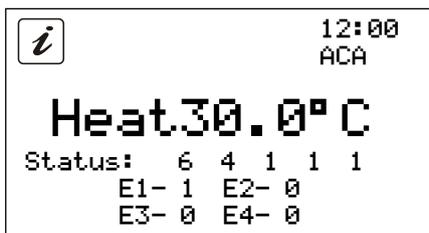
11.12.1 Extensionboard – Leakage Sensor

It is possible to integrate a leakage sensor over the extensionboard. The leakage sensor will measure the refrigerant concentration in the air. The measuring range is from 20 to 2000ppm. The leakage sensor must activate in mask "DQ2A". In the following masks you can set the first warning value and the alarm value. The default setting for warning value is 1500ppm. If this value is exceed it will occurred a warning message and an entry in a history mask. If the alarm value is exceeded then it will occurred a alarm message, an entry in history mask and a activation of the external suction pump. The pump will activated till the low- and high pressure is under 0,0Bar. For a premature deactivation of the suction pump you can open the digital input 1 (ID1). The actual measure leakage sensor value you can read in mask "DAW". The pLAN connection must always be active; otherwise it occur an error message.

12 Status indicator

You can obtain comprehensive information about the current status of the heat pump from the status indicator in the Information menu; here, for example, is the indicator for a standard compressor:

| | | |
|---------------|--|---|
| <p>Status</p> | <p>6</p> | <p>Generator 1 Generator 2 Generator 3 Generator 4</p> <p>4 1</p> |
| | <p>0 Switch off</p> <p>1 Off</p> <p>2 Flow</p> <p>3 Hot water</p> <p>5 Legionella protection</p> <p><u>6 Heating</u></p> <p>8 Cooling</p> <p>10 Pump protection</p> <p>12 Run-on</p> | <p>0- Switch off</p> <p><u>1- Off</u></p> <p>2- Delay for advance</p> <p>3- Wait for minimum runtime <Minimum runtime still in progress</p> <p><u>4- Normal operation</u></p> <p>6- Outside of temperature window (see below)</p> <p>8- Fault</p> <p>9- Switch-on delay</p> <p>10- Defrost</p> |



HEAT 30°C

| | | |
|--------|-----------------------|---------------|
| HW | Hot water | Setpoint 45°C |
| Heat | Heating | Setpoint 30°C |
| Legi | Legionella protection | Setpoint 60°C |
| Screed | Screed programme | Setpoint 30°C |
| | No tariff | |

E1: 1 E2: 0 E3: 0 E4: 0

- 0 Off -1 Outside of outdoor temperature window
- 1 On -2 Outside of limit temperature window
- 3 Defrost -3 Outside of Flow temperature window
- 4 Fan off
- 8 Delay time
- 9 Fault

13 Reset

The controller has a processor, just like a computer. Incorrect operation or overload can cause it to "hang". In such a case, it is possible to reboot the control by briefly disconnecting it from the power supply.

14 Resistance tables

Please use only the sensors prescribed by us, as other sensors can cause deviation in the measured values, thus significantly influencing the operation of the system.

| Temperature in °C | Resistance in kΩ | Temperature in °C | Resistance in kΩ |
|-------------------|------------------|-------------------|------------------|
| -50 | 329.5 | 25 | 10 |
| -45 | 247.7 | 30 | 8.31 |
| -40 | 188.5 | 35 | 6.94 |
| -35 | 144.1 | 40 | 5.83 |
| -30 | 111.3 | 45 | 4.91 |
| -25 | 86.43 | 50 | 4.16 |
| -20 | 67.77 | 55 | 3.54 |
| -15 | 53.41 | 60 | 3.02 |
| -10 | 42.47 | 65 | 2.59 |
| -5 | 33.9 | 70 | 2.23 |
| 0 | 27.28 | 75 | 1.92 |
| 5 | 22.05 | 80 | 1.67 |
| 10 | 17.96 | 85 | 1.45 |
| 15 | 14.69 | 90 | 1.27 |
| 20 | 12.09 | 95 | 1.11 |

Table 1 NTC resistance values

| Temperature in °C | Resistance in kΩ | Temperature in °C | Resistance in kΩ |
|-------------------|------------------|-------------------|------------------|
| 0 | 161.638 | | |
| 5 | 126.023 | 65 | 10.443 |
| 10 | 98.99 | 70 | 8.778 |
| 15 | 78.31 | 75 | 7.41 |
| 20 | 62.372 | 80 | 6.281 |
| 25 | 50 | 85 | 5.345 |
| 30 | 40.332 | 90 | 4.566 |
| 35 | 32.726 | 95 | 3.916 |
| 40 | 26.706 | 100 | 3.369 |
| 45 | 21.913 | 105 | 2.909 |
| 50 | 18.074 | 110 | 2.52 |
| 55 | 14.982 | 115 | 2.191 |
| 60 | 12.479 | 120 | 1.91 |

Table 2 NTC HT resistance values

| Voltage in V | Pressure in bar (sensor up to 9.3 bar) | Pressure in bar (sensor up to 34.5 bar) | Pressure in bar (sensor up to 17.3 bar) | Pressure in bar (sensor up to 45 bar) |
|--------------|---|--|--|--|
| 0 | -1 | 0 | 0 | 0 |
| 0.5 | 0.03 | 3.45 | 1.73 | 4.5 |
| 1 | 1.06 | 6.9 | 3.46 | 9 |
| 1.5 | 2.09 | 10.35 | 5.19 | 13.5 |
| 2 | 3.12 | 13.8 | 6.92 | 18 |
| 2.5 | 4.15 | 17.25 | 8.65 | 22.5 |
| 3 | 5.18 | 20.7 | 10.38 | 27 |
| 3.5 | 6.21 | 24.15 | 12.11 | 31.5 |
| 4 | 7.24 | 27.6 | 13.84 | 36 |
| 4.5 | 8.27 | 31.05 | 15.57 | 40.5 |
| 5 | 9.3 | 34.5 | 17.3 | 45 |

Table 3 Pressure transmitter values, 0-5V