

Heating circuit and solar controller

grandis 650 HK

Menus and controller functions

English version of original German installation and operating instructions

Version: 1.5

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This manual is designed to help you use the controller properly, safely and economically.



This manual represents only a part of the installation and operating instructions. Read the document before making any settings on the controller. *Installation and operating instructions.*

Target group

This manual is addressed to all persons who carry out any of the following tasks:

- Installing the controller
- Connecting the controller
- Putting the controller into operation
- Setting the controller
- Maintaining the solar power system
- Eliminating faults on the controller and the solar power system
- Disposing of the controller

These persons must have the following knowledge and skills:

- Knowledge about establishing electrical connections
- Knowledge about the hydraulic operation of solar power systems
- Knowledge of the applicable regulations at the point of use and the ability to apply them

These persons must have read and understood the contents of this manual.

Availability

This manual is part of the controller. Always keep it in an easily accessible location. Include this manual with the controller should the controller change hands.

If this manual gets lost or becomes unusable, you can contact the manufacturer for a new copy.

Style conventions used in the text

Specific style conventions are assigned to different elements in the manual. This makes it easy to recognise the type of text concerned:

Standard text,

"Menu", "Menu item", "Button designations",

- lists and

➤ actions.



Notes accompanied by this symbol contain information about how to operate the controller economically.

Style conventions for hazard warnings

This manual makes reference to the following categories of hazard warnings:



DANGER

Information or instructions accompanied by the word DANGER provide a warning about a hazardous situation that will lead to fatal or serious injuries.



WARNING

Information or instructions accompanied by the word WARNING provide a warning about a hazardous situation that may possibly lead to fatal or serious injuries.



CAUTION

Information or instructions accompanied by the word CAUTION provide a warning about a situation that can lead to minor or moderate injuries.

Style conventions for warnings of damage to property or the environment

ATTENTION

Information and instructions of this kind provide a warning about a situation that can lead to damage to property or the environment.

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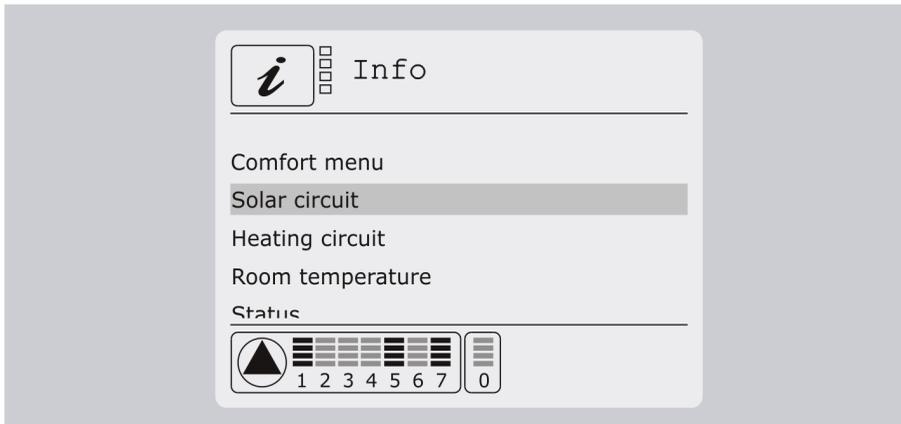
1 Displaying and changing the values in the menus

This chapter provides an overview of the menus and menu items. Menu items for the first menu level are displayed in **bold**. Menu items for the second menu level are displayed beneath in standard text.

1.1 Displaying values in the "Info" menu



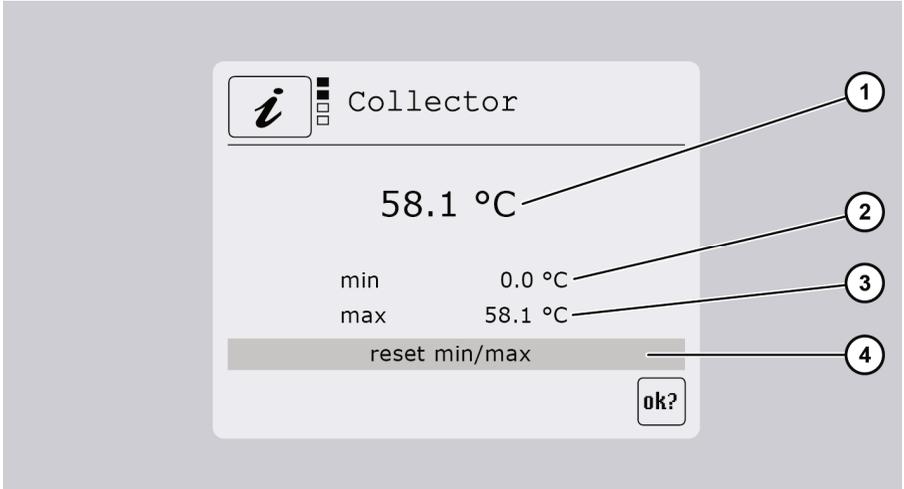
The "Info" menu allows you to display measurement and output values and status messages.



Depending on which additional functions have been activated, not all values will necessarily be displayed.

Solar circuit

This menu allows you to display measurement values in the solar circuit and to reset them to the current measurement value. In this case the terminal designation precedes the designation for the sensor (e. g. S01: Collector). Whenever you activate a menu item, the "Measurement value" display screen will be displayed.



Pos.	Description
1	Current measured value
2	Display of the minimum value reached so far
3	Display of the maximum value reached so far
4	Reset the minimum and maximum values to the current measurement value

To reset a value, proceed as follows:

➤ Select ➤ .

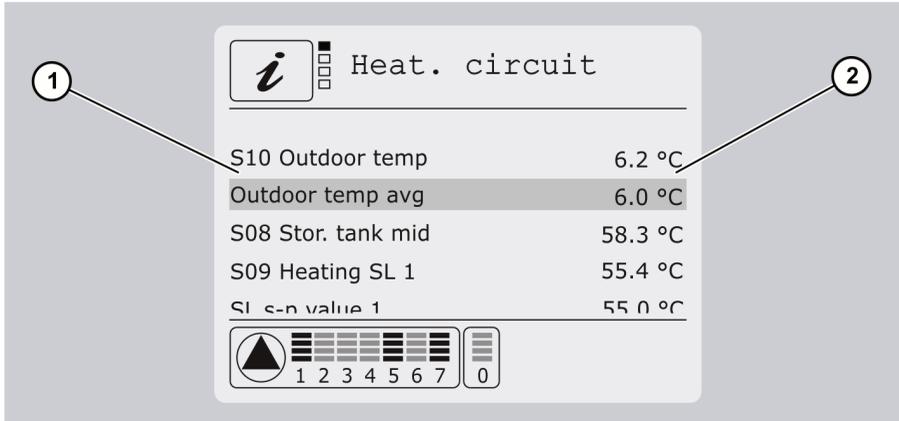
The OK symbol will be displayed.

➤ Press ➤ to confirm.

The value will be reset.

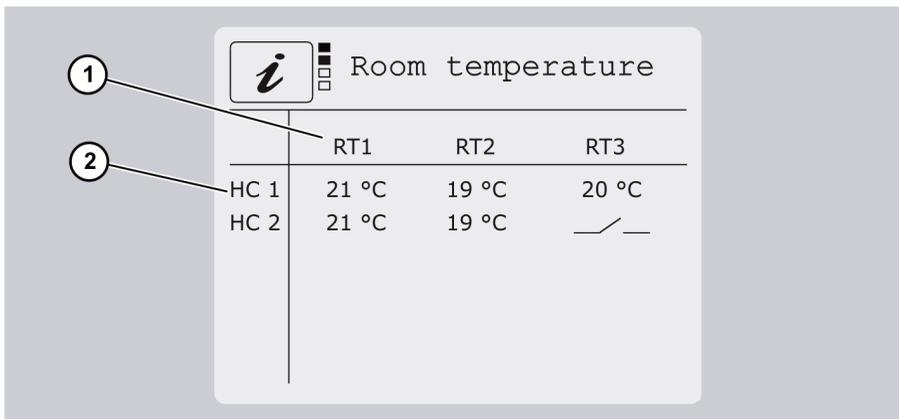
Heating circuit

In this menu you can view the measured values (1 and 2) in the heating circuits. In this case the terminal designation precedes the sensor designation (e.g. S10: Outdoor temperature). When you activate a menu item, the min and max values previously obtained will appear and you can reset to the current measured value.



Room temperature

This menu is visible only when you have activated at least one room user terminal (navo 400), room sensor or room actuator.



Item	Description
1	Room temperatures 1 to 3 for each heating circuit. Room actuators are shown as a switch symbol.
2	Assignment to the activated heating circuits

"Comfort" menu

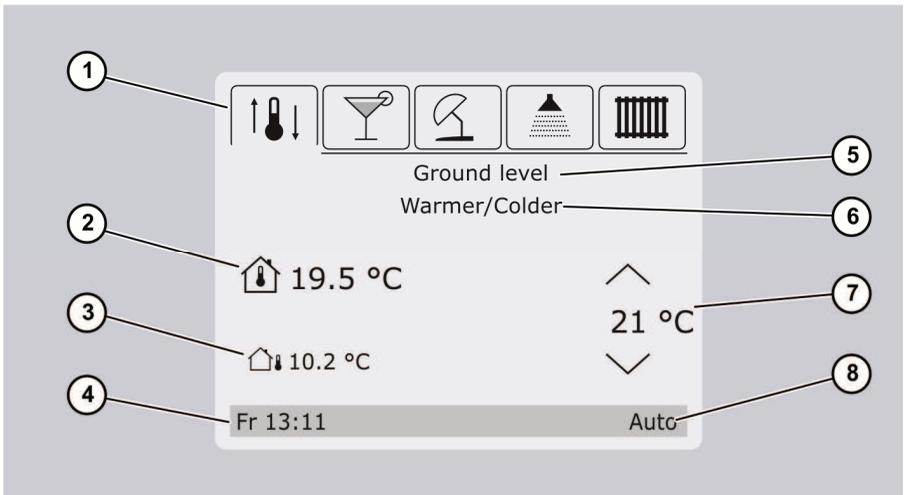
In this menu you can enter changes. Select heating functions are clearly presented and the parameters can be changed quickly and conveniently.

Use the buttons < or > to select the required menu.

Use the buttons ^ or v to increase or decrease the value in steps.

The change will be adopted immediately.

The "Comfort" menu can be closed by pressing the button < in the "Warmer/Colder" menu (far left) and confirming the prompt.



Item	Description
1	Active menu (here: "Warmer/Colder" menu)
2	Room temperature. This stands for the current temperature in the room where the room user terminal is located. It appears only when navo 400 is connected.
3	Outdoor temperature
4	Day and time
5	Heating circuit designation (here: heating circuit on "Ground level")
6	Menu designation (here: "Warmer/Colder" menu)
7	Target temperature. This can be changed with the button v or ^ . If a room thermostat or sensor is set as the room sensor, the warmer/colder supply line correction will appear in the range -10 to +10.
8	Current operating status (here: "Auto")

The following menu symbols appear in the top part of the display:

"Comfort" menu	
Symbol	Description
	"Warmer/Colder" menu Here you can increase or reduce the room temperature. The supply line temperature of the related heating circuit (5) will then be corrected by the value set here.
	"Party" menu Here you can enter the number of hours for which the heating system will adopt or remain in the "Manual day" operating mode. This applies only for the selected heating circuit (5).
	"Holiday" menu Here you can enter the number of days on which you will be absent. The heating circuit will adopt the "Manual night" mode for the number of days selected here. Then the heating circuit will return to the previously set operating mode. This applies only for the selected heating circuit (5).
	"Hot water" menu Here you can increase or reduce the temperature of the hot water. This applies for all heating circuits. Reducing the temperature can save energy when only little or no hot water is required. Increasing the temperature is useful when you need more hot water.
	"Heating circuits" menu Here you can change the heating circuit if more heating circuits are provided and activated.

The "Comfort" menu can be set as the idle screen (standard screen) at:

- Program/Idle screen/Comfort menu.

MFC 1-6

This menu allows you to display and reset measurement values of the multi-function controller. In this case the terminal designation precedes the designation for the sensor (e.g. S1: Source). As in the "Solar circuit" menu item, you can also reset the minimum and maximum values here.

Status

This menu allows you to display the following status messages:

Menu item	Description
Solar	The following status messages can be displayed: – Off – Charging priority 1/2 – Collector protection – System protection – Recooling – Anti-freeze – Waiting time – Tube collector – Drain-back – Parallel charging – Fault
Flow	Only if a flow fault occurs.
Heating circuit	The following status messages can be displayed: – Off/Summer – Day – Night – Party – Holiday – Eco mode active – Chimney sweep - time remaining.
MFC 1–6	The following status messages can be displayed: – On – Off

Efficiency

This menu allows you to display the following balance values and, if necessary, reset them:

- Operating hours (resetting is possible)
- Output (resetting is possible)
- Flow



For systems with two storage tanks, the tanks are denoted by the digits "1" and "2" respectively.

Overview

This menu allows you to display an overview of all outputs (2) and inputs (1). No value will be displayed if a sensor is not connected. If an arrow symbol is shown (3), you can use the buttons ▼ or ▲ to display the other values.

The HE outputs are displayed in the bottom part (4).

The screenshot shows a menu titled "Overview" with a sub-header "i" and a list of values. The menu is divided into two main sections: "S:" (Inputs) and "R:" (Outputs). The "S:" section contains a table of 10 input values (01-10). The "R:" section contains a table of 5 output values (1-5). Below these sections, there are three HE output values: HE1: 100, HE2: 0, and HE3: 0. Callout 1 points to the "S:" header, callout 2 points to the "R:" header, callout 3 points to a checkmark symbol next to the value "0" in the "R:" section, and callout 4 points to the HE output values.

S:		R:			
01:	69.7	06:	23.0	1:	100
02:	43.6	07:	43.6	2:	0
03:	40.7	08:	40.7	3:	30
04:	39.0	09:	39.0	4:	0
05:	40.7	10:	40.7	5:	0 ✓
HE1: 100		HE2: 0	HE3: 0		

If flex 400 modules are connected, a menu item with an overview of the inputs and outputs will appear for each of these modules.

1.2 Displaying and changing values in the "Program" menu



The "Program" menu allows you to display and change the parameters.



WARNING

Risk of scalding from hot water as a result of incorrect settings.

- Exercise particular care when configuring settings on the controller.
- Take water samples after completion of the settings and check them using a suitable thermometer.

ATTENTION

Risk of system malfunctions due to incorrect settings.

- Set parameters only if you know their effects.

Solar circuit

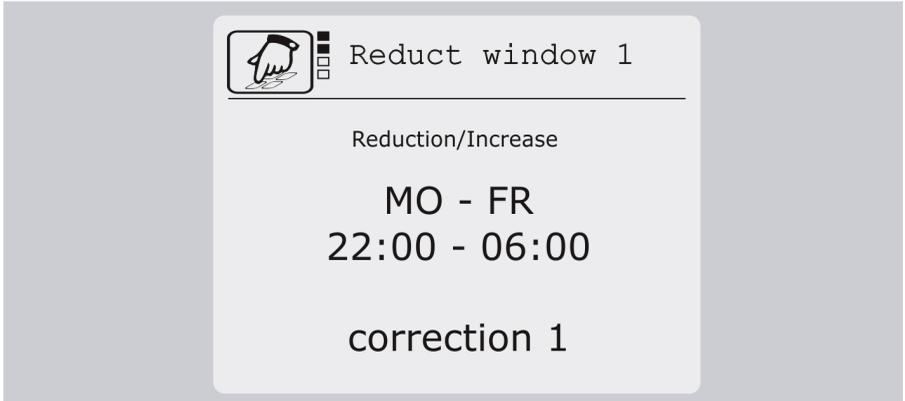
Menu item	Description
Storage tank 1/2	
Storage tank max	Required maximum temperature
dTon	Switch-on difference
dToff	Switch-off difference
Storage tank act	"Storage tank priority" function: Specify the storage tank priority Activate or deactivate the storage tank with priority 2
Parallel charging	Temperature difference for the "Parallel charging" function
Speed control	Minimum pump output with speed control 100% = Speed control off
Target temp	Required temperature for the "Target temperature" charging method
Radiation	Value at which the "Tube collector" or "Drain-back" (radiation-controlled) functions start.
Tube start time	Time at which the "Tube collector" or "Drain-back" (time-controlled) functions start
Tube stop time	Time at which the "Tube collector" or "Drain-back" (time-controlled) functions stop

Heating circuit 1-4

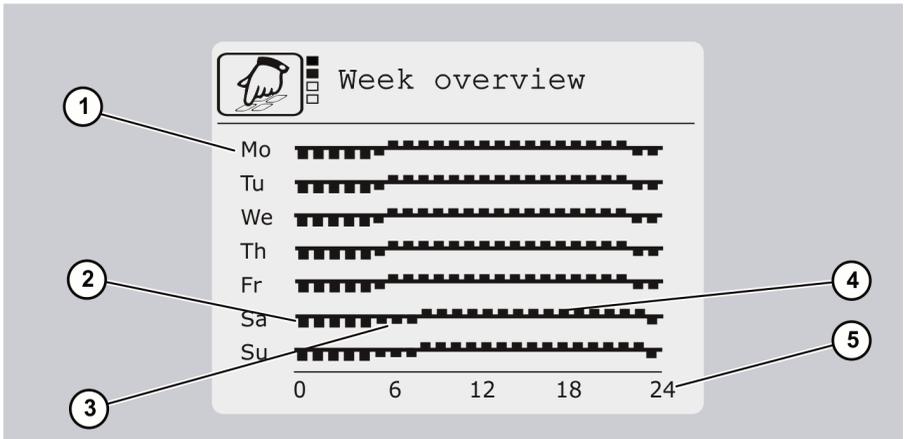
Menu item	Description
Description	Here you can specify a designation for the heating circuit. The following terms are available: Heating circuit, Basement, Ground level, Upper level, Floor, Radiator, Wall heating system, Ceiling heating system, Top floor, Flat, Building.
Number	You can also issue a number. This makes sense when there are several heating circuits e.g. on ground level.
Operating mode	
Automatic	The control system runs by time program on the basis of the set heating curves and in accordance with the outdoor temperature.
Manual day	The control system runs continuously in normal heating mode.
Manual night	The control system runs continuously in reduced mode.
Off/Summer	The heating circuits are switched off. The mixers close and remain in this position. The "Anti-freeze" function remains active.
Party	The heating circuit runs in "Manual day" mode for the duration of the value set here.
Holiday	The heating circuit runs in "Manual night" mode up until the date selected here. The heating circuit will return to the previously set operating mode when the selected date has elapsed.
Warmer-Colder/Room set-point	The setpoint temperature for the supply line is changed by the value set here. If a navo 400 room user terminal is connected, you can enter the required room temperature directly here.
Correction 1	The setpoint temperature for the supply line is reduced or increased by the value set here.
Correction 2	Second correction value for the supply line setpoint temperature. Positive values will increase the setpoint temperature.
Week overview	Complete week overview of the set time window.
Reduction windows 1-7	Here you can assign the 2 preset corrections and the "Off" mode to a specific time window. Outside the time window, the heating circuit will run in automatic mode.
Mo-Fr	Here you can select the week-days on which you want the programmed time window to be active. In this example the days selected are: Mo, Tu, We, Th, Fr.
22:00-06:00	Here you can select the start and stop times for the reduction windows. In this example the times are: Start: 22:00, Stop: 06:00

Time window adjustment - heating system

For each time window you can select one of the preset SL corrections or "Off" mode. In this way you can implement various reductions or increases as part of the day's program. In the example below, the heating circuit will be operated with SL correction 1 from Mo to Fr 22:00h. Outside the time window, the heating circuit will run in automatic mode.



Week overview



Pos.	Description
1	Week days
2	Supply line correction 1, here: reduction of -10K
3	Supply line correction 2, here: reduction of -5K
4	Normal heating mode (automatic mode) outside the time window
5	Day hours

ECO mode

Menu item	Description
Function	Switching the "ECO mode" function on or off This function can be switched on or off for each heating circuit and for the hot water request. Within the time window, the request values for the reheating will be reduced by the respective lowering values.
Heating circuit lower value	The request temperature for the heating circuit is lowered by the value set here.
HW lowering value	The request temperature for the hot water processing is lowered by the value set here.
Time window 1-3	Outside the time window the function is not active.
Mo-Fr	Here you can select the week-days on which you want the programmed time window to be active. In this example the days selected are: Mo, Tu, We, Th, Fr.
06:00-22:00	Here you can select the start and stop times for the time window. In this example the times are: Start: 06:00, Stop: 22:00

Hot water

Menu item	Description
Start setpoint value	If the process water temperature drops below the value set here, the hot water processing function will become active and the boiler request will be switched on.
Stop setpoint value	If the process water temperature rises above the value set here, the hot water processing function will be switched off.
Priority	Here you can define the response of the heating circuits during the hot water processing. Off: The heating circuits will continue to run during the hot water processing. On: When the hot water processing is active, the heating circuits will be switched off and the mixers will be closed. Alternate: When the hot water processing is active, the storage tank will be given charging priority during the set "Charging time". When the charging time comes to an end, the hot water processing will be switched off for the "Waiting time" and the heating circuits will be activated again. This alternation will continue until the setpoint temperature for the hot water processing is reached.
Charging time (alternating mode)	Here you can define for how long the hot water processing has priority during alternating mode.

Menu item	Description
Waiting time (alternating mode)	Here you can define for how long the hot water processing must remain in waiting mode.
Time window 1-3	
Mo-Fr	Here you can select the week-days on which you want the programmed time window to be active. In this example the days selected are: Mo, Tu, We, Th, Fr.
06:00-22:00	Here you can select the start and stop times for the time window. In this example the times are: Start: 06:00, Stop: 22:00

Chimney sweep

Menu item	Description
Function	Switch the "Chimney sweep" function on or off The night heating mode will be started and the heating pumps will be activated. The mixers move to position "Open".
Runtime	Here you can set the runtime for the "Chimney sweep" function. When this time has elapsed, the system will switch automatically to the previously selected operating mode.

MFC 1-6



Different menu points can be displayed in this menu depending on the functions selected for the multi-function controller.

Menu item	Description
Target temp	Switch-on temperature
Hysteresis	Temperature range
Waiting time	Duration of waiting time for the "Cascade" function
Tmax sink	Maximum temperature of the sink for the "Temperature difference controller" and "Wood-fired boiler" functions
Diff. controller max	Switch-on difference for the "Temperature difference controller" function
Tmin source	Minimum temperature of the source for the "Temperature difference controller" and "Wood-fired boiler" functions
Diff. controller min	Switch-off difference for the "Temperature difference controller" function

Menu item	Description
Tlimit min.	Lower limit of a temperature range With this value you can set the lower limit of a temperature range. The multi-function controller switches only within this temperature range.
Tlimit max.	Upper limit of a temperature range With this value you can set the upper limit of a temperature range. The multi-function controller switches only within this temperature range.
Date	Here you can enter the period (start date and end date) in which you want the multi-function controller be active. The year is not entered. If you enter an end date which precedes the start date, the end date will be set in the following year.
Time 1–3: Start	Start time for time windows 1-3: When the start time for time window 1 has been specified, you can specify the start times for time windows 2 and 3.
Time 1–3: Stop	Stop time for time windows 1-3. When the stop time for time window 1 has been specified, you can specify the stop times for time windows 2 and 3.

System

Menu item	Description
Idle screen	Here you can define to which display the controller will switch if no button is pressed for one minute. Heating circuit: An overview of the measured values in the heating circuit Solar circuit: An overview of the measured values in the solar circuit Comfort menu: In the "Comfort" menu you can enter changes
SD card on/off	Deactivate microSD card. This menu item will be displayed only if a microSD card has been inserted. When it is inserted, the microSD card is automatically activated. An SD card symbol in the "Info" menu indicates that data logging is in progress.
Warning signal	Switch the acoustic warning signal on or off when there are faults
Time	Current time
Date	Current date
Summer time	Automatic changeover between summer time and winter time
Firmware	Display of the current firmware version

1.3 Controlling switching outputs in the "Manual mode" menu



The "Manual mode" menu allows the controller's switching outputs to be turned on and off for test purposes. To enable the controller to run in automatic mode again, you have to exit manual mode after completion of setting tasks.

ATTENTION

Risk of system malfunctions due to incorrect settings.

- Make sure that only specialist personnel ever make any changes to the values in this menu.

Menu item	Description
Output R0-R7, HE1-HE3	Switch switching output R0-R7, HE1-HE3 on or off manually. Depending on the hydraulic layout which has been set, only the switching outputs in use will be displayed.
Delayed off	When the menu is closed, the controller will switch to automatic mode after the delayed off has elapsed. All outputs in manual mode remain active during the delayed off period. In the "Info" menu, a hand symbol appears instead of the pump symbol.

1.4 Displaying and changing values in the "Basic settings" menu



The "Basic settings" menu allows you to display and change basic settings.

ATTENTION

Risk of system malfunctions due to incorrect settings.

- Make sure that users use only user mode.
 - Make sure that the values are only ever changed by specialist personnel.
-

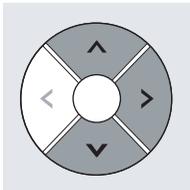
There are two operating modes:

- User mode
- Editing mode

In user mode you can display values in this menu, but you cannot make any changes to them. If user mode is activated, the menu symbol is displayed in the form of a "locked" symbol.

In editing mode you can display and make changes to values in this menu. If editing mode is activated, the menu symbol is displayed in the form of an "unlocked" symbol. Only specialist personnel are permitted to activate editing mode.

- To activate editing mode, press the **▲**, **➤** and **▼** buttons simultaneously.



The menu symbol will be displayed in the form of an "unlocked" symbol. Editing mode will be active.

Solar circuit

Menu item	Description
Hydraulic layout	Set the system type. Layout: abc.x a: Number of storage tanks b: Number of collectors c: Extensions (0=None, 1=Heat exchanger, 2=Bypass) x: Variant When the hydraulic layout is changed, all the preset parameters and additional functions will be reset.
Speed	With these parameters you can influence the speed control. P Prim: P (proportional) component gain, pump output in % per Kelvin. I-Time Prim: Time factor for correction by the I (integral action) component in seconds. Please change the preset values only if necessary.
Charging break	"Storage tank priority" function: Break between charging the storage tanks Multi-tank systems only
Priority	"Storage tank priority" function: Order in which storage tank 1 and storage tank 2 are charged. Only for multi-tank systems. Layout: ab a: Storage tank 1 b: Storage tank 2
Parallel charging	Switch the "Parallel charging" function on or off
Charging method	You can choose between the following charging methods: – deltaT (temperature difference) – Target temperature.
Collector prot	
Function	Switch the "Collector protection" function on or off
Temperature	Temperature at which the "Collector protection" function becomes active
Drain-back	(Only if collector protection is off)
Function	Switch on the "Drain-back" function in the required control type (temperature difference/radiation-controlled). Switch off the "Drain-back" function.
Fill time	Fill time for the "Drain-back" function
Min runtime	This parameter is used to set a minimum pump runtime.

Menu item	Description
Condition time	This parameter is used to set how long the conditions for switching on and off must be active in order to take effect.
Recooling	
Function	Switch the "Recooling" function on or off
Recooling temp	The temperature to which the storage tank is re-cooled after the "Collector protection" function was active
Tube collector	
Function	Switch on the "Tube collector" function in the required control type (time-controlled/control via temperature change/radiation-controlled). Switch off the "Tube collector" function.
Pump runtime	Pump runtime of the "Tube collector" function
Interval	Interval time between the pump runtimes
Time	Interval period for control via temperature change
deltaT	Temperature for control via temperature change
Anti-freeze	
Function	Switch the "Anti-freeze" function on or off
Sensor	Select the sensor input
Temperature	Temperature at which the "Anti-freeze" function becomes active
System protection	
Temperature	Temperature at which the "System protection" function becomes active
Pump type R1/R2/R3	You can choose between the following pump types at the R1/R2/R3 switching output: <ul style="list-style-type: none"> – 230 V block modulation – Analog (R1 and R2 only) – PWM – PWM inverted.

Heating circuit

Menu item	Description
Heating circuits 1-4*	For more settings for the individual heating circuits, see below this table.
Heating curve	
Linear	The heating circuit control of the two heating circuits is based on a linear calculation.
Curve set	The heating circuit control of the two heating circuits is based on a heating curve. Details can be found in the section <i>Selecting the heating curve from a set of curves</i> starting on page 29.
Multi-room control	<p>If you use more than one room sensor, you can implement multi-room control with this function. Comfort will be increased and energy consumption will be optimised.</p> <p>You can choose between the following room analysis methods:</p> <ul style="list-style-type: none"> - Min: The lowest temperature of all active sensors is decisive - Max: The highest temperature of all active sensors is decisive - Average: The average temperature of all active sensors is decisive - Switch: The heating circuit will be switched off when the room setpoint temperature is exceeded at all active sensors
Room influence	Here you can define the influencing factor of the room sensors. You can choose between low, medium and high and the supply line temperature correction will be calculated accordingly.
OT smoothing	<p>Here you can set a value in hours for the smoothing of the outdoor temperature according to the building's insulation. This makes allowance for the building's inertia.</p> <p>Examples: Poorly insulated building (e.g. an old building with no insulation): 4h. A very well insulated building (e.g. a new building, a KfW efficiency house type 70, 55, 40): 24h</p>
OT offset	Here you can set an offset for the outdoor temperature sensor.
dt On heat	<p>If the temperature at the middle of the storage tank lies below the calculated supply line setpoint value plus "dt On heat", the reheating by boiler will be switched on.</p> <p>If there are two heating circuits, the higher supply line setpoint value will be considered.</p>
dt Off heat	If the temperature at the middle of the storage tank lies above the calculated supply line setpoint value plus "dt On heat" plus "dt Off heat", the reheating will be switched off.
Request	<p>Switch the "Request" function on or off</p> <p>Here you can deactivate the boiler function. In this case the multi-function controller will become available on R0.</p>

Menu item	Description
Min runtime	This parameter is used to set a minimum time during which the request will remain active.
Delayed off	The request remains active during the delayed off period.
Reheat sensor 2	Sensor for switching off the burner request. This sensor is freely assignable. A message will appear if the sensor is not connected. The reheating function automatically uses the "Middle of storage tank" sensor.
Hot water	
Function	Switch the "Hot water" function on or off
Sensor ST top	Select the sensor input for the storage tank top
HW switch-off sensor	Sensor for switching off the burner request. This sensor is freely assignable. A message will appear if the sensor is not connected. The reheating function automatically uses the "Top of storage tank" sensor.
Anti-freeze	This function is active at all times. If the outdoor temperature drops below the threshold set here, the heating circuits will be activated. This happens irrespective of the selected operating mode.
Screed heating	Switching the "Screed heating" function on or off. Here you can start a defined program for heating and cooling the screed. You can choose between the following modes: <ul style="list-style-type: none"> - Auto: Screed heating in automatic mode - Hold: Holding the maximum value for the set "Duration max value" - Cool down: Cooling down according to profile, beginning with the 1st cool down step <p>Do not start the program until all the parameters have been set. Subsequent parameter changes will not take effect until the function is restarted.</p>

*** Heating circuits 1-4**

Menu item	Description
Heating circuit	<ul style="list-style-type: none"> - Unmixed: The "Unmixed heating circuit" is switched on - Mixed: The "Mixed heating circuit" is switched on
Assignment	The outputs and the sensors of every heating circuit can be assigned internal or to the external flex-modules. Internal 1 / 2: the integrated HCs of the controller Flex 1 / 2 / 3 / 4: HCs in the flex-modules 1, 2, 3 or 4
Heating curve 1-4	Here you can set either the linear heating curve or the heating curve selected from the set of curves, depending on the setting for the "Heating curve" menu point. You can set the following parameters:

Menu item	Description															
	<table border="1"> <thead> <tr> <th>Linear</th> <th>Curve set</th> </tr> </thead> <tbody> <tr> <td>Switch-off day (If the average outdoor temperature during the day lies above this value, the heating will be switched off.)</td> <td>Switch-off day</td> </tr> <tr> <td>Switch-off night (If the average outdoor temperature in the night lies above this value, the heating will be switched off.)</td> <td>Switch-off night</td> </tr> <tr> <td>Supply line max limit (Maximum supply line temperature)</td> <td>Supply line max limit</td> </tr> <tr> <td>Supply line min limit (Minimum supply line temperature)</td> <td>Supply line min limit</td> </tr> <tr> <td>Outdoor temp max</td> <td rowspan="4">Steepness</td> </tr> <tr> <td>Outdoor temp min</td> </tr> <tr> <td>Supply line temp max</td> </tr> <tr> <td>Supply line temp min</td> </tr> </tbody> </table>	Linear	Curve set	Switch-off day (If the average outdoor temperature during the day lies above this value, the heating will be switched off.)	Switch-off day	Switch-off night (If the average outdoor temperature in the night lies above this value, the heating will be switched off.)	Switch-off night	Supply line max limit (Maximum supply line temperature)	Supply line max limit	Supply line min limit (Minimum supply line temperature)	Supply line min limit	Outdoor temp max	Steepness	Outdoor temp min	Supply line temp max	Supply line temp min
	Linear	Curve set														
	Switch-off day (If the average outdoor temperature during the day lies above this value, the heating will be switched off.)	Switch-off day														
	Switch-off night (If the average outdoor temperature in the night lies above this value, the heating will be switched off.)	Switch-off night														
	Supply line max limit (Maximum supply line temperature)	Supply line max limit														
	Supply line min limit (Minimum supply line temperature)	Supply line min limit														
	Outdoor temp max	Steepness														
	Outdoor temp min															
	Supply line temp max															
Supply line temp min																
Mixer 1-4																
Mixer type	Mixer with 230V or analog actuation															
Settings for mixer with 230V actuation	<p>Total actuating time: Time taken by the mixer from the position "Open" to the position "Closed".</p> <p>Actuating time: Here you can set how long the mixer is actuated when the heating circuit actual value deviates from the supply line setpoint value. The deviation is entered in seconds per Kelvin.</p> <p>Cycle time: Here you can enter the time interval in which the mixer is actuated.</p>															
Settings for mixer with analog actuation	<p>P component: Influences how strongly the mixer reacts to a deviation from the supply line setpoint value.</p> <p>I component: Influences how strongly the mixer reacts to a lasting deviation from the supply line setpoint value.</p> <p>Cycle time: Here you can enter the time interval in which the mixer is actuated.</p> <p>Output assignment: Heating circuit assignment "Internal 1": HE2 Heating circuit assignment "Internal 2": HE1</p>															
Room sensor 1-3	<p>Here you can activate up to three room user terminals, room sensors or room actuators.</p> <p>You can choose between the following types:</p> <ul style="list-style-type: none"> - navo 400: Room user terminals with room temperature sensor. Is possible and recommended only as room sensor 1. - Room sensor: Commercially available room sensor with PT1000 sensor - Room actuator: Commercially available room actuator with potential-free output <p>For room sensors and room actuators you must assign another sensor input to which they are connected. The control time is also adjustable.</p>															

Yield measurement

Menu item	Description
Measurement method	Activate yield measurement with the preferred measurement method. You can choose between the following measurement methods: – DFG (flow sensor) – VFS (vortex flow sensor) – DFA (flow indicator –only for yield measurement 1 in the solar circuit)
Pulse value	Pulse value for the "DFG" measurement method
VFS type	Select type for the "VFS" measurement method.
DFA	Flow rate for the "DFA" measurement method. Unit: Litres per minute
Glycol type	You can choose between the following glycol types for the coolant: – Anro – Ilexan EG/E/P – Antifrogen L/N – Tyfocor L5.5 – Dowcal 10/20/N. – none (if you use only water)
Glycol percentage	Mixing ratio for the coolant

MFC 1-6

Menu item	Description
Function	Here you can switch on the MFC in the following functions: – Cooling – Heating – Difference controller – Threshold value – Return line boost – Wood-fired boiler – Circulation temp. – Circulation time – Alarm – Timer – HW reheating – Temperature range – Modulation – Cascade – Yield – Mixer (only MFC 1) – Valve (only MFC 2) – Storage tank cooling (only MFC 3).
Source sensor	Select the sensor input for the source

Menu item	Description
Sink sensor	Select the sensor input for the sink
Output	Select the output of the MFC
Speed	"Wood-fired boiler", "Return line boost" and "Wood-fired boiler" functions: Minimum pump output with speed control. 100% = Speed control off
Delayed off	The switching output remains active during the delayed off period. You can set the delayed off period here. The setting range is 0–600 sec. The delayed off is active irrespective of all trip conditions.
Runtime	Duration of runtime for following functions: – "Time-controlled circulation" – "Solar boost" – "Solar redundancy".
Waiting time	Duration of waiting time for the "Time-controlled circulation" function
Link	Logical link from the output to the other outputs with AND/OR logic. Details can be found in the section <i>Setting the logical link</i> starting on page 29.

System

Menu item	Description
Load language	Change the language
Parameter	Backup parameters from controller to microSD card. Load parameters from microSD card to the controller. This menu item will be displayed only if a microSD card has been inserted.
Generate record	The current settings and parameters will be saved in a text file to the microSD card. This menu item will be displayed only if a microSD card has been inserted.
Factory settings	Load factory settings
Firmware update	Carry out a firmware update. This menu item will be displayed only if a microSD card has been inserted. Only the firmware files will be displayed.
Number Flex I/O	If additional flex modules are connected, the number must be stated here.

2 "Heating circuit" function

The device can be used to control up to two heating circuits on the basis of the outdoor temperature. These circuits can be mixed or unmixed. You can define separate control characteristics for each heating circuit.

2.1 Mixed heating circuit

 The control characteristics described in the following can be configured only in the "Basic settings" menu.

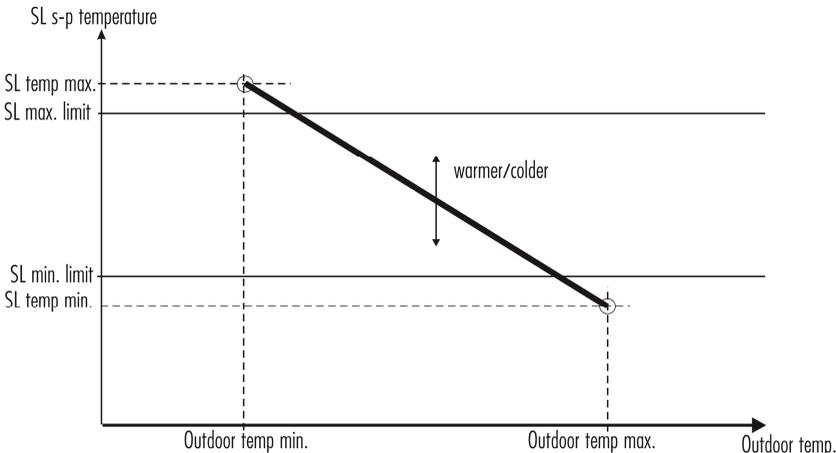
With this function, the control system adjusts to the setpoint temperature for the supply line by actuating the heating circuit pump and the heating circuit mixer according to the outdoor temperature development.

You can choose between two settings:

- Linear heating curve
- Heating curve from a set of curves.

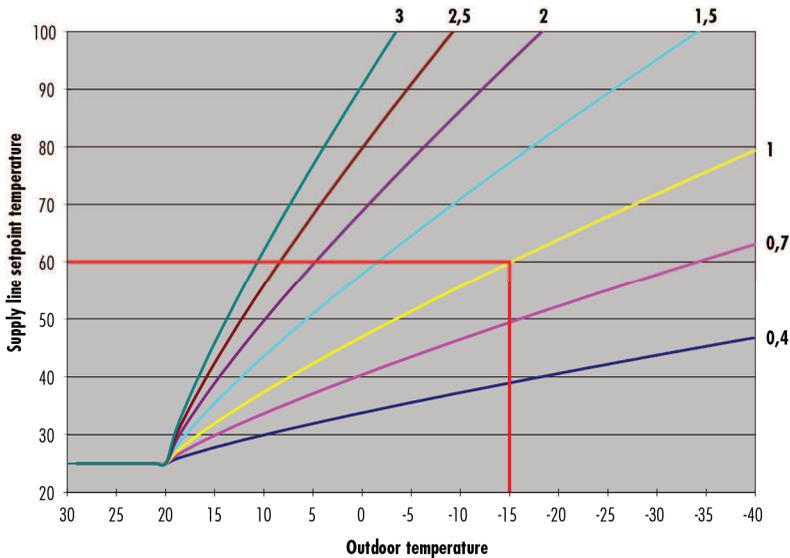
Defining the linear heating curve

The heating curve (thick line) is defined by two vertexes. The first or upper vertex is formed from the parameters "Supply line temperature max" and "Outdoor temperature min". The second or lower vertex is formed from the parameters "Supply line temperature min" and "Outdoor temperature max". The parameters "Supply line max limit" and "Supply line min limit" are used as absolute limits for the supply line setpoint temperatures of the upper and lower heating circuits. You can use the parameters "Switch-off day" and "Switch-off night" to define the outdoor temperature at which the heating circuits are switched off if exceeded.



Selecting the heating curve from a set of curves

Assuming a desired room temperature of 20 °C, a corresponding supply line setpoint temperature is derived from the selected heating curve and the outdoor temperature development. The parameters "Supply line max limit" and "Supply line min limit" are used as absolute limits for the supply line setpoint temperatures of the upper and lower heating circuits. You can use the parameters "Switch-off day" and "Switch-off night" to define the outdoor temperature at which the heating circuits are switched off if exceeded.



The example graphic shows that when curve 1 (yellow) is selected and the outdoor temperature is -15 °C, the supply line setpoint temperature will be 60 °C.

2.2 Unmixed heating circuit

The heat source of the heating circuit (middle of storage tank) will be adjusted to the corresponding supply line setpoint temperature on the basis of the configured settings (linear heating curve/selection from a set of curves) according to the development of the outdoor temperature.

-  When the heating circuit pump is activated, the requested temperature of the heat source (middle of storage tank) goes directly into the heating circuit without control and mixer control.

In the "Program" menu you can use the parameters "Warmer-Colder" and "Reduction temperature" to manually influence the supply line setpoint temperatures of the heating circuits. The "Warmer-Colder" parameter produces a general increase or reduction of the supply line setpoint temperature. The "Reduction temperature" indicates by how many

Kelvin the supply line setpoint temperature will be lowered in reduction mode, i.e. outside the active time windows.

2.3 Switching the heating circuit pumps off and on

Heating circuit pumps are switched off in the following cases:

- The value set for "Switch-off day" in the operating modes "Automatic" or "Manual day" for the respective heating circuit is exceeded.
- The value set for "Switch-off night" in the reduction mode for the respective heating circuit is exceeded.
- The value set for "Supply line max limit" plus 5 K control bandwidth is exceeded (only in the mixed heating circuit).
- The "HW priority" function is switched on and the "HW reheating" function is active.

Heating circuit pumps are switched on again in the following cases:

- The outdoor temperature drops below the outdoor temperature set in the respective operating mode of the heating circuit by more than 1 K.
- The supply line temperature drops below the set supply line limit temperature by more than 1 K.
- The "HW reheating" function is no longer active.

2.4 Hot water

If the temperature at the top of the storage tank lies below the value set for "Start setpoint value", the reheating by boiler will be switched on.

If the temperature at the top of the storage tank lies above the value set for "Stop setpoint value", the reheating by boiler will be switched off.

If the "HW priority" function is switched on, the heating circuit pumps will be switched off and the mixers will be closed during the HW reheating.

You can also switch on the "HW reheating" function by MFC. This MFC switches in parallel to the "Hot water" function and has no further parameters.

2.5 Putting the heating circuits into operation

-  More or fewer heating circuit functions are available depending on the scope of the selected solar functions.

The putting into operation of the heating circuit 1 as a mixed heating circuit will be described by way of example.

- Select the "Basic settings" menu.
- Select the "Heating circuit" menu point.
- Select the "Heating circuit 1" menu point.
- Select the "Mixed" menu point.

The OK symbol will be displayed and will flash.

- To confirm the entry, select  .

The value "Mixed" will be indicated for the "Heating circuit 1" menu point.

The heating circuit is thus activated as a mixed heating circuit. All related switching outputs and sensor inputs are now assigned and will be actuated or evaluated accordingly by the controller. Further details can be found in the document *Hydraulic layouts*.

-  **When you switch off the heating circuit (e.g. via the "Program/Operating mode" menu point), the supply line setpoint value will be set to 11 °C.** When you switch on the heating circuit again, the supply line setpoint value will be reset without delay to the regular working value.

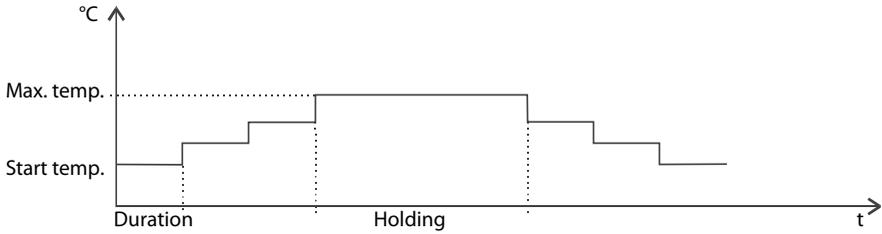
2.6 Screed heating

-  You can activate the function when all the relevant parameters have been set. If you change any parameters subsequently, you must restart the function for the changes to take effect.

Here you can start a defined program for heating and cooling the screed. You can choose between all mixed heating circuits. All other heating circuit functions are deactivated during screed heating.

When the heating and cooling down have ended, the control system will be reset to the previously selected mode. If there is a power failure, the function will be maintained and will continue from the point of disconnection.

A step pattern is defined using a start temperature and maximum temperature, step duration and increment, and holding duration of the maximum value.



The number of steps is calculated from the difference between the start temperature and the maximum temperature and from the increment.

2.7 Room sensor (RS)

You can connect up to 3 room sensors per heating circuit. The navo 400 room user terminal, which acts as both a room sensor and remote control, can be connected respectively as room sensor 1 via the bus.

Otherwise you can connect commercially available room sensors with PT 1000 and room actuators with potential-free output in any order and combination.

In this way you can create multi-room controllers for greater comfort and a more efficient energy consumption.

3 "Solar" function

Setting the general controller functions

The general controller functions allow you to configure the settings for charging the storage tanks. You can set the following controller functions:

- Charging method
- "Storage tank priority" function
- "Parallel charging" function
- Pump control
- "Tube collector" function

3.1 Setting the charging method

In order to optimise the energy output, you can choose from the following charging principles:

- "Temperature difference" charging principle
- "Target temperature" charging principle

The charging principle is selected in the following menu item:

- Basic settings/Solar circuit/Charging principle

"Temperature difference" charging method

In the case of the "Temperature difference" charging principle, the solar circuit pump is controlled in such a way that the temperature difference between the collector and the storage tank is maintained at as constant a level as possible.

"Target temperature" charging method

The purpose of the "target temperature" charging method is to achieve a usable effective temperature as quickly as possible. The solar circuit pump is switched on when the set target temperature has been reached. The pump output is adjusted in accordance with the value of the target temperature + switch-on difference.

For layouts with an external heat exchanger, the secondary circuit is also controlled to achieve the right value. Minimum runtimes and delayed off times are used to ensure that the solar energy is used to optimum effect.

For this function you can set the following parameters:

- Program/Solar circuit/Target temperature

3.2 Setting the "Storage tank priority" function



This function is available only for 2 or more storage tank systems.

The "Storage tank priority" function controls the tank charging of dual tank systems. There are the following types of dual tank systems:

- Systems with two separate storage tanks
- Systems with a stratified storage tank (a storage tank with two heat exchangers, one on top of the other)
- Systems with a storage tank in combination with a swimming pool
- etc.

In control mode, the first storage tank is charged as a storage tank with priority 1. If more heat is generated than required, the excess energy is fed into the second storage tank (storage tank with priority 2). In the case of the stratified storage tank, the top heat exchanger is defined as the first storage tank.

For this function you can set the following parameters:

- Basic settings/Solar circuit/Hydraulic layout
- Basic settings/Solar circuit/Charging break
- Basic settings/Solar circuit/Priority
- Program/Solar circuit/Storage tank active

3.3 Setting the "Parallel charging" function



This function is available only for 2 or more storage tank systems with pumps or pump two-way valves. 2 storage tanks are charged in parallel.

This function allows you to charge 2 storage tanks simultaneously. This requires the charging conditions for one storage tank to be fulfilled. At the same time the parallel charging conditions for one storage tank with lower priority must be fulfilled. Both pumps run with a pump output of 100 %. For layouts with valves, both valves will be opened. The energy output is divided between the two storage tanks.

For this function you can set the following parameters:

- Basic settings/Solar circuit/Hydraulic layout
- Basic settings/Solar circuit/Parallel charging
- Program/Solar circuit/Parallel charging

3.4 Setting the pump control system

You can connect standard pumps and high-efficiency pumps (HE pumps). For these you can set the following types of control system:

- 230 V block modulation (standard pumps)
- Analog control (HE pumps)
- Non-inverted PWM control (HE pumps)
- Inverted PWM control (HE pumps)

In order to keep the storage tank temperature as constant as possible, the solar circuit pumps can be controlled by means of speed control. You can set the minimum pump output with speed control between 30 % and 100 %. At 100 % the speed control will be switched off.

For this function you can set the following parameters:

- Basic settings/Solar circuit/Pump type R1 (R2, R3)
- Program/Solar circuit/Speed control



For HE pumps the following applies:

Switching outputs R1 and R2 switch only the pump supply. They are not speed-controlled. Their minimum switch-on time is 5 seconds.

To reduce the switching frequency of the high-efficiency pump, it is better to connect it directly to the 230V supply.

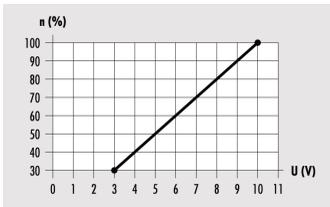
Controlling HE pumps with analog signals

In the case of the pump control system complete with analog signal, the controller sends a 0–10 V analog signal to terminals HE1 and HE2.

Definitions for the output voltage (U):

- Pump off: $0.5 \text{ V} < U < 1.0 \text{ V}$
- Speed control: Linear characteristic $3 \text{ V} < U < 10 \text{ V}$ (for a minimum pump output of 30 %)

The following diagram shows the power curve for the pump control system with analog signal.



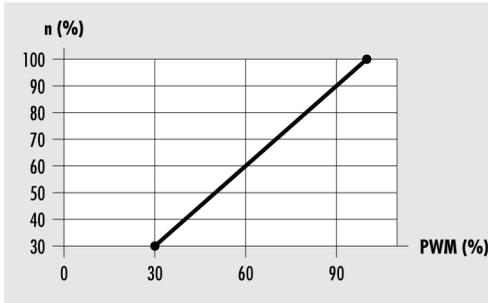
n (%) – Pump output

U (V) – Output voltage

Controlling HE pumps with PWM signals

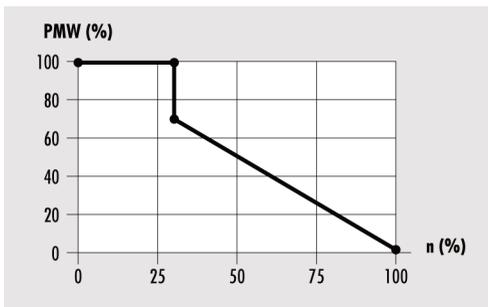
In the case of the pump control system with PWM signal, the controller sends a PWM signal (pulse width modulation signal) to terminals HE1, HE2 and HE3. The PWM signal can be sent normally (not inverted) or inverted.

In the case of the pump control system with a non-inverted PWM signal, the nominal speed of the pump (0–100 %) corresponds to the PWM signal (0–100 %). The following diagram shows the power curve for the pump control system with a non-inverted PWM signal.



n (%) – nominal speed of the pump
PWM (%) – non-inverted PWM signal

In the case of the pump control system with an inverted PWM signal, the nominal speed of the pump (0–100 %) corresponds to the PWM signal (100–0 %). The following diagram shows the power curve for the pump control system with an inverted PWM signal at a minimum pump output of 30 %.



PWM (%) – inverted PWM signal
n (%) – pump speed sent by the controller

3.5 Setting the "Tube collector" function

If the solar power system is equipped with tube collectors, you have to activate this function.

The control type is selected in the following menu item:

- Basic settings/Solar circuit/Tube collector/Function
 - Time-controlled
 - Radiation-controlled
 - Control via temperature change

Time-controlled

You can set a time window and a pump runtime. In the time window the solar circuit pump is switched on at certain specific intervals for the duration of the preset pump runtime.

For this function you can set the following parameters:

- Basic settings/Solar circuit/Tube collector/Pump runtime
- Program/Solar circuit/Tube start time (stop)

Radiation-controlled

When the level of radiation reaches the preset radiation value, the solar circuit pump is switched on for the duration of the preset pump runtime.

For this function you can set the following parameters:

- Basic settings/Solar circuit/Tube collector/Pump runtime
- Program/Solar circuit/Radiation

Control via temperature change

Whenever the collector temperature rises by a predefined value within a predefined interval period, the solar circuit pump will be switched on.

For this function you can set the following parameters:

- Basic settings/Solar circuit/Tube collector/Time
- Basic settings/Solar circuit/Tube collector/delta T

3.6 Bypass function / external heat exchanger

When the criteria for switching on are met, the solar circuit pump is activated first in order to warm up the collector circuit. This optimizes the energy generation process, especially in larger solar power systems.

The storage tank is not charged until the temperature in the solar circuit is sufficient to do so. The parameters for switching on and off are permanently set in the controller.

4 Setting protective functions

In order to protect the solar power system against frost and overheating, the controller is equipped with the following protective functions:

- "Collector protection" function
- "Storage tank protection" function
- "System protection" function
- "Pump protection" function
- "Heat exchanger protection"
- "Recooling" function
- "Drain-back" function
- "Anti-freeze protection" function

4.1 Setting the "Collector protection" function

This function protects the collector against overheating. If the preset collector protection temperature is exceeded, the solar circuit pump switches on. The pump runs until the temperature limit in the storage tank (95 °C) has been reached. This is done irrespective of the preset maximum storage tank temperature.

If the temperature of the collector falls below the preset collector protection temperature by 10 °C, the solar circuit pump switches off. The system will run again in normal operating mode.

For this function you can set the following parameters:

- Basic settings/Solar circuit/Collector protection

4.2 "Storage tank protection" function

 If a hydraulic layout with two storage tanks is used, the "Storage tank protection" function will be automatically active and cannot be changed.

This function protects the storage tanks against overheating caused by faulty wiring or any other possible faults. If the temperature limit is exceeded in one of the storage tanks (95 °C), all switching outputs will be switched off. The storage tank will no longer be charged.

When the temperature in the storage tank falls below the temperature limit again, the system will be in normal operating mode again.

4.3 "System protection" function

 This function is active at all times.

This function protects the system against overheating. If the temperature of the collector rises above the preset system protection temperature, the solar circuit pump switches off. When the temperature falls below the system protection temperature, the system will be in the "Collector protection" function again. When the temperature falls below the collector protection temperature, the system will be in normal operating mode.

For this function you can set the following parameters:

- Basic settings/Solar circuit/System protection

4.4 "Pump protection" function

 This function is active at all times and cannot be changed.

If the solar circuit pump is not activated for 10 days, the controller starts the solar power system automatically for 30 seconds.

4.5 "Heat exchanger protection" function

 This function is automatically active if a hydraulic layout with external heat exchanger is activated.

This function protects the heat exchanger against damage from frost. Whenever the temperature on the collector falls below 5 °C, the heat exchanger pump switches on.

4.6 Setting the "Recooling" function

ATTENTION

Risk of damage to the solar power system if operated with the "Recooling" function in combination with reheating.

- Make sure that reheating is not in operation before you activate the "Recooling" function.

 The "Recooling" function can be activated only if the "Collector protection" function is active.

This function protects the system against overheating in the following situations:

- If no hot water is used over an extended period of time (e. g. during a vacation)
- If the collector protection temperature is exceeded

If the temperature in the collector falls below the temperature in the storage tank (usually at night), the solar circuit pump switches on. This recools the storage tank to a preset temperature.

For this function you can set the following parameters:

- Basic settings/Solar circuit/Collector protection
- Basic settings/Solar circuit/Recooling

4.7 Setting the "Drain-back" function



The "Drain-back" function can be activated only if the "Recooling" function has been deactivated.

With drain-back systems, the collector will be drained empty when the pump is off. To pump the air out of the system, the pump will be operated at 100 % for an adjustable time.

The "Min runtime" parameter is used to set a minimum pump runtime.

The "Condition time" parameter is used to set how long the conditions for switching on and off must be active in order to take effect.

The fill time and the minimum runtime are reduced in the case of short switch-off times.

For this function you can set the following parameters:

- Basic settings/Solar circuit/Drain-back
- Basic settings/Solar circuit/Drain-back/Fill time
- Basic settings/Solar circuit/Drain-back/Min runtime
- Basic settings/Solar circuit/Drain-back/Condition time

You can choose between the control types "Temperature difference" and "Radiation-controlled".

Temperature difference

In the case of the "Temperature difference" charging principle, the solar circuit pump is controlled in such a way that the temperature difference between the collector and the storage tank is maintained at as constant a level as possible.

Radiation-controlled

When the level of radiation reaches the preset radiation value, the solar circuit pump is switched on for the duration of the preset pump runtime.

For this control type you can set the following parameters:

- Program/Solar circuit/Radiation

4.8 Setting the "Anti-freeze" function



The "Anti-freeze protection" function can be activated only if the "Drain-back" function has been deactivated.

This function protects the solar power system against the heat transfer fluid freezing. If the temperature falls below the preset temperature, the solar circuit pump switches on. If the preset temperature is exceeded, the solar circuit pump switches off. The system will run again in normal operating mode.

For this function you can set the following parameters:

- Basic settings/Solar circuit/Anti-freeze protection
- Basic settings/Solar circuit/Anti-freeze protection/Sensor
- Basic settings/Solar circuit/Anti-freeze protection /Start temperature
- Basic settings/Solar circuit/Anti-freeze protection /Hysteresis
- Basic settings/Solar circuit/Anti-freeze protection/Min. runtime

5 Measuring the energy yield

The controller can calculate and display the energy yield of the solar power system. You can assign yield measurement 1 to the solar circuit or set it as an independent yield measurement.

The controller can calculate and display the energy yield of the solar power system as the yield measurement in the solar circuit. To do so, it requires the following values:

- Flow rate
- Temperature difference between the collector and collector return flow temperatures
- Glycol type and glycol concentration in the heat transfer fluid

The energy output is displayed in the following menu item:

- Info/Balance values/Output

For the energy yield measurement you can set the following parameters:

- Basic settings/Yield measurement

You can choose from the following measurement methods:

- DFG (flow sensor)
- VFS (vortex flow sensor)
- DFA (flow indicator) – only yield measurement 1 in the solar circuit.

Energy yield measurement in any hydraulic circuit is possible with yield measurement 1 (set as independent) and energy yield measurement 2.

This is also possible with energy yield 3 to 6 if flex 400 modules are connected optionally.

An additional flow sensor or vortex flow sensor is needed for energy yield measurement 2 and 3–6 (when flexboxes connected). This additional sensor must be installed in the hydraulic circuit which is to be measured. Note the flow sensor specifications.

The two temperature sensors needed can be freely assigned to the function. It is thus possible to measure the energy yield in any hydraulic circuit.

5.1 DFG (flow sensor)

The flow sensor measures the flow rate mechanically. It is located on the return flow pipe of the solar power system. To determine the energy output with a flow sensor, the pipe-mounted sensor S4 must also be connected for temperature measurement.

5.2 VFS (vortex flow sensor)

The VFS measures the flow rate and the temperature. The following types can be installed in the solar power system:

- VFS Type 1–20 (Measuring range of 1 to 20 litres/minute)
- VFS Type 2-40 (Measuring range of 2 to 40 litres/minute)

5.3 DFA (flow indicator)

Only with yield measurement 1 in the solar circuit.

In the case of this measurement principle the flow rate is measured just the once by a flow indicator (flow indicator on the solar pump group – Tacosetter or adjustment valve) at a pump output of 100 % (e. g. in manual mode). The measurement value is entered at the controller. The flow indicator can then be removed again. The energy output is determined on the basis of this measurement value.

-  If you use the "Flow indicator" measurement principle, you must make sure that you do not operate the solar circuit pump with speed control. This would lead to incorrect results for the energy yield measurement. Enter the value "100 %" in the "Program/Solar circuit/Speed control" menu item.

6 Setting multi-function controllers (MFC)

You can activate up to 6 multi-function controllers (MFC). The sensors and the output (incl. HE1-HE3) can be freely assigned. The connected flex-modules can be also used for that purpose.



The outputs are not linked to the PWM outputs (HE1-HE3). This can be achieved via a respective link. R0 is not speed-controlled.

You can assign the following functions to the multi-function controllers:

- "Heating" function
- "Cooling" function
- "Temperature difference controller" function
- "Threshold value switch" function
- "Return flow boost" function
- "Wood-fired boiler" function
- "Circulation" function
- "Alarm" function
- "Timer" function
- "HW reheating" function
- "Temperature range" function
- "Modulation" function
- "Cascade" function
- "Yield" function
- "Mixer" function (only MFC 1)
- "Valve" function (only MFC 2)
- "Storage tank cooling" function (only MFC 3)

You can select the function for the required multi-function controller in:

- Basic settings/MFC 1–6/Function.

6.1 Setting the "Cooling" function

In the case of the "Cooling" function, the switching output of the multi-function controller switches on as soon as the preset switch-on temperature is exceeded. If the temperature drops below the lower limit of the preset temperature range (hysteresis), the switching output of the multi-function controller switches off.

For this function you can set the following parameters:

- Basic settings/MFC 1-6/Source sensor, Output
- Program/MFC 1-6/Setpoint temperature
- Program/MFC 1-6/Hysteresis
- Program/MFC 1-6/Time 1–3: Start (Stop)

6.2 Setting the "Heating" function

In the case of the "Heating" function, the switching output of the multi-function controller switches on as soon as the temperature falls below the preset switch-on temperature. If the temperature rises above the upper limit of the preset temperature range (hysteresis), the switching output of the multi-function controller switches off.

For this function you can set the following parameters:

- Basic settings/MFC 1-6/Source sensor, Output
- Program/MFC 1-6/Setpoint temperature
- Program/MFC 1-6/Hysteresis
- Program/MFC 1-6/Time 1–3: Start (Stop)

6.3 Setting the "Temperature difference controller" function

In the case of the "Temperature difference controller" there is a measurement point at both the source and the sink. If the difference between the temperatures of the two measurement points exceeds a predefined value, the switching output of the multi-function controller switches on.

In addition, a minimum temperature can be set at the source and a maximum temperature at the sink. If the maximum temperature is exceeded or the temperature falls below the minimum temperature, the switching output of the multi-function controller switches off.

For this function you can set the following parameters:

- Basic settings/MFC 1-6/Source sensor, Sink sensor, Output
- Basic settings/MFC 1-6/Speed
- Program/MFC 1-6/Tmax sink
- Program/MFC 1-6/Diff. controller max
- Program/MFC 1-6/Tmin source
- Program/MFC 1-6/Diff. controller min
- Program/MFC 1-6/Time 1–3: Start (Stop)

6.4 Setting the "Threshold value switch" function

In the case of the "Threshold value switch" function, the switching output of the multi-function controller switches on as soon as the temperature reaches the preset switch-on temperature. If the temperature drops below or rises above the preset temperature range (hysteresis), the switching output of the multi-function controller switches off.

To use this function for heating, set the "Hysteresis" value to greater than 0. To use this function for cooling, set the "Hysteresis" value to less than 0.

For this function you can set the following parameters:

- Basic settings/MFC 1-6/Source sensor, Output
- Program/MFC 1-6/Setpoint temperature
- Program/MFC 1-6/Hyteresis

6.5 Setting the "Return line boost" function

To save energy, energy is supplied to the heating return flow from the solar circuit or storage tank. The mode of operation and relevant parameters are similar to those of the "Temperature difference controller" function.

6.6 Setting the "Wood-fired boiler" function

This function allows you to re-heat the storage tank from a solid fuel boiler. The switching output of the multi-function controller will be activated if the boiler temperature (source sensor) plus the selected temperature range (hysteresis) exceeds the storage tank temperature (sink sensor).

In addition you can also define a switch-on temperature (T_{min} source). In this case the pump will not start until the switch-on temperature has been reached.

With this function the storage tank will be heated to a maximum temperature of 95 °C.

For this function you can set the following parameters:

- Basic settings/MFC 1-6/Source sensor, Sink sensor, Output
- Basic settings/MFC 1-6/Speed
- Program/MFC 1-6/ T_{min} source
- Program/MFC 1-6/Hysteresis

6.7 Setting the "Circulation" function

This function provides you with hot water at all times. You can choose from the following control types:

- Temperature-controlled
- Time-controlled

Temperature-controlled

The switching output of the multi-function controller switches on as soon as the temperature falls below the preset setpoint temperature. If the temperature rises above the upper limit of the preset temperature range (hysteresis), the switching output switches off. The sensor must be fitted in the circulation return line.

For this control type you can set the following parameters:

- Basic settings/MFC 1-6/Source sensor , Output
- Program/MFC 1-6/Setpoint temperature
- Program/MFC 1-6/Hysteresis

Time-controlled

The circulation pump is switched on and off in alternation within a preset time window. You can configure the setting for the duration of the respective runtime and waiting time.

For this control type you can set the following parameters:

- Basic settings/MFC 1-6/Runtime, Output
- Basic settings/MFC 1-6/Waiting time
- Program/MFC 1-6/Time 1–3 start (stop)

6.8 Setting the "Alarm" function

In the case of this function, the switching output of the multi-function controller switches on or off when there is a fault on the sensors used. For this function you can set the following parameters:

- Basic settings/MFC 1–6/Output, Link.

6.9 Setting the "Timer" function

In the case of this function, the switching output of the multi-function controller switches on within the preset time window. For this function you can set the following parameters:

- Basic settings/MFC 1–6/Output
- Program/MFC 1-6/Time 1–3 start (stop)

6.10 Setting the "HW reheating" function

With this function, the MFC output will be switched on when the hot water request is active. The HW reheating can thus be implemented in layers using a three-way reversing valve. No further parameters can be set for this function.

6.11 Setting the "Temperature range" function

With this function you can set the upper limit and the lower limit of a temperature range. The multi-function controller will switch only within this temperature range.

For this function you can set the following parameters:

- Basic settings/MFC 1–6/Source sensor, Output
- Program/MFR 1–6/Tlimit max.
- Program/MFR 1–6/Tlimit min.

6.12 Setting the "Modulation" function

With this function you can also request modulating heaters in accordance with the required supply line temperature.

The operating range (linear curve) is defined by two vertexes. The first vertex is formed from the parameters „Actuate min. [V]“ and „Demand min. [°C]“. The second vertex is formed from the parameters „Actuate max. [V]“ and „Demand max. [°C]“.

If no request is active, 0V will be output.

If hot water is active (ch. 2.4), the voltage set in the "Actuate HW" parameter will be output for the duration of the hot water processing at the output.

The analog output for the modulation is freely assignable. Outputs HE1 and HE2, and the HE outputs from additionally connected flex 400 modules, are available.

The link is set by default to R0 (heat generator request), but it can be changed if required.

The **Control time** parameter is used for setting the following:

If the control time = 0 sec: The power control is given on the basis of the required supply line setpoint temperature.

If the control time is > 0 sec: The control time is used to set the time interval after which the control power is periodically increased in 100mV steps. The power control is increased in steps until reheating is completed or until maximum control is reached. The periodic increase in power will only be active if there is a request for heating

For this function you can set the following parameters:

- Basic settings/MFC 1–6/output.
- Basic settings/MFC 1–6/Control time.
- Basic settings/MFC 1–6/ Demand min.
- Basic settings/MFC 1–6/ Demand max.
- Basic settings/MFC 1–6/Actuate min.
- Basic settings/MFC 1–6/Actuate max.
- Basic settings/MFC 1–6/Actuate HW.

6.13 Setting the "Cascade" function

With this function you can create a cascade of energy generators or enable actuation from one output in accordance with a particular time or the heating supply line temperature. The MFC must be linked by "and" to the output it is to follow.

When the leading output is switched on, the delay time will begin to run. When the time has ended, the assigned output will be switched on.

When the leading output is switched off, the MFC will also be switched off and reset to its initial state.

If the heating supply line temperature has to be taken into account as well in the process, you must assign a sensor, normally S8.

The MFR will be switched off when the switch-off temperature + offset are reached. You can also specify negative values for the offset and therefore enable the second boiler to be switched off prematurely. In this case, please note that a negative offset value with an absolute value which is higher than the "dt Off heat" is not sensible.

For this function you can set the following parameters:

- Basic settings/MFC 1–6/output.
- Basic settings/MFC 1–6/Delayed off period
- Basic settings/MFC 1–6/Link
- Program/MFC 1–6/Waiting time

6.14 Setting the "Yield" function

With this function you can perform an energy yield measurement via an S0 interface. The total yield and the day yield then appear in the "Info" menu.

For this function you can set the following parameters:

Basic settings/MFR 1–6/Input S00, S12-S15 (Please note: S0+ to 5V, S0- to the sensor input)

- Basic settings/MFC 1–6/Pulse number per kWh

6.15 Setting the "Mixer" function (only MFC 1)

This function allows you to control the target temperature of a mixer.

The multi-function controller can use different temperatures as the reference (control temperature):

1. **Heating:** The control temperature is the highest SL setpoint temperature from the heating circuits + the offset value from the program menu.
2. **Hot water:** The control temperature in this case is the HW stop value + the offset value from the program menu.
3. **Fixed value:** The control temperature in this case is the target temperature value entered in the basic settings menu.

You can set the following control modes:

- **Supply line:** The mixer is installed in the supply line. If the control temperature drops below the limit by 1K, the mixer will be opened (the duration depends on the control setting).

If the temperature of the sink exceeds the control temperature by 1K, the mixer will be closed.

- **Return flow line:** The mixer is installed in the return flow line. If the control temperature falls below the limit, the mixer will close, whereas if it is exceeded, the mixer will open.

The reference sensor (sink sensor) is freely assignable.

With enable temperature:

For both control modes the option "with enable" is available. You can specify an enable sensor (source sensor) with which the function is activated: If the source exceeds the target temperature, the function will be active and the mixer will be adjusted to the target temperature. Below this temperature, the mixer will be closed. For this function you can set the following parameters:

- Basic settings/MFC 1/Target type
- Basic settings/MFC 1/ Output 1 (mixer open), Output 2 (mixer closed)
- Basic settings/MFC 1/Source sensor, Target temperature sensor
- Basic settings/MFC 1/ Mixer parameters (total actuating time, actuating time, cycle time)
- Program/MFC 1/Hysteresis

An example layout can be found in the document *Hydraulic layouts*.

6.16 Setting the "Valve" function (only MFC 2)

With this function you can boost the return line by valve in accordance with the calculated maximum supply line setpoint temperature of the heating circuits.

The multi-function controller uses the currently highest supply line setpoint temperature as reference and switches the valve in accordance with the source sensor (e.g. an external heat source). If the source rises above the HC supply line setpoint temperature + hysteresis, the function will become active and the valve will be actuated.

If the source drops below the HC supply line setpoint temperature, the valve will be switched off.

For this function you can set the following parameters:

- Basic settings/MFC 2/Source sensor
- Basic settings/MFC 2/Output
- Basic settings/MFC 2/Delayed off period
- Basic settings/MFC 2/Link
- Program/MFC 2/Hysteresis

6.17 Setting the "Storage tank cooling" function (only MFC 3)

With this function you can cool the storage tank via a heating circuit.

No output is assigned to this MFC. If the temperature rises above the set storage tank start temperature, the respective radiator thermostat pump will be switched on and the mixer controlled accordingly. In this way the storage tank can be cooled when there is surplus solar energy, and stagnation of the solar power system can be prevented.

The function will end when the temperature drops below the set storage tank stop temperature.

i This function makes sense for systems with a solar combination storage tank. You must set the respective radiator thermostats by hand in order to prevent unwanted heating of the rooms in the summer.

For this function you can set the following parameters:

- Basic settings/MFC 3/Heating circuit
- Basic settings/MFC 3/Source sensor
- Basic settings/MFC 3/Start temperature
- Basic settings/MFC 3/Stop temperature
- Basic settings/MFC 3/Delayed off period

6.18 Setting the logical link

In principle, all MFCs can be linked with other outputs. This means that the status of another output will influence the control operation of the respective MFC.

Example for MFC R3 with AND-AND logic:

The screenshot shows a control panel interface for a 'Link' function. At the top, there is a wrench icon labeled '1' and a padlock icon. Below this, the text 'Link' is displayed. Underneath, the configuration is shown as 'R3 Cooling AND'. A vertical line separates the configuration from the status list. The status list includes: 'R1 : 1 on', 'and', 'R2 : 0 off', 'and', 'R3 : -', 'and', 'R4 : X None', 'and', 'R5 : X None'. A label 'AND' with a line pointing to the logic is labeled '2'.

Pos.	Description
1	AND/OR logic between R3 and the remaining outputs
2	AND/OR logic between the individual outputs. This setting also defines the logic between the individual outputs of the flex modules if any are connected.

This would mean that MFC with output R3 is active only if:

- The switch-on conditions are met **AND**
- R1 is on (1) **AND** R2 is off (0).

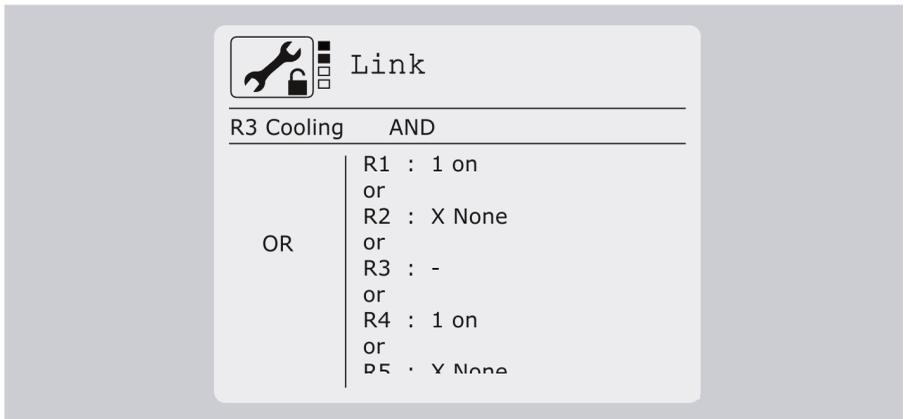
R3, R4, R5, R6, R7, R0, HE1, HE2 and HE3 do not need to be taken into account (x).

 Its own output (in this case R3) cannot be edited.

The value "10xxxxxxx" is entered in the menu point Basic settings/MFC/Link. Assignment:

R1	R2	R3	R4	R5	R6	R7	R0	HE1	HE2	HE3
1	0	x	x	x	x	x	x	x	x	x

Example for MFC R3 with AND-OR logic:



This would mean that MFC with output R3 is active only if:

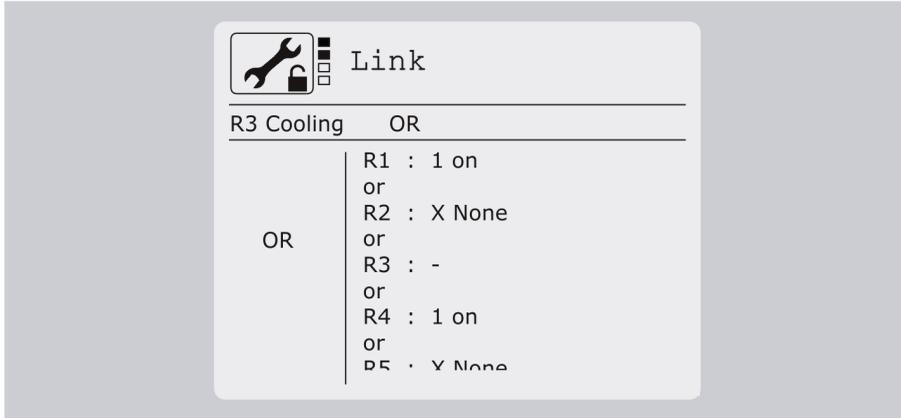
- The switch-on conditions are met **AND**
- R1 is on (1) **OR** R4 is on (1).

With the OR link there is no "0" selection.

The value „1xx1xxxxxx“ is entered in the menu point Basic settings/MFC/Link. Assignment:

R1	R2	R3	R4	R5	R6	R7	R0	HE1	HE2	HE3
1	x	x	1	x	x	x	x	x	x	x

Example for MFC R3 with OR-OR Logic:



This would mean that MFC with output R3 is active only if:

- The switch-on conditions are met **OR**
- R1 is on (1) **OR** R4 is on (1).

The value „1xx1xxxxxx“ is entered in the menu point Basic settings/MFC/Link.

Assignment:

R1	R2	R3	R4	R5	R6	R7	R0	HE1	HE2	HE3
1	x	x	1	x	x	x	x	x	x	x

 If you change the link type, the set links will be deleted.