

UVR65

UNIVERSAL CONTROLLER

Version 1.03



Programs
Installation
Electric Connection
User Guide

Diese Anleitung ist im Internet auch in anderen Sprachen unter www.ta.co.at verfügbar.

This instruction manual is available in English at www.ta.co.at

Ce manuel d'instructions est disponible en langue française sur le site Internet www.ta.co.at

Questo manuale d'istruzioni è disponibile in italiano sul sito Internet www.ta.co.at

Estas instrucciones de funcionamiento están disponibles en español, en Internet www.ta.co.at.

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Safety requirements



All installation and wiring work on the controller must only be carried out in a zero volt state. The opening, connection and commissioning of the device may only be carried out by competent personnel. While doing so, they must observe all local safety requirements.

This device is state of the art and meets all necessary safety regulations. It may only be used in accordance with the technical data and the safety requirements and regulations listed below. When using the device, also observe the statutory and safety regulations apposite to the particular use. Any other use will automatically void all warranty rights.

- The device must only be installed in a **dry** interior room.
- It must be possible to isolate the controller from the mains using an omnipolar isolating facility (plug/socket or 2-pole isolator).
- Before starting installation or wiring work, the controller must be completely isolated from the mains and protected against reconnection. Never interchange the safety low voltage connections (e.g. sensor connections) with the 230 V connections. Destruction and life threatening voltages at the device and the connected sensors may occur.
- Solar thermal systems can become very hot. Consequently there is a risk of burns. Proceed with caution when fitting temperature sensors.
- For safety reasons, the outputs should only be left in manual mode when testing. In this operating mode, no maximum temperatures or sensor functions are monitored.
- Safe operation is no longer possible if the controller or connected equipment exhibits visual damage, no longer functions or has been stored for lengthy periods in unsuitable conditions. If this is the case, disable the controller and equipment and secure against unintentional use.

Maintenance

If treated and used correctly, the device will not require any maintenance. Use a cloth moistened with mild alcohol (such as methylated spirits) to clean. Never use corrosive cleaning agents or solvents such as chloroethylene or trichloroethylene.

No components relevant to long term accuracy are subject to loading if the device is used correctly. Consequently long term drift is extremely low. The device therefore cannot be calibrated. Thus applying any compensation is impossible.

The design characteristics of the device must not be changed during repairs. Spare parts must correspond to the original spare parts and must be used in accordance with the build version.

Disposal



- Devices no longer in use or beyond a state of repair must be disposed of in an environmentally responsible manner by an authorised collection point. They must never be treated as ordinary household waste.
- We can undertake the environmentally responsible disposal of devices sold by the Technischen Alternative company upon request.
- Packaging material must be disposed of in an environmentally responsible manner.
- Incorrect disposal may result in considerable damage to the environment, as many of the materials used require professional handling.

Generally applicable rules

For the proper use of this device

The manufacturer's warranty does not cover any indirect damage to the unit if the technician installing the unit does not equip it with any additional electromagnetic modules (thermostat, possibly in combination with a one-way valve) to protect the device from damage as a result of malfunction under the following circumstances:

- **Swimming pool system:** If used with a high-performance collector and heat-sensitive components (such as plastic lines), the supply line must have an excess temperature thermostat with all of the necessary self-closing valves (closed when without current). The controller's pump output may provide these currents, if needed. As such, all heat-sensitive parts would be protected from overheating if the system was idle, even if steam was to form due to stagnation. This technique is mandatory, especially in systems with heat exchangers, as a failure of the secondary pump might cause great damage to the plastic tubes.
- **Conventional solar power systems with an external heat exchanger:** in such systems, the secondary heat transfer medium is usually pure water. If the pump runs at temperatures below the freezing point because of controller malfunction, the heat exchanger and other components may suffer frost damages. In this case, a thermostat must be installed on the supply line of the secondary side after the heat exchanger to automatically stop the primary pump when the temperature falls below 5°C, regardless of the controller's output.
- **When used for floor and wall heating:** A safety thermostat must be used, just as with conventional heating controllers. The heat circuit pump must be shut down if overheating occurs, regardless of the controller's output, to prevent indirect damage from excess temperatures.

Solar systems - tips for idle systems (stagnation):

Generally, stagnation is not problematic and cannot be ruled out if there is a power outage, for instance. In the summertime, the controller's storage limit may switch off the system repeatedly. Every system must thus be intrinsically safe. If the expansion container is properly designed, this is ensured. Tests have shown that the heat transfer medium (anti-freeze) is under less stress during stagnation than when it is just below the steam phase.

Data sheets of collector manufacturers list idle temperatures above 200°C. However, these temperatures generally only occur during operation with dry steam, i.e. if the heat exchange medium has completely turned to steam in the collector, or if the collector has been completely emptied due to steam. The damp steam then dries quickly and is no longer able to conduct heat. Hence, it can be assumed that these high temperature cannot occur at the measuring point of the collector sensor (when installed in the collector tube as usual), as the remaining thermal line would cool down the temperature via the metal connections between the absorber and the sensor.

„Step by Step“ Setup guide

The following guide might give you instructions on setting up the device, but it is of utmost importance to read the entirety of the instruction manual – especially the chapters „Programs“ and „Operation“.

	Level	
1		Choose a hydraulic diagram based on the sketches of system diagrams. Mind the arrow diagram, as well as the the program extensions „+1“, „+2“ and such, as far as they are specified in the diagram.
2		Choose a program based on its number. It may be feasible to use one or more program extension such as „+1“ or „+2“ to optimize your system’s regulation.
3		Connect the sensors to the inputs, as well as pumps, valves etc. to the outputs according to the chosen program. If used, connect the data link (DL-Bus), the CAN-Bus and the control outputs.
4	Expert	Access the Expert level using the access code 64 and input your chosen program’s number under „Program settings“.
5	Technician	Setting up the priority allocation in the sub-menu Technician/Parameters/Priority ranking .
6	Technician	Enter the necessary setting values max, min, diff according to the list of „ necessary settings “ below your chosen program’s diagram.
7	Technician	Enter the time, date and summer time properties.
8	Technician	If required, specify time programs under Time program .
9	Technician	Menu Manual Operation : the choices „Manual/ON“ and „Manual/OFF“ offer the possibility to set outputs to be turned permanently on or off in order to check their connection. It’s crucial to set the outputs back to „Auto“ after you’re done checking their functionality. If the chosen program uses control outputs or if they’ve been set up manually, they can be set up to „Manual/ON“ (= 10V or 100% PWM) or „Manual/OFF“ (= 0V or 0% PWM). Alternatively, you can choose a specific voltage or PWM-percentage to be output. Don’t forget to set the outputs back to <i>Auto</i> after checking their functionality.
10	Expert	Outputs can be crossed out, if so desired. Find the option under Crossout .
11	Expert	If you’re not using the standard type PT1000 temperature sensors, you must change your inputs’ type of sensor in the Sensor menu .
12	Expert	If so desired, activate additional functions like <i>starting function, cooling function, heat meter</i> etc.
13		Check the displayed sensor measurements on whether or not they’re plausible. Disconnected or incorrectly parameterized sensors display a value of 9999,9°C.

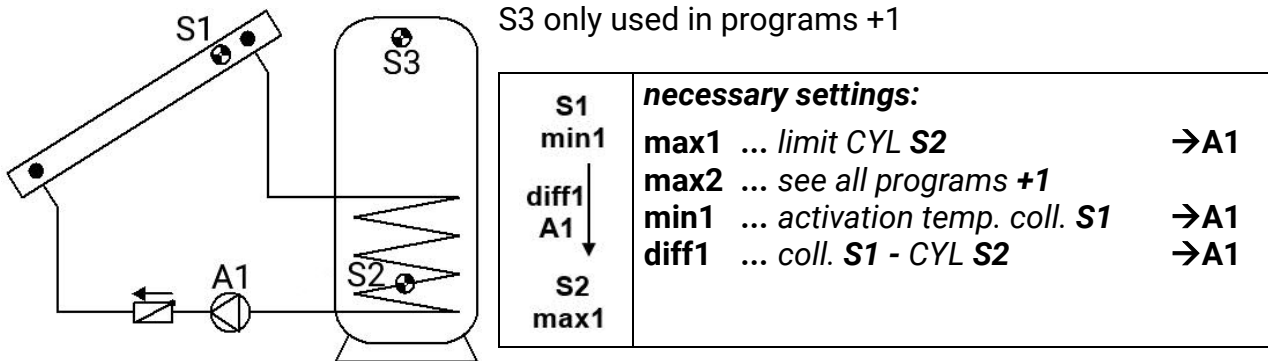
Hydraulic diagrams

The hydraulic diagrams displayed in this booklet are practical sketches. They serve to ease the choice of the correct program, but don't replace or even describe the planning of your system's construction. As such, we can't guarantee your system's functionality if you imitate this booklet's hydraulic diagrams with your construction.

- The following functions can be activated in addition to **all** programs:
Pump run-on time, 0-10V or PWM outputs (if not already in use by the program), System function check, Heat meter, Pasteurisation (excl. building drying), Blocking protection (excl. building drying).
- The following functions only make sense when a solar panel is used in your system.
Excess temperature limiter, Frost protection, Start function, Solar priority, Cooling function, Drainback function (only for drainback systems)
- The outputs **A2, A3** and/or **A5** can be logically connected (And/Or) to other outputs if they're not used by your chosen program. Find the corresponding settings under **Expert level/Program settings/Assign unused outputs**. Alternatively, you can simply control them with manual settings.
- A hold circuit (= burner request using one sensor, deactivation using another) predominantly reacts to the deactivation sensor. This that, if through disadvantageous sensor placement or choice of parameters, the conditions for both request and deactivation are met, the deactivation holds higher priority.

Differential control – Programs

Program 0 – Simple solar system (factory settings)



Program 0: Pump **A1** runs if:

- **S1** is greater than threshold **min1** and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded threshold **max1**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

All Programs +1:

In addition, if **S3** exceeds the threshold **max2**, pump **A1** is deactivated.

All Programs +4: Simple drain-back solar system with valve

This program may only be selected if the drain-back function (*Expert level/Drain-back*) is activated.

The basic settings are the same as with program 0:

S1 min1	necessary settings: max1 ... limit CYL S2 max2 ... see programs 1 or 5 min1 ... see program 0 diff1 ... coll S1 - CYL S2
diff1 A1 ↓	
S2 max1	

A valve on output 3 prevents the heat transfer medium from flowing out of the solar panel during the day.

Once the filling time has elapsed, the valve connected to **A3** is switched **on**.

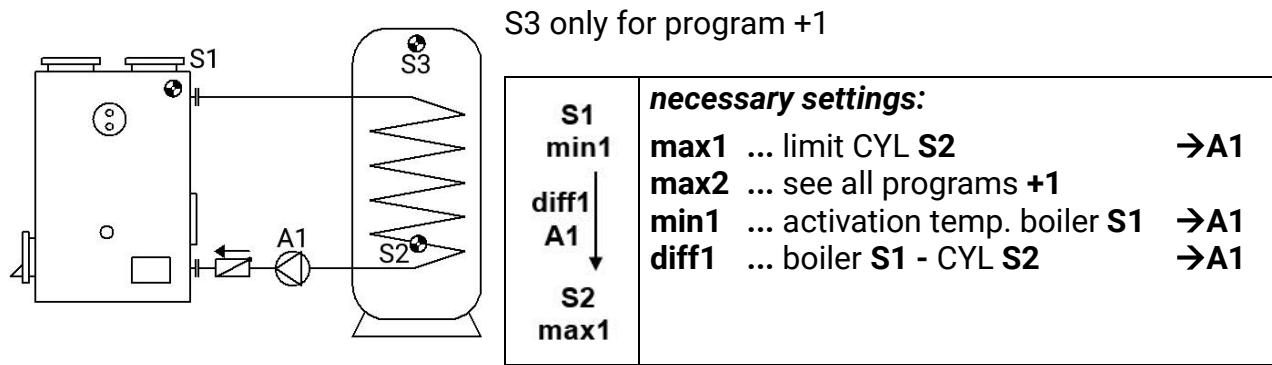
If the pump **A1** is switched off due to the **temperature difference**, the valve **A3** will remain switched on for another 2 hours.

If the excess temp. limiter or frost protection are activated, the sun radiation value goes below 50W/m² (only if a radiation sensor is used) or if the low water level protection detects a low volume flow after the filling time, the valve is closed **immediately**.

All Programs +1:

In addition, if **S3** exceeds the threshold **max2**, pump **A1** is deactivated.

Program 16 – Cylinder charge from a boiler



Program 16: The pump **A1** runs, if:

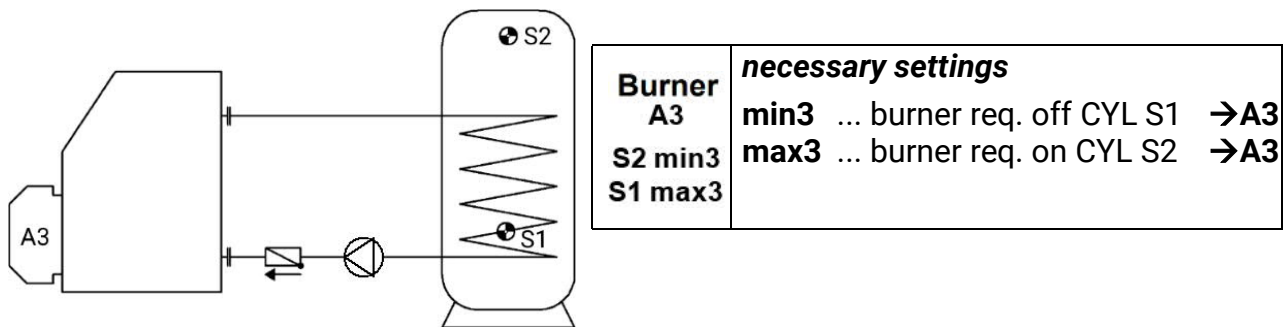
- **S1** is greater than threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded threshold **max1**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

All Programs +1:

Additionally, if **S3** exceeds the threshold **max2**, pump **A1** is deactivated.

Program 32 – Burner request via cylinder sensors



Program 32:

Output **A3** switches on, if **S2** falls below the threshold **min3**.

Output **A3** switches off (dominantly), if **S1** exceeds the threshold **max3**.

$$A3 \text{ (on)} = S2 < min3 \qquad A3 \text{ (off)} = S1 > max3$$

All Programs +1:

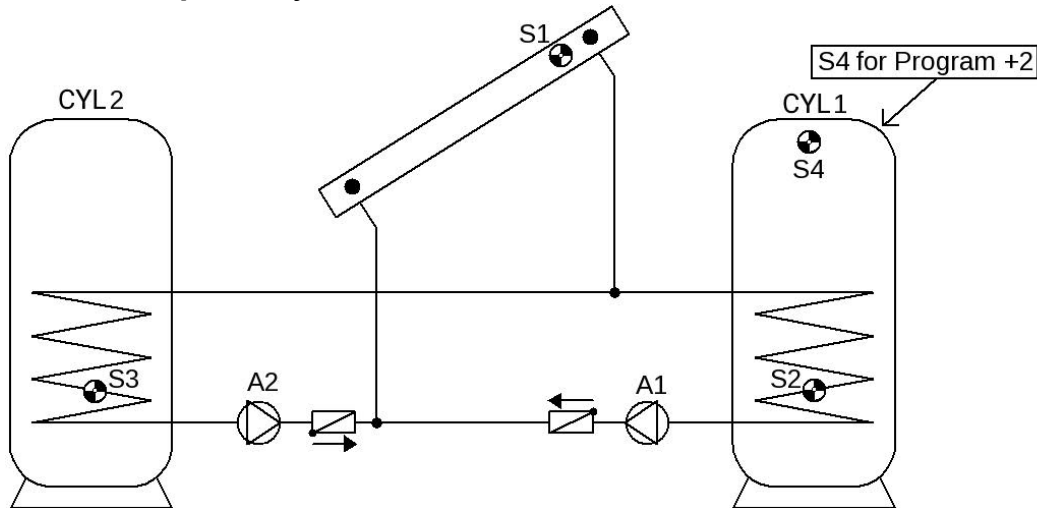
The burner request (**A3**) is made only via **S2**.

Output **A3** switches on, if **S2** falls below the threshold **min3**.

Output **A3** switches off (dominantly), if **S2** exceeds the threshold **max3**.

$$A3 \text{ (on)} = S2 < min3 \qquad A3 \text{ (off)} = S2 > max3$$

Program 48 – Solar power system with 2 consumers



<pre> S1 min1 / \ diff1 / \ diff2 A1 / \ A2 / \ S2 S3 max1 max2 </pre>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 →A1</p> <p>max2 ... limit CYL2 S3 →A2</p> <p>max3 ... see all programs +2</p> <p>min1 ... activation temp. coll. S1 →A1, A2</p> <p>min2 ... see all programs +4</p> <p>diff1 ... coll. S1 - CYL1 S2 →A1</p> <p>diff2 ... coll. S1 - CYL2 S3 →A2</p> <p>Excess temperature limiter: ... activate for S1 and A1+A2</p>
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Program 48: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max2**.

Pump **A2** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S1 > (S3 + diff2) \ \& \ S1 > min1 \ \& \ S3 < max2$$

All programs +1:

Instead of two pumps, one pump and a three-way valve are used.

Without priority allocation, cylinder 2 is filled by default.

A1 ... common pump

A2 ... Valve (A2/NO receives voltage when filling CYL2)

All programs +2:

Additionally, if **S4** exceeds the threshold **max3**, pump **A1** is switched off.

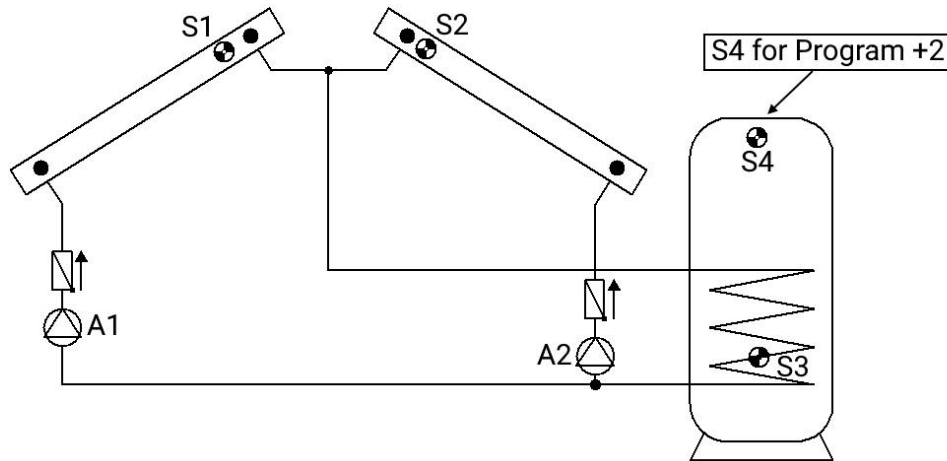
All programs +4:

Both solar circuits have separate activation thresholds measured via **S1**.

Output **A1** retains **min1**, and **A2** activates via **min2**.

The **Priority ranking** between **CYL1** and **CYL2** can be set in the menu **Settings/Technician level/Parameters/Priority ranking**. Additionally, a solar priority function can be set up in the menu **Settings/Expert level/Solar priority** (see „Solar Priority“ for more details).

Program 64 – Solar power system with 2 solar panels



<p>S1 min1</p> <p>S2 min2</p> <p>diff1 A1</p> <p>diff1 A2</p> <p>S3 max1</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S3 →A1, A2</p> <p>max2 ... see all programs +2</p> <p>min1 ... activation temp. coll. 1 S1 →A1</p> <p>min2 ... activation temp. coll. 2 S2 →A2</p> <p>diff1 ... coll.1 S1 - CYL S3 →A1</p> <p>... coll.2 S2 - CYL S3 →A2</p> <p>diff3 ... see all programs +1</p> <p>Excess temperature limiter 2: ...activate for S2 and A2</p>
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Program 64: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

$$A1 = S1 > (S3 + diff1) \& S1 > min1 \& S3 < max1$$

$$A2 = S2 > (S3 + diff1) \& S2 > min2 \& S3 < max1$$

All programs +1:

If the difference between the solar panel sensors **S1** and **S2** exceeds the difference **diff3**, the circuit with the colder solar panel is deactivated. This should, in most cases, prevent heat from being lost on the colder solar panel as a result of temperatures mixing.

All programs +2:

Additionally, if **S4** exceeds the threshold **max2**, pumps **A1** and **A2** are deactivated.

All programs +4:

Instead of two pumps, one pump **A1** and a three-way valve **A2** are used. If both solar circuits are activated, circuit 2 is prioritized.

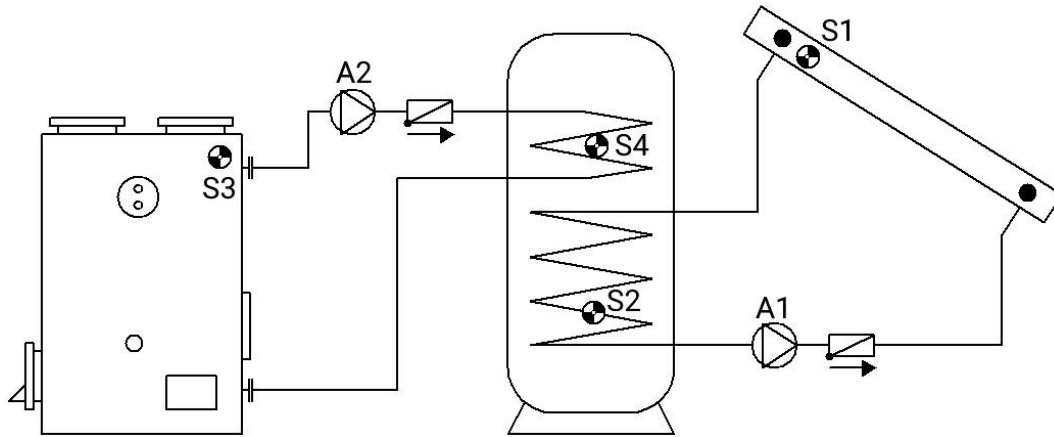
WARNING: This program is not intended for systems with two solar panels fields, since the usage of a three-way valve always leaves one solar panel field idle.

Note: The additional application of the priority circuit „All programs +1“ is recommended.

A1 ... common pump

A2 ... valve

Program 80 – Simple solar system and cylinder charge from a boiler



<p>S1 min1</p> <p>↓ diff1 A1</p> <p>S2 max1</p>	<p>S3 min2</p> <p>↓ diff2 A2</p> <p>S4 max2</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S2 →A1</p> <p>max2 ... limit CYL S4 →A2</p> <p>max3 ... see all programs +4</p> <p>min1 ... activation temp. coll. S1 →A1</p> <p>min2 ... activation temp. boiler S3 →A2</p> <p>diff1 ... coll. S1 - CYL S2 →A1</p> <p>diff2 ... boiler S3 - CYL S4 →A2</p>
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Program 80: Pump A1 runs, if:

- S1 exceeds the threshold **min1** • and S1 is greater than S2 by the difference **diff1**
- and S2 has not exceeded the threshold **max1**.

Charging pump A2 runs, if:

- S3 exceeds the threshold **min2** • and S3 is greater than S4 by the difference **diff2**
- and S4 has not exceeded the threshold **max2**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S3 > (S4 + diff2) \ \& \ S3 > min2 \ \& \ S4 < max2$$

All programs +1:

<p>S1 min1</p> <p>↓ diff1 A1</p> <p>S2 max1 max2</p>	<p>S3 min2</p> <p>↓ diff2 A2</p>	<p>necessary settings</p> <p>max1 ... limit CYL S2 →A1</p> <p>max2 ... limit CYL S2 →A2</p> <p>max3 ... see all programs +4</p> <p>min1 ... activation temp. coll. S1 →A1</p> <p>min2 ... activation temp. boiler S3 →A2</p> <p>diff1 ... coll. S1 - CYL S2 →A1</p> <p>diff2 ... boiler S3 - CYL S2 →A2</p>
--	---	---

Pump A1 runs, if:

- S1 exceeds threshold **min1** • and S1 is greater than S2 by the difference **diff1**
- and S2 has not exceeded the threshold **max1**.

The charging pump **A2** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S2** by the difference **diff2**
- and **S2** has not exceeded the threshold **max2**.

$$A1 = S1 > (S2 + diff1) \& S1 > min1 \& S2 < max1$$

$$A2 = S3 > (S2 + diff2) \& S3 > min2 \& S2 < max2$$

All programs +2:

If sensor **S2** has reached the threshold **max1** (or if **S4** has reached the threshold **max3** in conjunction with All Programs +4), pump **A2** is activated and pump **A1** keeps running. This provides a cooling function with the boiler without causing idle temperatures in the solar panel.

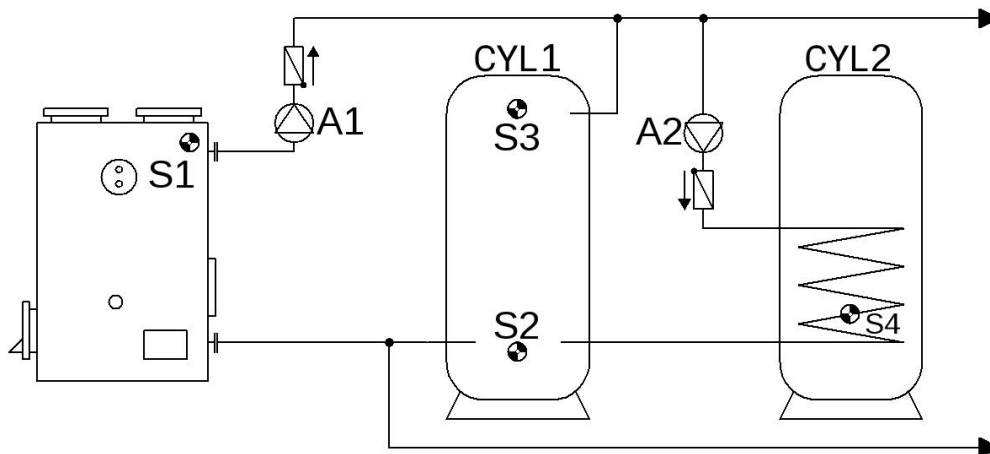
All programs +4:

Additionally, if **S4** exceeds the threshold **max3**, pump **A1** is switched off.

All programs +8:

If the re-cooling function (all programs +2) is activated, **A3** runs concurrently.

Program 96 – Buffer and hot water cylinder charging via solid fuel boiler



S1	S3	necessary settings	
min1	min2		max1 ... limit CYL1 S2 →A1
↓ diff1	↓ diff2		max2 ... limit CYL2 S4 →A2
A1	A2		max3 ... see all programs +2
↓	↓		min1 ... activation temp. boiler S1 →A1
S2	S4		min2 ... activation temp. CYL1 S3 →A2
max1	max2		min3 ... see all programs +2
			diff1 ... boiler S1 - CYL1 S2 →A1
			diff2 ... CYL1 S3 - CYL2 S4 →A2
			diff3 ... see all programs +1, +2

Program 96: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S4** by the difference **diff2** S4
- and **S4** has not exceeded **max2**.

$$A1 = S1 > (S2 + diff1) \& S1 > min1 \& S2 < max1$$

$$A2 = S3 > (S4 + diff2) \& S3 > min2 \& S4 < max2$$

All programs +1:

Additionally, the charging pump **A2** is also regulated via the heater boiler temperature **S1**.

Pump **A2** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S4** by the difference **diff3**
- and **S4** has not exceeded **max2**
- or **S3** is greater than threshold **min2** • and **S3** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded **max2**.

$$A2 = (S1 > (S4 + diff3) \& S1 > min1 \& S4 < max2) \\ \text{or} \\ (S3 > (S4 + diff2) \& S3 > min2 \& S4 < max2)$$

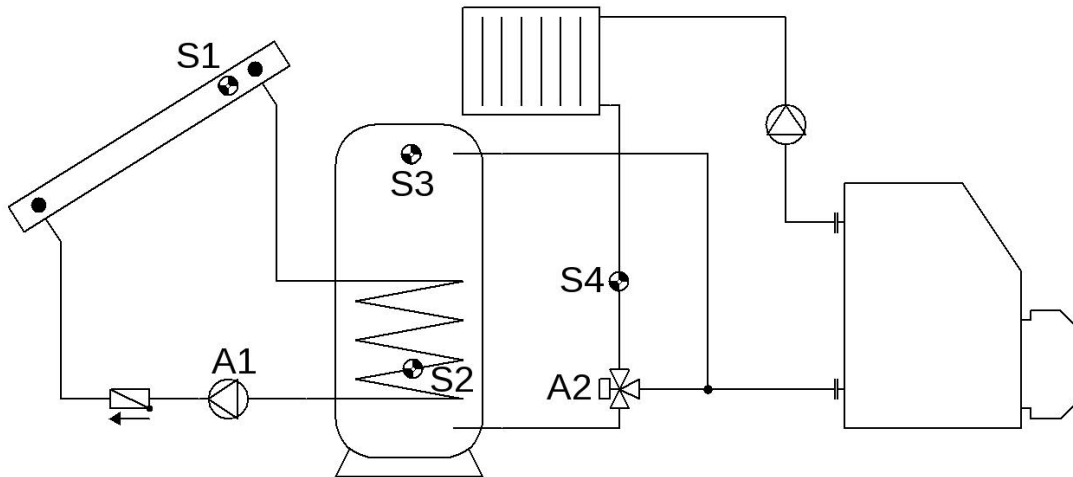
All programs +2: Pump **A3** runs, if:

- **S5** exceeds the threshold **min3** • and **S5** is greater than **S6** by the difference **diff3**
- and **S6** has not exceeded the threshold **max3**.

$$A3 = S5 > (S6 + diff3) \& S5 > min3 \& S6 < max3$$

Program 112 – 2 independent differential circuits

Example: solar system with return rise



<p>S1 min1</p> <p>↓ diff1 A1</p> <p>S2 max1</p>	<p>S3 min2</p> <p>↓ diff2 A2</p> <p>S4 max2</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S2 → A1</p> <p>max2 ... limit return flow S4 → A2</p> <p>min1 ... activation temp. coll. S1 → A1</p> <p>min2 ... activation temp. CYL top S3 → A2</p> <p>diff1 ... coll. S1 - CYL S2 → A1</p> <p>diff2 ... CYL S3 - return flow S4 → A2</p>
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Program 112: Pump **A1** runs, if:

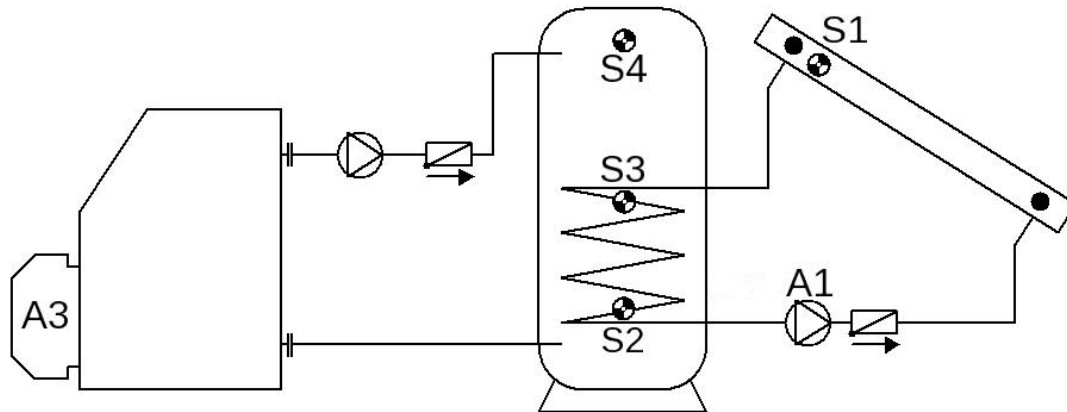
- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The output **A2** is activated, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

$$A1 = S1 > (S2 + diff1) \& S1 > min1 \& S2 < max1 \\ A2 = S3 > (S4 + diff2) \& S3 > min2 \& S4 < max2$$

Program 128 – Burner request and solar system (or charging pump)



<p>S1 min1</p> <p>diff1 A1 ↓</p> <p>S2 max1</p>	<p>Burner A3</p> <p>S4 min3 S3 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S2 → A1</p> <p>max3 ... burner req. off CYL S3 → A3</p> <p>min1 ... activation temp. coll. S1 → A1</p> <p>min2 ... see all programs +2</p> <p>min3 ... burner req. on CYL S4 → A3</p> <p>diff1 ... coll. S1 - CYL S2 → A1</p> <p>diff2 ... see all programs +2</p>
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Program 128: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

Output **A3** is activated, if **S4** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S3** exceeds the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A3 \ (on) = S4 < min3 \quad A3 \ (off) = S3 > max3$$

All programs +1: The burner request (**A3**) is regulated only via **S4**.

Output **A3** switches on, if **S4** falls below the threshold **min3**.

Output **A3** switches off (dominantly), if **S4** exceeds the threshold **max3**.

$$A3 \ (on) = S4 < min3 \quad A3 \ (off) = S4 > max3$$

All programs +2:

Additionally, pump **A1** switches between sensors **S4** and **S2**, if the difference **diff2** is reached (for applications such as a boiler-buffer-cylinder system).

Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
 - and **S2** has not exceeded the threshold **max1**,
- or
- **S4** has exceeded the threshold **min2** • and **S4** is greater than **S2** by the difference **diff2**
 - and **S2** has not exceeded the threshold **max1**.

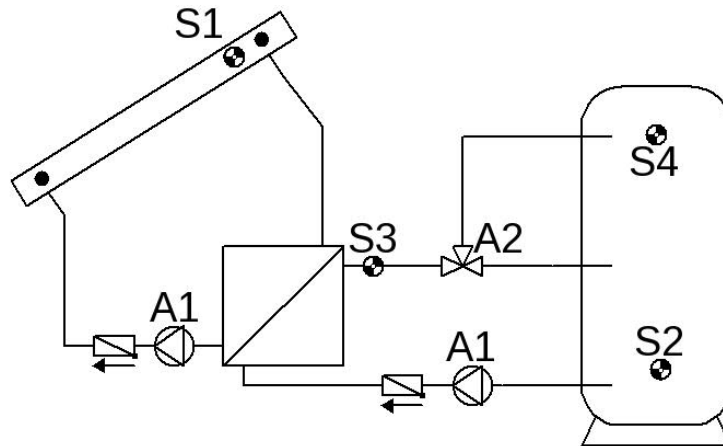
$$A1 = (S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1)$$

or

$$(S4 > (S2 + diff2) \ \& \ S4 > min2 \ \& \ S2 < max1)$$

Program 144 – Solar system with layered cylinder charging

Layered systems are only practical if the speed control is activated
(Absolute value control system: Mode „Normal“ and sensor input S1)



S1 min1 ↓ diff1 A1 ↓ S2 max1	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 50%;">S3</td> <td style="text-align: center; width: 50%;">S3</td> </tr> <tr> <td style="text-align: center;"><min2</td> <td style="text-align: center;">>min2</td> </tr> <tr> <td style="text-align: center;">↓</td> <td style="text-align: center;">↓</td> </tr> <tr> <td style="text-align: center;">diff2</td> <td style="text-align: center;">diff2</td> </tr> <tr> <td style="text-align: center;">A2</td> <td style="text-align: center;">A2</td> </tr> <tr> <td style="text-align: center;">↓</td> <td style="text-align: center;">↓</td> </tr> <tr> <td style="text-align: center;">S4</td> <td style="text-align: center;">S4</td> </tr> <tr> <td style="text-align: center;">max2</td> <td style="text-align: center;">max2</td> </tr> </table>	S3	S3	<min2	>min2	↓	↓	diff2	diff2	A2	A2	↓	↓	S4	S4	max2	max2	necessary settings max1 ... limit CYL S2 → A1 max2 ... limit CYL S4 → A2 min1 ... activation temp. coll. S1 → A1 min2 ... activation temp. HE S3 → A2 diff1 ... coll. S1 - CYL S2 → A1 diff2 ... HE S3 - CYL S4 → A2
S3	S3																	
<min2	>min2																	
↓	↓																	
diff2	diff2																	
A2	A2																	
↓	↓																	
S4	S4																	
max2	max2																	

Program 144: The solar pumps **A1** run, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The three-way valve **A2** switches **upwards** if:

- **S3** exceeds the threshold **min2** • or, if **S3** falls below **min2**, **S3** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

$$A1 = S1 > (S2 + diff1) \& S1 > min1 \& S2 < max1$$

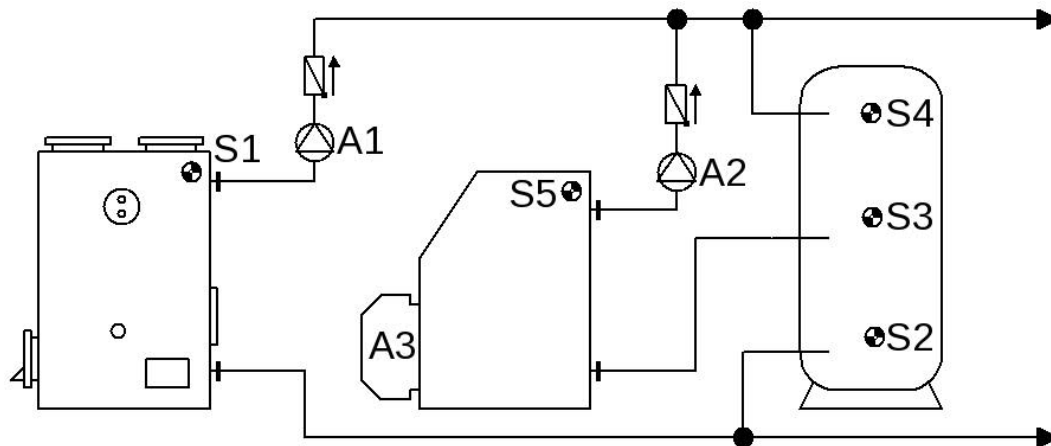
$$A2 = (S3 > min2 \text{ or } S3 > (S4 + diff2)) \& S4 < max2$$

Program 145:

If **S4** has reached the threshold **max2**, the rapid warm-up phase is completed and the speed control is blocked, which achieves optimal efficiency.

If Control Output A4 is activated, the analogue level for maximum speed will be output. Control Output A5 is not affected and continues regulating.

Program 160 – Insertion of two boilers into a heating system



<p>S1 min1</p> <p>diff1 A1</p> <p>↓</p> <p>S2 max1</p>	<p>S5 min2</p> <p>diff2 A2</p> <p>↓</p> <p>S3 max2</p>	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>Burner A3</p> <p>S4 min3 S3 max3</p> </div>	<p>necessary settings</p> <p>max1 ... limit CYL S2 → A1</p> <p>max2 ... limit CYL S3 → A2</p> <p>max3 ... burner req. off CYL S3 → A3</p> <p>min1 ... activation temp. boiler S1 → A1</p> <p>min2 ... activation temp. boiler S5 → A2</p> <p>min3 ... burner req. on CYL S4 → A3</p> <p>diff1 ... boiler S1 - CYL S2 → A1</p> <p>diff2 ... boiler S5 - CYL S3 → A2</p>
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Program 160: The charging pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded **max1**.

The charging pump **A2** runs, if:

- **S5** exceeds the threshold **min2** • and **S5** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

Output **A3** is activated, if **S4** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S3** exceeds the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S5 > (S3 + diff2) \ \& \ S5 > min2 \ \& \ S3 < max2$$

$$A3 \ (on) = S4 < min3 \quad A3 \ (off) = S3 > max3$$

All programs +1: The burner request (**A3**) is regulated using only **S4**.

$$A3 \ (on) = S4 < min3$$

$$A3 \ (off) = S4 > max3 \ (dominant)$$

All programs +2: **A3** activation is only permitted, if **A1** is deactivated.

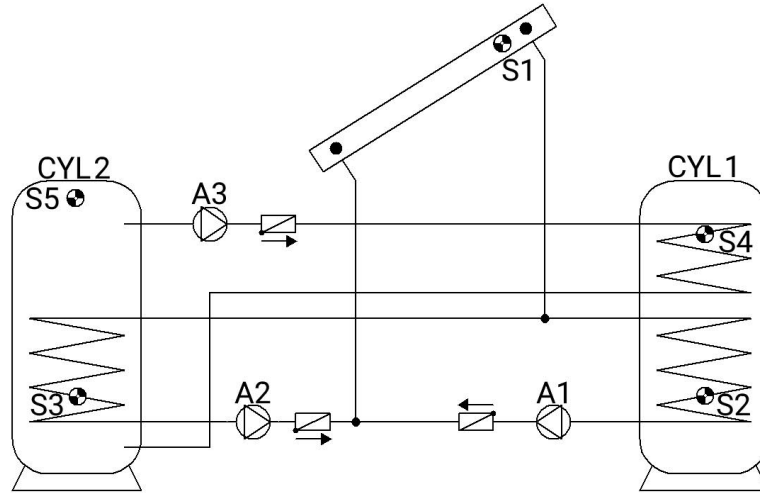
All programs +4 (only practical in conjunction with „all programs +1“): Pump **A2** runs, if:

- **S5** exceeds the threshold **min2** • and **S5** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

$$A2 = S5 > (S4 + diff2) \ \& \ S5 > min2 \ \& \ S4 < max2$$

All programs +8 (additional sensor **S6**): If **S6** exceeds the threshold **max1** (no longer on **S2**), **A3** (burner request) is deactivated. The sensor **S6** is to be fitted to the flue tube or can be replaced with flue-gas thermostat.

Program 176 – Solar system with 2 consumers and charging pump functionality



<p>S1 min1</p> <p>diff1 A1</p> <p>S2 max1</p> <p>diff2 A2</p> <p>S3 max2</p>	<p>S5 min2</p> <p>diff3 A3</p> <p>S4 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL2 S3 → A2</p> <p>max3 ... limit CYL1 S4 → A3</p> <p>min1 ... activation temp. coll. S1 → A1, A2</p> <p>min2 ... activation temp. CYL2 S5 → A3</p> <p>min3 ... see all programs +4</p> <p>diff1 ... coll. S1 - CYL1 S2 → A1</p> <p>diff2 ... coll. S1 - CYL2 S3 → A2</p> <p>diff3 ... SP2 S5 - CYL1 S4 → A3</p> <p>Excess temperature limiter: ... activate for S1 and A1+A2</p>
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Program 176: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

- **S5** exceeds the threshold **min2** • and **S5** is greater than **S4** by the difference **diff3**
- and **S4** has not exceeded the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \& S1 > min1 \& S2 < max1$$

$$A2 = S1 > (S3 + diff2) \& S1 > min1 \& S3 < max2$$

$$A3 = S5 > (S4 + diff3) \& S5 > min2 \& S4 < max3$$

All programs +1: Instead of the two pumps **A1** and **A2**, one pump **A1** and a three-way valve **A2** are used.

Without priority allocation, cylinder 2 is filled by default.

A1 ... mutual pump **A2** ... valve (A2/NO receives voltage when filling CYL2)

All programs +2: If both cylinders have reached their maximum temperatures due to the solar system, pump **A3** is activated (re-cooling function).

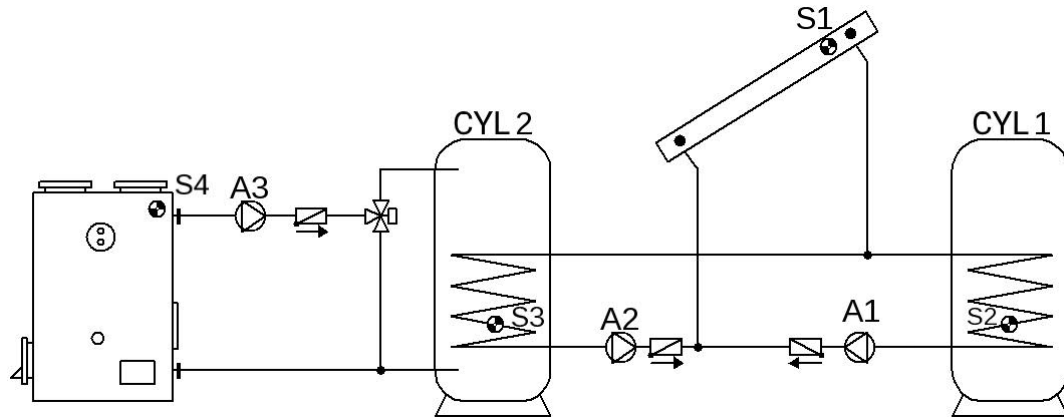
All programs +4: Both solar circuits have separate activation thresholds at **S1**:

Output **A1** retains **min1**, and **A2** is regulated via **min3**.

All programs +8: The limitation of cylinder CYL1 is regulated via the independent sensor **S6** and the threshold **max1** (no maximum threshold **S2!**).

The **Priority Ranking** between **CYL1** and **CYL2** is parameterized in the menu **Settings/Technician level/Parameters/Priority ranking**. Additionally, a solar priority function can be set up in the menu **Settings/Expert level/Solar priority** (more information in the chapter „Solar Priority“).

Program 192 – Solar system with 2 consumers and charging pump (heating boiler)



<p>S1 min1</p> <p>diff1 A1</p> <p>S2 max1</p> <p>diff2 A2</p> <p>S3 max2 max3</p> <p>diff3 A3</p> <p>S4 min2</p>	<p>necessary settings</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL2 S3 → A2</p> <p>max3 ... limit CYL2 S3 → A3</p> <p>min1 ... activation temp. coll. S1 → A1, A2</p> <p>min2 ... activation temp. boiler S4 → A3</p> <p>min3 ... see all programs +4</p> <p>diff1 ... coll. S1 – CYL1 S2 → A1</p> <p>diff2 ... coll. S1 – CYL2 S3 → A2</p> <p>diff3 ... boiler S4 – CYL2 S3 → A3</p> <p>Excess temperature limiter: ... activate for S1 and A1+A2</p>
---	--

Program 192: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

- **S4** exceeds the threshold **min2** • and **S4** is greater than **S3** by the difference **diff3**
- and **S3** has not exceeded the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \& S1 > min1 \& S2 < max1$$

$$A2 = S1 > (S3 + diff2) \& S1 > min1 \& S3 < max2$$

$$A3 = S4 > (S3 + diff3) \& S4 > min2 \& S3 < max3$$

All programs +1: Instead of the two pumps **A1** and **A2**, on pump **A1** and a three-way valve **A2** are used. Without priority allocation, cylinder 2 is charged by default.

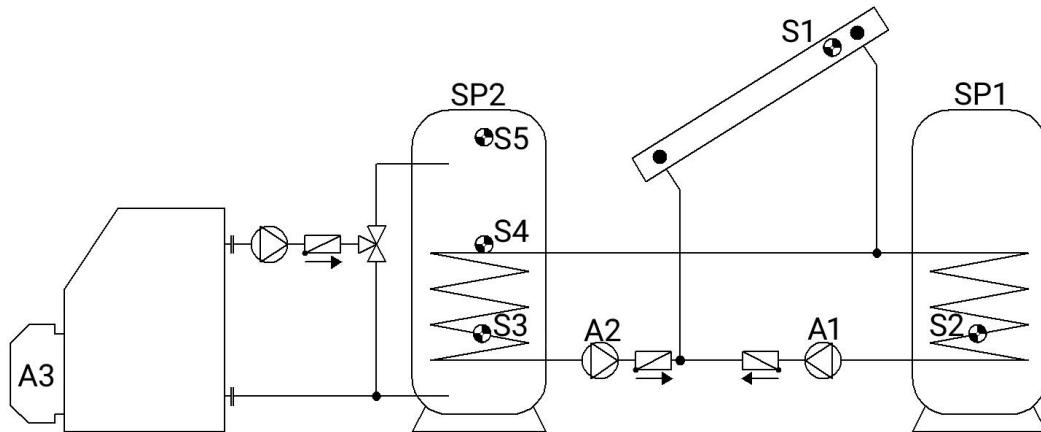
A1 ... mutual pump **A2**... Valve (A2/NO receives voltage when charging CYL2)

All programs +2: If both cylinders have reached their maximum temperatures due to the solar system, pump **A3** is activated (re-cooling function).

All programs +4: Both solar circuits have separate activation thresholds at **S1**: Output **A1** retains *min1* and **A2** regulates via *min3*.

The **Priority Ranking** between **CYL1** and **CYL2** can be parameterized in the menu **Settings/Technician level/Parameters/Priority ranking**. Additionally, a solar priority function can be set up in the menu **Settings/Expert level/Solar priority** (further details in chapter „Solar Priority“).

Program 208 – Solar system with 2 consumers and burner request



<p>S1 min1</p> <p>diff1 A1</p> <p>S2 max1</p> <p>diff2 A2</p> <p>S3 max2</p>	<p>Burner A3</p> <p>S5 min3 S4 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL2 S3 → A2</p> <p>max3 ... burner req. off CYL2 S4 → A3</p> <p>min1 ... activation temp. coll. S1 → A1, A2</p> <p>min2 ... see all programs +4</p> <p>min3 ... burner req. on CYL2 S5 → A3</p> <p>diff1 ... coll. S1 - CYL1 S2 → A1</p> <p>diff2 ... coll. S1 - CYL2 S3 → A2</p> <p>Excess temperature limiter: ... activate for S1 and A1+A2</p>
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Program 208: Pump **A1** runs, if:

- **S1** exceeds the threshold *min1* • and **S1** is greater than **S2** by the difference *diff1*
- and **S2** has not exceeded the threshold *max1*.

Pump **A2** runs, if:

- **S1** exceeds the threshold *min1* • and **S1** is greater than **S3** by the difference *diff2*
- and **S3** has not exceeded the threshold *max2*.

Output **A3** is activated, if **S5** falls below the threshold *min3*.

Output **A3** is deactivated (dominant), if **S4** exceeds the threshold *max3*.

$$\begin{aligned}
 A1 &= S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1 \\
 A2 &= S1 > (S3 + diff2) \ \& \ S1 > min1 \ \& \ S3 < max2 \\
 A3 \ (on) &= S5 < min3 \qquad A3 \ (off) = S4 > max3
 \end{aligned}$$

All programs +1: Instead of the two pumps **A1** and **A2**, one pump **A1** and a three-way valve **A2** are used. Without priority allocation cylinder 2 is filled by default..

A1... mutual pump **A2** ... Valve (A2/NO receives voltage when charging CYL2)

All programs +2: The burner request (**A3**) is only regulated via sensor **S5**.

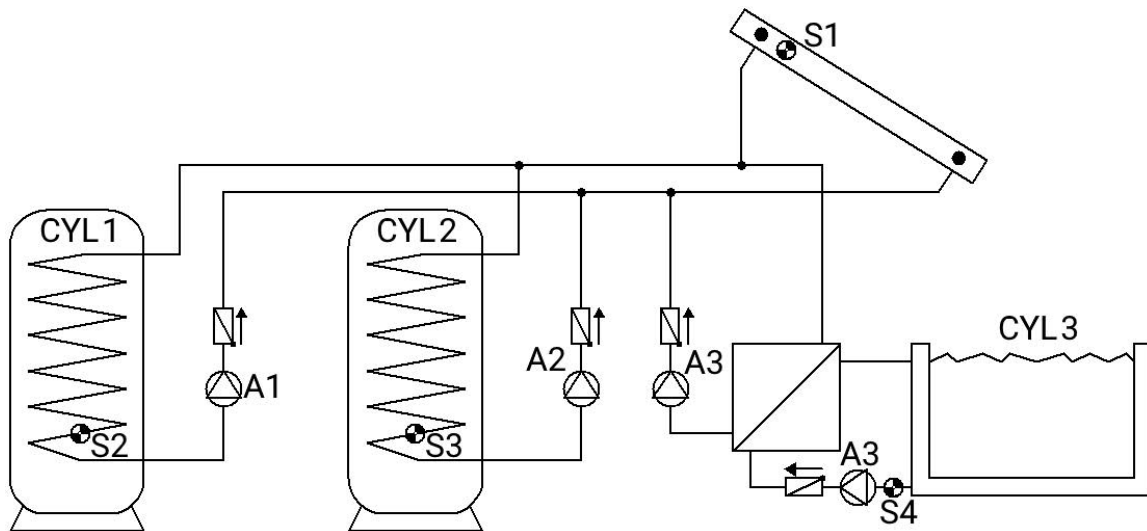
$$A3 \text{ (on)} = S5 < \text{min3} \quad A3 \text{ (off)} = S5 > \text{max3 (dominant)}$$

All programs +4: Both solar circuits have separate activation thresholds at **S1**:
Output **A1** retains **min1** and **A2** is regulated via **min2**.

All programs +8: If at least one of the two solar circuits is active, the burner request is blocked. If both solar circuits are inactive, the burner request is unblocked after a 5 minute delay.

The **Priority Ranking** between **CYL1** and **CYL2** can be parameterized in the menu **Settings/Technician level/Parameters/Priority ranking**. Additionally, a solar priority function can be set up in the menu **Settings/Expert level/Solar priority** (further details in chapter „Solar Priority“).

Program 224 – Solar system with 3 consumers



	<p>necessary setting</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL2 S3 → A2</p> <p>max3 ... limit CYL3 S4 → A3</p> <p>min1 ... activation temp. coll. S1 → A1, A2, A3</p> <p>min2 ... see all programs +8</p> <p>min3 ... see all programs +8</p> <p>diff1 ... coll. S1 - CYL1 S2 → A1</p> <p>diff2 ... coll. S1 - CYL2 S3 → A2</p> <p>diff3 ... coll. S1 - CYL3 S4 → A3</p> <p>Excess temperature limiter: ... activate for S1 and A1+A2+A3</p>
--	---

Program 224: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

Pump **A3** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S4** by the difference **diff3**
- and **S4** has not exceeded the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \& S1 > min1 \& S2 < max1$$

$$A2 = S1 > (S3 + diff2) \& S1 > min1 \& S3 < max2$$

$$A3 = S1 > (S4 + diff3) \& S1 > min1 \& S4 < max3$$

Program 225: Instead of the two pumps **A1** and **A2**, one pump **A1** and a three-way valve **A2** are used (pump-valve-system between CYL1 and CYL2).

A1... mutual pump

A2... Valve (A2/NO receives voltage when charging CYL2)

Program 226: Instead of the two pumps **A1** and **A3**, one pump **A1** and a three-way valve **A3** are used (pump-valve-system between CYL1 and CYL3).

A1... mutual pump

A3... Valve (A3/NO receives voltage when charging CYL3)

Program 227: All three cylinders are charged via one pump (**A1**) and two serially connected three-way valves (**A2**, **A3**). If both valves are without voltage, **CYL1** is being charged.

A1 ... mutual pump

A2 ... valve (A2/NO receives voltage when charging cylinder CYL2)

A3 ... valve (A3/NO receives voltage when charging cylinder CYL3)

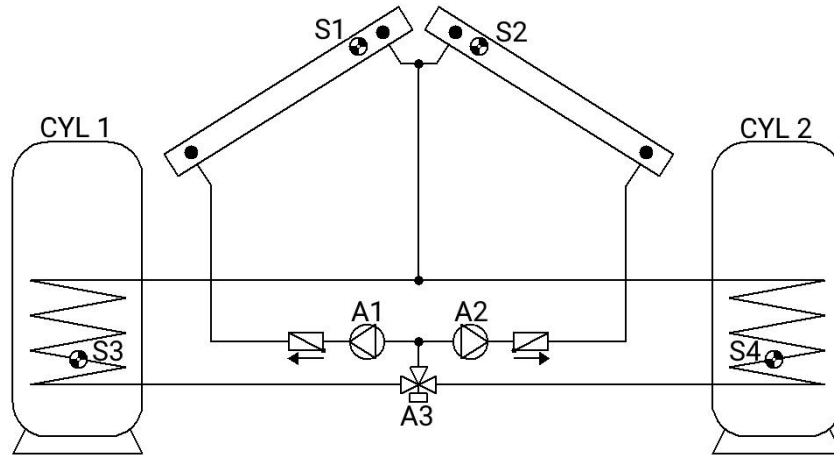
If **priority allocation** is active, as set up in the menu **Settings/Technician level/Parameters/ Priority ranking**, both valves **A2** and **A3** are never active simultaneously: When charging CYL2, only pump **A1** and valve **A2** are active; when charging CYL3, only pump **A1** and valve **A3** are active.

All programs +4: If all cylinders have reached their maximum temperatures, charging of CYL2 continues regardless of **max2**.

All programs +8: All solar circuits have separate activation thresholds at **S1**: Output **A1** retains **min1**, but **A2** switches at **min2** and **A3** at **min3**.

The **Priority Ranking** between **CYL1**, **CYL2** and **CYL3** can be parameterized in the menu **Settings/Technician level/Parameters/Priority ranking**. Additionally, a solar priority function can be set up in the menu **Settings/Expert level/Solar priority** (further details in chapter „Solar Priority“).

Program 240 – Solar system with 2 solar panels and 2 consumers



A1, A2 ... pumps

A3 ... switch-over valve (A3/S receives voltage when charging CYL2)

<p>S1 min1</p> <p>diff1 A1</p> <p>S3 max1</p>	<p>S2 min2</p> <p>diff2 A2, A3</p> <p>S4 max2</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S3 → A1, A2</p> <p>max2 ... limit CYL2 S4 → A1, A2, A3</p> <p>min1 ... activation temp. coll.1 S1 → A1</p> <p>min2 ... activation temp. coll. 2 S2 → A2</p> <p>diff1 ... coll. 1 S1 - CYL1 S3 → A1</p> <p>... coll. 2 S2 - CYL1 S3 → A2</p> <p>diff2 ... coll. 1 S1 - CYL2 S4 → A1, A3</p> <p>... coll. 2 S2 - CYL2 S4 → A2, A3</p> <p>diff3 ... see all programs +1</p> <p>Excess temperature limiter 2: ... activate for S2 and A2</p>
<p>diff1 A1</p> <p>diff1 A2</p>	<p>diff2 A2, A3</p> <p>diff2 A1, A3</p>	

Program 240: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff1**
 - and **S3** has not exceeded the threshold **max1**
- or, together with valve A3**
- **S1** exceeds the threshold **min1** • and **S1** is greater than **S4** by the difference **diff2**
 - and **S4** has not exceeded the threshold **max2**.

Pump **A2** runs, if:

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff1**
 - and **S3** has not exceeded the threshold **max1**
- or, together with valve A3**
- **S2** exceeds the threshold **min2** • and **S2** is greater than **S4** by the difference **diff2**
 - and **S4** has not exceeded the threshold **max2**.

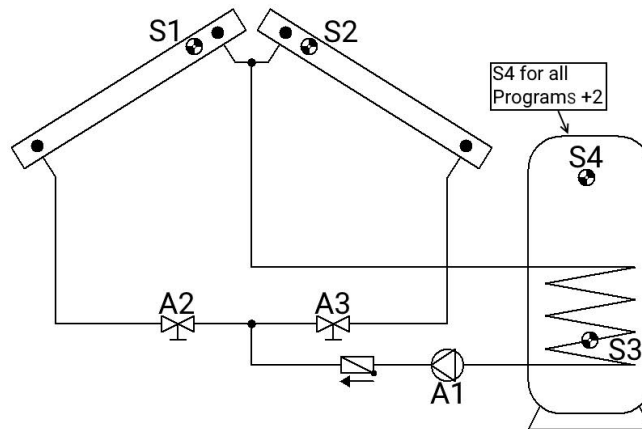
The valve **A3** switches dependent on the chosen (solar) priority. Without priority allocations, CYL2 will be charged by default.

$$\begin{aligned}
 & \text{or} \quad A1 = S1 > (S3 + diff) \ \& \ S1 > min1 \ \& \ S3 < max1 \ \& \ (A3 = off) \\
 & \quad \quad S1 > (S4 + diff2) \ \& \ S1 > min1 \ \& \ S4 < max2 \ \& \ (A3 = on) \\
 & \quad \quad A2 = S2 > (S3 + diff1) \ \& \ S2 > min2 \ \& \ S3 < max1 \ \& \ (A3 = off) \\
 & \text{or} \quad \quad S2 > (S4 + diff2) \ \& \ S2 > min2 \ \& \ S4 < max2 \ \& \ (A3 = on) \\
 & \quad \quad A3 = dependent \ on \ chosen \ priority
 \end{aligned}$$

All programs +1: If the difference between the solar panel sensors **S1** and **S2** exceeds the difference **diff3**, the colder panel's circuit will be deactivated. This prevents heat from being lost on the colder panel when temperatures are mixed.

WARNING: In this program, the priority settings do not refer to the pumps, but rather their respective cylinders. The **Priority Ranking** between **CYL1** and **CYL2** can be parameterized in the menu **Settings/Technician level/Parameters/Priority ranking**. Additionally, a solar priority function can be set up in the menu **Settings/Expert level/Solar priority** (further details in chapter „Solar Priority“).

Program 256 – Solar power system with two solar panels (1 pump, 2 stop valves)



<p>S1 min1</p> <p>S2 min2</p> <p>diff1 A1, A2</p> <p>diff2 A1, A3</p> <p>S3 max1</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S3 → A1, A2, A3</p> <p>max2 ... see all programs +2</p> <p>min1 ... activation temp. coll. 1 S1 → A1, A2</p> <p>min2 ... activation temp. coll. 2 S2 → A1, A3</p> <p>diff1 ... coll.1 S1 - CYL S3 → A1, A2</p> <p>diff2 ... coll.2 S2 - CYL S3 → A1, A3</p> <p>diff3 ... see all programs +1</p> <p>Excess temperature limiter 2: ... activate for S2 and A1</p>
---	--

Program 256: Pump **A1** runs, if:

- Valve **A2** is activated • or valve **A3** is activated.

Valve **A2** is activated, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

Valve **A3** is activated, if:

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max1**.

$$A1 = (A2 = on) \text{ or } (A3 = off)$$

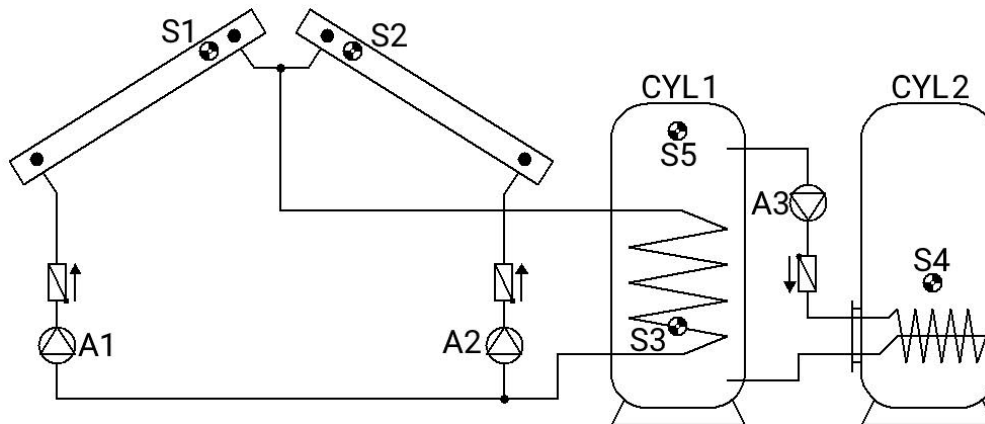
$$A2 = S1 > (S3 + diff1) \ \& \ S1 > min1 \ \& \ S3 < max1$$

$$A3 = S2 > (S3 + diff2) \ \& \ S2 > min2 \ \& \ S3 < max1$$

All programs +1: If the difference between the solar panel sensors **S1** and **S2** exceeds the difference **diff3**, the colder panel's circuit is deactivated. This prevents heat from being lost on the colder panel when temperatures are mixed.

All programs +2: Additionally, if **S4** exceeds the threshold **max2**, the outputs **A1**, **A2** and **A3** are deactivated.

Program 272 – Solar system with 2 collector panels and charging pump function



<p>S1 min1</p> <p>S2 min2</p> <p>diff1 A1</p> <p>diff1 A2</p> <p>S3 max1</p>	<p>S5 min3</p> <p>diff2 A3</p> <p>S4 max2</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S3 → A1, A2</p> <p>max2 ... limit CYL2 S4 → A3</p> <p>min1 ... activation temp. coll. 1 S1 → A1</p> <p>min2 ... activation temp. coll. 2 S2 → A2</p> <p>min3 ... activation temp. CYL1 S5 → A3</p> <p>diff1 ... coll.1 S1 - CYL1 S3 → A1</p> <p>... coll.2 S2 - CYL1 S3 → A2</p> <p>diff2 ... CYL1 S5 - CYL2 S4 → A3</p> <p>diff3 ... see all programs +1</p> <p>Excess temperature limiter 2: ... activate for S2 and A2</p>
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Program 272: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

The charging pump **A3** runs, if:

- **S5** exceeds the threshold **min3** • and **S5** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

$$A1 = S1 > (S3 + diff1) \& S1 > min1 \& S3 < max1$$

$$A2 = S2 > (S3 + diff1) \& S2 > min2 \& S3 < max1$$

$$A3 = S5 > (S4 + diff2) \& S5 > min3 \& S4 < max2$$

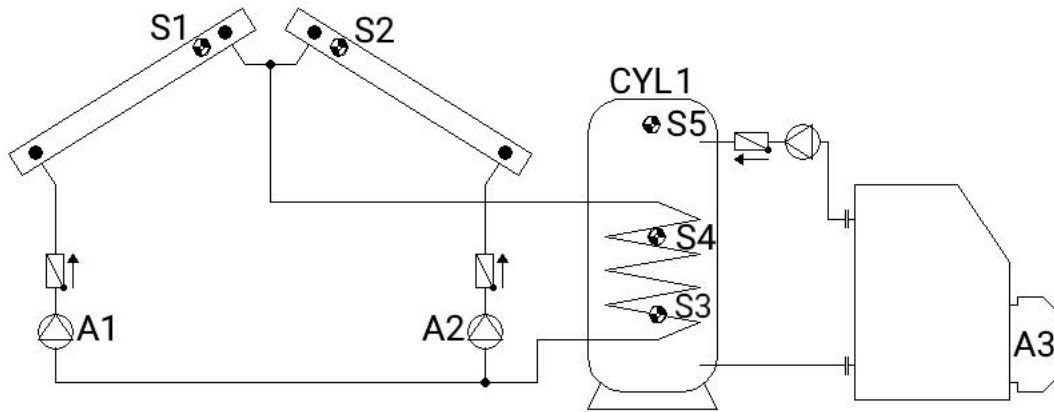
All programs +1: If the difference between the solar panel sensors **S1** and **S2** exceeds the difference **diff3** the colder panel's circuit is deactivated. This prevents heat from being lost on the colder panel when temperatures are mixed.

All programs +2: Instead of the two pumps **A1** and **A2**, one pump **A1** and a three-way valve **A2** are used. Without priority allocation, collector 2 will be preferred.

WARNING: This program is not intended for systems with two solar panels fields, since the usage of a three-way valve always leaves one solar panel field idle.

Note: The additional application of the priority circuit „All programs +1“ is recommended.

Program 288 – Solar system with 2 collector panels and burner request



	Burner A3 S5 min3 S4 max3	necessary settings: max1 ... limit CYL S3 → A1, A2 max3 ... burner req. off CYL S4 → A3 min1 ... activation temp. coll.1 S1 → A1 min2 ... activation temp. coll.2 S2 → A2 min3 ... burner req. on CYL S5 → A3 diff1 ... coll. 1 S1 - CYL S3 → A1 ... coll. 2 S2 - CYL S3 → A2 diff3 ... see all programs +1 Excess temperature limiter 2: ... activate for S2 and A2
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Program 288: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

Output **A3** is activated, if **S5** falls below threshold **min3**.

Output **A3** is deactivated (dominant), if **S4** exceeds the threshold **max3**.

$$A1 = S1 > (S3 + diff1) \ \& \ S1 > min1 \ \& \ S3 < max1$$

$$A2 = S2 > (S3 + diff1) \ \& \ S2 > min2 \ \& \ S3 < max1$$

$$A3 \ (on) = S5 < min3 \qquad A3 \ (off) = S4 > max3$$

All programs +1: If the difference between the two solar panel sensors **S1** and **S2** exceeds the difference **diff3**, the colder panel's circuit is deactivated. This prevents heat from being lost on the colder panel when temperatures are mixed.

All programs +2: The burner request (**A3**) is regulated only via **S5**.

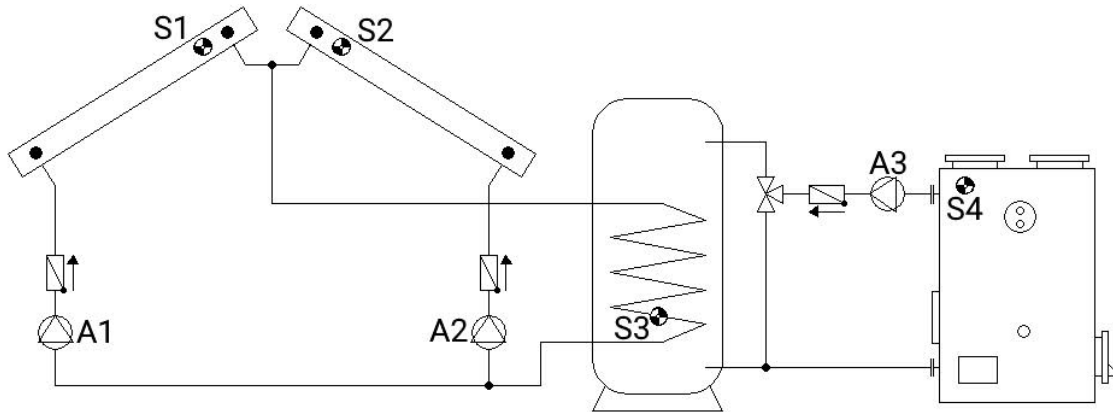
$$A3 \ (on) = S5 < min3 \qquad A3 \ (off) = S5 > max3 \ (dominant)$$

All programs +4: Instead of the pumps **A1** and **A2**, one pump **A1** and a three-way valve **A2** are used. Without priority allocation, solar panel 2 will be preferred.

WARNING: This program is not intended for systems with two solar panels fields, since the usage of a three-way valve always leaves one solar panel field idle.

Note: The additional application of the priority circuit „All programs +1“ is recommended.

Program 304 – Solar system with 2 collector panels + charging pump (boiler)



<p>S1 min1</p> <p>S2 min2</p> <p>S4 min3</p> <p>diff1 A1</p> <p>diff1 A2</p> <p>diff2 A3</p> <p>S3 max1 max2</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S3 → A1, A2</p> <p>max2 ... limit CYL S3 → A3</p> <p>min1 ... activation temp. coll.1 S1 → A1</p> <p>min2 ... activation temp. coll.2 S2 → A2</p> <p>min3 ... activation temp. boiler S4 → A3</p> <p>diff1 ... coll.1 S1 - CYL S3 → A1</p> <p>... coll.2 S2 - CYL S3 → A2</p> <p>diff2 ... boiler S4 - CYL S3 → A3</p> <p>diff3 ... see all programs +1</p> <p>Excess temperature limiter 2: ... activate for S2 and A2</p>
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Program 304: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

The charging pump **A3** runs, if:

- **S4** exceeds the threshold **min3** • and **S4** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

$$A1 = S1 > (S3 + diff1) \& S1 > min1 \& S3 < max1$$

$$A2 = S2 > (S3 + diff1) \& S2 > min2 \& S3 < max1$$

$$A3 = S4 > (S3 + diff2) \& S4 > min3 \& S3 < max2$$

All programs +1: If the difference between the two solar panel sensors **S1** and **S2** exceeds the difference **diff3**, the colder panel's circuit is deactivated. This prevents heat from being lost on the colder panel when temperatures are mixed.

All programs +2: Instead of the pumps **A1** and **A2**, one pump **A1** and a three-way valve **A2** are used. Without priority allocation, solar panel 2 will be preferred.

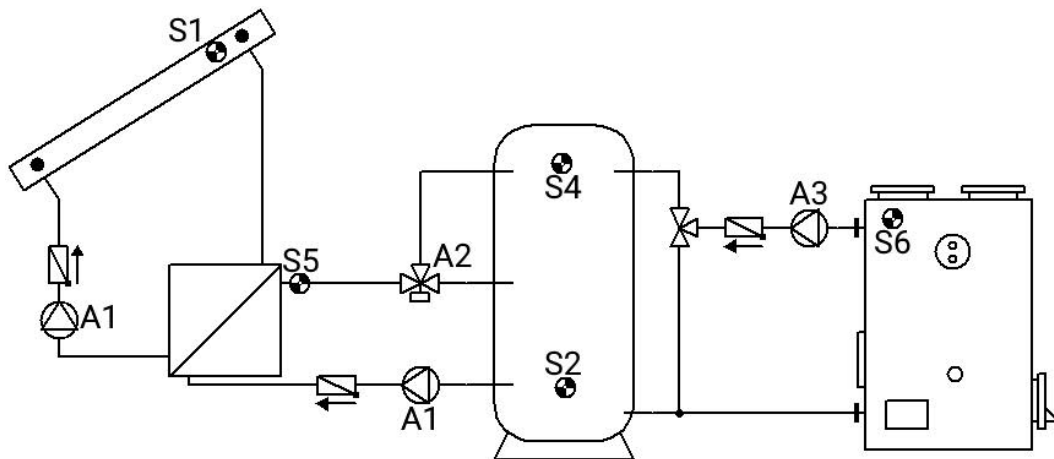
WARNING: This program is not intended for systems with two solar panels fields, since the usage of a three-way valve always leaves one solar panel field idle.

Note: The additional application of the priority circuit „All programs +1“ is recommended.

Program 320 – Layered cylinder and charging pump

Only practical with speed control activated!

(Absolute value control: mode „Normal“ and sensor input S1)



<p>S1 min1</p> <p>S6 min3</p> <p>diff1 A1</p> <p>diff3 A3</p> <p>S2 max1 max3</p>	<p>S5 <min2</p> <p>diff2 A2</p> <p>S4 max2</p>	<p>S5 >min2</p> <p>A2</p> <p>S4 max2</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S2 → A1</p> <p>max2 ... limit CYL S4 → A2</p> <p>max3 ... limit CYL S2 → A3</p> <p>min1 ... activation temp. coll. S1 → A1</p> <p>min2 ... activation temp. HE S5 → A2</p> <p>min3 ... activation temp. boiler S6 → A3</p> <p>diff1 ... coll. S1 - CYL S2 → A1</p> <p>diff2 ... HE S5 - CYL S4 → A2</p> <p>diff3 ... boiler S6 - CYL S2 → A3</p>
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Program 320: Solar pumps **A1** run, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The three-way valve **A2** switches **upwards**, if:

- **S5** exceeds the threshold **min2**, • or, if **S5** falls below **min2**, **S5** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

- **S6** exceeds the threshold **min3** • and **S6** is greater than **S2** by the difference **diff3**
- and **S2** has not exceeded the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \& S1 > min1 \& S2 < max1$$

$$A2 = (S5 > min2 \text{ or } S5 > (S4 + diff2)) \& S4 < max2$$

$$A3 = S6 > (S2 + diff3) \& S6 > min3 \& S2 < max3$$

All programs +1: If **S4** has reached the threshold **max2**, the rapid warm-up phase is completed and the speed control is blocked, which achieves optimal efficiency.

If control Output **A4** is activated, the analogue level for maximum speed will be output. Control Output **A5** is not affected and continues regulating.

All programs +8 (independent charging pump **A3**): charging pump **A3** runs, if:

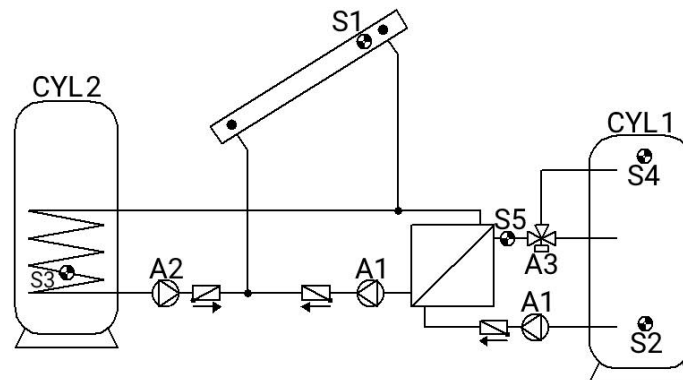
- **S6** exceeds the threshold **min3** • and **S6** is greater than **S3** by the difference **diff3**
- and **S3** has not exceeded the threshold **max3**.

$$A3 = S6 > (S3 + diff3) \& S6 > min3 \& S3 < max3$$

Program 336 – Solar system with 2 consumers and layered cylinder charging

Layered system only practical with speed control activated!

(Absolute value control: mode „Normal“ and sensor input S1)



<p>S1 min1</p> <p>diff1 A1</p> <p>S2 max1</p> <p>diff2 A2</p> <p>S3 max2</p>	<p>S5 S5</p> <p><min3 >min3</p> <p>diff3 A3</p> <p>S4 S4</p> <p>max3 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL2 S3 → A2</p> <p>max3 ... limit CYL1 S4 → A3</p> <p>min1 ... activation temp. coll S1 → A1, A2</p> <p>min2 ... see all programs +4</p> <p>min3 ... activation temp. HE S5 → A3</p> <p>diff1 ... coll. S1 - CYL1 S2 → A1</p> <p>diff2 ... coll. S1 - CYL2 S3 → A2</p> <p>diff3 ... HE S5 - CYL1 S4 → A3</p> <p>Excess temperature limiter: ... activate for S1 and A1+A2</p>
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Program 336: The solar pumps **A1** run, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The solar pump **A2** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

The three-way valve **A3** switches **upwards**, if:

- **S5** exceeds the threshold **min3** • or, if **S5** falls below the threshold **min3**, **S5** is greater than **S4** by the difference
- and **S4** has not exceeded the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \& S1 > min1 \& S2 < max1$$

$$A2 = S1 > (S3 + diff2) \& S1 > min1 \& S3 < max2$$

$$A3 = (S5 > min3 \text{ or } S5 > (S4 + diff3)) \& S4 < max3$$

All programs +2: If **S4** has reached the threshold **max3**, the rapid warm-up phase is completed and the speed control is blocked, which achieves optimal efficiency.

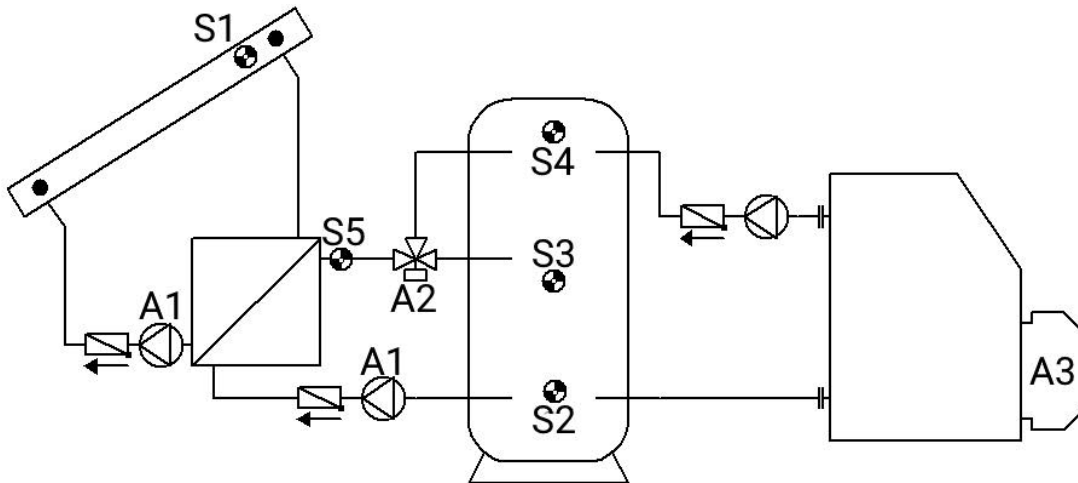
If control Output **A4** is activated, the analogue level for maximum speed will be output. Control Output **A5** is not affected and continues regulating.

All programs +4: Both solar circuits receive separate activation thresholds **S1**: Output **A1** retains **min1** and **A2** is regulated via **min2**.

The **Priority Ranking** between **CYL1** and **CYL2** can be parameterized in the menu **Settings/Technician level/Parameters/Priority ranking**. Additionally, a solar priority function can be set up in the menu **Settings/Expert level/Solar priority** (further details in chapter „Solar Priority“).

Program 352 – Layered cylinder and burner request

Layered system only practical with speed control activated!
 (Absolute value control: mode „Normal“ and sensor input S1)



<p>S1 min1</p> <p>↓ diff1 A1</p> <p>S2 max1</p>	<p>S5 <min2 >min2</p> <p>↓ diff2 A2</p> <p>S4 max2</p>	<p>S5 >min2</p> <p>↓ A2</p> <p>S4 max2</p>	<p>Burner A3</p> <p>S4 min3 S3 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S2 → A1</p> <p>max2 ... limit CYL S4 → A2</p> <p>max3 ... burner req. off CYL S3 → A3</p> <p>min1 ... activation temp. coll. S1 → A1</p> <p>min2 ... activation temp. HE S5 → A2</p> <p>min3 ... burner req. on CYL S4 → A3</p> <p>diff1 ... coll. S1 - CYL S2 → A1</p> <p>diff2 ... HE S5 - CYL S4 → A2</p>
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Program 352: Pumps **A1** run, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The three-way valve **A2** switches **upwards**, if:

- **S5** exceeds the threshold **min2** • or, if **S5** falls below **min2**, **S5** is greater than **S4** by the difference **diff2**.
- and **S4** has not exceeded the threshold **max2**.

Output **A3** is activated, if **S4** falls below **min3**.

Output **A3** is deactivated (dominantly), if **S3** exceeds the threshold **max3**.

$$\begin{aligned}
 A1 &= S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1 \\
 A2 &= (S5 > min2 \ \text{or} \ S5 > (S4 + diff2)) \ \& \ S4 < max2 \\
 A3 \ (on) &= S4 < min3 & \quad A3 \ (off) &= S3 > max3
 \end{aligned}$$

All programs +1: All programs +1: If **S4** has reached the threshold **max2**, the rapid warm-up phase is completed and the speed control is blocked, which achieves optimal efficiency.

If control Output **A4** is activated, the analogue level for maximum speed will be output. Control Output **A5** is not affected and continues regulating.

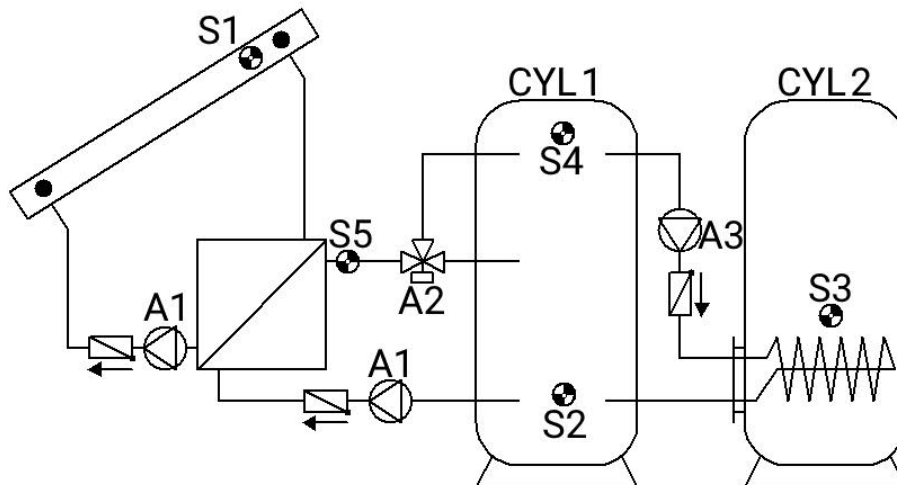
All programs +4: The burner request (**A3**) is only regulated via **S4**.

$$A3 \ (on) = S4 < min3 \quad A3 \ (off) = S4 > max3 \ (dominant)$$

All programs +8: If the solar circuit is active, the burner request is blocked. If the solar circuit is inactive, the burner request is unblocked after a 5 minute delay..

Program 368 – Layered cylinder and charging pump

Layered system only practical with speed control activated!
 (Absolute value control: mode „Normal“ and sensor input S1)



<p>S1 min1</p> <p>diff1 A1</p> <p>S2 max1</p>	<p style="text-align: center;">S5</p> <p><min2 >min2</p> <p>diff2 diff2</p> <p>A2 A2</p> <p>S4 S4</p> <p>max2 max2</p> <p>min3 diff3</p> <p>A3</p> <p style="text-align: right;">→ S3 / max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL1 S4 → A2</p> <p>max3 ... limit CYL2 S3 → A3</p> <p>min1 ... activation temp. coll. S1 → A1</p> <p>min2 ... activation temp. HE S5 → A2</p> <p>min3 ... activation temp. CYL1 S4 → A3</p> <p>diff1 ... coll. S1 - CYL1 S2 → A1</p> <p>diff2 ... HE S5 - CYL1 S4 → A2</p> <p>diff3 ... CYL1 S4 - CYL2 S3 → A3</p>
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Program 368: Pumps **A1** run, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The three-way valve **A2** switches **upwards**, if:

- **S5** exceeds the threshold **min2** • or, if **S5** falls below **min2**, **S5** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

- **S4** exceeds the threshold **min3** • and **S4** is greater than **S3** by the difference **diff3**
- and **S3** has not exceeded the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \& S1 > min1 \& S2 < max1$$

$$A2 = (S5 > min2 \text{ or } S5 > (S4 + diff2)) \& S4 < max2$$

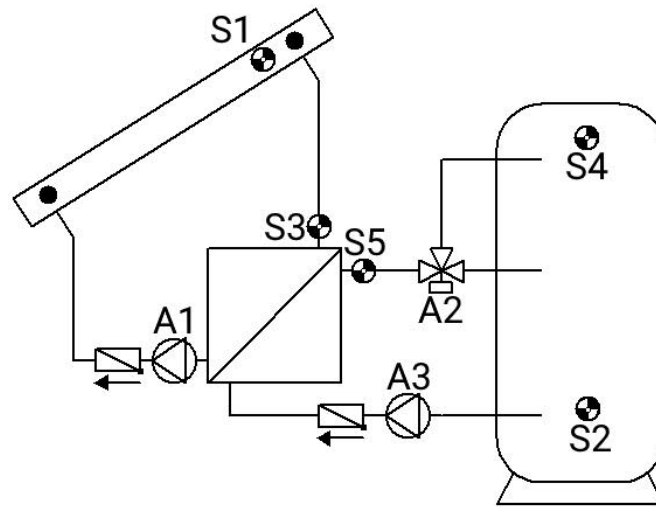
$$A3 = S4 > (S3 + diff3) \& S4 > min3 \& S3 < max3$$

+ All programs +1: If **S4** has reached the threshold **max2**, the rapid warm-up phase is completed and the speed control is blocked, which achieves optimal efficiency.

If control Output **A4** is activated, the analogue level for maximum speed will be output. Control Output **A5** is not affected and continues regulating.

Program 384 – Layered cylinder with bypass functionality

Layered system only practical with speed control activated!
 (Absolute value control: mode „Normal“ and sensor input S1)



<p>S1 min1</p> <p>diff1 A1</p> <p>S2 max1</p>	<p>S3</p> <p>diff3 A3</p>	<p>S5 <min2</p> <p>diff2 A2</p> <p>S4 max2</p>	<p>S5 >min2</p> <p>A2</p> <p>S4 max2</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S2 → A1</p> <p>max2 ... limit CYL S4 → A2</p> <p>min1 ... activation. coll. S1 → A1</p> <p>min2 ... activation. HE1 S5 → A2</p> <p>diff1 ... coll. S1 - CYL S2 → A1</p> <p>diff2 ... HE S5 - CYL S4 → A2</p> <p>diff3 ... solar flow S3 - CYL S2 → A3</p>
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Program 384: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The three-way valve **A2** switches **upwards**, if:

- **S5** exceeds the threshold **min2** • or, if **S5** falls below the threshold **min2**, **S5** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

Pump **A3** runs, if:

- **S3** is greater than **S2** by the difference **diff3** • and pump **A1** is running.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = (S5 > min2 \ \text{or} \ S5 > (S4 + diff2)) \ \& \ S4 < max2$$

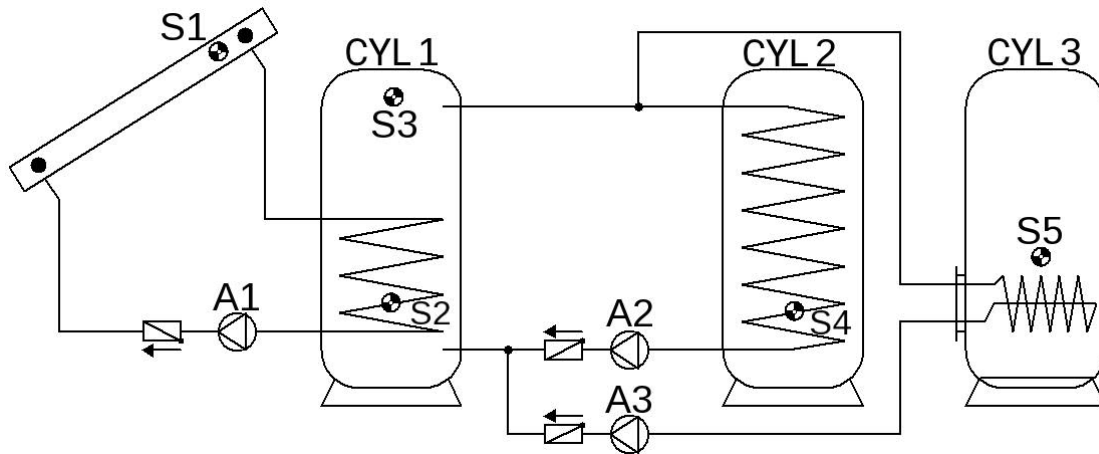
$$A3 = S3 > (S2 + diff3) \ \& \ (A1 = on)$$

All programs +1: If **S4** has reached the threshold **max2**, the rapid warm-up phase is completed and the speed control is blocked, which achieves optimal efficiency.

If control Output **A4** is activated, the analogue level for maximum speed will be output. Control Output **A5** is not affected and continues regulating.

To prevent frost damages to the heat exchanger, a frost protection function should be activated for sensor **S3** and output **A3**.

Program 400 – Solar system with 1 consumer and 2 charging pump functions



<p>S1 min1</p> <p>↓ diff1 A1</p> <p>S2 max1</p>	<p>S3 min2</p> <p>↙ ↘ diff2 diff3 A2 A3</p> <p>S4 S5 max2 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL2 S4 → A2</p> <p>max3 ... limit CYL3 S5 → A3</p> <p>min1 ... activation temp. coll. S1 → A1</p> <p>min2 ... activation temp. CYL1 S3 → A2, A3</p> <p>min3 ... see all programs +2</p> <p>diff1 ... coll. S1 - CYL1 S2 → A1</p> <p>diff2 ... CYL1 S3 - CYL2 S4 → A2</p> <p>diff3 ... CYL1 S3 - CYL3 S5 → A3</p>
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Program 400: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The charging pump **A2** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S5** by the difference **diff3**
- and **S5** has not exceeded the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S3 > (S4 + diff2) \ \& \ S3 > min2 \ \& \ S4 < max2$$

$$A3 = S3 > (S5 + diff3) \ \& \ S3 > min2 \ \& \ S5 < max3$$

All programs +1: Instead of the two pumps **A2** and **A3**, one pump **A2** and a three-way valve **A3** are used. Without priority allocation, cylinder 3 is charged by default.

A2... mutual pump

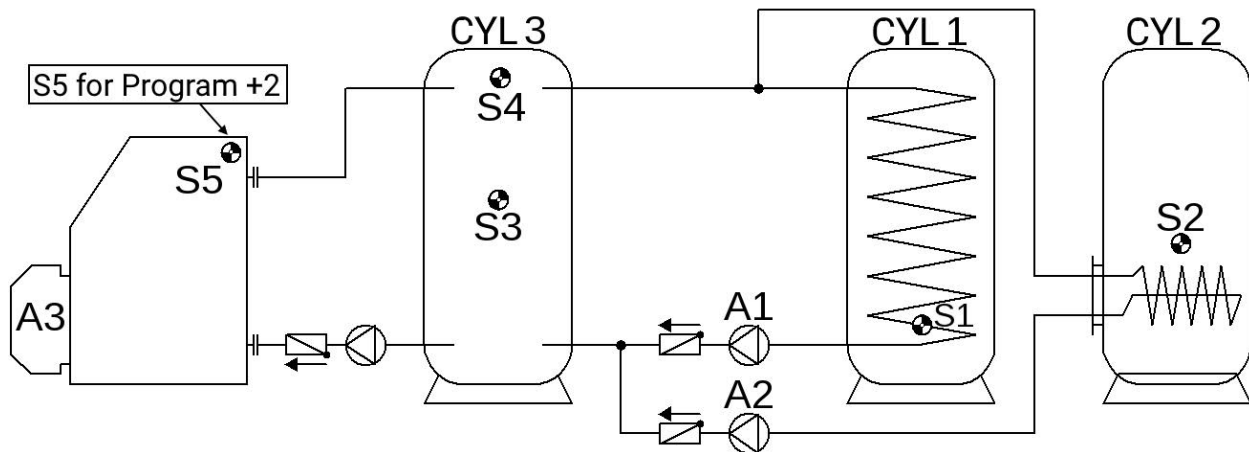
A3... valve (A3/NO receives voltage when charging cylinder CYL3)

All programs +2: Separate activation thresholds for the charging pump circuits. Output **A2** retains **min2** and **A3** is regulated via **min3**.

The **Priority Ranking** between **CYL1** and **CYL2** can be set in the menu **Settings/Technician level/Parameters/Priority ranking**.

Program 416 – 1 consumer, 2 charging pumps and burner request

Priority allocation between SP1 and SP2 possible



<p>S4 min1</p> <p>diff1 diff2</p> <p>A1 A2</p> <p>S1 S2</p> <p>max1 max2</p>	<p>Burner</p> <p>A3</p> <p>S4 min3</p> <p>S3 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S1 → A1</p> <p>max2 ... limit CYL2 S2 → A2</p> <p>max3 ... burner req. off CYL3 S3 → A3</p> <p>min1 ... activation temp. CYL3 S4 → A1, A2</p> <p>min2 ... see all programs +2 and +8</p> <p>min3 ... burner req. on CYL3 S4 → A3</p> <p>diff1 ... CYL3 S4 - CYL1 S1 → A1</p> <p>diff2 ... CYL3 S4 - CYL2 S2 → A2</p> <p>diff3 ... see all programs +2</p>
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Program 416: The charging pump **A1** runs, if:

- **S4** exceeds the threshold **min1** • and **S4** is greater than **S1** by the difference **diff1**
- and **S1** has not exceeded the threshold **max1**.

The charging pump **A2** runs, if:

- **S4** exceeds the threshold **min1** • and **S4** is greater than **S2** by the difference **diff2**
- and **S2** has not exceeded the threshold **max2**.

Output **A3** is activated, if **S4** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S3** exceeds the threshold **max3**.

$$A1 = S4 > (S1 + diff1) \& S4 > min1 \& S1 < max1$$

$$A2 = S4 > (S2 + diff2) \& S4 > min1 \& S2 < max2$$

$$A3 \text{ (on)} = S4 < min \quad A3 \text{ (off)} = S3 > max3$$

All programs +1: Instead of the two pumps **A1** and **A2**, one pump **A1** and a three-way valve **A2** are used. Without priority allocation, cylinder 2 is charged by default.

A1... mutual pump **A2**... valve (A2/NO receives voltage when charging cylinder CYL2)

All programs +2: Additionally, charging pump **A1** is activated, if the temperature of cylinder **S1** (CYL1) falls below the boiler flow temperature **S5** by the difference **diff3**.

Additionally, charging pump **A2** is activated, if the temperature of cylinder **S2** (CYL2) falls below the boiler flow temperature **S5** by the difference **diff3**.

Pump **A1** runs, if:

- **S4** exceeds the threshold **min1** • and **S4** is greater than **S1** by the difference **diff1**
- and **S1** has not exceeded the threshold **max1**.

or

- **S5** exceeds the threshold **min2** • and **S5** is greater than **S1** by the difference **diff3**
- and **S1** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S4** exceeds the threshold **min1** • and **S4** is greater than **S2** by the difference **diff2**
- and **S2** has not exceeded the threshold **max2**.

or

- **S5** exceeds the threshold **min2** • and **S5** is greater than **S2** by the difference **diff3**
- and **S2** has not exceeded the threshold **max2**.

$$\text{or} \quad \begin{aligned} A1 &= (S4 > (S1 + \text{diff1}) \ \& \ S4 > \text{min1} \ \& \ S1 < \text{max1}) \\ &(S5 > (S1 + \text{diff3}) \ \& \ S5 > \text{min2} \ \& \ S1 < \text{max1}) \end{aligned}$$

$$\text{or} \quad \begin{aligned} A2 &= (S4 > (S2 + \text{diff2}) \ \& \ S4 > \text{min1} \ \& \ S2 < \text{max2}) \\ &(S5 > (S2 + \text{diff3}) \ \& \ S5 > \text{min2} \ \& \ S2 < \text{max2}) \end{aligned}$$

All programs +4: The burner request (**A3**) is only regulated via **S4**.

$$A3 \text{ (on)} = S4 < \text{min3} \quad A3 \text{ (off)} = S4 > \text{max3} \text{ (dominantly)}$$

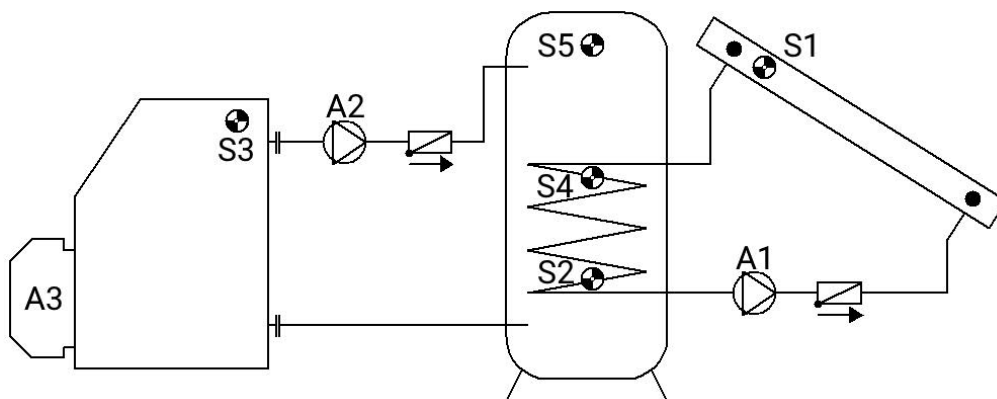
All programs +8: (Not usable in conjunction with +2)

Both charging pump circuits have separate activation thresholds at **S4**:

Output **A1** retains **min1** and **A2** is regulated via **min2**.

The **Priority Ranking** between **CYL1** and **CYL2** can be set in the menu **Settings/Technician level/Parameters/Priority ranking**.

Program 432 – Solar system, burner request, and one charging pump



<p>S1 min1</p> <p>↓ diff1 A1</p> <p>S2 max1</p>	<p>S3 min2</p> <p>↓ diff2 A2</p> <p>S4 max2</p>	<p>Burner A3 S5 min3 S4 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S2 → A1</p> <p>max2 ... limit CYL S4 → A2</p> <p>max3 ... burner req. off S S4 → A3</p> <p>min1 ... activation temp. coll. S1 → A1</p> <p>min2 ... activation temp. boiler S3 → A2</p> <p>min3 ... burner req. on CYL S5 → A3</p> <p>diff1 ... coll. S1 - CYL S2 → A1</p> <p>diff2 ... boiler S3 - CYL S4 → A2</p>
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Program 432: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The charging pump **A2** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

Output **A3** is activated, if **S5** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S4** exceeds the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S3 > (S4 + diff2) \ \& \ S3 > min2 \ \& \ S4 < max2$$

$$A3 \ (on) = S5 < min3 \qquad A3 \ (off) = S4 > max3$$

All programs +1

	<table border="1"> <tr><td>Burner</td></tr> <tr><td>A3</td></tr> <tr><td>S5 min3</td></tr> <tr><td>S4 max3</td></tr> </table>	Burner	A3	S5 min3	S4 max3	<p>required settings:</p> <table> <tr><td>max1</td><td>... limit CYL S2</td><td>→ A1</td></tr> <tr><td>max2</td><td>... limit CYL S2</td><td>→ A2</td></tr> <tr><td>max3</td><td>... burner req. off CYL S4</td><td>→ A3</td></tr> <tr><td>min1</td><td>... activation temp. coll. S1</td><td>→ A1</td></tr> <tr><td>min2</td><td>... activation temp. boiler S3</td><td>→ A2</td></tr> <tr><td>min3</td><td>... burner req. on CYL S5</td><td>→ A3</td></tr> <tr><td>diff1</td><td>... coll. S1 - CYL S2</td><td>→ A1</td></tr> <tr><td>diff2</td><td>... boiler S3 - CYL S2</td><td>→ A2</td></tr> </table>	max1	... limit CYL S2	→ A1	max2	... limit CYL S2	→ A2	max3	... burner req. off CYL S4	→ A3	min1	... activation temp. coll. S1	→ A1	min2	... activation temp. boiler S3	→ A2	min3	... burner req. on CYL S5	→ A3	diff1	... coll. S1 - CYL S2	→ A1	diff2	... boiler S3 - CYL S2	→ A2
Burner																														
A3																														
S5 min3																														
S4 max3																														
max1	... limit CYL S2	→ A1																												
max2	... limit CYL S2	→ A2																												
max3	... burner req. off CYL S4	→ A3																												
min1	... activation temp. coll. S1	→ A1																												
min2	... activation temp. boiler S3	→ A2																												
min3	... burner req. on CYL S5	→ A3																												
diff1	... coll. S1 - CYL S2	→ A1																												
diff2	... boiler S3 - CYL S2	→ A2																												

Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The charging pump **A2** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S2** by the difference **diff2**
- and **S2** has not exceeded the threshold **max2**.

Output **A3** is activated, if **S5** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S4** exceeds the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S3 > (S2 + diff2) \ \& \ S3 > min2 \ \& \ S2 < max2$$

$$A3 \ (on) = S5 < min3 \qquad A3 \ (off) = S4 > max3$$

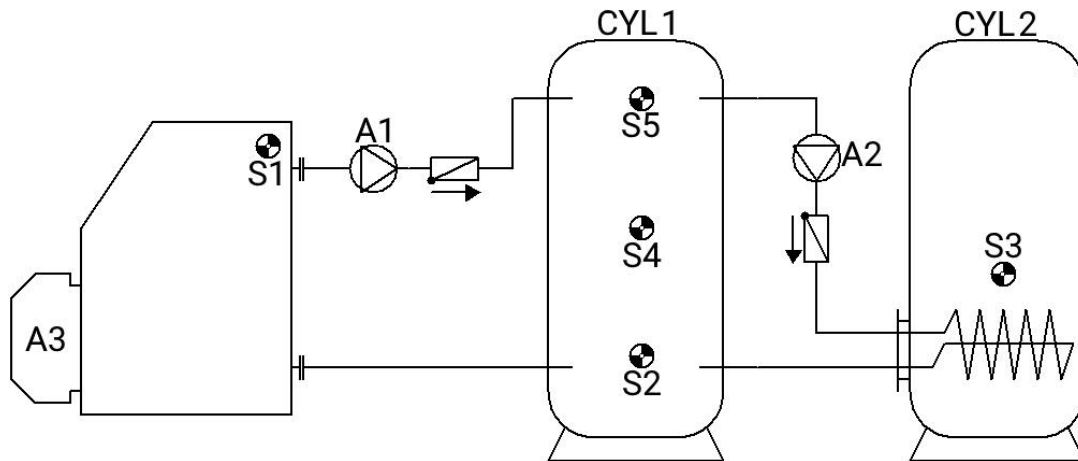
All programs +2: The burner request (**A3**) is only regulated via **S5**.

$$A3 \ (on) = S5 < min3 \qquad A3 \ (off) = S5 > max3 \ (dominant)$$

All programs +4: If the sensor **S2** has reached the threshold **max1**, pump **A2** is activated and pump **A1** continues operation. This achieves a „cooling function“ with the boiler/heating without idle temperatures at the solar panel.

All programs +8: Activity of the solar circuit blocks the burner request. If the solar circuit is deactivated, the burner request is unblocked after a 5 minute delay.

Program 448 – Burner request and 2 charging pumps



<p>S1 min1</p> <p>↓ diff1 A1</p> <p>S2 max1</p>	<p>S5 min2</p> <p>↓ diff2 A2</p> <p>S3 max2</p>	<p>Burner A3</p> <p>S5 min3 S4 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL2 S3 → A2</p> <p>max3 ... burner req. off CYL1 S4 → A3</p> <p>min1 ... activation temp. boiler S1 → A1</p> <p>min2 ... activation temp. CYL1 S5 → A2</p> <p>min3 ... burner req. on CYL1 S5 → A3</p> <p>diff1 ... boiler S1 - CYL1 S2 → A1</p> <p>diff2 ... CYL1 S5 - CYL2 S3 → A2</p> <p>diff3 ... see all programs +2</p>
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Program 448: The charging pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded **max1**.

The charging pump **A2** runs, if:

- **S5** exceeds the threshold **min2** • and **S5** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

Output **A3** is activated, if **S5** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S4** exceeds the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S5 > (S3 + diff2) \ \& \ S5 > min2 \ \& \ S3 < max2$$

$$A3 \ (on) = S5 < min3 \qquad A3 \ (off) = S4 > max3$$

All programs +1:

<p>S1 min1</p> <p>↓ diff1 A1</p> <p>S4 max1</p>	<p>S5 min2</p> <p>↓ diff2 A2</p> <p>S3 max2</p>	<p>Burner A3</p> <p>S5 min3 S4 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S4 → A1</p> <p>max2 ... limit CYL2 S3 → A2</p> <p>max3 ... burner req. off CYL1 S4 → A3</p> <p>min1 ... activation temp. boiler S1 → A1</p> <p>min2 ... activation temp. CYL1 S5 → A2</p> <p>min3 ... burner req. on CYL1 S5 → A3</p> <p>diff1 ... boiler S1 - CYL1 S4 → A1</p> <p>diff2 ... CYL1 S5 - CYL2 S3 → A2</p> <p>diff3 ... see all programs +2</p>
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The charging pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S4** by the difference **diff1**
- and **S4** has not exceeded the threshold **max1**.

The charging pump **A2** runs, if:

- **S5** exceeds the threshold **min2** • and **S5** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the difference **max2**.

Output **A3** is activated, if **S5** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S4** exceeds the threshold **max3**.

$$A1 = S1 > (S4 + diff1) \ \& \ S1 > min1 \ \& \ S4 < max1$$

$$A2 = S5 > (S3 + diff2) \ \& \ S5 > min2 \ \& \ S3 < max2$$

$$A3 \ (on) = S5 < min3 \quad A3 \ (off) = S4 > max3$$

All programs +2: Additionally, the charging pump **A2** is activated if the cylinder temperature **S3** (CYL2) falls below the boiler temperature **S1** by the difference **diff3**.

The charging pump **A2** runs, if:

- **S5** exceeds the threshold **min2** • and **S5** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

or

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff3**
- and **S3** has not exceeded the threshold **max2**.

$$A2 = (S5 > (S3 + diff2) \ \& \ S5 > min2 \ \& \ S3 < max2)$$

or

$$(S1 > (S3 + diff3) \ \& \ S1 > min1 \ \& \ S3 < max2)$$

All programs +4: The burner request (**A3**) is regulated only via sensor **S5**.

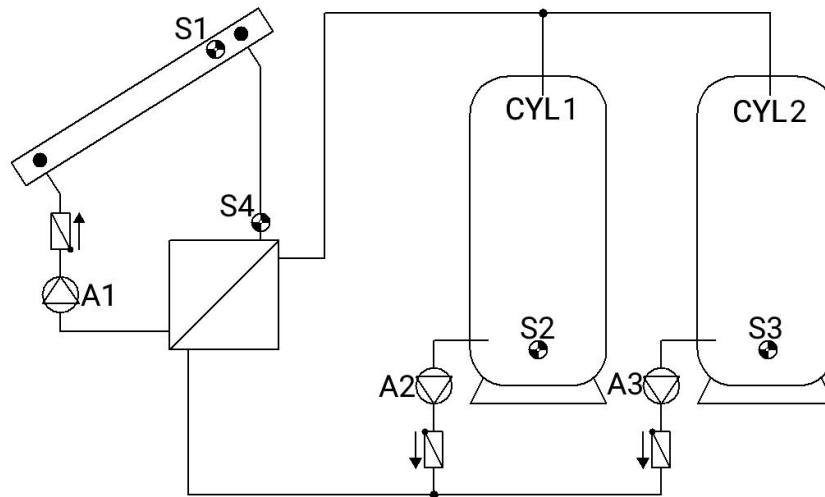
$$A3 \ (on) = S5 < min3 \quad A3 \ (off) = S5 > max3 \ (dominant)$$

All programs +8: The burner request (**A3**) is regulated only via sensor **S4**.

$$A3 \ (on) = S4 < min3 \quad A3 \ (off) = S4 > max3 \ (dominant)$$

Combining additions **+4** and **+8** is not permitted. An attempt to set this up (P460) will result in the program number resetting to **+4** (P452).

Program 464 – Solar system with 2 consumers and bypass function



	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1, A2</p> <p>max2 ... limit CYL2 S3 → A1, A3</p> <p>min1 ... activation temp. coll. S1 → A1</p> <p>min2 ... activation temp. solar flow S4 → A2, A3</p> <p>min3 ... see all programs +2</p> <p>diff1 ... coll. S1 - CYL1 S2 → A1</p> <p>... coll. S1 - CYL2 S3 → A1</p> <p>diff2 ... solar flow S4 - CYL1 S2 → A2</p> <p>diff3 ... solar flow S4 - CYL2 S3 → A3</p>
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Program 464: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- or **S1** is greater than **S3** by the difference **diff1**.
- and both temperature thresholds (**S2** > **max1** and **S3** > **max2**) are not exceeded at once.

Pump **A2** runs, if:

- **S4** exceeds the threshold **min2** • and **S4** is greater than **S2** by the difference **diff2**
- and **S2** has not exceeded the threshold **max1**.

Pump **A3** runs, if:

- **S4** exceeds the threshold **min2** • and **S4** is greater than **S3** by the difference **diff3**
- and **S3** has not exceeded the threshold **max2**.

$$A1 = (S1 > (S2 + diff1) \text{ or } S1 > (S3 + diff1)) \& S1 > min1 \\ \& (S2 < max1 \text{ or } S3 < max2)$$

$$A2 = S4 > (S2 + diff2) \& S4 > min2 \& S2 < max1$$

$$A3 = S4 > (S3 + diff3) \& S4 > min2 \& S3 < max2$$

All programs +1: Instead of both charging pumps **A2** and **A3**, on pump **A2** and a three-way valve **A3** are used. Valve **A3**/NO receives voltage when charging **CYL2**.

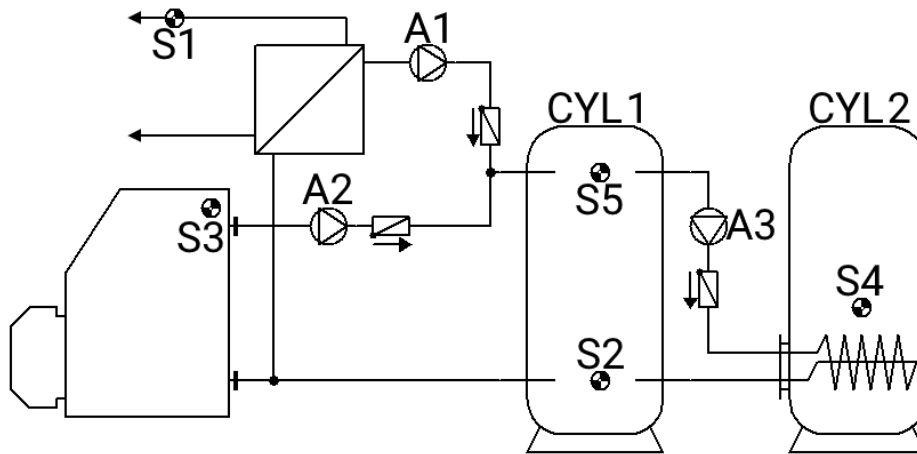
Speed control: Both control outputs are set to full speed once **max1** has been reached.

All programs +2: Separate activation thresholds at **S4** for the secondary solar circuit: Output **A2** retains **min2** and **A3** is regulated via **min3**.

All programs +4: The two secondary pumps **A2** and **A3** are only permitted to run if the primary pump **A1** runs in automatic mode.

The **Priority Ranking** between **CYL1** and **CYL2** can be set in the menu **Settings/Technician level/Parameters/Priority ranking**. Additionally, a solar priority function can be set up in the menu **Settings/Expert level/Solar priority** (see „Solar Priority“ for more details).

Program 480 – 2 consumers and 3 charging pump functions



<p>S1 min1</p> <p>S3 min2</p> <p>diff1 A1</p> <p>diff2 A2</p> <p>S2 max1 max2</p>	<p>S5 min3</p> <p>diff3 A3</p> <p>S4 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL1 S2 → A2</p> <p>max3 ... limit CYL2 S4 → A3</p> <p>min1 ... activation temp. heat source. S1 → A1</p> <p>min2 ... activation temp. boiler S3 → A2</p> <p>min3 ... activation temp. CYL1 S5 → A3</p> <p>diff1 ... heat source S1 - CYL1 S2 → A1</p> <p>diff2 ... boiler S3 - CYL1 S2 → A2</p> <p>diff3 ... CYL1 S5 - CYL2 S4 → A3</p>
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Program 480: The charging pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded **max1**.

The charging pump **A2** runs, if:

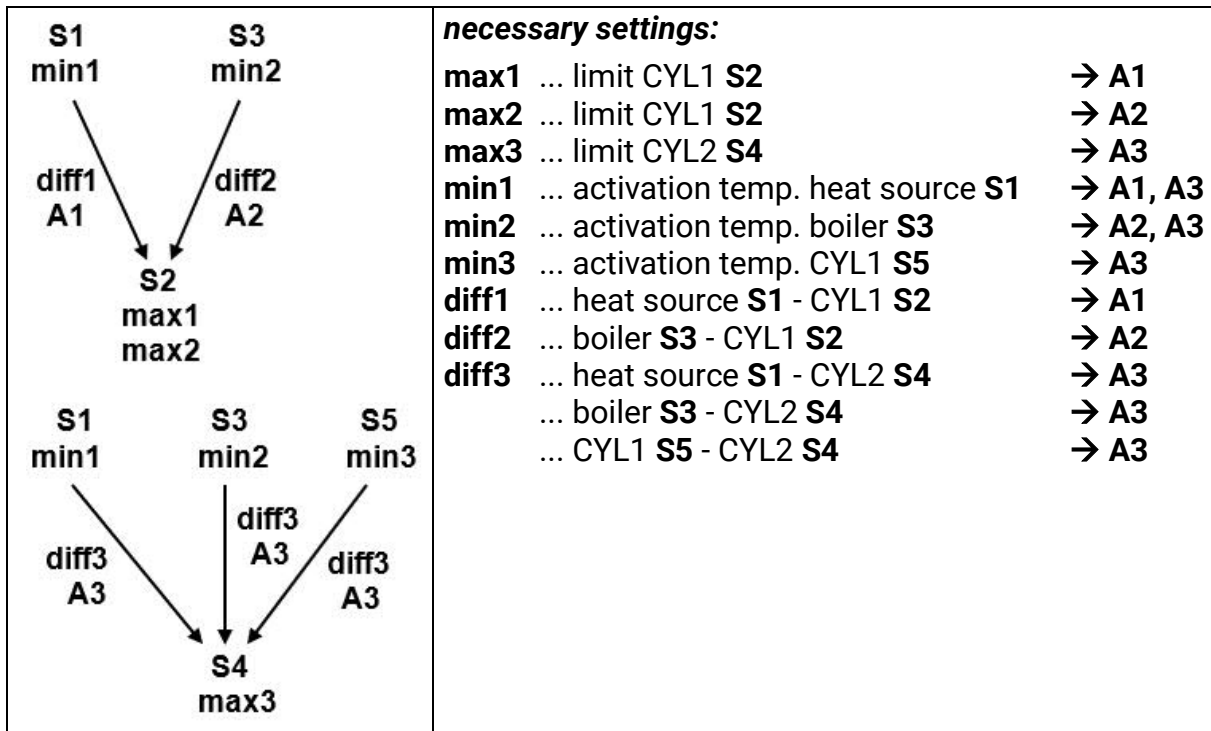
- **S3** exceeds the threshold **min2** • and **S3** is greater than **S2** by the difference **diff2**
- and **S2** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

- **S5** exceeds the threshold **min3** • and **S5** is greater than **S4** by the difference **diff3**
- and **S4** has not exceeded the threshold **max3**.

$$\begin{aligned}
 A1 &= S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1 \\
 A2 &= S3 > (S2 + diff2) \ \& \ S3 > min2 \ \& \ S2 < max2 \\
 A3 &= S5 > (S4 + diff3) \ \& \ S5 > min3 \ \& \ S4 < max3
 \end{aligned}$$

All programs +1:



Charging pump **A3** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S4** by the difference **diff3**
 - and **S4** has not exceeded the threshold **max3**
- or
- **S3** exceeds the threshold **min2** • and **S3** is greater than **S4** by the difference **diff3**
 - and **S4** has not exceeded the threshold **max3**
- or
- **S5** exceeds the threshold **min3** • and **S5** is greater than **S4** by the difference **diff3**
 - and **S4** has not exceeded the threshold **max3**.

$$A3 = (S1 > (S4 + diff3) \& S1 > min1 \& S4 < max3)$$

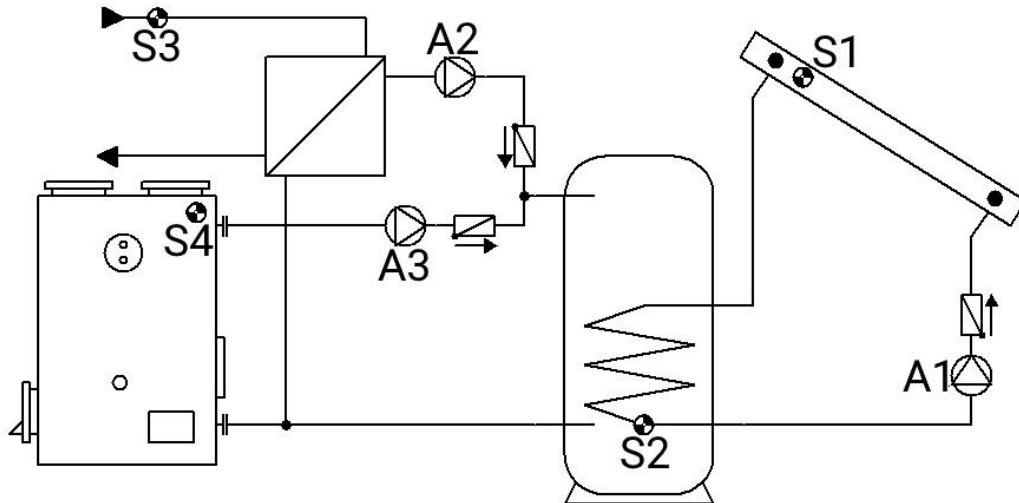
or

$$(S3 > (S4 + diff3) \& S3 > min2 \& S4 < max3)$$

or

$$(S5 > (S4 + diff3) \& S5 > min3 \& S4 < max3)$$

Program 496 – 1 Consumer and 3 charging pump functions



<p>S1 min1</p> <p>diff1 A1</p>	<p>S3 min2</p> <p>diff2 A2</p>	<p>S4 min3</p> <p>diff3 A3</p>	<p>S2 max1 max2 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S2 → A1</p> <p>max2 ... limit CYL S2 → A2</p> <p>max3 ... limit CYL S2 → A3</p> <p>min1 ... activation temp. coll. S1 → A1</p> <p>min2 ... activation temp. heat source S3 → A2</p> <p>min3 ... activation temp. boiler S4 → A3</p> <p>diff1 ... coll. S1 - CYL S2 → A1</p> <p>diff2 ... heat source S3 - CYL S2 → A2</p> <p>diff3 ... boiler S4 - CYL S2 → A3</p>
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Program 496: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The charging pump **A2** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S2** by the difference **diff2**
- and **S2** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

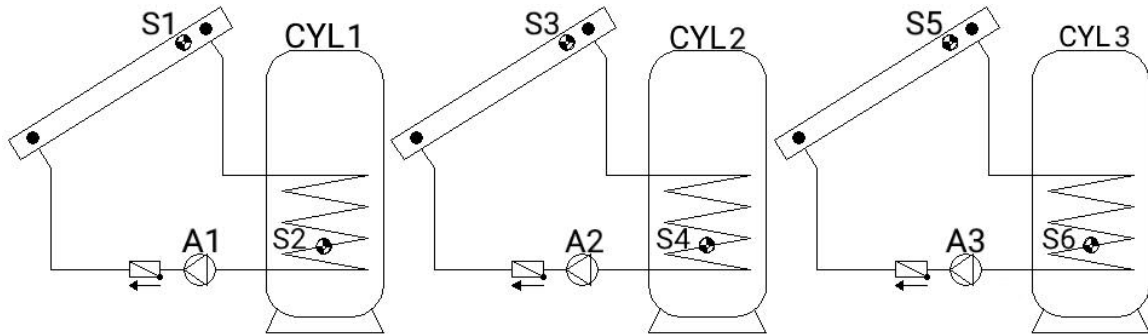
- **S4** exceeds the threshold **min3** • and **S4** is greater than **S2** by the difference **diff3**
- and **S2** has not exceeded the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S3 > (S2 + diff2) \ \& \ S3 > min2 \ \& \ S2 < max2$$

$$A3 = S4 > (S2 + diff3) \ \& \ S4 > min3 \ \& \ S2 < max3$$

Program 512 – 3 independent differential circuits



S1 min1 ↓ diff1 A1 ↓ S2 max1	S3 min2 ↓ diff2 A2 ↓ S4 max2	S5 min3 ↓ diff3 A3 ↓ S6 max3	necessary settings: max1 ... limit CYL1 S2 → A1 max2 ... limit CYL2 S4 → A2 max3 ... limit CYL3 S6 → A3 min1 ... activation temp. coll. 1 S1 → A1 min2 ... activation temp. coll. 2 S3 → A2 min3 ... activation temp. coll. 3 S5 → A3 diff1 ... coll. 1 S1 - CYL1 S2 → A1 diff2 ... coll. 2 S3 - CYL2 S4 → A2 diff3 ... coll. 3 S5 - CYL3 S6 → A3
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Program 512: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

Pump **A3** runs, if:

- **S5** exceeds the threshold **min3** • and **S5** is greater than **S6** by the difference **diff3**
- and **S6** has not exceeded the threshold **max3**.

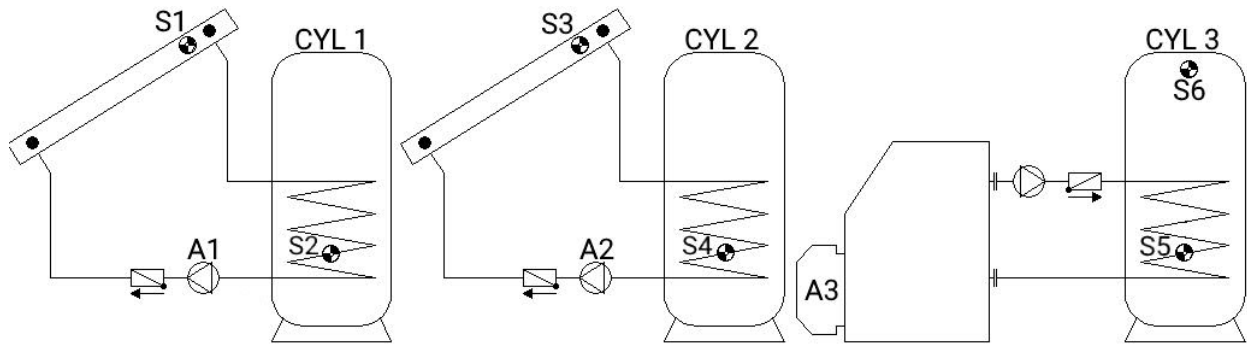
$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S3 > (S4 + diff2) \ \& \ S3 > min2 \ \& \ S4 < max2$$

$$A3 = S5 > (S6 + diff3) \ \& \ S5 > min3 \ \& \ S6 < max3$$

All programs +1: If sensor **S2** has reached the threshold **max1**, pump **A2** is activated and pump **A1** keeps running. This provides a cooling function with the boiler without causing idle temperatures in the solar panel.

Program 528 – 2 independent differential circuits & independent burner request



<p>S1 min1</p> <p>↓ diff1 A1</p> <p>S2 max1</p>	<p>S3 min2</p> <p>↓ diff2 A2</p> <p>S4 max2</p>	<p>Burner A3</p> <p>S6 min3 S5 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL2 S4 → A2</p> <p>max3 ... burner req. off CYL3 S5 → A3</p> <p>min1 ... activation temp. coll.1 S1 → A1</p> <p>min2 ... activation temp. coll.2 S3 → A2</p> <p>min3 ... burner req. on CYL3 S6 → A3</p> <p>diff1 ... coll. 1 S1 - CYL1 S2 → A1</p> <p>diff2 ... coll. 2 S3 - CYL2 S4 → A2</p>
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Program 528: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

Output **A3** is activated, if **S6** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S5** exceeds the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

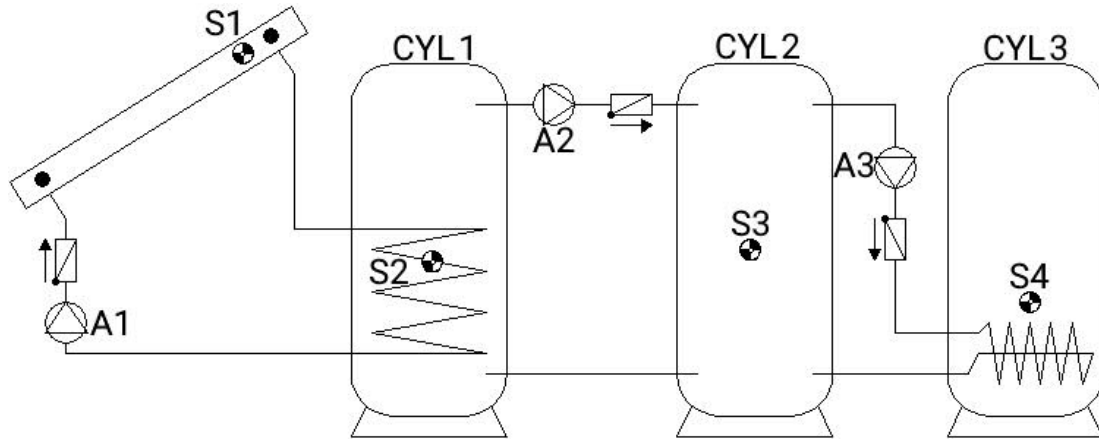
$$A2 = S3 > (S4 + diff2) \ \& \ S3 > min2 \ \& \ S4 < max2$$

$$A3 \ (on) = S6 < min3 \quad A3 \ (off) = S5 > max3$$

All programs +1: The burner request (**A3**) is regulated only via sensor **S6** (deactivation dominant).

$$A3 \ (on) = S6 < min3 \quad A3 \ (off) = S6 > max3$$

Program 544 – Cascade: S1 -> S2 -> S3 -> S4



S1 min1 ↓ diff1 A1 ↓ max1 S2 min2 ↓ diff2 A2 ↓ max2 S3 min3 ↓ diff3 A3 ↓ S4 max3	necessary settings: max1 ... limit CYL1 S2 → A1 max2 ... limit CYL2 S3 → A2 max3 ... limit CYL3 S4 → A3 min1 ... activation temp. coll. S1 → A1 min2 ... activation temp. CYL1 S2 → A2 min3 ... activation temp. CYL2 S3 → A3 diff1 ... coll. S1 - CYL1 S2 → A1 diff2 ... CYL1 S2 - CYL2 S3 → A2 diff3 ... CYL2 S3 - CYL3 S4 → A3
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Program 544: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The charging pump **A2** runs, if:

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

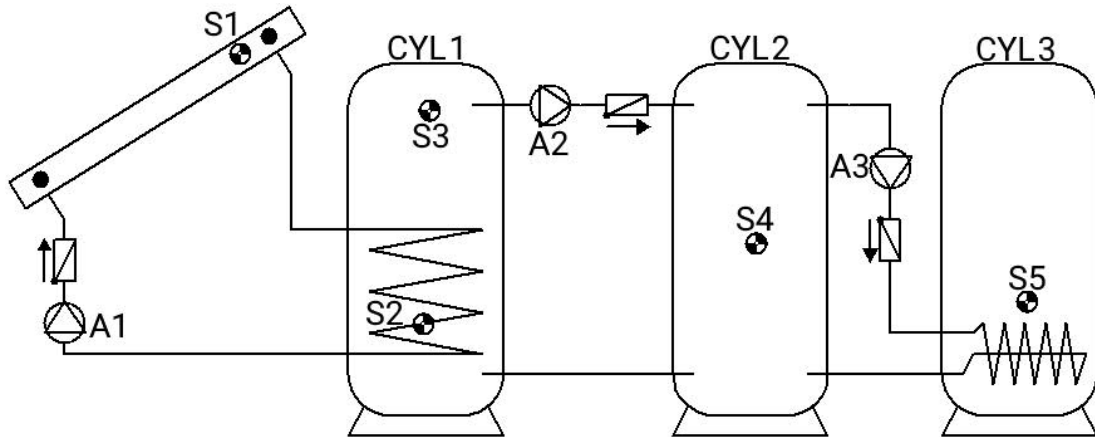
- **S3** exceeds the threshold **min3** • and **S3** is greater than **S4** by the difference **diff3**
- and **S4** has not exceeded the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S2 > (S3 + diff2) \ \& \ S2 > min2 \ \& \ S3 < max2$$

$$A3 = S3 > (S4 + diff3) \ \& \ S3 > min3 \ \& \ S4 < max3$$

Program 560 – Cascade: S1 -> S2 / S3 -> S4 -> S5



<p>S1 min1</p> <p>diff1 ↓ A1</p> <p>S2 max1</p> <p>S5 ← diff3 max3 A3</p>	<p>S3 min2</p> <p>diff2 ↓ A2</p> <p>S4 max2 min3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL2 S4 → A2</p> <p>max3 ... limit CYL3 S5 → A3</p> <p>min1 ... activation temp. coll. S1 → A1</p> <p>min2 ... activation temp. CYL1 S3 → A2</p> <p>min3 ... activation temp. CYL2 S4 → A3</p> <p>diff1 ... coll. S1 - CYL1 S2 → A1</p> <p>diff2 ... CYL1 S3 - CYL2 S4 → A2</p> <p>diff3 ... CYL2 S4 - CYL3 S5 → A3</p>
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Program 560: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The charging pump **A2** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

- **S4** exceeds the threshold **min3** • and **S4** is greater than **S5** by the difference **diff3**
- and **S5** has not exceeded the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S3 > (S4 + diff2) \ \& \ S3 > min2 \ \& \ S4 < max2$$

$$A3 = S4 > (S5 + diff3) \ \& \ S4 > min3 \ \& \ S5 < max3$$

All programs +1: Pump **A3** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S5** by the difference **diff3**
- and **S5** has not exceeded the threshold **max3**

or

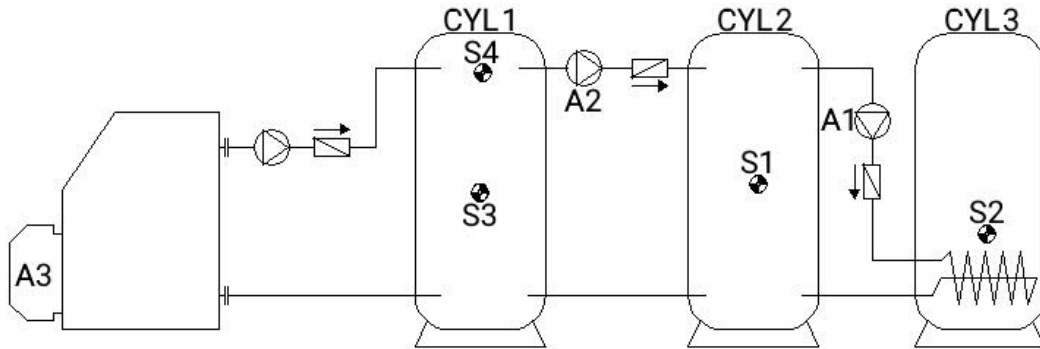
- **S4** exceeds the threshold **min3** • and **S4** is greater than **S5** by the difference **diff3**
- and **S5** has not exceeded the threshold **max3**.

$$A3 = (S3 > (S5 + diff3) \ \& \ S3 > min2 \ \& \ S5 < max3)$$

or

$$(S4 > (S5 + diff3) \ \& \ S4 > min3 \ \& \ S5 < max3)$$

Program 576 – Cascade: S4 -> S1 -> S2 + burner request



<p>S4 min2</p> <p>↓ diff2 A2</p> <p>S1 max2 min1</p> <p>↓ diff1 A1</p> <p>S2 max1</p>	<p>Burner A3</p> <p>S4 min3 S3 max3</p>	<p>necessary settings:</p> <p>max1 ... limit CYL3 S2 → A1</p> <p>max2 ... limit CYL2 S1 → A2</p> <p>max3 ... burner req. off CYL1 S3 → A3</p> <p>min1 ... activation temp. CYL2 S1 → A1</p> <p>min2 ... activation temp. CYL1 S4 → A2</p> <p>min3 ... burner req. on CYL1 S4 → A3</p> <p>diff1 ... CYL2 S1 - CYL3 S2 → A1</p> <p>diff2 ... CYL1 S4 - CYL2 S1 → A2</p>
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Program 576: The charging pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

The charging pump **A2** runs, if:

- **S4** exceeds the threshold **min2** • and **S4** is greater than **S1** by the difference **diff2**
- and **S1** has not exceeded the threshold **max2**.

Output **A3** is activated, if **S4** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S3** exceeds the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S4 > (S1 + diff2) \ \& \ S4 > min2 \ \& \ S1 < max2$$

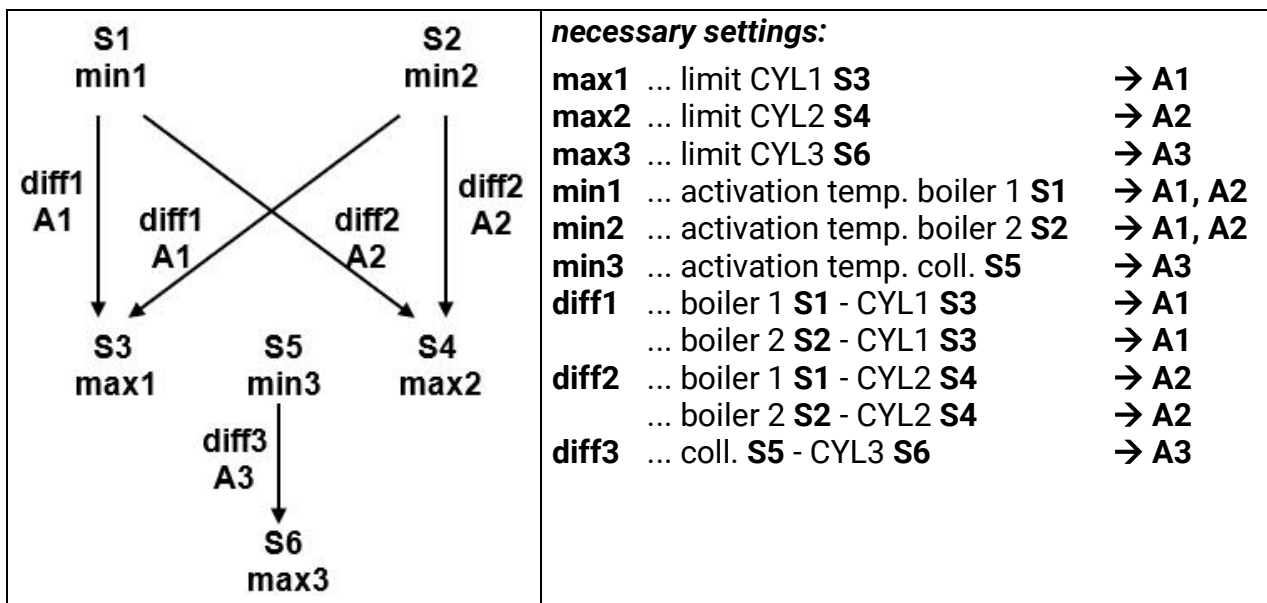
$$A3 \ (on) = S4 < min3 \quad A3 \ (off) = S3 > max3$$

All programs +1: The burner request (**A3**) is regulated only via **S4** (deactivation dominant).

$$A3 \ (on) = S4 < min3 \quad A3 \ (off) = S4 > max3$$

Program 592 – 2 generators for two consumers + independent differential circuit

No diagram available



Program 592: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff1**
 - and **S3** has not exceeded the threshold **max1**
- or
- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff1**
 - and **S3** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S4** by the difference **diff2**
 - and **S4** has not exceeded the threshold **max2**.
- or
- **S2** exceeds the threshold **min2** • and **S2** is greater than **S4** by the difference **diff2**
 - and **S4** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

- **S5** exceeds the threshold **min3** • and **S5** is greater than **S6** by the difference **diff3**
- and **S6** has not exceeded the threshold **max3**.

$$A1 = S1 > (S3 + diff1) \ \& \ S1 > min1 \ \& \ S3 < max1$$

or

$$S2 > (S3 + diff1) \ \& \ S2 > min2 \ \& \ S3 < max1$$

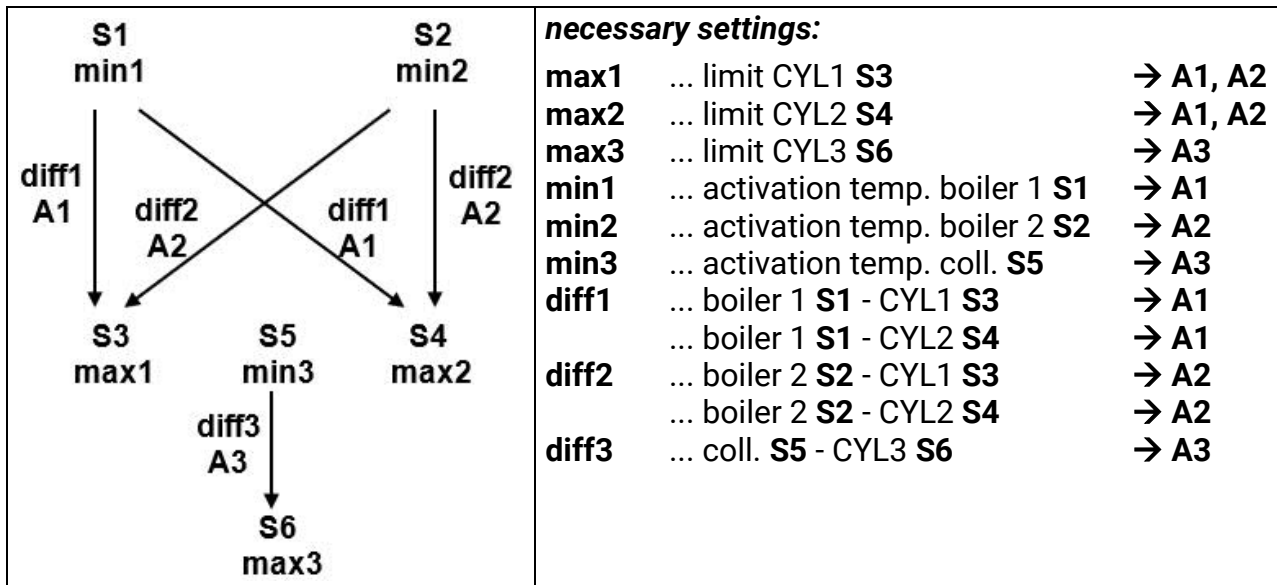
$$A2 = S1 > (S4 + diff2) \ \& \ S1 > min1 \ \& \ S4 < max2$$

or

$$S2 > (S4 + diff2) \ \& \ S2 > min2 \ \& \ S4 < max2$$

$$A3 = S5 > (S6 + diff3) \ \& \ S5 > min3 \ \& \ S6 < max3$$

Program 593:



Program 593: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff1**
 - and **S3** has not exceeded the threshold **max1**.
- or
- **S1** exceeds the threshold **min1** • and **S1** is greater than **S4** by the difference **diff1**
 - and **S4** has not exceeded the threshold **max2**.

Pump **A2** runs, if:

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff2**
 - and **S3** has not exceeded the threshold **max1**.
- or
- **S2** exceeds the threshold **min2** • and **S2** is greater than **S4** by the difference **diff2**
 - and **S4** has not exceeded the threshold **max2**.

The charging pump **A3** runs, if:

- **S5** exceeds the threshold **min3** • and **S5** is greater than **S6** by the difference **diff3**
- and **S6** has not exceeded the threshold **max3**.

$$A1 = S1 > (S3 + diff1) \ \& \ S1 > min1 \ \& \ S3 < max1$$

or

$$S1 > (S4 + diff1) \ \& \ S1 > min1 \ \& \ S4 < max2$$

$$A2 = S2 > (S3 + diff2) \ \& \ S2 > min2 \ \& \ S3 < max1$$

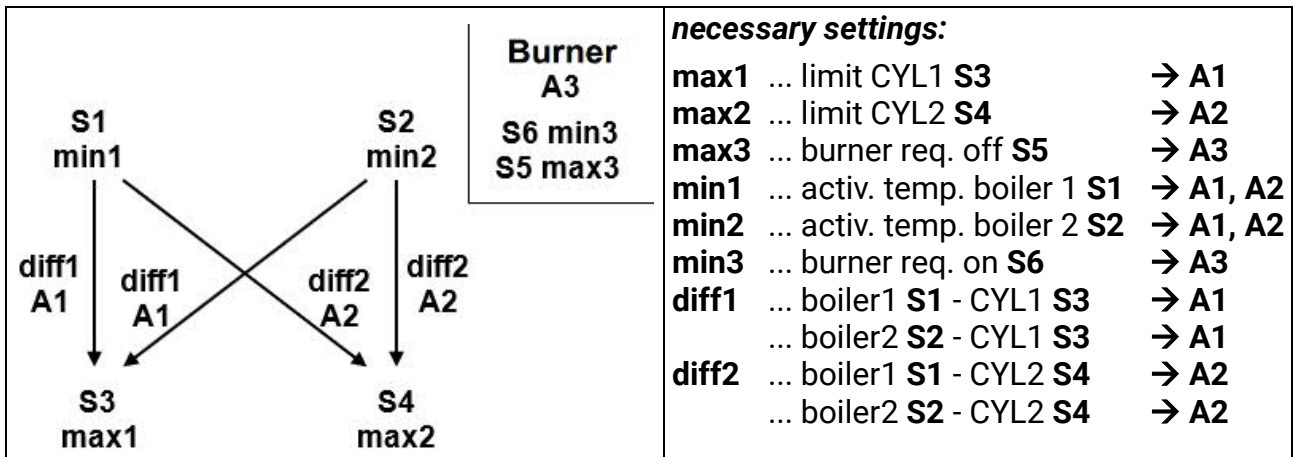
or

$$S2 > (S4 + diff2) \ \& \ S2 > min2 \ \& \ S4 < max2$$

$$A3 = S5 > (S6 + diff3) \ \& \ S5 > min3 \ \& \ S6 < max3$$

Program 608 – 2 generators for 2 consumers + burner request

No diagram available



Program 608: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

or

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

or

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

Output **A3** is activated, if **S6** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S5** exceeds the threshold **max3**.

$$A1 = S1 > (S3 + diff1) \ \& \ S1 > min1 \ \& \ S3 < max1$$

or

$$S2 > (S3 + diff1) \ \& \ S2 > min2 \ \& \ S3 < max1$$

$$A2 = S1 > (S4 + diff2) \ \& \ S1 > min1 \ \& \ S4 < max2$$

or

$$S2 > (S4 + diff2) \ \& \ S2 > min2 \ \& \ S4 < max2$$

$$A3 \ (on) = S6 < min3 \quad A3 \ (off) = S5 > max3$$

Program 609: The burner request (**A3**) is regulated only via sensor **S6**.

$$A3 \ (on) = S6 < min3 \quad A3 \ (off) = S6 > max3 \ (dominant)$$

Program 610: Like P608, but the request (**A3**) is regulated via sensors **S2** and **S5**.

$$A3 \ (on) = S2 < min3 \quad A3 \ (off) = S5 > max3 \ (dominant)$$

Program 611: Like P608, but the request (**A3**) is regulated only via sensor **S2**.

$$A3 \ (on) = S2 < min3 \quad A3 \ (off) = S2 > max3 \ (dominant)$$

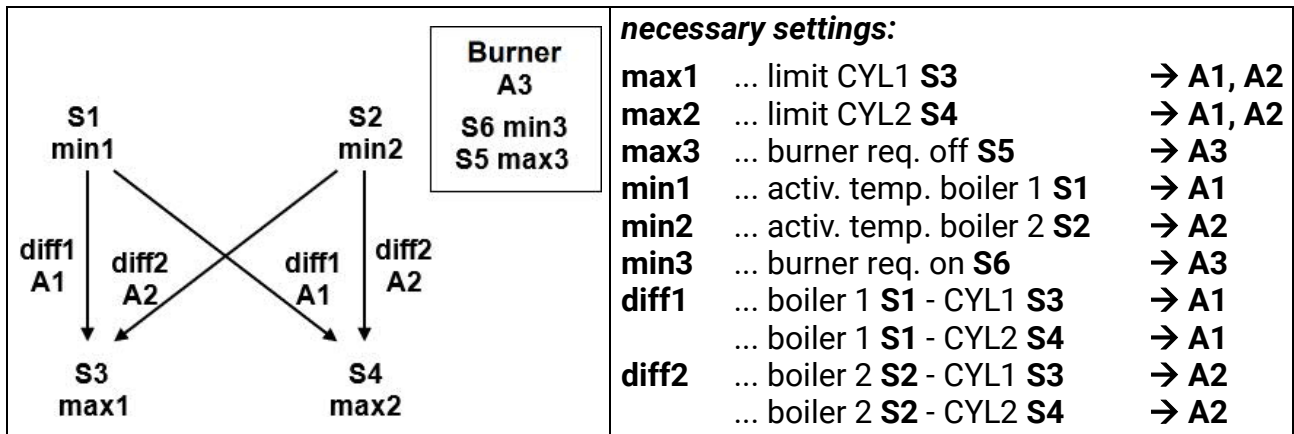
Program 612: Like P608, but the request (**A3**) is regulated via sensors **S4** and **S5**.

$$A3 \ (on) = S4 < min3 \quad A3 \ (off) = S5 > max3 \ (dominant)$$

Program 613: Like P608, but the request (**A3**) is regulated only via sensor **S4**.

$$A3 \ (on) = S4 < min3 \quad A3 \ (off) = S4 > max3 \ (dominant)$$

All programs +8:



Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff1**
- and **S3** has not exceeded the threshold **max1**.

or

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S4** by the difference **diff1**
- and **S4** has not exceeded the threshold **max2**.

Pump **A2** runs, if:

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max1**.

or

- **S2** exceeds the threshold **min2** • and **S2** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

$$A1 = S1 > (S3 + diff1) \ \& \ S1 > min1 \ \& \ S3 < max1$$

or

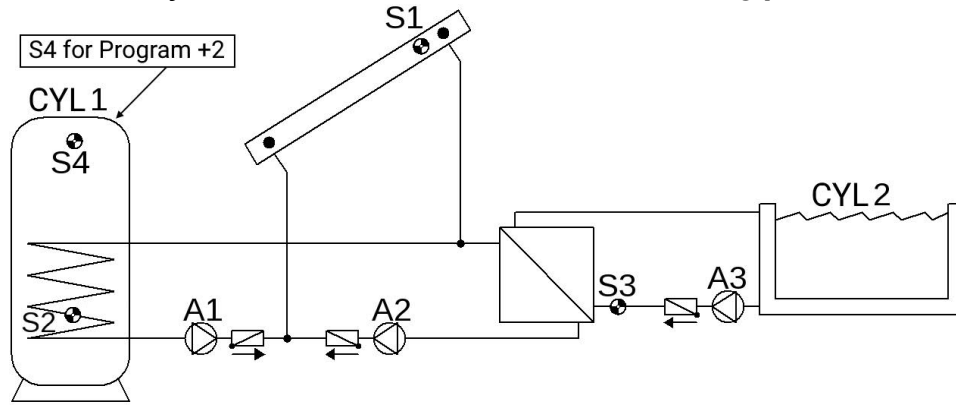
$$S1 > (S4 + diff1) \ \& \ S1 > min1 \ \& \ S4 < max2$$

$$A2 = S2 > (S3 + diff2) \ \& \ S2 > min2 \ \& \ S3 < max1$$

or

$$S2 > (S4 + diff2) \ \& \ S2 > min2 \ \& \ S4 < max2$$

Program 624 – Solar system with one consumer and swimming pool



<p>S1 min1</p> <p>diff1 diff2 A1 A2, (A3)</p> <p> ↙ ↘</p> <p>S2 S3 max1 max2</p>	<p>necessary settings:</p> <p>max1 ... limit CYL1 S2 → A1</p> <p>max2 ... limit CYL2 S3 → A2</p> <p>max3 ... see all programs +2</p> <p>min1 ... activation temp. coll. S1 → A1, A2</p> <p>min2 ... see all programs +4</p> <p>diff1 ... coll. S1 - CYL1 S2 → A1</p> <p>diff2 ... coll. S1 - CYL2 S3 → A2</p> <p>Excess temperature limiter: ... activate for S1 and A1+A2</p>
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Program 624: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S3** by the difference **diff2**
- and **S3** has not exceeded the threshold **max2**.

Filter pump **A3** runs, if:

- **A3** is enabled via an **Or** time program
- or pump **A2** is running in automatic mode.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S1 > (S3 + diff2) \ \& \ S1 > min1 \ \& \ S3 < max2$$

$$A3 = (A3 = time \ program \ on) \ or \ (A2 = automatic \ on)$$

All programs +1: Instead of the two pumps **A1** and **A2**, one pump **A1** and a three-way valve **A2** are used.

Without priority allocation, cylinder 2 is filled by default.

A1... mutual pump **A2**... valve (A2/NO receives voltage when charging cylinder CYL2)

All programs +2: Additionally: If sensor **S4** exceeds the threshold **max3**, then pump **A1** is deactivated.

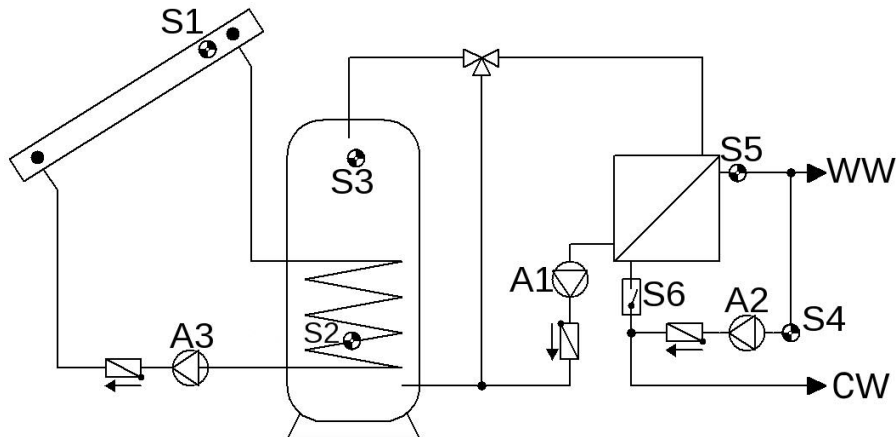
All programs +4: Both solar circuits receive separate activation thresholds at **S1**. Output **A1** retains **min1** and **A2** is regulated via **min2**.

The **Priority Ranking** between **CYL1** and **CYL2** can be set in the menu **Settings/Technician level/Parameters/Priority ranking**. Additionally, a solar priority function can be set up in the menu **Settings/Expert level/Solar priority** (see „Solar Priority“ for more details).

Program 640 – DHW preparation incl. circulation

Only practical with speed control activated!

(Absolute value control: mode „Inverted“ input S5, Differential v.c. mode „Normal“ sensors S3 and S5)



WARNING: The excess collector temperature limiter is activated for **A1** by default. This must be changed to **A3** or deactivated entirely.

<p>S1 min1</p> <p>diff1 A3</p> <p>↓</p> <p>S2 max1</p>	<p>S3 min2</p> <p>diff2 A2</p> <p>↓</p> <p>S4 max2</p>	<p>necessary settings:</p> <p>max1 ... limit CYL S2 → A3</p> <p>max2 ... limit circ. return S4 → A2</p> <p>min1 ... activation temp. coll. S1 → A3</p> <p>min2 ... activation temp. CYL S3 → A2</p> <p>diff1 ... coll. S1 - CYL S2 → A3</p> <p>diff2 ... CYL S3 - circ.return. S4 → A2</p> <p>Excess temperature limiter: ... activate for S1 and A3</p>
<p>A1 = FIS (S6) = ON</p>		

Program 640: Pump **A1** runs, if:

- the flow switch (**FIS**) **S6** detects a flow. The nominal value for the speed control (absolute value control) of pump **A1** is specified for sensor **S5**.

Pump **A2** runs, if:

- **S3** exceeds the threshold **min2** • and **S3** is greater than **S4** by the difference **diff2**
- and **S4** has not exceeded the threshold **max2**.

Pump **A3** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

A1 = flow switch (S6) = ON

A2 = S3 > (S4 + diff2) & S3 > min2 & S4 < max2

A3 = S1 > (S2 + diff1) & S1 > min1 & S2 < max1

All programs +1: Pump **A2** is only activated, if **S6** is **ON**, in addition to basic regulation.

All programs +4: Pump **A1** runs, if:

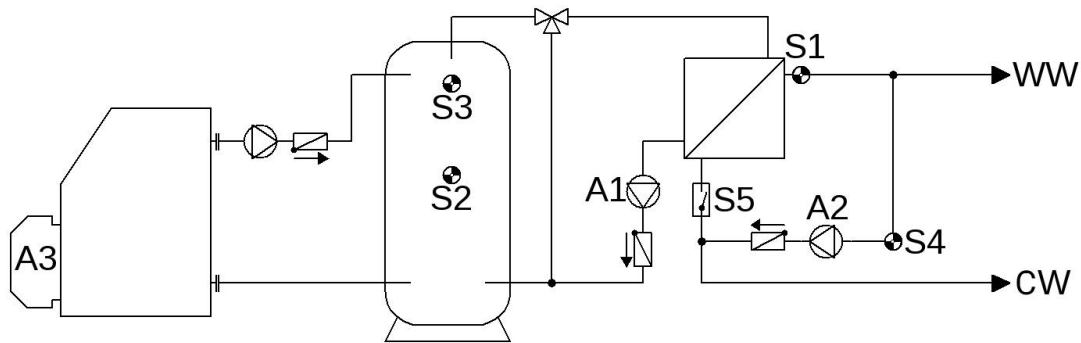
- the flow switch **S6** detects a flow or pump **A2** is activated.

A1 = A2 or flow switch S6 = EIN

Program 656 – DHW preparation incl. circulation + burner request

Only practical with speed control activated!

(Absolute value control: mode „Inverted“ input S1, Differential v.c. mode „Normal“ sensors S3 and S1)



<p>S3 min1</p> <p>diff1 A2</p> <p>S4 max1</p> <p>A1 = FLS (S5) = ON</p>	<p>Burner A3</p> <p>S3 min3 S2 max3</p>	<p>necessary settings:</p> <p>max1 ... limit circulation return S4 → A2</p> <p>max2 ... burner req. off CYL S2 → A3</p> <p>min1 ... activation temp. CYL S3 → A2</p> <p>min3 ... burner req. off CYL S3 → A3</p> <p>diff1 ... CYL S3 - circ. return S4 → A2</p>
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Program 656: Pump **A1** runs, if:

- Flow switch **S5** detects flow. The nominal value for the speed control (absolute value control) of pump **A1** is specified for **S1**.

Pump **A2** runs, if:

- **S3** exceeds the threshold **min1** • and **S3** is greater than **S4** by the difference **diff1**
- and **S4** has not exceeded the threshold **max1**.

Output **A3** is activated, if **S3** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S2** exceeds the threshold **max3**.

$$A1 = \text{flow switch } (S5) = ON$$

$$A2 = S3 > (S4 + \text{diff1}) \ \& \ S3 > \text{min1} \ \& \ S4 < \text{max1}$$

$$A3 \text{ (on)} = S3 < \text{min3} \quad A3 \text{ (off)} = S2 > \text{max3}$$

All programs +1: Circulation pump **A2** is only activated, if flow switch **S5** is **ON** (**A1** = ON), in addition to basic regulation.

All programs +2: The burner request (**A3**) is regulated using only sensor **S3**.

$$A3 \text{ (on)} = S3 < \text{min3} \quad A3 \text{ (off)} = S3 > \text{max3} \text{ (dominant)}$$

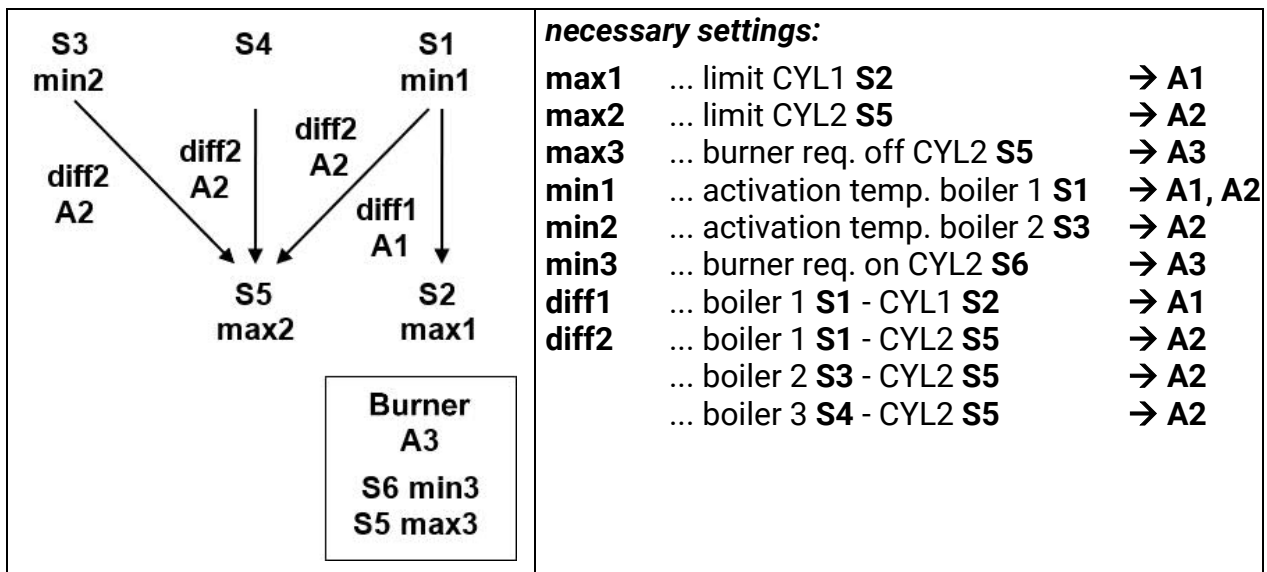
All programs +4: Pump **A1** runs, if:

- Flow switch **S5** or pump **A2** is active.

$$A1 = A2 \text{ or flow switch } S5 = ON$$

Program 672 – 3 generators for 1 consumer + differential circuit + burner request

No diagram available



Program 672: Pump **A1** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S2** by the difference **diff1**
- and **S2** has not exceeded the threshold **max1**.

Pump **A2** runs, if:

- **S1** exceeds the threshold **min1** • and **S1** is greater than **S5** by the difference **diff2**
 - and **S5** has not exceeded the threshold **max2**.
- or
- **S3** exceeds the threshold **min2** • and **S3** is greater than **S5** by the difference **diff2**
 - and **S5** has not exceeded the threshold **max2**.
- or
- **S4** is greater than **S5** by the difference **diff2**
 - and **S5** has not exceeded the threshold **max2**.

Output **A3** is activated, if **S6** falls below the threshold **min3**.

Output **A3** is deactivated (dominantly), if **S5** exceeds the threshold **max3**.

$$A1 = S1 > (S2 + diff1) \ \& \ S1 > min1 \ \& \ S2 < max1$$

$$A2 = S1 > (S5 + diff2) \ \& \ S1 > min1 \ \& \ S5 < max2$$

or

$$S3 > (S5 + diff2) \ \& \ S3 > min2 \ \& \ S5 < max2$$

or

$$S4 > (S5 + diff2) \ \& \ S5 < max2$$

$$A3 \ (on) = S6 < min3 \quad A3 \ (off) = S5 > max3$$

Program 673: The burner request (**A3**) is regulated using only sensor **S6**.

$$A3 \ (on) = S6 < min3 \quad A3 \ (off) = S6 > max3 \ (dominant)$$

Program 674: The burner request (**A3**) is regulated using only sensor **S5**.

$$A3 \ (on) = S5 < min3 \quad A3 \ (off) = S5 > max3 \ (dominant)$$

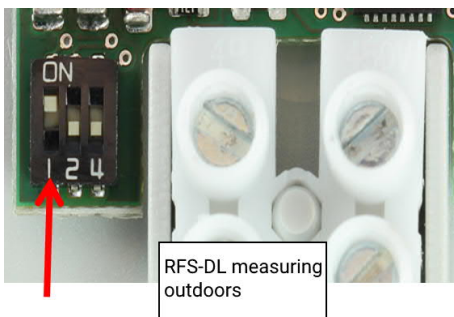
Building drying – General Information

A special application of the universal controller UVR65 is the energy-saving and cost-effective drying of basements and other building parts via regulation of ventilation. The special functionality of the sensor RFS-DL (measurement of absolute humidity) enables the comparison of the values for absolute humidity indoors and outdoors to turn a fan on or off.

Goals:

- Lowering of humidity through targeted ventilation with dry air
- Improvement of air quality and odor with frequent ventilation
- Replacement of energy-inefficient dehumidification devices

Two humidity sensors 01/**RFS-DL** are required.



The RFS-DL intended to measure **outdoors** must have its DL-Bus address adjusted.
Dip-switch 1 must be set to **ON**.
This changes the sensor's address to **2**.

Basics

- **The direction of the fan must have it blowing from outdoors to the inside**
If the fan blows from indoors to the outside, you risk warm and humid air streaming in from adjacent building parts, which humidifies the room even more, rather than drying it.
- **A supply fan suffices in most cases**
The exhaust air is pushed out through leaks in the building. Airtight buildings must have an overflow opening added. If a supply fan and an exhaust fan are used, the throughput of the exhaust fan must never exceed that of the supply fan.
- **The ventilated building/room must be as airtight as possible.**
In order to prevent an unwanted influx of humid air through natural circulation, windows and doors should remain closed.
- In order to keep the resulting cooling of ventilated rooms within reasonable limits (especially in cold seasons), timer-controlled interval operation is useful. An additional temperature monitoring can be implemented.
- The exterior humidity sensor must be protected from direct insolation and rain. If necessary, it must be physically shielded from such dangers to its functionality.

External sensors

Ext. sensors
Ext. sens. 1 EXT input 1
Ext. sens. 2 EXT input 2

The humidity sensors **RFS-DL** aren't usual sensors and must be connected to the **Dataline (DL-Bus)**. The chapter „**Electrical connection**“ explains the **Dataline** in further detail.

The humidity sensors are automatically parameterized as *External Sensors* (Expert level) if a building drying program is input. This includes address and index of the sensors, but adjusting the exterior sensor's address to 2 on the sensor itself is still necessary (as described above).

Choosing a building drying program automatically binds inputs and external sensors according to the table below to reduce the amount of necessary manual setup. These settings can of course be changed, if so desired.

Input	Ext. Sensor	Value
S1	E1	Absolute humidity indoors
S2	E2	Absolute humidity outdoors
S3	E3	Temp. indoors
S4	E4	Temp. outdoors
S5	E5	Relative humidity indoors
S6	E6	Relative humidity outdoors

Programs – Building drying

Program 688 – Only room drying

A room's humidity is to be reduced. As soon as the absolute humidity *outdoors* falls below the humidity *indoors*, a fan is activated.

The fan runs, if

- the absolute humidity outdoors falls below the absolute humidity indoors **and**
- the optional interval operation („timer“) is active **and**
- the relative humidity *indoors* exceeds the minimal humidity **min1**.

necessary settings:		factory setting
min1	... minimum relative humidity indoors	62/60%
diff1	... minimum difference in humidity indoors/outdoors	1,0/0,5 g/m ³

$$A1 = S5 > min1 \ \& \ S1 > (S2 + diff1)$$

No time programs can be set up for this program.

Program 689 – Room drying and minimum temperature monitoring

A room's humidity is to be reduced. If it becomes too cold in the ventilated room, the fan is deactivated.

The fans runs, if

- the absolute humidity outdoors falls below the absolute humidity indoors **and**
- the room temperature is high enough (to prevent excessive cooling in cold seasons) **and**
- the optional interval operation („timer“) is active **and**
- the relative humidity *indoors* exceeds the minimum humidity **min1**

necessary settings:		factory setting
min1	... minimum relative humidity indoors	62/60%
diff1	... minimum difference in humidity indoors/outdoors	1,0/0,5 g/m ³
min3	... minimum temperature indoors	10/9 °C

$$A1 = S5 > min1 \ \& \ S1 > (S2 + diff1) \ \& \ S3 > min3$$

No time programs can be set up for this program.

Program 690 – Room drying, minimum temperature monitoring, comfort ventilation

A room's humidity is to be reduced. If it becomes too cold in the ventilated room, the fan is deactivated.

In order to guarantee a certain degree of air quality, the fan is activated despite exterior humidity or if the room temperature falls below a set minimum. The fan is activated via one or more time programs, preferably in the cool morning hours, to achieve the „comfort ventilation“.

The fan runs for *room drying* purposes, if

- the absolute humidity outdoors falls below the absolute humidity indoors **and**
- the temperature is high enough (to prevent excessive cooling in cold seasons) **and**
- the optional interval operation („timer“) is active **and**
- the relative humidity *indoors* exceeds the minimum humidity **min1**.

The fan runs for *comfort ventilation* purposes daily, according to time programs.

necessary settings:		factory setting
min1	... minimum relative humidity indoors	62/60%
diff1	... minimum difference in humidity indoors/outdoors	1,0/0,5 g/m ³
min3	... minimum temperature indoors	10/9 °C

$$A1 = S5 > min1 \ \& \ S1 > (S2 + diff1) \ \& \ S3 > min3 \ || \ TW(1-3)$$

This program has the time programs 1-3 affecting A1. Time program 1 has factory settings for 6:00-6:30 daily.

Program 691 – Room drying & comfort ventilation, minimal temp. monitoring for both

A room's humidity is to be reduced. To ensure a certain level of air quality, the fan is activated despite exterior humidity. The fan is activated via one or more time programs, preferably in the cool morning hours. If the set minimum room temperature is underrun, the comfort ventilation is deactivated as well.

The fan runs for room drying purposes, if

- the absolute humidity outdoors falls below the absolute humidity indoors **and**
- the temperature is high enough (to prevent excessive cooling in cold seasons) **and**
- the optional interval operation („timer“) is active **and**
- the relative humidity *indoors* exceeds the minimum humidity **min1**.

The fan runs for *comfort ventilation* purposes daily, according to time programs, as long as the room temperature is high enough.

necessary settings:		factory setting
min1	... minimum relative humidity indoors	62/60%
diff1	... minimum difference in humidity indoors/outdoors	1,0/0,5 g/m ³
min3	... minimum temperature indoors	10/9 °C

$$A1 = S5 > min1 \ \& \ S1 > (S2 + diff1) \ \& \ S3 > min3 \ || \ (TW(1-3) \ \& \ S3 > min3)$$

This program has the time programs 1-3 affecting A1. However, if the minimum room temperature is underrun, time program 1 will be blocked (TW1 has factory settings for 6:00-6:30 daily).

Program 692 – Room drying, room temp. monitoring, comfort ventilation, for wine cellars

A wine cellar’s humidity is to be lowered. To ensure a certain level of air quality, the fan is activated despite exterior humidity. The fan is activated via one or more time windows, preferably in the cool morning hours.

The fan runs for *room drying* purposes, if

- the **absolute** humidity outdoors falls below the absolute humidity indoors **and**
- the **relative** humidity indoors exceeds 60% (for example) **and**
- the room temperature exceeds the desired temperature (example: 10°C) **and**
- the optional interval operation („timer“) is active **and**
- die maximum temperature indoors **max1** has not been exceeded.

The fan runs for *comfort ventilation* purposes daily, according to the time programs, without regard to other settings (example: 10:00 bis 10:30). Up to 3 time programs can be set up.

necessary settings:		factory setting
min1	... minimum relative humidity indoors	62/60%
diff1	... minimum difference in humidity indoors/outdoors	1,0/0,5 g/m ³
min3	... minimum temperature indoors	10/9 °C
max1	... maximum temperature indoors	14/13 °C

The time programs 1-3 affect A1 (TW1 has factory settings for 6:00-6:30 daily)

$$A1 = (S5 > min1 \ \& \ S1 > (S2 + diff1) \ \& \ S3 > min3 \ \& \ S3 < max1) \ || \ TW(1-3)$$

All building drying programs +8 (additional dehumidifier)

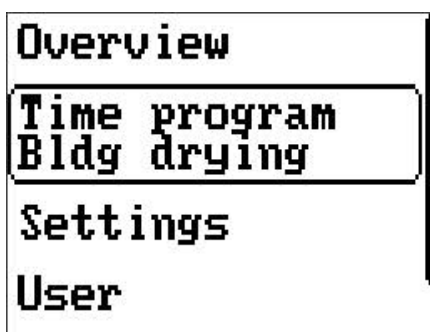
Additional parameters:

min2 (Factory settings = 72/70% minimum relative humidity indoors)

Priority ventilation (Factory settings = False)

$$A3 = S5 > min2 \ (activation \ dehumidifier)$$

Setting up time programs



Setting up a building drying program that features time programs will cause the option „**Time program Bldg drying**“ to appear in the main menu, used to parameter.

Three time programs are available, each with three adjustable time frames. A time programs can be bound to any days of the week. These bindings count for all of the time program’s time frames.



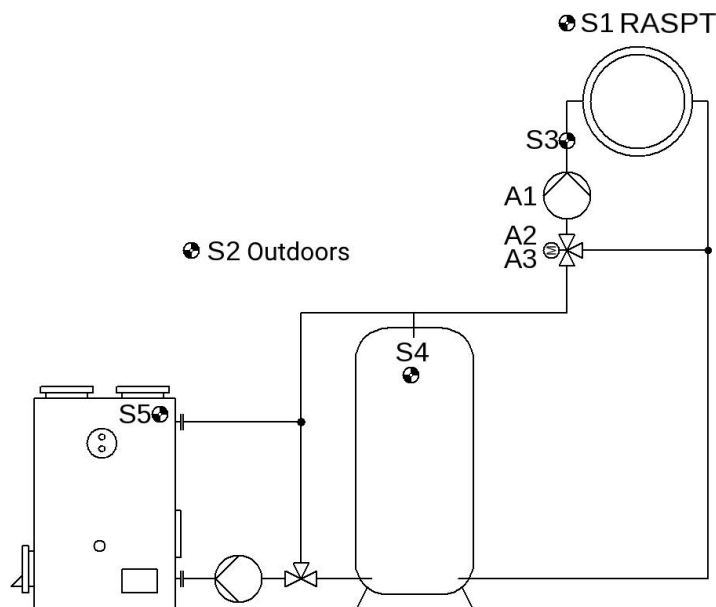
The chosen time program (and its assigned days of the week) have a black background. To change a time frame, the wheel must be turned until the desired value is framed in bold. Pushing the wheel down opens a window to adjust the frame’s time.

Heating circuit control - Programs

All heating circuit programs (except program groups 816 and 976 as well as other stated exceptions) require the following settings:

<p>Overview</p> <p>Time/Date</p> <p>Mode (preferably Auto)</p> <p>Time programs</p> <p>Expert level:</p> <p>Menu <i>Programming settings</i></p> <p>Program (number)</p> <p>Room sensor present (Y/N)</p> <p>Use S4 (only P800 - 802)</p> <p>Menus <i>Shutdown conditions & Mixer</i></p>	<p>Technician level:</p> <p>Menu <i>Parameters</i></p> <p>Basic parameters</p> <p>Heat curve</p> <p>Set flow temp. at +10°C and at -20°C or Slope</p> <p>Flow temperature <i>min</i> and <i>max</i></p> <p>Frost protection conditions</p> <p>Time program set values (Y/N)</p> <p>Mixer selection (only P832 and above)</p>
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Program 800 – Heating circuit with up to 2 heat sources



<p>S1... Room sensor</p> <p>S2... Temperature outdoors</p> <p>S3... Heating circuit flow</p> <p>S4... Cylinder top</p> <p>S5... Boiler</p>	<p>A1... Heating circuit pump</p> <p>A2... Mixer OPEN</p> <p>A3... Mixer CLOSE</p>
---	---

A1 = S4 > min1 & (Heating circuit = active)

A2/A3 = Mixer

If no room sensor is in use, the room influence in the menu point **Expert level/Mixer** must be set to **0.0%**.

Program 800: Activation of heating circuit pump **A1**, if sensor **S4** has exceeded the threshold **min1**. If sensor **S4** is not in use, then the corresponding program setting must be adjusted accordingly.

All programs +1: Like program 800, but the heating circuit pump **A1** is also enabled via sensor **S5** and the minimum threshold **min2** (2 generators for the heating circuit).

$$A1 = ((S4 > min) \text{ or } (S5 > min2)) \& (heating = active)$$

All programs +2: Like program 800, but the **set flow temperature** is output via control output A4 (e.g. for burner modulation).

Scaling: 0°C = 0.0 V
 100°C = 10.0 V

Example: The set flow temperature of 55°C is output via control output A4 as 5,5 Volt. However, the voltage being output does not fall below the threshold **min1**. If the pump is deactivated via a shutdown condition (menu **Shutdown conditions**), then the control output will output 0,5V. If it is deactivated by the shutdown condition **S4 < min1**, voltage equal to the set flow temperature (as calculated by the controller) will be output, however not below the threshold **min1**.

The menu **Technician level/Parameters** features several adjustment settings under the point **Modulation**:

Offset-value for the set flow temp., range of -50,0K to +50,0K. (FS = 0,0K)

Inverse output Yes/No, FS = No

Min. output range of 0.00V - 10.00V, FS = 0.00V

Max. output range of 0.00V - 10.00V, FS = 10.00V

All programs +4: Like program 800, but the **mixer control** is output via control output A5 (for mixers with 0-10V-regulation).

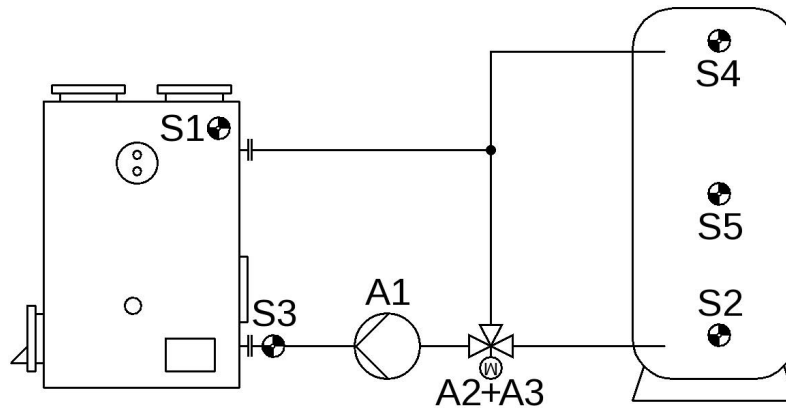
The menu **Technician level/Parameters** features adjustment settings under the point **0-10V mixer**:

Inverse output Yes/No, FS = NO

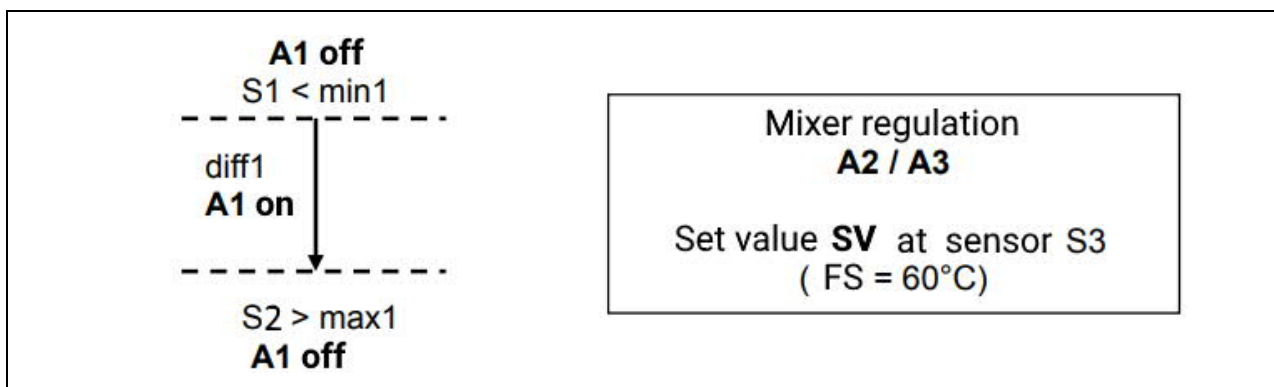
Min. output range of 0.00V - 10.00V, FS = 0.00V

Max. output range of 0.00V - 10.00V, FS = 10.00V

Program 816 – Boiler circuit pump, mixer for return flow boosting



Program 816: Boiler circuit pump **A1** is enabled, if **S1** exceeds the threshold **min1** and **S4** is greater than **S2** by the difference **diff1** and **S2** has not exceeded the threshold **max1**.



$$A1 = S1 > min1 \ \& \ S1 > (S2 + diff1) \ \& \ S2 < max1$$

Program 817: Like program 816, however with additional 10V burner request via sensors **S4** and **S2** at the control output **A4**.

min3 ... A4 on (10V)	S4 (FS = 60°C)
max3 ... A4 off (0V)	S2 (FS = 75°C)

$$A1 = S1 > min1 \ \& \ S1 > (S2 + diff1) \ \& \ S2 < max1$$

$$A4 \ on = S4 < min3$$

$$A4 \ off = S2 > max3$$

The menu **Technician level/Parameters** features a setting to change the control output from **inverse no** to **inverse yes**. The setting **inverse yes** has the control output generating 0 Volts, if the threshold **min3** is underrun and 10 Volts, if the threshold **max3** is exceeded.

Program 818: Like program 816, but with additional 10 V burner request via sensors **S4** and **S5** at the control output **A5**.

min3 ... A5 on (10V)	S4 (FS = 60°C)
max3 ... A5 off (0V)	S5 (FS = 75°C)

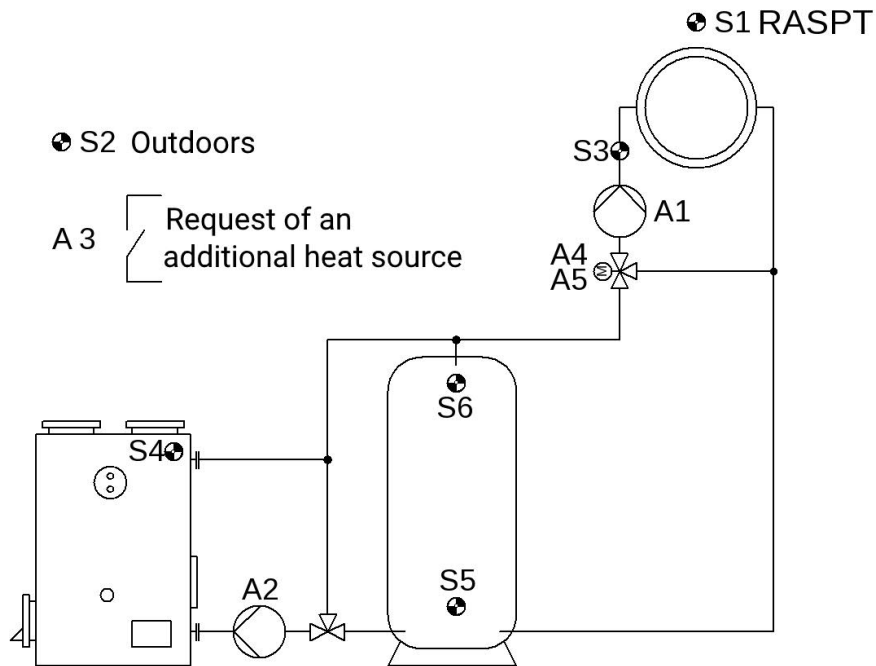
$$A1 = S1 > min1 \ \& \ S1 > (S2 + diff1) \ \& \ S2 < max1$$

$$A5 \ on = S4 < min3$$

$$A5 \ off = S5 > max3$$

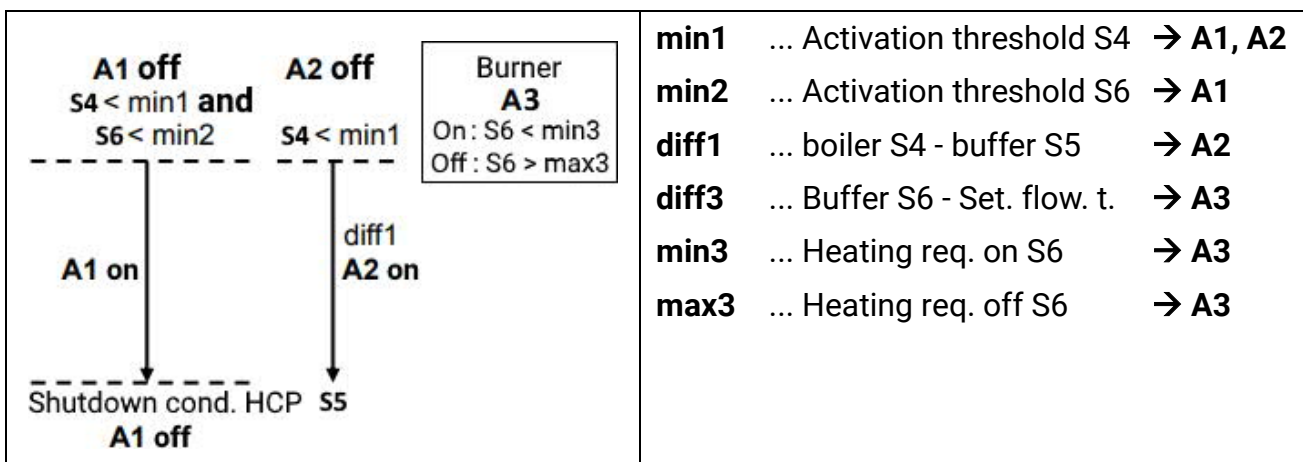
The menu **Technician level/Parameters** features a setting to change the control output from **inverse no** to **inverse yes**. The settings **inverse yes** has the control output generating 0 Volts, if the threshold **min3** is underrun and 10 Volts, if the threshold **max3** is exceeded.

Program 832 – Solid fuel burner, buffer cylinder, heating circuit, additional heating req.



S1 ... Room sensor	A1 ... Heating circuit pump
S2 ... Temperature outdoors	A2 ... Buffer charging pump
S3 ... Heating circuit flow	A3 ... Heating request
S4 ... Boiler	A4 ... Mixer OPEN
S5 ... Buffer bottom	A5 ... Mixer CLOSE
S6 ... Buffer top	

Program 832: Enabling of the heating circuit pump **A1** via boiler temp. and buffer temp., regulation of buffer charging pump **A2**, burner request related to buffer.



$$A1 = (S4 > \text{min1} \text{ or } S6 > \text{min2}) \ \& \ (\text{Heating} = \text{active})$$

$$A2 = S4 > \text{min1} \ \& \ S4 > S5 + \text{diff1}$$

$$A3 \text{ on} = S6 < \text{min3}$$

$$A3 \text{ off} = S6 > \text{max3}$$

$$A4/A5 = \text{Mixer}$$

Program 833: The burner is regulated only via **S5**.

A3 on = S5 < min3

A3 off = S5 > max3

Program 834: Separate activation and deactivation thresholds via sensors **S5** and **S6**.

A3 on = S6 < min3

A3 off = S5 > max3

Program 835: Activation and deactivation thresholds are related to the set flow temperature.

A3 on = S6 < Set flow temp. + diff3 & Heating active

A3 off = S6 > Set flow temp. + diff3

Program 836: Separate activation and deactivation thresholds for the heating request. Both thresholds are related to the set flow temperature.

A3 on = S6 < Set flow temp. + diff3 & Heating active

A3 off = S5 > Set flow temp. + diff3

Program 837: The heating request is related to the set flow temperature.

A3 on = S6 < Set flow temp. + diff3 & Heating active

A3 off = S6 > max3

Program 838: Separate activation and deactivation thresholds for the heating request. The heating request is related to the set flow temperature, the deactivation threshold is regulated via **S5**.

A3 on = S6 < Set flow temperature + diff3 & Heating active

A3 off = S5 > max3

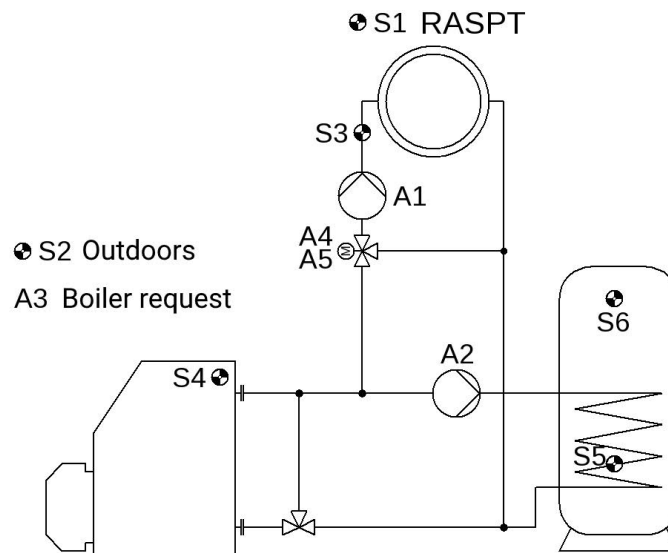
All programs +8: The heating request is only permissible, if the solid fuel burner is cold.

A3 (+8) = S4 < min1 & Conditions for A3 of other programs

All programs +16: The heating circuit pump **A1** is regulated **only** via the buffer temperature **S6** and **not** via the boiler temperature **S4**.

A1 = S6 > min2 & Heating = active

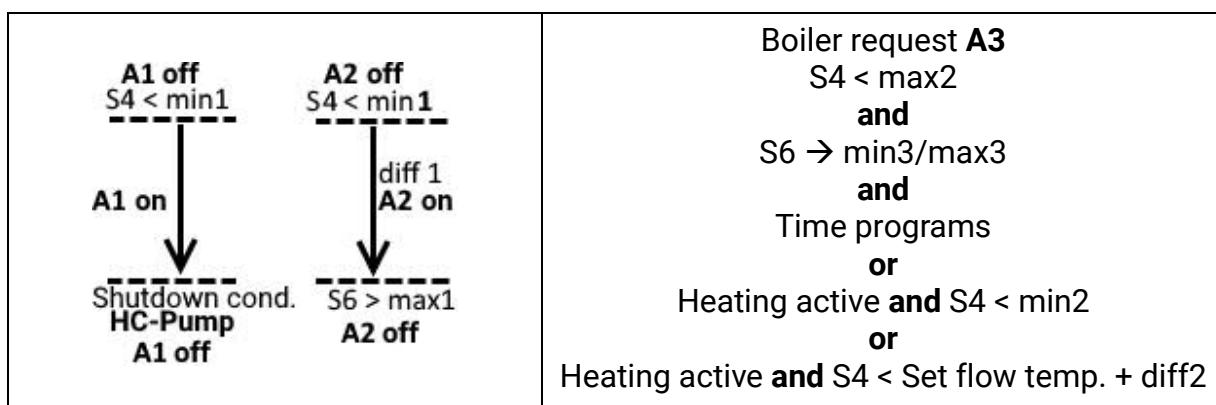
Program 896 – Automatic burner, cylinder, heating circuit, boiler request



Sensors	Outputs
S1 ... Room sensor	A1 ... Heating circuit pump
S2 ... Temperature outdoors	A2 ... Cylinder charging pump
S3 ... Heating circuit flow	A3 ... Boiler request
S4 ... Boiler	A4 ... Mixer OPEN
S5 ... Cylinder bottom	A5 ... Mixer CLOSE
S6 ... Cylinder top	

Basic functionality (P896): No buffer, cylinder charging pump = **A2**, Boiler request = **A3**.

For a **modulating boiler operation without a mixer** it's feasible to set the thresholds **min1** and **min2** to 5°C (= no functionality) and to activate the pump shutdown condition Set flow temp. in the menu Shutdown conditions.



necessary parameter settings:

min1 ... Activation threshold S4 → A1+A2	min3 ... Heating request on S6 → A3
min2 ... Basic temperature S4 → A3	max3 ... Heating request off S6 → A3
max1 ... Limit cylinder S6 → A2	diff1 ... Burner S4 - cylinder S6 → A2
max2 ... Limit boiler S4 → A3	diff2 ... Burner S4 < set flow t. → A3

Program 896:

$$A1 = S4 > min1 \& Heating = active$$

$$A2 = S4 > min1 \& S4 > S6 + diff1 \& S6 < max1$$

$$A3 = [(S6 \rightarrow min3/max3 \& TP_{Req. DHW}) \text{ or } ((S4 < min2 \text{ or } S4 < Set flow temp + diff2) \& (Heating = active))] \& S4 < max2$$

All programs +1: Cylinder priority

$$A1 (+1) = \text{only if } [(S6 < max1) \& TP_{Req. DHW}] \text{ is false}$$

Together with „All programs +2“:

$$A1 (+3) = \text{only if } [(S5 < max1) \& TP_{Req. DHW}] \text{ is false}$$

All programs +2: Separate sensors for activation and deactivation threshold of the DHW request

$$A2 = S4 > min1 \& S4 > S5 + diff1 \& (S5 < max1)$$

$$A3 \text{ on} = \{(S6 < min3 \& TP_{Req. DHW}) \text{ or } [(S4 < min2 \text{ or } S4 < Set flow temp + diff2) \& Heating = active]\} \& S4 < max2$$

$$A3 \text{ off} = \{(S5 > max3 \& [(S4 > min2 \& S4 > Set flow temp + diff2) \& Heating = active]) \text{ or } S4 > max2\}$$

All programs +4: Like program 896, however limit **max1** at **S6** only active, if heating = active.

$$A2 = S4 > min1 \& S4 > S6 + diff1 \& (S6 < max1 \& Heating = active)$$

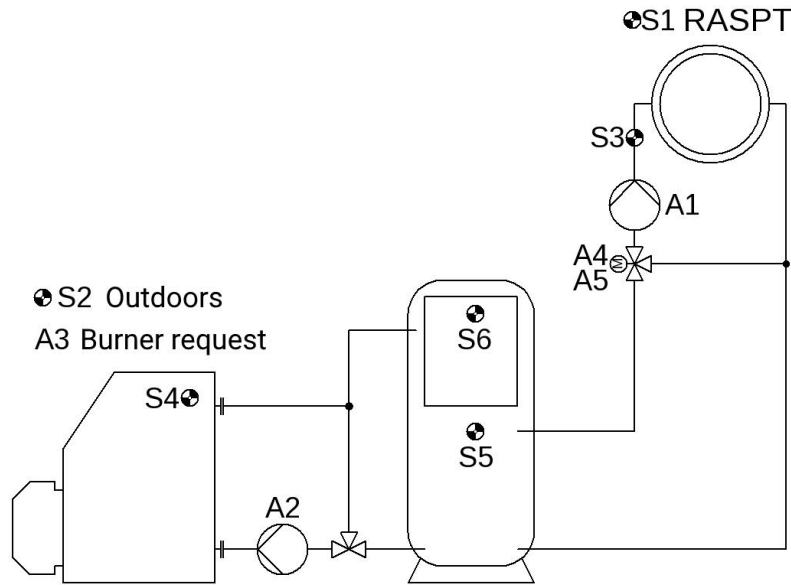
All programs +8: Like program 896, however the burner request is only related to the demand of the heating circuit and the cylinder charging rather than to a comparison with the boiler temperature.

$$A3 \text{ on} = [(S6 < min3 \& TP_{Req. DHW}) \text{ or } (Heating = active)] \& (S4 < max2)$$

$$A3 \text{ off} = (S6 > max3 \& Heating = inactive) \text{ or } S4 > max2$$

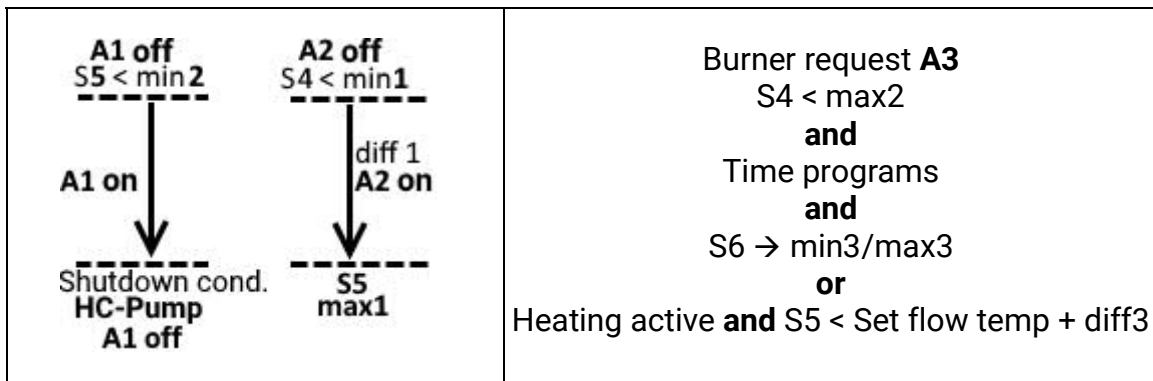
Time programs are not possible for the heating circuit **A1** and the DHW request **A3**. The time program **TP_{Req. DHW}** **only** affects the request **A3** and **not** the charging pump.

Program 912 – Automatic boiler, (combined) buffer, heating circuit, burner request



Sensors	Outputs
S1 ... Room sensor	A1 ... Heating circuit pump
S2 ... Temperature outside	A2 ... Buffer charging pump
S3 ... Heating circuit flow	A3 ... Burner request
S4 ... boiler	A4 ... Mixer OPEN
S5 ... Buffer top	A5 ... Mixer CLOSE
S6 ... Buffer bottom	

Basic functionality (P912): The combined buffer is held to a certain temperature by the automatic burner. Buffer charging pump **A2**, burner request **A3**, Mixer regulation **A4+A5**.



necessary parameter settings			
min1 ... activation threshold S4 → A2	max1 ... limit buffer S5		→ A2
min2 ... activation threshold S5 → A1	max2 ... limit boiler S4		→ A3
min3 ... Heating request on S6 → A3	max3 ... Heating request off S6 (S5) → A3		
diff1 ... Burner S4 - CYL bot. S5 → A2	diff3 ... CYL bottom S5 < set flow t. → A3		

$$A1 = S5 > min2 \ \& \ (Heating = active)$$

$$A2 = S4 > min1 \ \& \ S4 > S5 + diff1 \ \& \ S5 < max1$$

$$A3 \ on = [(S6 < min3 \ \& \ TP_{Req. \ DHW}) \ or \ (S5 < set \ flow \ temp + diff3 \ \& \ (Heating = active))] \ \& \ TP_{Req. \ Burner} \ \& \ S4 < max2$$

$$A3 \ off = [S6 > max3 \ \& \ (S5 > set \ flow \ temp + diff3 \ \& \ (Heating = active))] \ or \ S4 > max2$$

Program 913: Separate deactivation threshold for the burner request at **S5** and **S6** (hold circuit).

$$A3 \text{ on} = S6 < \text{min}3 \ \& \ S4 < \text{max}2 \ \& \ TP_{\text{Req. DHW}} \ \& \ TP_{\text{Req. burner}}$$

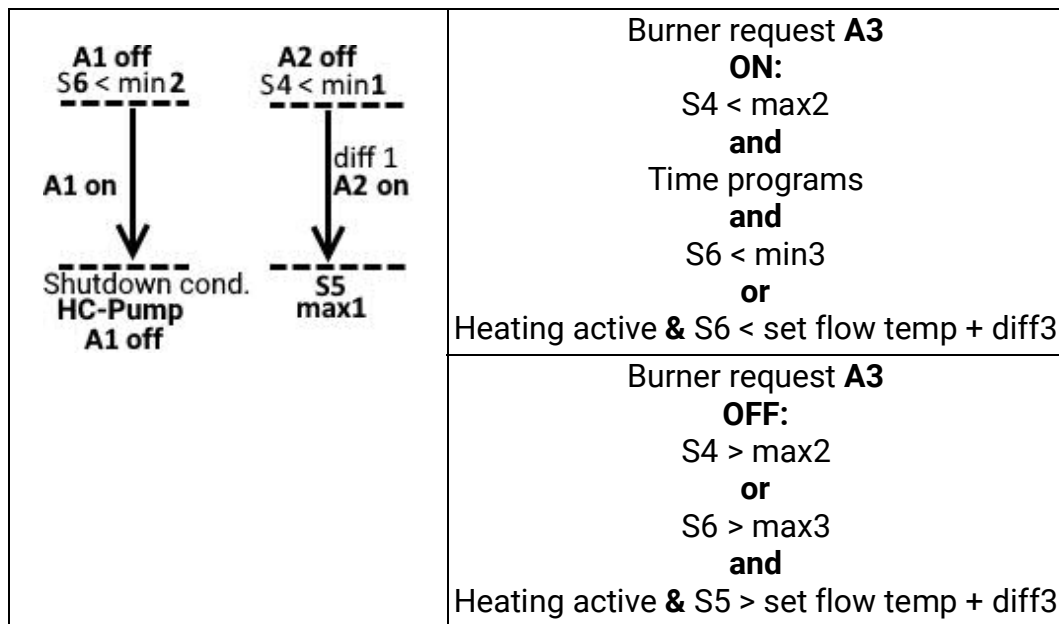
$$A3 \text{ off} = S5 > \text{max}3 \ \text{or} \ S4 > \text{max}2$$

Program 914: Hold circuit with difference to the set flow temperature.

$$A1 = S6 > \text{min}2 \ \& \ (\text{Heating} = \text{active})$$

$$A3 \text{ on} = [(S6 < \text{min}3 \ \& \ TP_{\text{Req. DHW}}) \ \text{or} \ (S6 < \text{set flow temp} + \text{diff}3 \ \& \ \text{Heating} = \text{active})] \ \& \ TP_{\text{Req. burner}} \ \& \ S4 < \text{max}2$$

$$A3 \text{ off} = [S6 > \text{max}3 \ \& \ (S5 > \text{set flow temp} + \text{diff}3 \ \& \ \text{Heating} = \text{active})] \ \text{or} \ S4 > \text{max}2$$



Program 915: Burner request unrelated to the heating circuit.

$$A1 = S6 > \text{min}2 \ \& \ (\text{Heating} = \text{active})$$

$$A2 = S4 > \text{min}1 \ \& \ S4 > S5 + \text{diff}1 \ \& \ S5 < \text{max}1$$

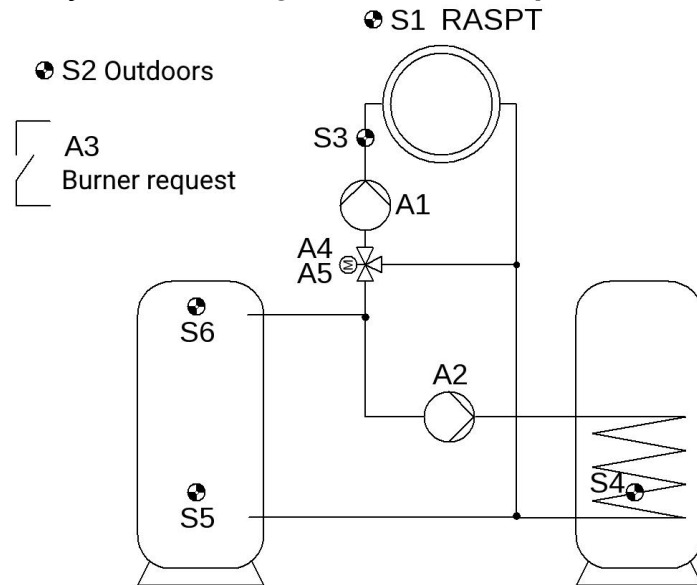
$$A3 = S5 \rightarrow \text{min}3/\text{max}3 \ \& \ TP_{\text{Req. burner}} \ \& \ S4 < \text{max}2$$

All programs +4: The buffer charging pump **A2** is activated along with the burner request (intended for condensing boilers with a minimum circulating water level).

$$A2 = \text{Conditions for A2 or A3 of the corresponding program}$$

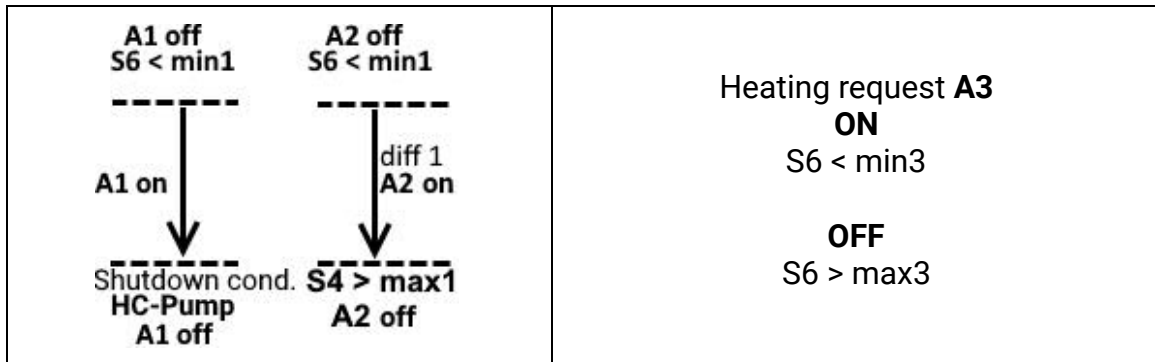
Time programs for heating circuit **A1**, DHW request **A3** and burner request **A3** possible.

Program 928 – Buffer, Cylinder, Heating circuit, boiler request



Sensors	Outputs
S1 ... Room sensor	A1 ... Heating circuit pump
S2 ... Temperature outdoors	A2 ... Cylinder charging pump
S3 ... Heating circuit flow	A3 ... Heating request
S4 ... Cylinder bottom	A4 ... Mixer OPEN
S5 ... Buffer bottom	A5 ... Mixer CLOSE
S6 ... Buffer top	

Basic functionality (P928): Regulation of the heating circuit pump **A1**, cylinder charging pump **A2**, burner request **A3**.



necessary parameter settings:		
min1	... Activation threshold S6	→ A1, A2
min3	... Heating request ON S6	→ A3
max1	... Limit cylinder S4	→ A2
max3	... burner request OFF S6	→ A3
diff1	... Buffer S6 - cylinder S4	→ A2

$$A1 = S6 > min1 \text{ \& (Heating = active)}$$

$$A2 = S6 > min1 \text{ \& } S6 > S4 + diff1 \text{ \& } S4 < max1 \text{ \& } TP_{Req. DHW}$$

$$A3 \text{ on} = S6 < min3$$

$$A3 \text{ off} = S6 > max3$$

Program 929: Like program 928, deactivation threshold of the burner request at **S5** (holding circuit).

$$A2 = S6 > min1 \& S6 > S4 + diff1 \& S4 < max1 \& ZP_{Req. DHW}$$

$$A3 \text{ on} = S6 < min3 \quad A3 \text{ off}, = S5 > max3$$

Program 930: Burner request related to set flow temperature and sensor **S5**.

$$A2 = S6 > min1 \& S6 > S4 + diff1 \& S4 < max1$$

$$A3 = (S5 \rightarrow min3/max3 \& TP_{Req. DHW}) \text{ or } (S6 < set \text{ flow temp} + diff3 \& Heating \text{ active})$$

Program 931: Like program 930, however with regard to the cylinder temperature **S4**.

$$A2 = S6 > min1 \& S6 > S4 + diff1 \& S4 < max1$$

$$A3 = (S4 \rightarrow min3/max3 \& TP_{Req. DHW}) \text{ or } (S6 < set \text{ flow temp} + diff3 \& Heating \text{ active})$$

Program 932: Separate sensors for activation and deactivation thresholds of the burner request related to set flow temperature (holding circuit).

$$A2 = S6 > min1 \& S6 > S4 + diff1 \& S4 < max1 \& TP_{Req. DHW}$$

$$A3 \text{ on} = S6 < (set \text{ flow temp} + diff3 \& Heating \text{ active}) \quad A3 \text{ off} = S5 > set \text{ flow temp} + diff3$$

Program 933: Like program 932 but with regard to the cylinder temperature and the status of the cylinder charging pump (holding circuit).

$$A3 \text{ on} = [S4 < min3 \& TP_{Req. DHW} \& (S6 < min1 \text{ or } S6 < S4 + diff1)]$$

or

$$(S6 < set \text{ flow temp} + diff3 \& Heating \text{ active})$$

$$A3 \text{ off} = S5 > set \text{ flow temp} + diff3 \& S4 > max3$$

Program 934: Like program 932, but **A2** (DHW) is prioritized over **A1**.

$$A1 = (S6 > min1 \& (Heating = active)) \& S4 > max1$$

$$A3 \text{ on} = S6 < (set \text{ flow temp} + diff3 \& Heating \text{ active})$$

$$A3 \text{ off} = S5 > set \text{ flow temp} + diff3$$

Program 935: Like program 933, but **A2** (DHW) is prioritized over **A1**.

$$A1 = (S6 > min1 \& (Heating = active)) \& S4 > max1$$

$$A3 \text{ on} = [S4 < min3 \& TP_{Req. DHW} \& (S6 < min1 \text{ or } S6 < S4 + diff1)] \text{ or } (S6 < set \text{ flow temp} + diff3 \& Heating = active)$$

$$A3 \text{ off} = S5 > set \text{ flow temp} + diff3 \& S4 > max3$$

All programs +8: Second energy source next to the buffer with sensor **S5**.

All conditions at **S6** also count for **S5**. The **higher** temperature comes into effect.

However all conditions only at **S5** remain unchanged.

Example: program 936 (= 928 + 8)

$A1 = (S6 > min1 \text{ or } S5 > min1) \& (Heating = active)$

$A2 = (S6 > min1 \text{ or } S5 > min1) \& (S6 > S4 + diff1 \text{ or } S5 > S4 + diff1) \& S4 < max1$

$A3 \text{ on} = S6 < min3 \text{ and } S5 < min3$

$A3 \text{ off} = S6 > max3 \text{ or } S5 > max3$

Example: program 937 (= 929 + 8)

$A1 = (S6 > min1 \text{ or } S5 > min1) \& (Heating = active)$

$A2 = (S6 > min1 \text{ or } S5 > min1) \& (S6 > S4 + diff1 \text{ or } S5 > S4 + diff1) \& S4 < max1$

$A3 \text{ on} = S6 < min3 \text{ and } S5 < min3$

$A3 \text{ off} = S5 > max3$

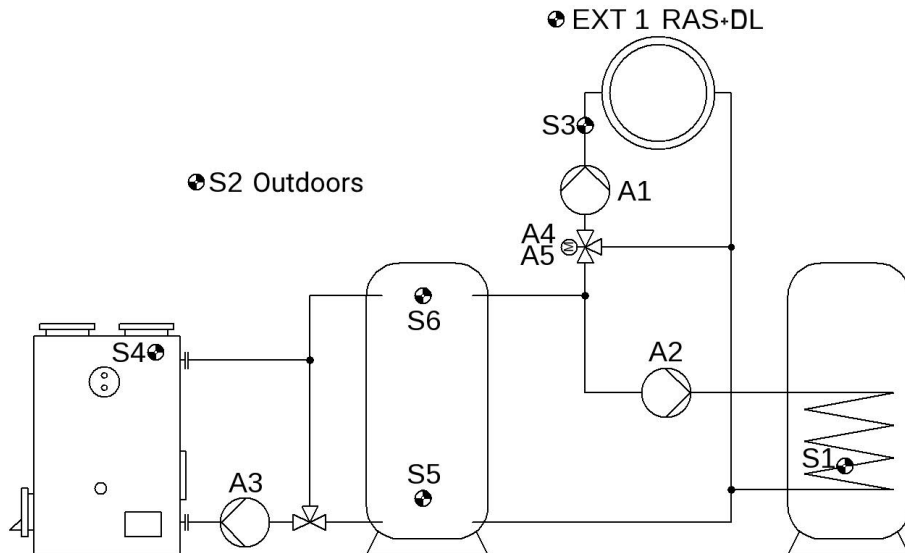
Note regarding Time programs:

Time programs possible for **A1**, **A2** and **A3**.

The programs 928, 929, 932 and 934 (and all programs +8) have the time program **Req. DHW** affecting the cylinder charging pump **A2**.

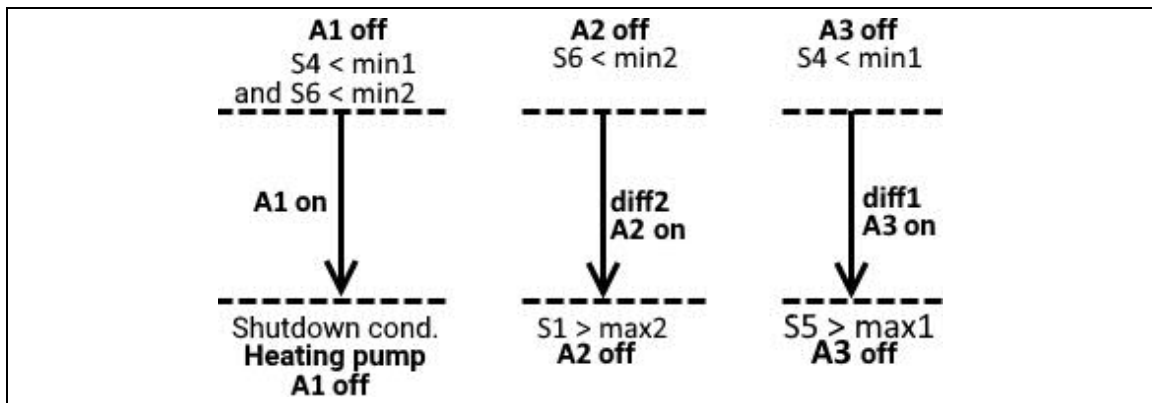
The program 930, 931, 933 and 935 (and all programs +8) have the time program **Req. DHW** affecting the heating request pump **A3** for the preparation of DHW (only thresholds min3/max3).

Program 944 – Solid fuel boiler, buffer, cylinder, heating circuit



Sensors	Outputs
S1 ... Cylinder bottom	A1 ... Heating circuit pump
S2 ... Temperature outdoors	A2 ... Cylinder charging pump
S3 ... Heating circuit flow	A3 ... Buffer charging pump
S4 ... Boiler	A4 ... Mixer OPEN
S5 ... Buffer bottom	A5 ... Mixer CLOSE
S6 ... Buffer top	
EXT1 Room sensor RAS+DL	

Basic functions (P944): Clearance for the heating circuit pump **A1**, if either the boiler's or the buffer's temperature has exceeded its respective minimum threshold, regulation of the cylinder charging pump **A2**, mixer regulation **A4+A5**, regulation of the buffer charging pump **A3**. The room sensor at EXT1 is intended to be an **RAS+DL** (not included).



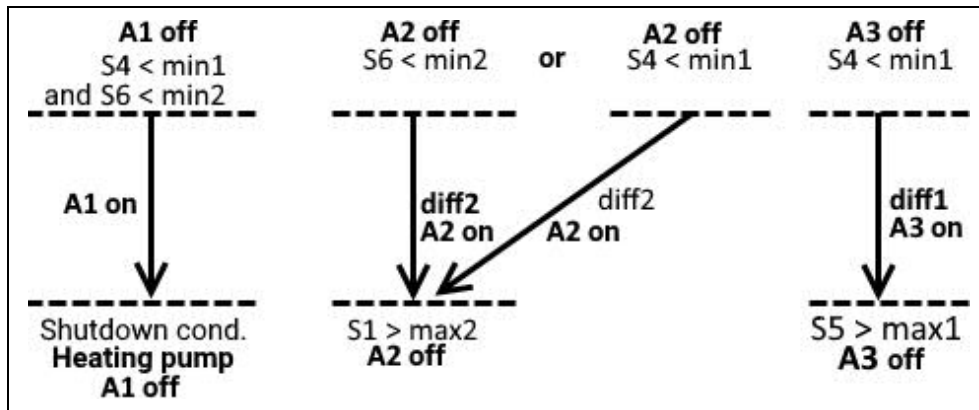
necessary parameter settings:			
min1 ... Activation threshold S4	→ A1, A3	max2 ... Limit cylinder S1	→ A2
min2 ... Activation threshold S6	→ A1, A2	diff1 ... Boiler S4 - buffer S5	→ A3
max1 ... Limit buffer S5	→ A3	diff2 ... Buffer S6 - cylinder S1	→ A2

$$A1 = (S4 > min1 \text{ or } S6 > min2) \& (\text{Heating} = \text{active})$$

$$A2 = (S6 > min2 \& S6 > S1 + diff2 \& S1 < max2) \& TP_{Req. \text{ DHW}}$$

$$A3 = S4 > min1 \& S4 > S5 + diff1 \& S5 < max1$$

All programs +1: The cylinder is charged in regard to both the boiler's and the buffer's temperature.



$$A2 = [(S4 > min1 \ \& \ S4 > S1 + diff2) \ \text{or} \ (S6 > min2 \ \& \ S6 > S1 + diff2)] \ \& \ S1 < max2] \ \& \ TP_{Req. \ DHW}$$

all programs +2: The heating circuit pump **A1** is activated **only** via the buffer temperature **S6** and **not** via the burner temperature **S4**.

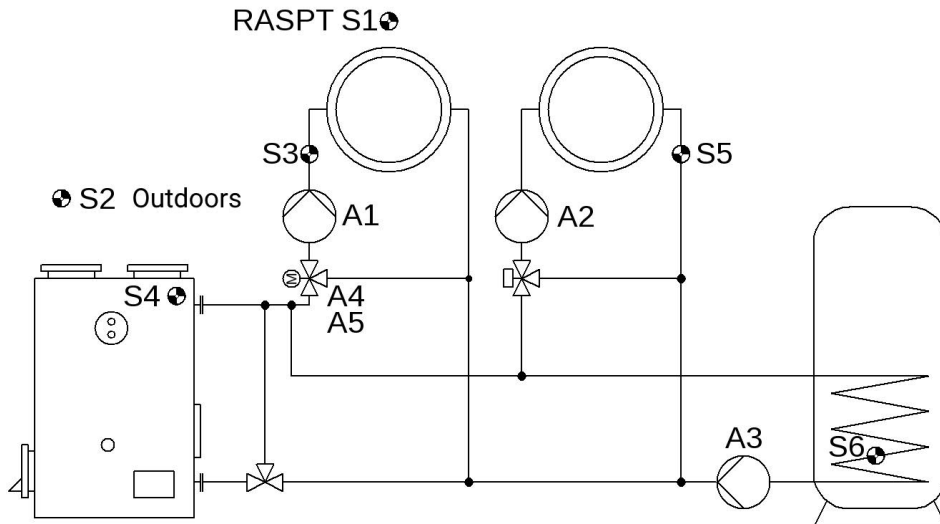
$$A1 = S6 > min2 \ \& \ (Heating = active)$$

all programs +4: Cylinder priority – Heating circuit **A1** is blocked, if the boiler charge **A2** goes active.

$$A1 = A1\text{-Conditions according to program} \ \& \ A2 \text{ inactive}$$

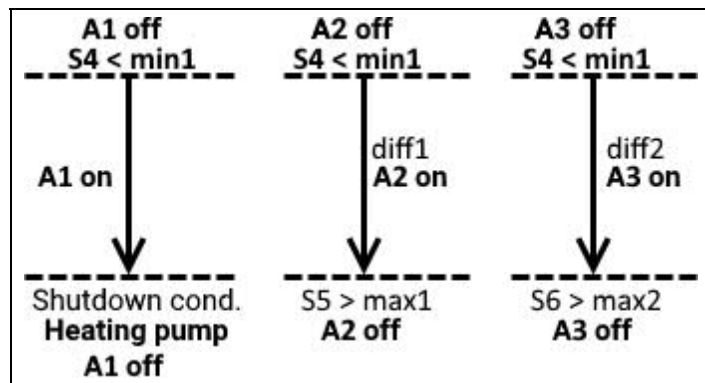
Time programs possible for heating circuit **A1** and cylinder charge (DHW request) **A2**.

Program 960 – Boiler (or buffer), cylinder, 1 regulated & 1 unregulated heating circuit



Sensors	Outputs
S1 ... Room sensor	A1 ... Heating circuit pump 1
S2 ... Temperature outdoors	A2 ... Heating circuit pump 2
S3 ... Flow heating circuit 1	A3 ... Cylinder charging pump
S4 ... Boiler	A4 ... Mixer OPEN
S5 ... Return heating circuit 2	A5 ... Mixer CLOSE
S6 ... Cylinder bottom	

Basic functionality (P960): Regulation of the heating circuit pumps **A1**, **A2**, and the cylinder charging pump **A3**, mixer regulation for the first heating circuit **A4+A5**; regulation of the second heating circuit can be achieved via speed control for **A2**.



necessary parameter settings:			
min1 ... Activation threshold S4	→ A1, A2, A3	diff2 ... Difference S4 - S6	→ A3
max1 ... Limit S5	→ A2	min3 ... hold circuit (S4/S6)	→ A3
max2 ... Limit S6	→ A3	max3 (programs +2, +4)	
diff1 ... Difference S4 - S5	→ A2		

$$A1 = S4 > min1 \text{ \& } (\text{Heating} = \text{active})$$

$$A2 = (S4 > min1 \text{ \& } S4 > S5 + diff1 \text{ \& } S5 < max1) \text{ \& } (\text{Heating} = \text{active}) \text{ \& } TP_{HC2}$$

$$A3 = (S4 > min1 \text{ \& } S4 > S6 + diff2 \text{ \& } S6 < max2) \text{ \& } TP_{Req. DHW}$$

Program 962: Combined buffer instead of the boiler and the cylinder. As such, output **A3** is used for the heating demand via **S4**.

$$A3 \text{ on} = S4 < min3$$

$$A3 \text{ off} = S4 > max3$$

Program 964: Like program 962, but with the deactivation threshold of the heating request at **S6** in the buffer (hold circuit)

$$A3 \text{ on} = S4 < min3$$

$$A3 \text{ off} = S6 > max3$$

All programs +1: The pump shutdown conditions of heating circuit 1 do not affect output **A2**.

$$A2 = (S4 > min1 \ \& \ S4 > S5 + diff1 \ \& \ S5 < max1) \ \& \ TP_{HC2}$$

Programs 976/977/978 – Screed drying

This group of programs enables the drying of screed without having to change the connections of inputs and outputs, since all heating circuit programs use **A1** for a heating pump and **S3** as the flow sensor.

The mixer is regulated via the outputs A2+A3, A4+A5 or only the control output A4 (0-10 V mixer), depending on the program.

S3 ... Flow	A1 ... Heating pump
	A2 + A3 ... Mixer program 976
	A4 + A5 ... Mixer program 977
	A4 ... Mixer program 978 (0-10 V mixer)

necessary settings :
Technician level/parameters
Number of stages , range 1-64
Cycle time , range of 1 second to 3 days
Set temperature per stage , range 0.0 - 100,0°C
Buttons: Start, Next stage, Reset
Indicators: Remaining runtime stage, Total remaining runtime
Expert level
Menu Shutdown conditions: Mixer action
Menu Mixer: Mixer run time, control speed

Installation instructions

Sensor installation

Correct arrangement and installation of the sensors is extremely important for correct functioning of the system. To this end, also ensure that they are completely inserted in their sensor wells. The cable fittings provided serve as strain relief. When used outdoors, no water must be allowed to penetrate the sensor wells (**risk of frost**).

Fundamentally, sensors should not be exposed to moisture (such as condensation) since this can diffuse through the cast resin and damage the sensor. If this happens, heating the sensor to 90 °C for an hour may help. When using sensor wells in stainless steel cylinders or swimming pools, particular attention must be given to their **corrosion resistance**.

- **Collector sensor:** Either insert into a pipe which is brazed or riveted directly to the absorber and protrudes from the collector housing or insert a tee into the flow manifold of the outermost collector into which the sensor well, together with the brass cable fitting (= protection against moisture), can be inserted; then insert the sensor. To protect against lightning damage, the junction box has a surge protection (voltage dependent resistor) which is clamped in parallel between the sensor and the extension cable.
- **Boiler sensor (boiler flow):** This sensor is either inserted into a sensor well in the boiler or fitted to the flow line as close to the boiler as possible.
- **DHW cylinder sensor:** The sensor required for the solar thermal system should be used with a sensor well for finned tube heat exchangers just above the exchanger or, if integrated smooth tube heat exchangers are used, in the lower third of the exchanger or the exchanger's return outlet so that the sensor well protrudes into the heat exchanger tube. The sensor monitoring the heating of the DHW cylinder by the boiler is installed at a level corresponding to the amount of domestic hot water required during the heating season. The supplied cable fitting acts as strain relief. Installation below the associated coil or heat exchanger is not permissible under any circumstances.
- **Buffer sensor:** The sensor required for the solar thermal system is fitted in the lower section of the cylinder just above the solar indirect coil using the sensor well supplied. The supplied cable fitting acts as strain relief. As the reference sensor for the heating system hydraulics, it is recommended to insert the sensor into the sensor well between the center and upper third of the buffer cylinder, or positioned against the cylinder wall underneath the insulation.
- **Pool sensor (swimming pool):** Fit a T-piece into the suction line immediately on the pool outlet and insert the sensor with a sensor well. In the process, ensure the material used is corrosion-resistant. A further option would be to fit the sensor as a contact sensor with appropriate thermal insulation against ambient influences..
- **Contact sensor:** Use scroll springs, pipe clips, etc. to attach the contact sensor to the respective line. Ensure the material used is suitable (corrosion, temperature resistance, etc.). Then insulate the sensor thoroughly so that the pipe temperature is captured accurately and ambient temperatures cannot falsify the result.

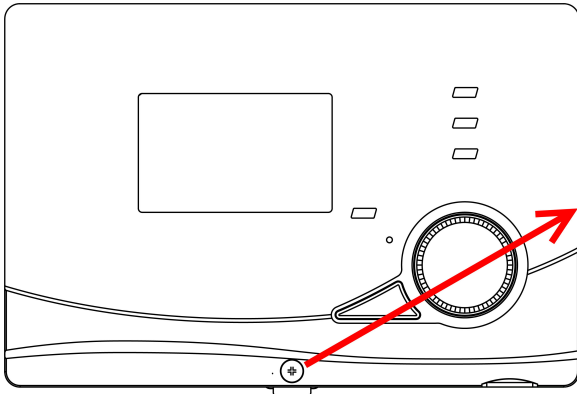
- **DHW sensor:** A **rapid reaction** to changes in the water volume is extremely important when using the controller in systems that generate domestic hot water by means of an external heat exchanger and variable speed pump (freshwater module). Therefore fit the DHW sensor directly on the heat exchanger outlet. This **ultra-quick** sensor (special accessory, type **MSP** ...) should protrude into the output with the aid of a tee sealed in with an O-ring. The heat exchanger should be installed upright with the DHW outlet at the **top**.
- **Radiation sensor:** The parallel collector orientation is important in order to obtain a measurement that corresponds to the collector position. Consequently it should be secured to the sheet steel covering or adjacent to the collector on an extension of the mounting rail. To this end, the sensor casing has a blind hole that can be opened at any time. The sensor is also available as a wireless version.
- **Room sensor:** This sensor is intended for installation in the living space (reference room). Do not install the room sensor near a heat source or window. By simply replugging a jumper inside the sensor, each room sensor can also be used exclusively as a remote adjuster (no room temperature influence). It is only suitable for operation in dry rooms. The sensor is also available as a wireless version.
- **Outdoors temperature sensor:** This sensor is installed on the coldest wall (usually facing north) some two meters above the ground. Avoid temperature influences from nearby air shafts, open windows, cable ways, etc. It must not be subjected to direct insolation.

Sensor lines

All of the sensor lines with a cross-section of 0.5mm² can be extended up to 50m. With this length of line and a Pt1000 temperature sensor, the measurement error is approx. +1K. Longer lines or a lower measurement error require an appropriately larger cross-section. In order to prevent measurement fluctuations, the sensor cables must not be subject to negative external influences to ensure fault-free signal transmission. When using non-screened cables, sensor cables and 230V network cables must be laid in separate cable channels and at a minimum distance of 5 cm. If screened cables are used, the screen must be connected to the sensor earth.

Device installation

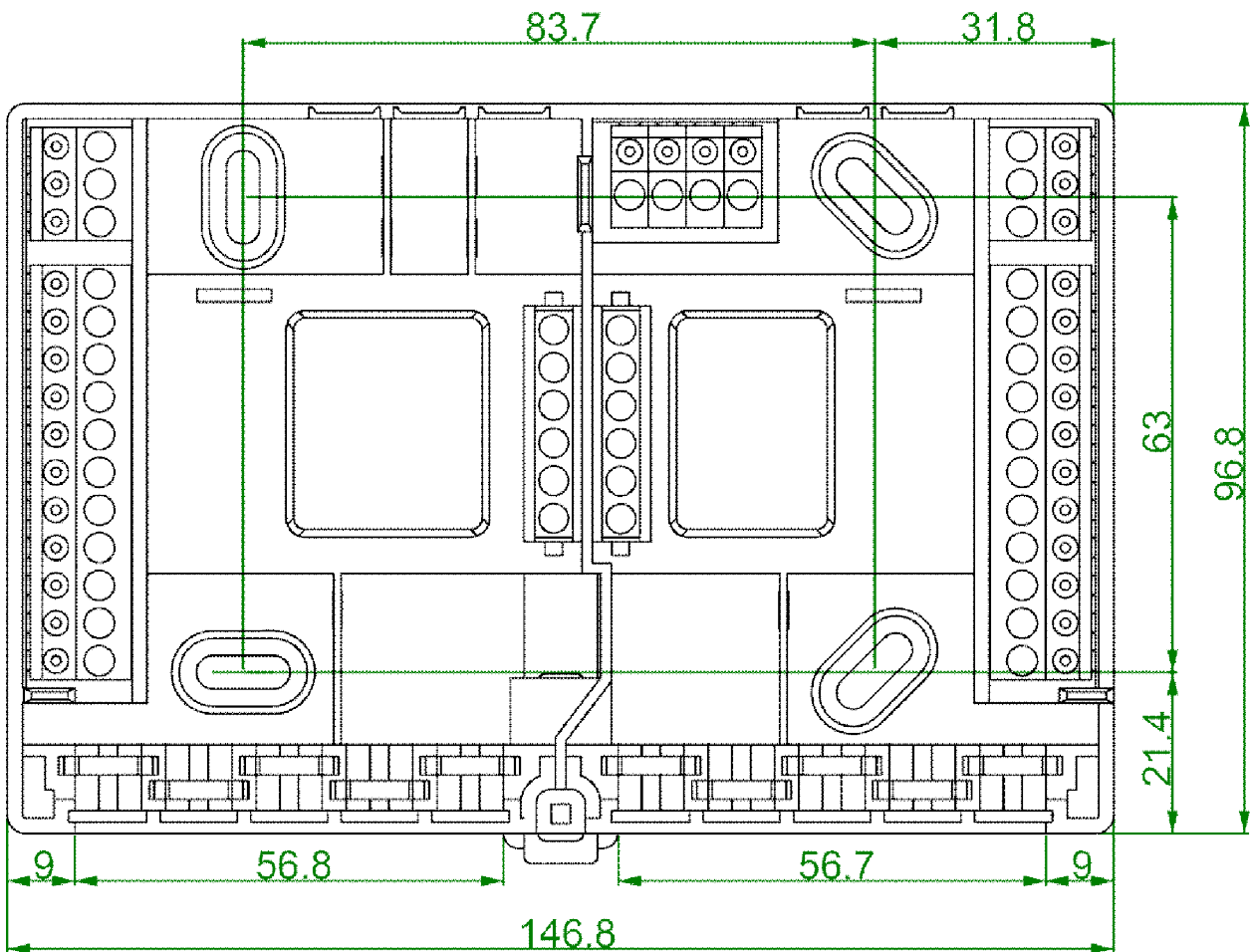
CAUTION! Always disconnect the mains plug before opening the casing!
Only work inside the controller with the power cable disconnected.



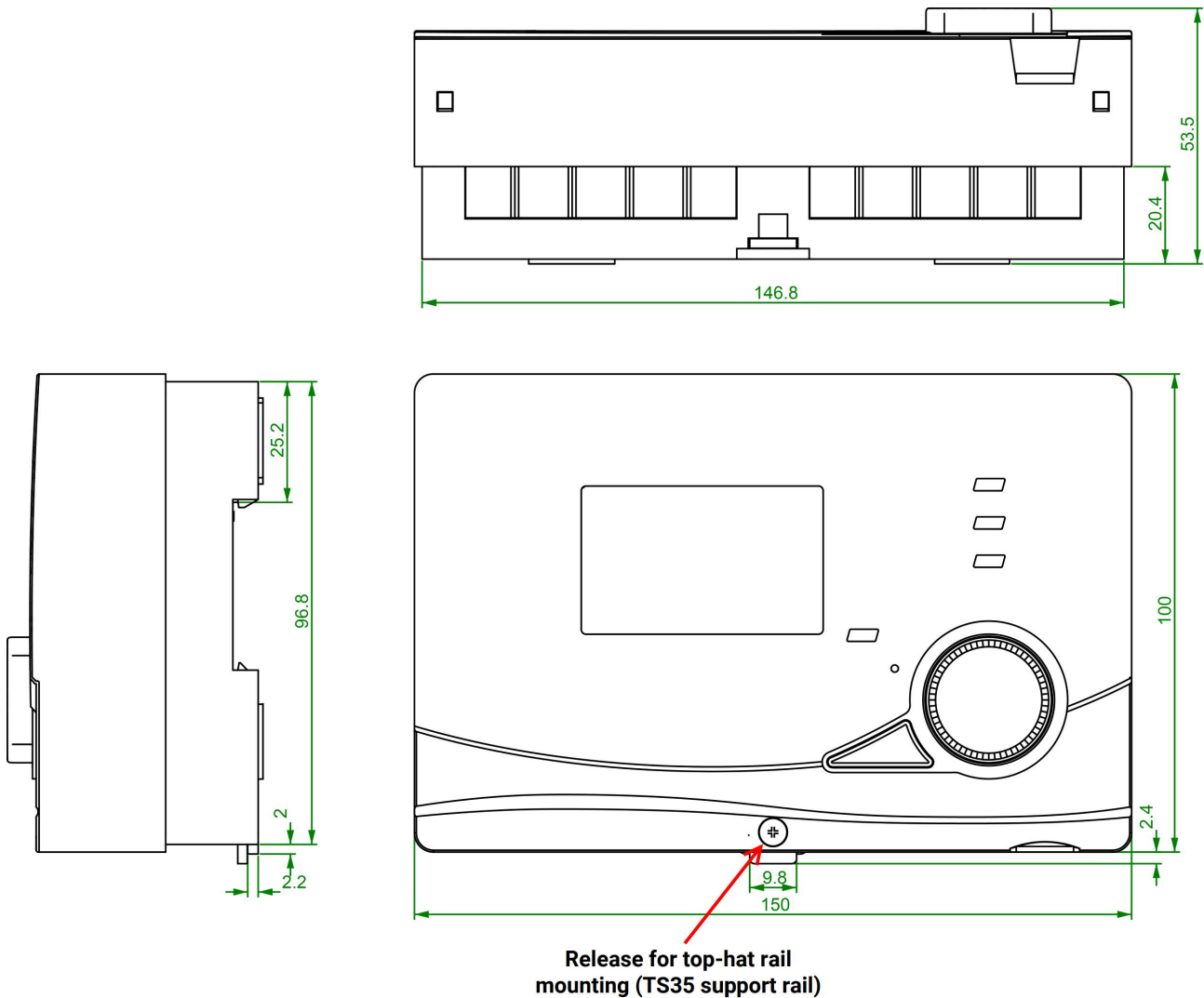
Unscrew the screws on the front and lift the cover.

The electronics are located in the cover. The connection to the terminals in the lower section of the enclosure is made by contact pins when the cover is put in place. The lower section can be wall mounted through the slots provided (with the cable entries in the side facing down) or mounted on a top-hat rail (TS35 support rail as defined by the EN50022 standard).

Mounting dimensions (in mm)



Measurement drawing of casing (in mm)



Electrical connection

Caution: This must only be carried out by a qualified electrician in accordance with the relevant local regulations. The sensor lines may not be fed through the same cable channel as the supply voltage. The maximum load of all switching outputs A1-A3 equals 2.5A. All of the outputs are fused along with the equipment at 3.15A. If filter pumps are directly connected, mind their rating plate. The fuse protection can be increased to max. 5A (medium-lag). The strip terminal PE must be used for all protective conductors.

Note: The system has to be grounded properly and furnished with surge arresters to protect it from damage due to lightning. Sensor failures due to storms and static electricity are usually the result of faulty construction.

All sensor ground wires (⊕) are internally looped and can be exchanged as needed.

Mixer drive and pumps for PWM or 0-10V signals

Programs which use outputs A4 + A5 to regulate a **three-point mixer** via an auxiliary relay leave no control outputs to generate PWM or 0-10V signals for pumps. All heating circuit programs beginning at 832 are affected.

If pumps requiring PWM or 0-10V signals are in use, then they must be set to heating mode (PWM 1). In this mode, the pump runs at full speed if it receives no control signal. Alternatively, pumps requiring no control signal can be used.

If a mixer using **0-10V signals** via control output A4 is in use, control output A5 is free to generate PWM or 0-10V signals for a pump. Most 0-10V mixers require external 24V supply voltage, which must be supplied using an external main supply unit.

The choice of the used mixer type is made in the menu point *Expert level/Mixer*.

Special connections

Control outputs A4 and A5 (0-10V / PWM)

These outputs are intended for the speed control of electronic pumps, to control the burner output (0-10V or PWM) for switching tasks with an auxiliary relay (e.g. HIREL-22) in certain programs. They can be operated via respective menu functions parallel to the outputs A1 to A3, if they are not in use by the used program.

Sensor input S6

Compared to the other inputs, input S6 has the special feature of being able to record fast signal changes of the type supplied by volume flow encoders (type VIG...) and wind sensors (type WIS01).

The data line (DL-Bus)

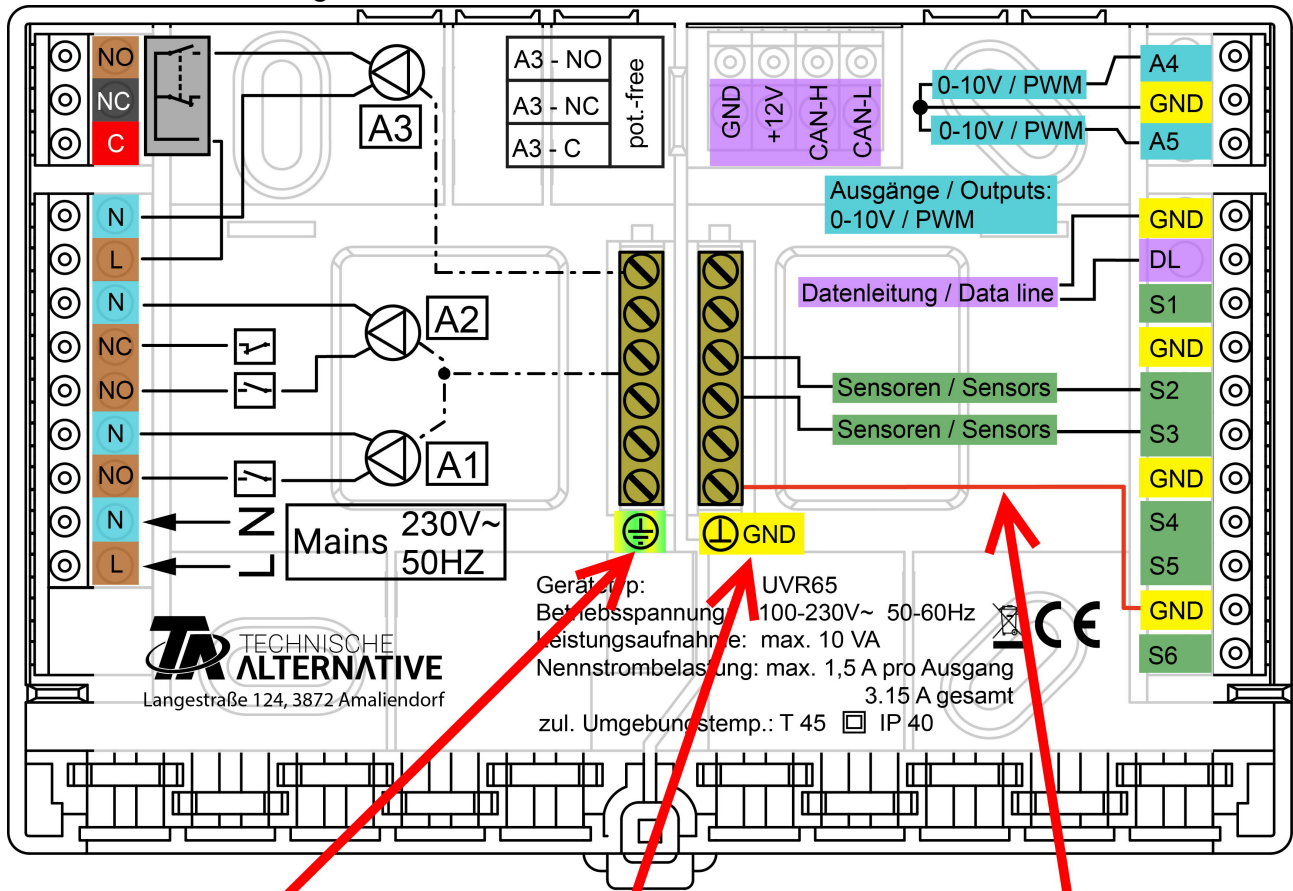
The bi-directional data link (DL-Bus) was developed for the UVR-controller series and is only compatible with products of the Technische Alternative company. Any cable with a cross section of 0.75 mm² can be used for the data link (e.g. twin-strand) with a maximum length of 30 m. For longer cables, we recommend the use of a screened cable. If screened cables are used, the screen must be connected to the sensor earth.

CAN-Bus

The CAN-Bus serves the purpose of accessing the UVR65 controller from other devices (and vice-versa) and for C.M.I. data logging. The basics of CAN-Bus connections are described in further detail in the coming pages.

Terminal diagram

View of the lower casing section with terminals:



Earth conductor PE

Sensor earth

CAUTION! This connection cable requires further fittings.

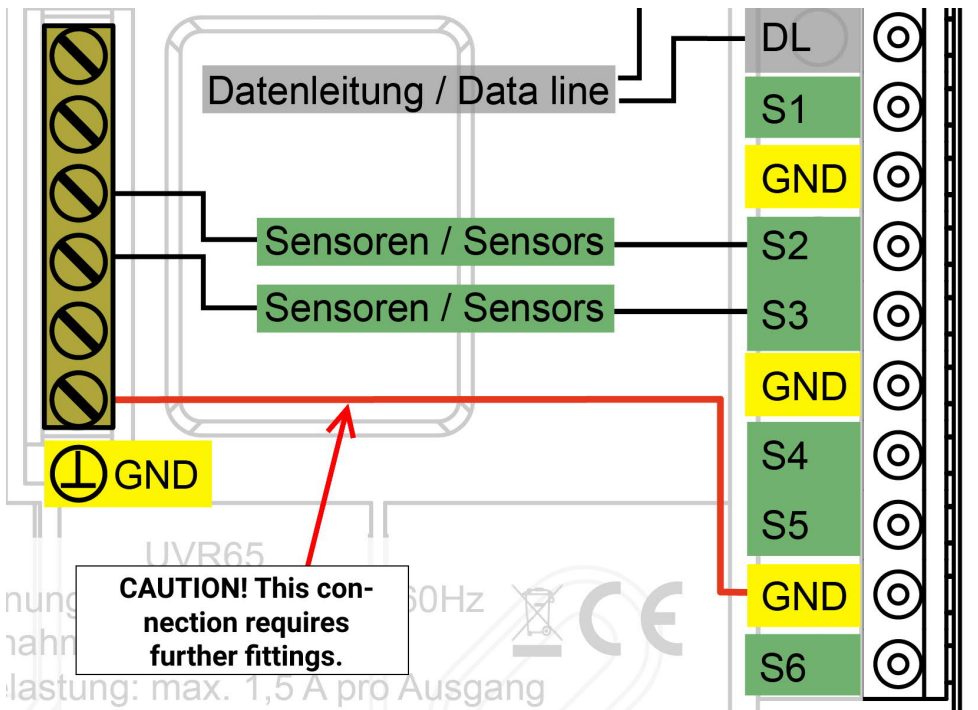
Mains:	
L...	Phase conductor
N...	Neutral conductor
PE...	Earth conductor
Outputs:	
C...	Root (A3)
A1 & A2...	NO contact
NC...	N/C contact
N...	Neutral conductor

Mains connection

Power is supplied through a power supply unit integrated into the device. The mains connection must therefore be 230 V 50 Hz. This is also the voltage conducted by the output relay. The integral power supply unit also supplies power to the CAN bus.

Sensor leads

Sensor terminal diagram



Sensors are always connected across the relevant sensor terminal (S1 – S6) and sensor earth (GND). There is an earth strip in the base. A connection to the GND terminal must be laid using this strip before the sensors are connected.

In order to prevent measurement fluctuations and ensure perfect signal transmission, sensor leads must not be subject to external negative influences through 230 V cables.

Never run sensor leads together with mains voltage cables in the same conduit.

When using non-screened cables, route sensor leads and 230 V cables either in separate cable conduits or with a **minimum distance of 5 cm**.

If screened cables are used, the screen must be connected to the sensor earth (GND).

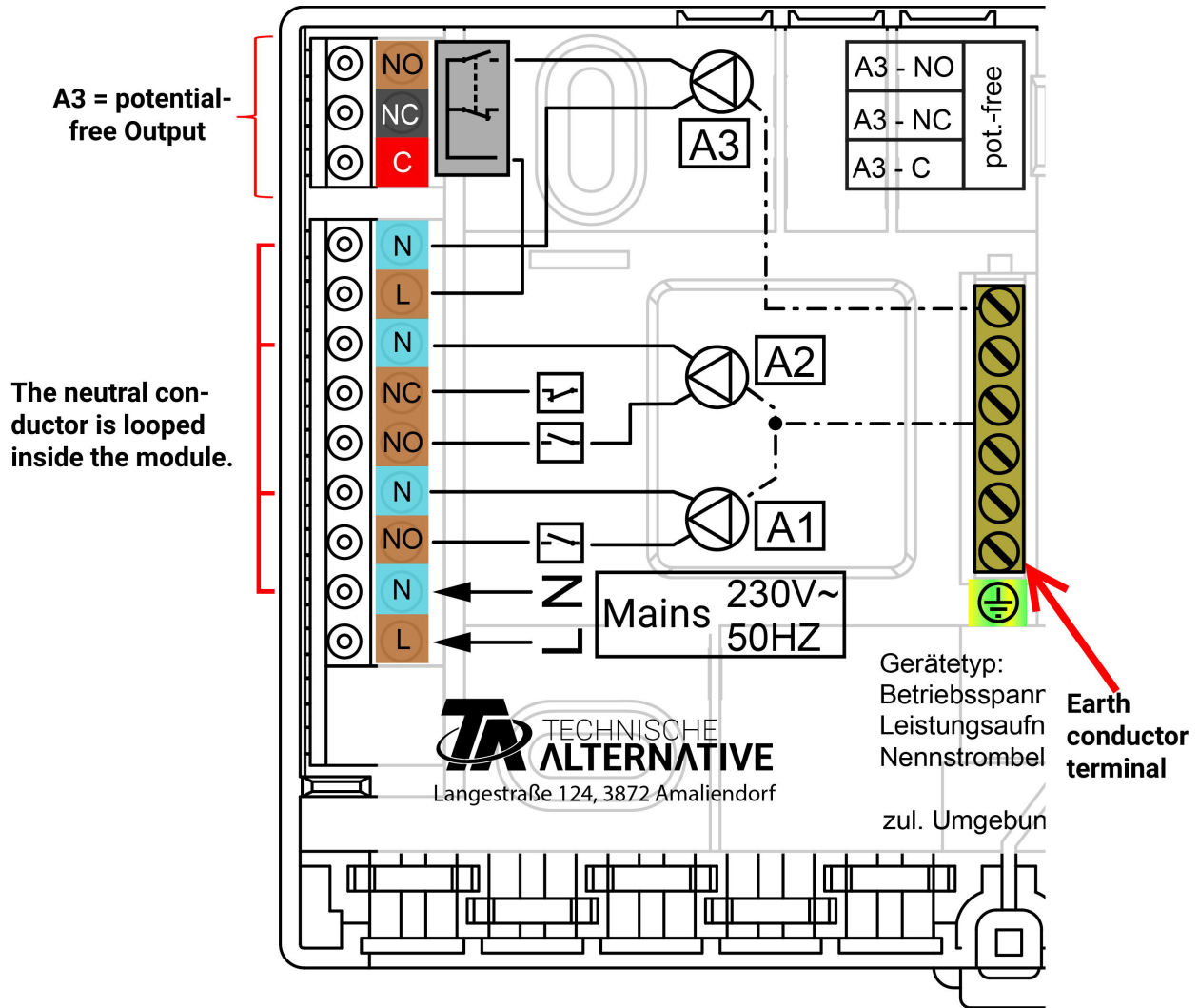
All sensor leads with a cross-section of 0.5 mm² can be extended to up to 50 meters. With this lead length and a PT1000 temperature sensor, the measuring error is approximately +1 K. A correspondingly larger cross-section is required for longer leads or a lesser measuring error.

The connection between the sensor and the extension can be made by pushing heat shrink tubing (trimmed to 4 cm) over one core and twisting the **bare** wire ends. **Solder** the connection if one of the wire ends has been **tin-plated**.

Then push the heat shrink tubing over the connection and heat up carefully (e.g. with a lighter) until it sits tightly over the connection.

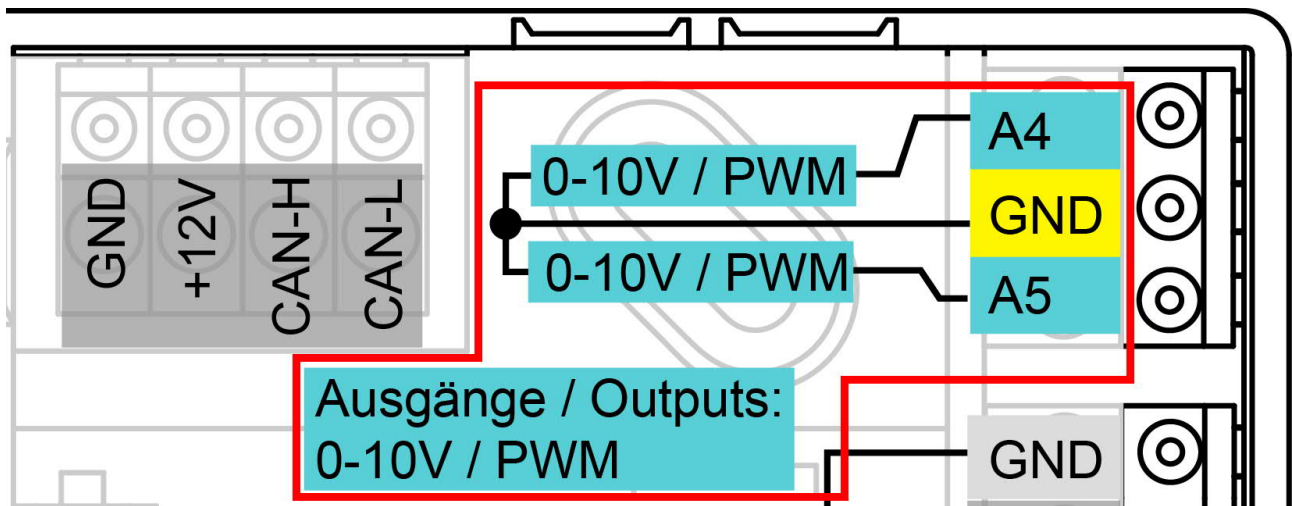
Outputs

Terminal diagram, switching outputs



The maximum current load of the outputs is noted in the chapter **Technical data**.

Terminal diagram for analogue outputs (0-10V / PWM)

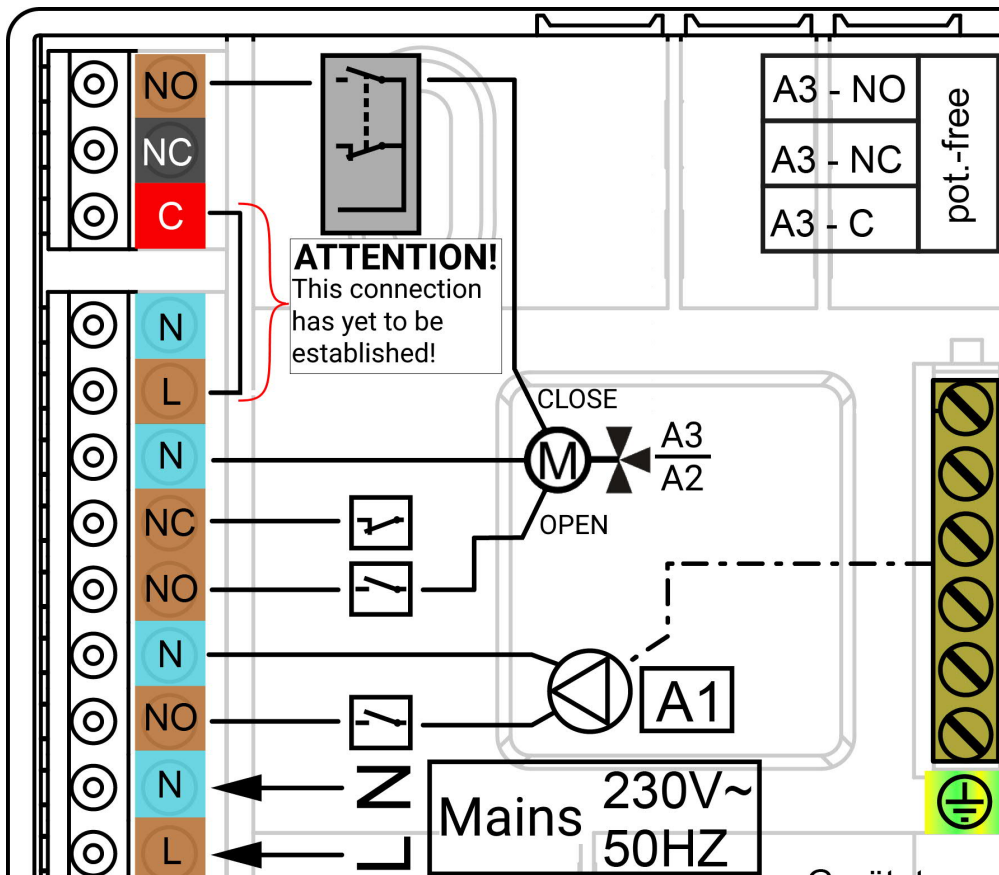


The connections A4 & A5 are the positive pole, the GND connection is the negative pole.

Mixer connection

When using a three-point mixer, a connection between the root **C** and the phase conductor **L** must be established.

This connection plan only applies to program groups 800 and 816.



Output A3 serves to close, Output A2 serves to open the mixer.

Mains:	
L...	Phase conductor
N...	Neutral conductor
Outputs:	
C...	Root
NO	N/O contact
NC...	N/C contact
N...	Neutral conductor

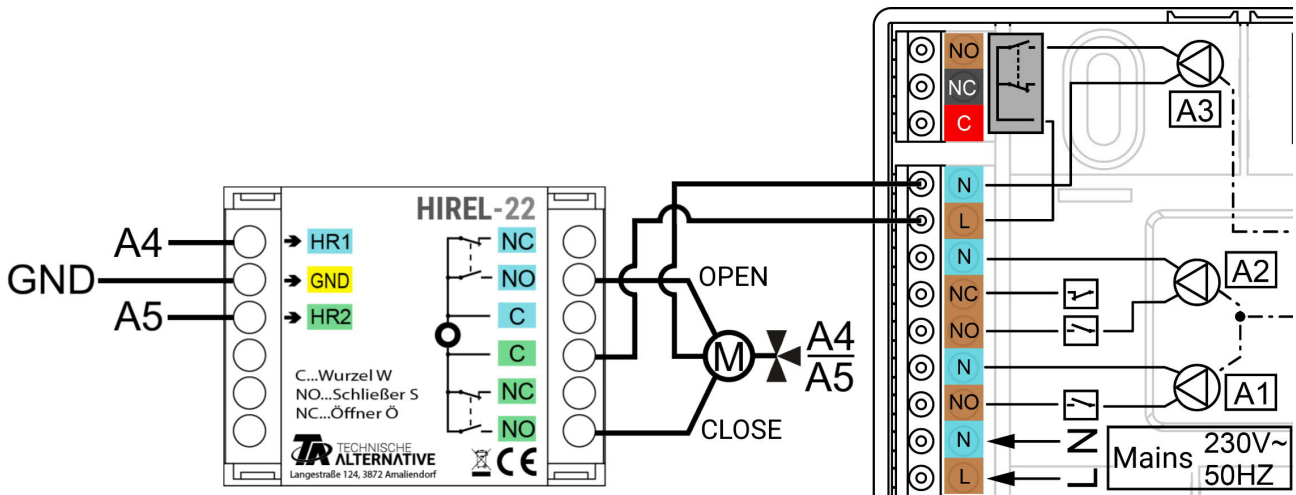
Alternatively, the auxiliary relay **HIREL-22** can be used to connect a mixer to the analogue outputs A4 and A5. This is the case in all heating circuit programs except program groups 800 and 816. The terminal diagram for this variant follow on the next page.

Connection auxiliary relay HIREL-22

Connection of a three-way mixer to the analogue outputs A4 and A5

The auxiliary relay is not to be mounted in the device itself, as it has its own casing.

This connection plan only applies to program groups 832 and above.



Data line for DL-Bus

The DL-Bus consists of just 2 wires: **DL** and **GND** (sensor earth). The DL-Bus itself supplies the necessary power for the DL-Bus sensors.

Cables can be routed with a star topology but also in serial formation (from one device to the next).

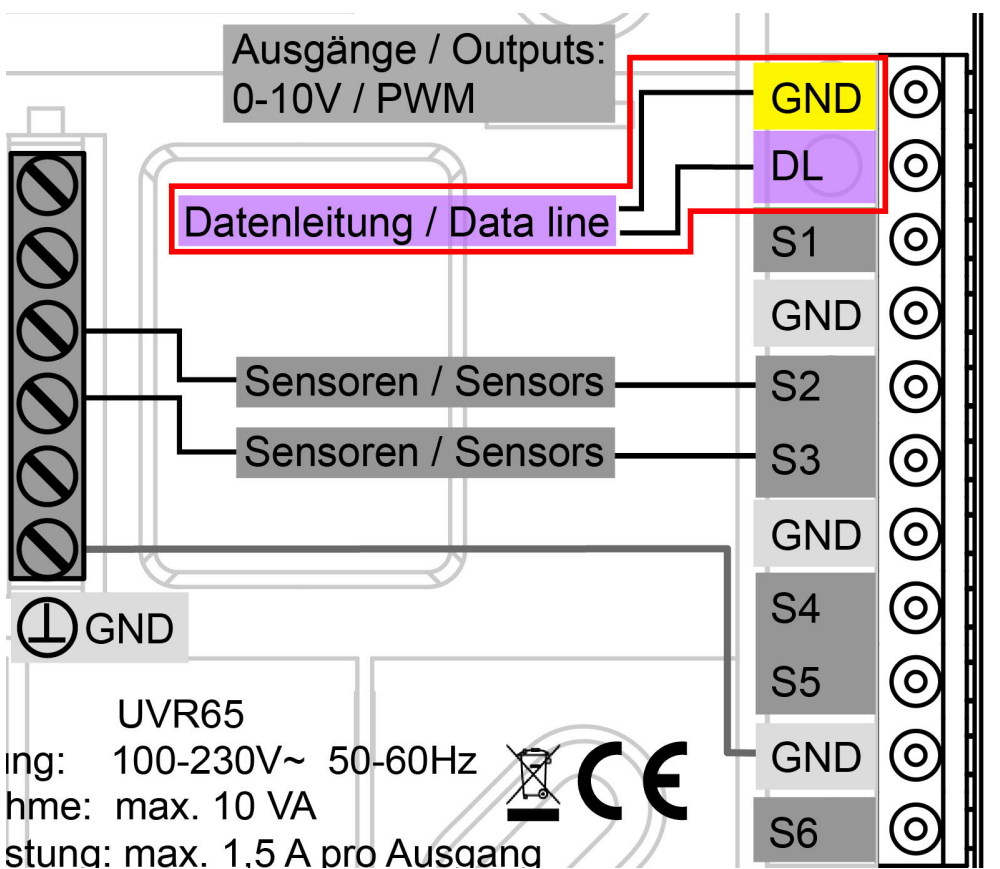
Any cable with a cross-section of 0.75 mm² up to 30 m in length can be used as data cable. For longer cables, we recommend the use of a screened cable.

If screened cables are used, the screen must be connected to GND

Long cable conduits routed closely next to each other for mains and data cables result in faults being induced into the data cables from the mains. We therefore recommend a minimum clearance of 20 cm between two cable conduits or the use of screened cables.

Use separate, screened cables when capturing data from two controllers with a single datalogger. Never run the data cable together with a CAN-Bus cable in the same conduit.

Terminal diagram for DL-Bus



Bus load of DL sensors

A 2-pole cable provides both the power supply and the signal transfer from DL bus sensors. Take the "bus load" into consideration, as the sensors have a relatively high current demand. An additional power supply by means of an external source (such as with the CAN bus) is only possible in some devices via an external 12 V supply, but this must be specified explicitly in the operating instructions for the DL device.

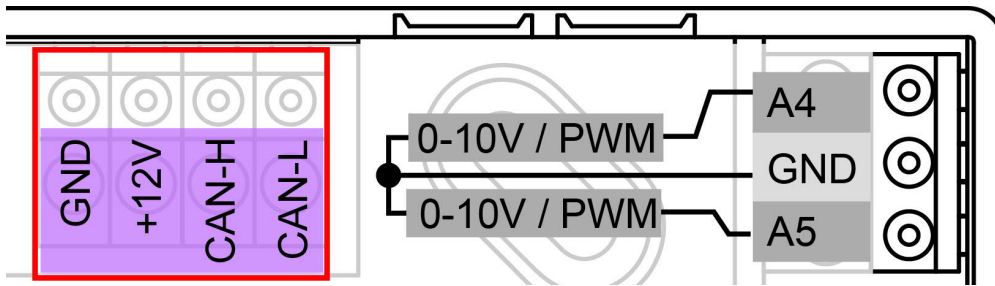
Take the „BUS load“ into consideration as sensors have a relatively high current demand:

The controller UVR65 supplies a maximum bus load of 100%. The bus loads of the electronic sensors are listed in the technical data of the relevant sensors.

Example: The electronic sensor FTS4-50DL has a BUS load of 25 %. Consequently up to four FTS4-50DL can be connected to the DL BUS.

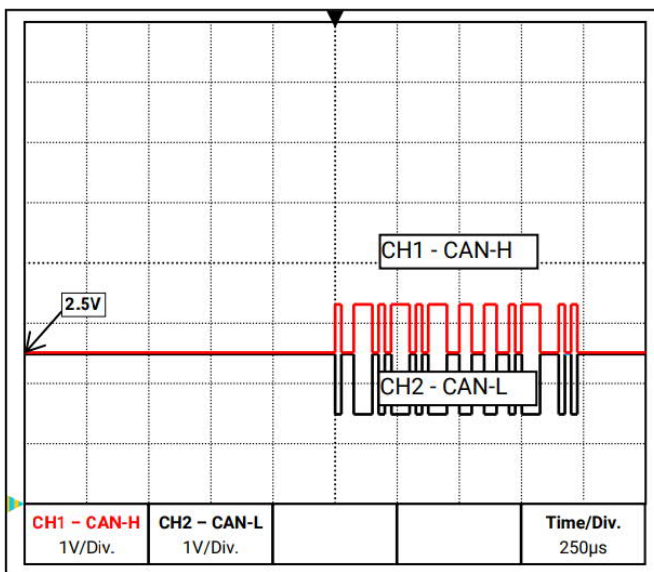
CAN-Bus network

Terminal CAN-Bus line



Guidelines for the topology of a CAN network

Technical principles



CAN-H and CAN-L data signals

- **Cable screening**

The BUS cable screen must be connected well at every node to provide continuity. For larger networks we recommend including the screen in the equipotential bonding, in line with the examples shown.

- **Equipotential bonding**

The lowest possible ohm connection to the earth potential is particularly important. Where cables enter buildings, ensure that the cable entries are in the same location where possible and that all are connected to the same equipotential bonding system (Single-entry-point principle). The purpose is to create potentials that are as similar as possible, in order to achieve the smallest possible potential difference to adjacent lines in case one line suffers a voltage surge (lightning strike). Also ensure a corresponding clearance between the cable and lightning protection systems.

The equipotential bonding also has positive properties to counteract interferences emitted from linked cables..

The CAN BUS comprises the cables CAN-High, CAN-Low, GND and one +12 V supply cable for bus components without their own power supply. The combined total load of all devices with 12 V and 24 V supply must not exceed 6 W.

Design CAN networks in a linear fashion and set a terminator at each network termination. This is ensured by the termination of the end devices.

In the case of larger networks (covering several buildings), problems can occur through electromagnetic interference and potential differences.

To avoid or to the greatest extent manage such problems, take the following measures:

- **Avoiding earth loops**

If a bus cable is routed between several buildings, ensure that earth loops are avoided. The reason for this is that buildings actually have different potentials compared to the earth potential. An earth loop is created when connecting one cable screen in each building directly with the equipotential bonding system. In other words, a current flows from the higher to the lower potential. For example, if lightning strikes near one of the buildings, the potential of that building will briefly be raised by several kV.

In this case, the equalizing current flows to earth via the bus screen and causes an extreme electromagnetic input which can result in the destruction of the bus components..

Lightning protection

Efficient lightning protection is highly dependent on good building earthing that meets the relevant regulations.

An external lightning protection system offers protection against a direct lightning strike.






In order to protect against voltage surges in the 230 V mains supply cable (indirect lightning strike), appropriate lightning conductors and surge arresters compliant with local regulations must be fitted in the upstream distribution systems.

In order to protect the individual components of a CAN network against indirect lightning strike, we recommend the use of surge arresters specifically developed for BUS systems.

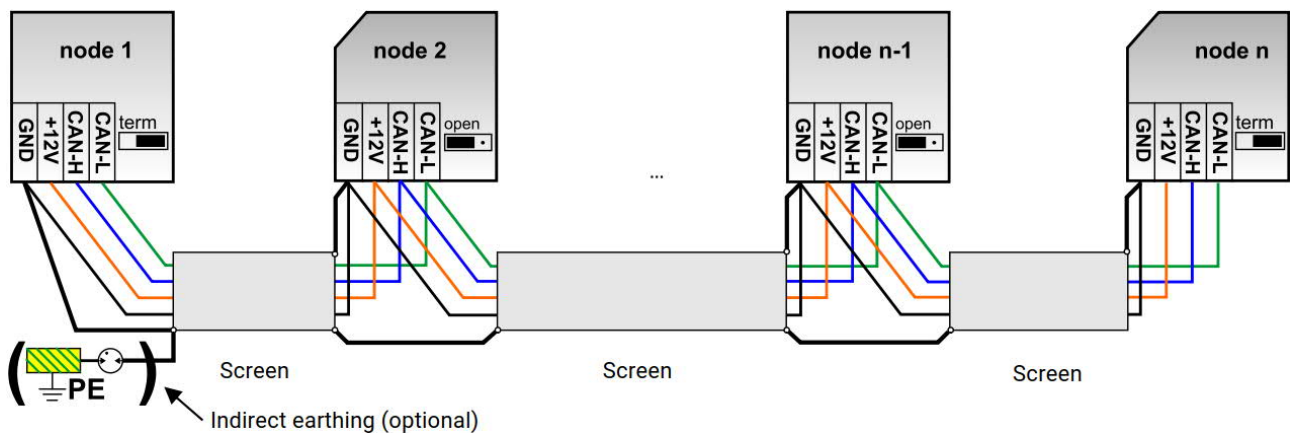
Beispiel: CAN bus surge arresters CAN-UES from Technische Alternative
Gas discharge arrester for indirect earthing EPCOS N81-A90X

Examples of different network variants

Key to symbols:

-  ... device with its own power supply (RSM610, UVR16x2, UVR1611, UVR65)
-  ... device is supplied by the CAN-Bus (CAN-I/O 45, CAN-MTx2, ...)
-  term ... terminated (end devices)
-  open ... open termination
-  ... gas discharge arrester for indirect earthing

„Small“ network (within one building)



Max. cable length: 1000 m at 50 kbit/s

The screen must be continued at each network node and be connected to the device earth (GND). The screen earthing or GND must only be implemented indirectly via a gas discharge arrester.

Ensure that no unintentional direct connection of earth or screen and the earth potential is created (e.g. via sensors and the earthed pipework).

Cable selection and network topology

Screened twisted pairs have proven useful in CANopen networks. These are cables with twisted pairs of conductors and a shared external screen. Such cables are relatively resistant to EMC interference and can still carry 50 kbit/s for up to 1000 m. The CANopen recommendations (CiA DR 303-1) for cable cross-sections are given in the table below.

Bus length [m]	Resistance in terms of length [mΩ/m]	Cross-section [mm ²]
0...40	70	0,25...0,34
40...300	< 60	0,34...0,60
300...600	< 40	0,50...0,60
600...1000	< 26	0,75...0,80

The maximum cable length also depends on the number of nodes [n] linked with the BUS cable and the cable cross-section [mm²].

Cable cross-section [mm ²]	Maximum length [m]	
	n=32	n=63
0,25	200	170
0,50	360	310
0,75	550	470

Bus rate

In the CAN BUS / CAN settings menu of the UVR65, the BUS rate can be set to between 5 and 500 kbit/s, whereby lower BUS rates enable longer cable networks.. However in this case, the cable cross-section must be increased accordingly.

The standard BUS rate of the CAN network is 50 kbit/s (50 kBaud), which is specified for many CAN BUS devices.

Important: All devices in the CAN BUS network must have the same transfer rate in order to be able to communicate with each other.

Bus rate [kbit/s]	Maximum permissible total bus length [m]
5	10.000
10	5.000
20	2.500
50 (standard)	1.000
125	400
250	200
500	100

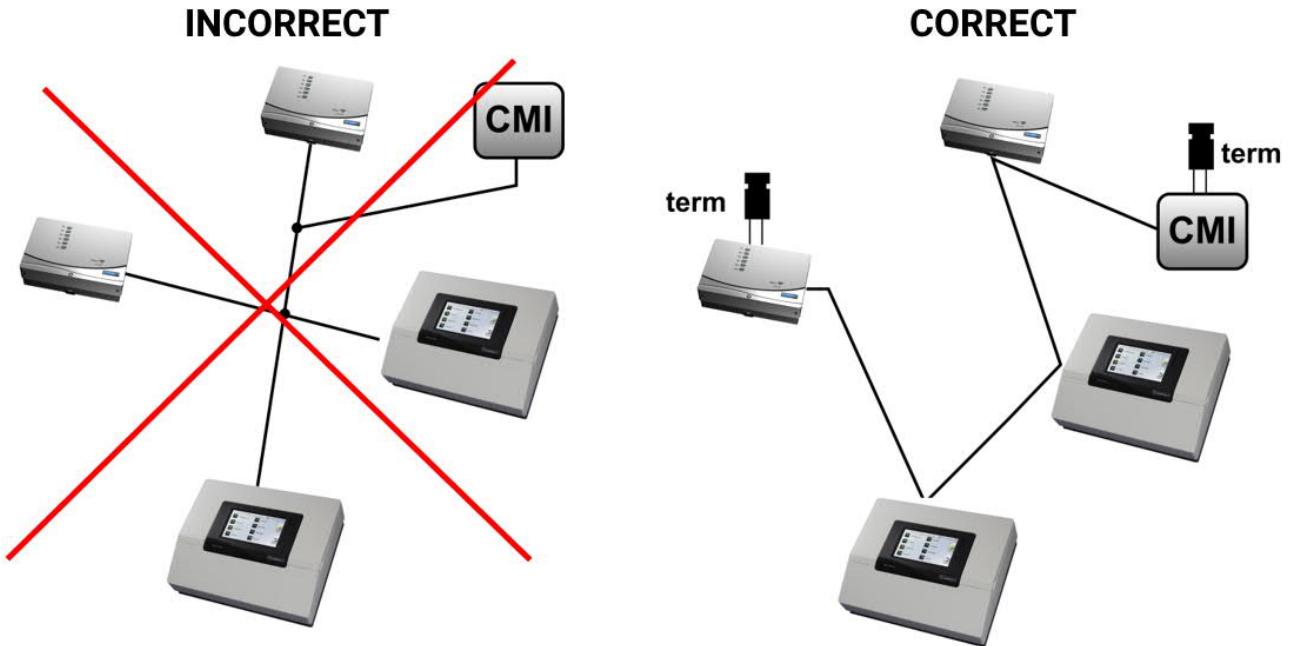
Recommendations

A 2x2-pole, screened twisted pair (twist CAN-L with CAN-H or +12 V with GND) with a cable cross-section of at least 0.5 mm² and a conductor-to-conductor capacity of no more than 60 pF/m and a nominal impedance of 120 ohms. The standard BUS speed of the UVR65 is 50 kbit/s. This recommendation corresponds, for example, to cable type Unitronic®-BUS CAN 2x2x0.5 supplied by Lapp Kabel for permanent installation in buildings or conduits. Theoretically this would enable a BUS length of approx. 500 m to guarantee reliable transmission.



For direct routing underground, earth cable 2x2x0.5 mm² supplied by HELUKABEL, part no. 804269, or earth cable 2x2x0.75 mm² supplied by Faber Kabel, part no. 101465, would be suitable.

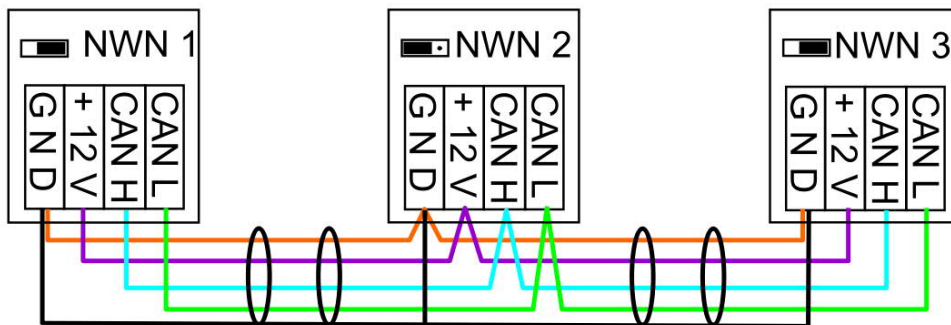
Wiring

A CAN BUS network should never have a star topology. Rather, the correct topology is a line from the first device (with terminator) to the second, third and so forth. The last bus device has the termination jumper again.

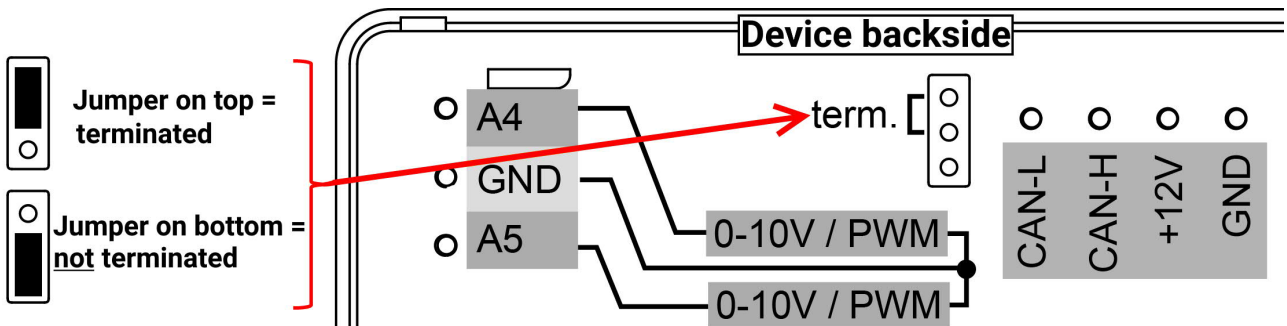


Example: Connection of three network nodes (NWN) with a 2x2-pole cable and termination of the terminal network nodes (network inside one building)

-  terminated (termination resistor 120 Ohm)
-  termination open



Each CAN network is to be provided with a 120 ohm BUS terminator at the first and last network subscriber (= **termination**). This is achieved with a plug-in jumper at the back of the controller. Each CAN network therefore always has two terminators (one at each end). Branch cables or a star topology are not permissible for CAN wiring.



CAN-Bus – Output values

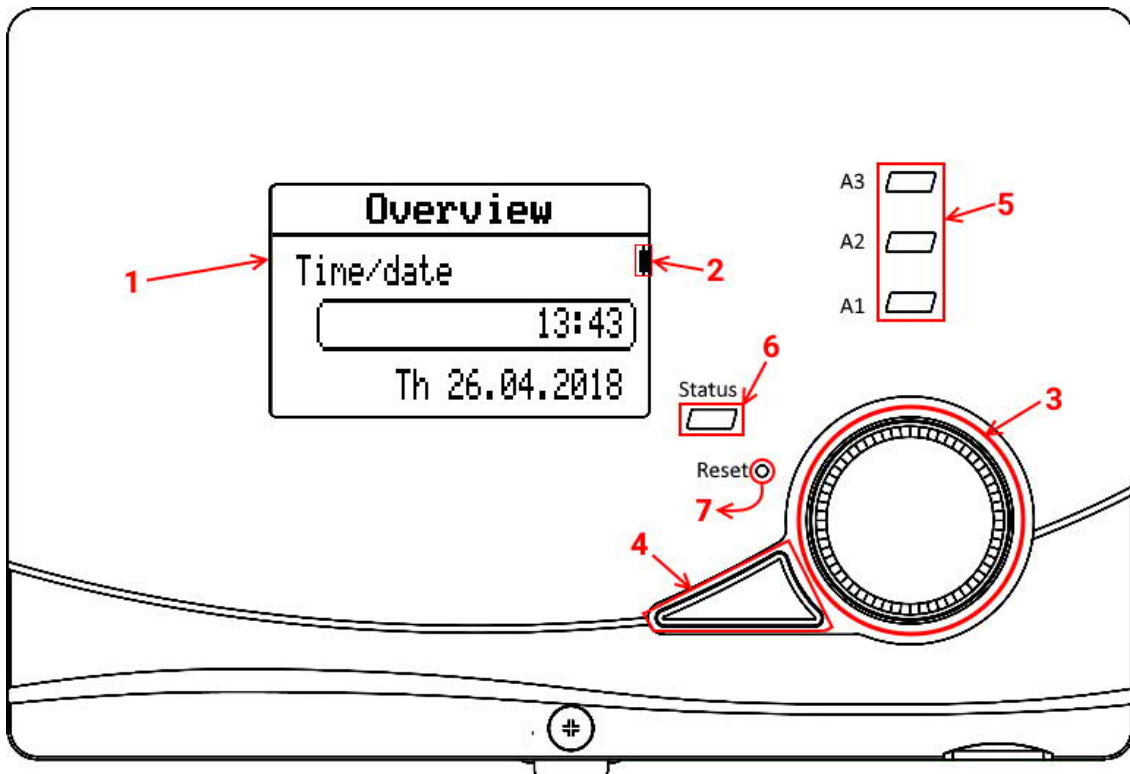
The controller sends the same set of data to the CAN-Bus, in the form of analogue and digital values. If a value can't be sent (for example: value of an external sensor that isn't connected) the output will read zero.

Output	Value
Analogue 1	Measurement sensor S1
Analogue 2	Measurement sensor S2
Analogue 3	Measurement sensor S3
Analogue 4	Measurement sensor S4
Analogue 5	Measurement sensor S5
Analogue 6	Measurement sensor S6
Analogue 7	Measurement external sensor 1
Analogue 8	Measurement external sensor 2
Analogue 9	Measurement external sensor 3
Analogue 10	Measurement external sensor 4
Analogue 11	Measurement external sensor 5
Analogue 12	Measurement external sensor 6
Analogue 13	Measurement external sensor 7
Analogue 14	Measurement external sensor 8
Analogue 15	Measurement external sensor 9
Analogue 16	Actuating variable sent to control output A4
Analogue 17	Actuating variable sent to control output A5
Analogue 18	Current yield of heat meter 1
Analogue 19	Meter reading of heat meter 1 (kWh) ¹
Analogue 20	Current yield of heat meter 2
Analogue 21	Meter reading of heat meter 1 (kWh) ¹
Analogue 22	Current yield of heat meter 3
Analogue 23	Meter reading of heat meter 1 (kWh) ¹
Analogue 24	Status heating circuit control (only for heating circuit programs)
Analogue 25	Set flow temperature (only for heating circuit programs)
Analogue 26	Request set flow temperature (only for heating circuit programs)
Analogue 27	Request DHW (only for heating circuit programs 896 and 912)
Digital 1	Output status A1
Digital 2	Output status A2
Digital 3	Output status A3
Digital 4	Output status A4
Digital 5	Output status A5
Digital 6	Status function control
Digital 7	Status frost protection

¹Only relevant for data logging purposes – When regularly accessed via CAN-Bus, zero will be output.

Operation – Basics

Device overview



The display (1) on the front shows information about sensor measurements, menu position, parameters and such.

The bar (2) on the right side of the display moves along with the vertical position in the currently opened menu (= scroll bar).

The wheel (3) to the right of the menu serves to navigate through menus. Twisting it clockwise navigates downwards in a menu, twisting it counter-clockwise navigates upwards.

Pushing the wheel (3) down opens the currently selected menu/enables changing the currently selected value/parameter. (= Enter button)

Pushing the button (4) left of the wheel leaves the current menu. (= Back button)

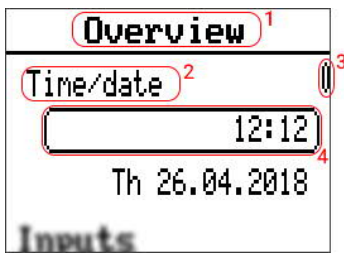
Pushing the „Enter button“ (3) or the „Back button“ (4) is related to the value/menu point that's framed.

The three LEDs (5) above one another, on the right side of the display, are indicators for the status of the outputs. A green LED indicates an active output.

The single LED (6) between the display and the wheel indicates the status of the device and the system. Green flashing indicates a booting up of the device. Constant green light indicates normal operation. Orange indicates a „Message“, e.g. an active excess collector temperature limiter. Red indicates an „Error“ such as the loss of any signal from a DL-sensor. If a message or error is present, the menu **System status** (bottom of the **Overview**) offers further details.

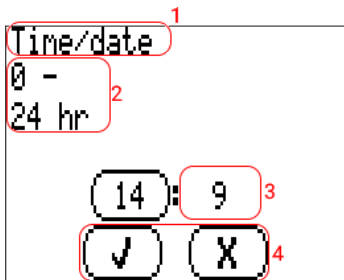
At a short push of the Reset button (7), the device reboots. To carry out a total reset of the device, push the button until the status LED stops rapidly flashing orange and begins slowly flashing in red.

Example of menu view



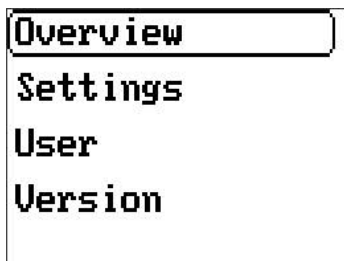
- 1 Title of the current menu
- 2 Sub-title (not selectable)
- 3 Scroll bar (indicates vertical menu position)
- 4 Selected menu point (framed)

Pushing down the wheel („Enter“) opens the following window to input/adjust values:



- 1 Chosen parameter
- 2 Range of adjustment
- 3 Chosen value (framed)
- 4 Confirm/cancel changes

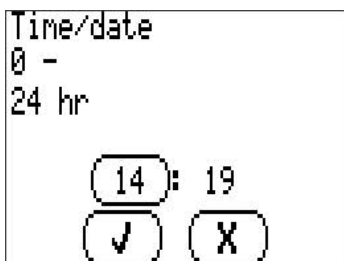
Main menu



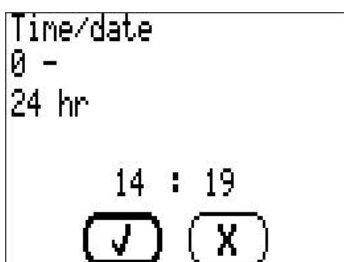
- Overview**
Measurements, system status etc.
- Settings**
Adjustments to regulation, display settings, data administration
- User**
Administrate users and their passwords
- Version**
Infos about your device

Overview

Time/date



- Range: 00:00-24:00
- Pushing the wheel activates adjustment of the hours. The frame becomes thicker when selecting such a button. Confirm your adjustments by pushing the wheel (Enter) or by hitting the button (Back).
- Same goes for the adjustment of the minutes.

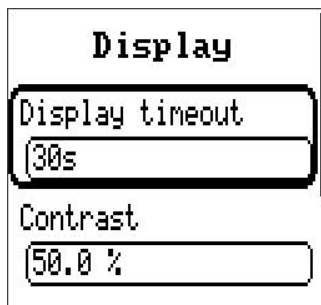


- Select the tick to confirm changes, select the cross to abort. The selected option is highlighted with a thicker frame. Pushing the back-button also aborts adjustments.

Operation – General

Note: The abbreviation „FS“ as in „Factory settings“ is used frequently.

Display (under *Settings*)



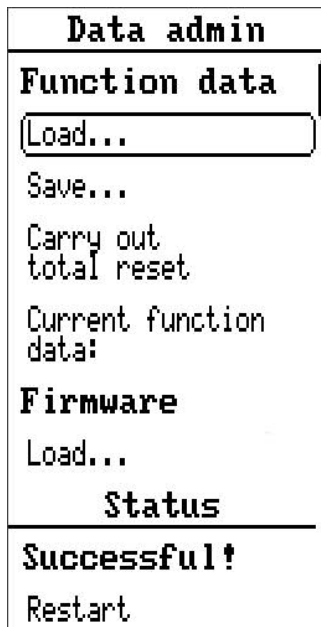
Display Timeout

Time after which the display's background lighting turns off if the device is idle. (FS = 30 seconds)

Contrast

Screen contrast in percent. (FS = 50.0%)

Data admin (under *Settings*)



Function data

Load function data from the SD card

Save current function data to the SD card

Carry out total reset (device is reset to factory settings, with the exception of CAN-Bus settings)

Name of the **current function data** loaded into the device (no data has been loaded in the example)

Firmware

Load **Firmware** from the SD card

Status

Status of the loading of function data

Restart your device (not a reset of settings)

The „**function data**“ refers to a collection of data such as parameters, chosen program and such, not to actual programming like with freely programmable devices.

User

The 3 different user levels have different kinds of rights to access and modify data.


User level	Rights
User No password	Overview: Change time and date View: Inputs, control outputs, system status, chosen program, Adjust: Time programs Settings: Data admin: Load and save function data, view current function data, load Firmware, view system status Display: All settings User: Change user level (with corresponding passwords) Version: View version information, serial number, date of manufacturer and internal ID
Technician Standard password: 32	All rights of the User level, additionally: Settings: Access to the Technician level Data admin: Carry out total reset and Restart User: Change Technician password, switch to User level, switch to Expert level (with password)
Expert Standard password: 64	The Expert has access to all menu points and all settings .

Version

```

Version
Version: U
1.00
Serial number:
UUR65-000000
Date of
manufacturer:
0.1.1900
Hardware (cover):
00
Rev: A300
Current function
data: Function
data.dat
(27.4.2018-6:44)
Internal ID:
00000000

```



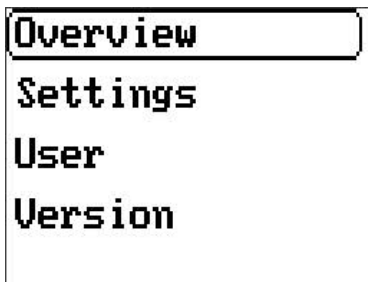
- Version*** Firmware version of your device*
- Serial number***
- Date of manufacturer**
- Hardware (cover)**
- Rev** Revision number
- Current function data** Name of the currently loaded function data, time and date of loading
- Internal ID** Used to access menus if the passwords have been forgotten.

*Keep this information at the ready when contacting technical support!

Operation – Differential control

Main Menu

This instruction manual shows menus with expert level access.



Overview

- Time/Date
- Inputs
- Status control output
- System status
- Chosen program

Settings

- Technician level (e.g. parameter menu)
- Expert level (basic system settings)
- Data admin

User

- Choice between user/technician/expert level
- Change passwords of the different user levels

Version

- See chapter **Operation - General**

Overview

Overview	
Time/date	10:30 Fr 27.04.2018
Inputs	
Sensor 1	0.0 °C
Sensor 2	0.0 °C
Sensor 3	0.0 °C
Sensor 4	0.0 °C
Sensor 5	0.0 °C
Sensor 6	0.0 °C
Control output 4	0.0 %
Heat meter	
Heat meter 1	0.00 kW 50 l/h 0.0 kWh
System status	
System status	Ok
Program 144	

Time/Date

Change time and date

Inputs*

Measurements of the sensors

Unused inputs can be set to „unused“ under the menu **Settings/Expert level/Sensor menu** which will hide them from this overview. If no sensor is connected but the input is not set to unused, an error value of 9999,9°C will be displayed (= interruption).

Control output 4/5

Current level of the control output

Heat meter

Readings of the heat meter

System status

Messages and Errors are displayed here („Ok“ if function check deactivated)

Program

Chosen program (can't be changed here)

Sensor 1	
Designation	Sensor 1
Sensor	PT 1000
Value	0.0 °C

*Each sensor has a sub-menu for a short overview.

Designation

(Custom) designation of the sensor

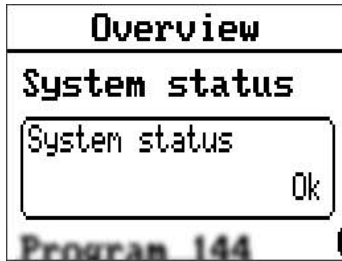
Sensor

Chosen sensor type

Value

Current measurement

System status



Select the menu point for further information. The example shows no messages or errors being present.

Possible displays: „Ok“ (Fct. control), Error.

Possible **errors**: Excess temp. shutdown, Drainback error, Pasteurization. With function control activated: Lead break, short circuit, circulation error.

Errors can only be deleted once their cause has been resolved.

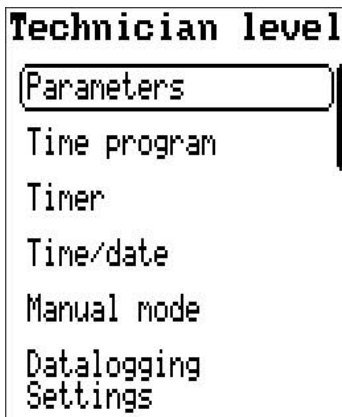
Settings



Depending on the active user level, not all of these options might be visible.

The points **Display** and **Data admin** are described in the chapter **Operation – General**.

Technician level



Parameters

Adjusting activation, deactivation and difference thresholds (min/max/diff), Priority ranking (only programs with priorities)

Time program

Setting up 5 time programs with 3 time windows each

Timer

Setting up a timer function

Time/date

Time, date, summer time, automatic time change

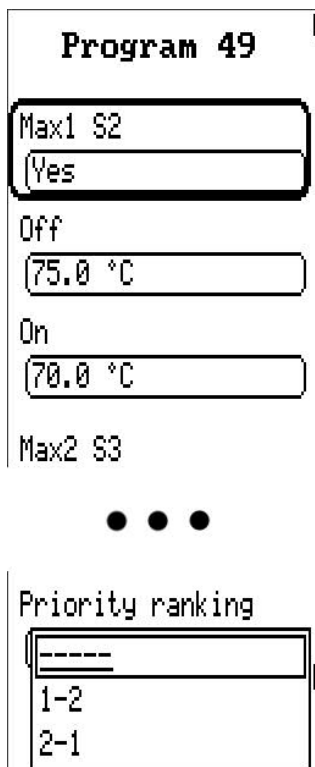
Manual mode

Set outputs to *Automatic/Manual ON/Manual OFF*

Datalogging Settings

Datalogging to SD card Yes/No, Interval time

Parameter



Chosen **program** (only display)

Value / Sensor (Yes/No = Usage) (Example: Max1 S2)

Off: Deactivation threshold of the value above (Example: 75.0°C)

On: Activation threshold (Example: 70.0°C)

Next value (Example: Max2 / S3)

The hystereses of these values are a result of the difference between their activation and deactivation thresholds. As such, a maximum threshold for example should have its deactivation threshold should be several degrees above the activation threshold.

Further down in this menu, you might (depending on the chosen program) find several maximum thresholds (MAX), minimum thresholds (MIN) and differential thresholds (DIFF).

Priority ranking

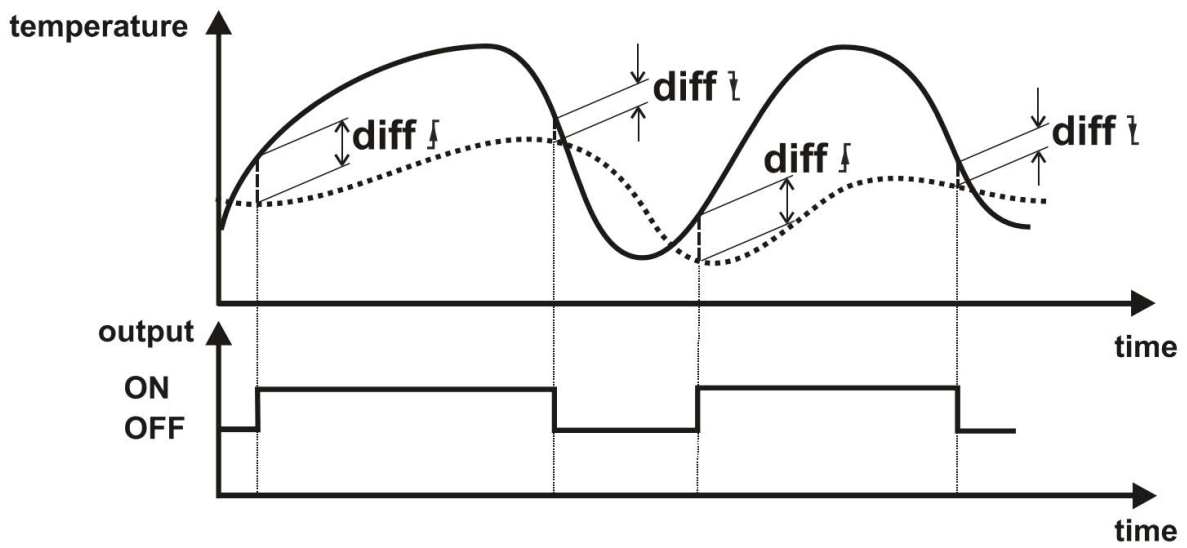
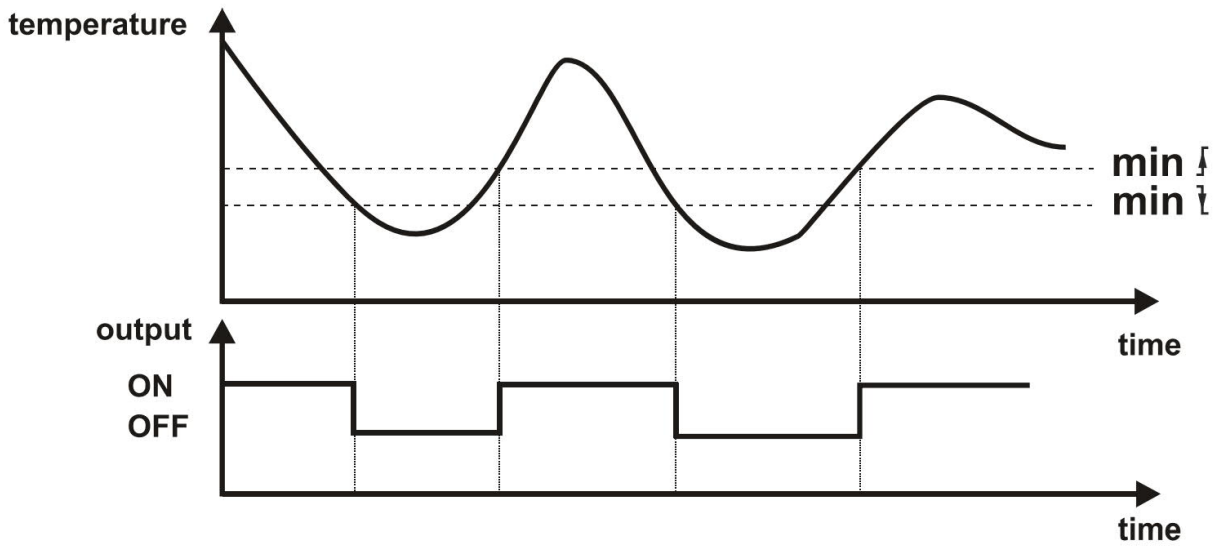
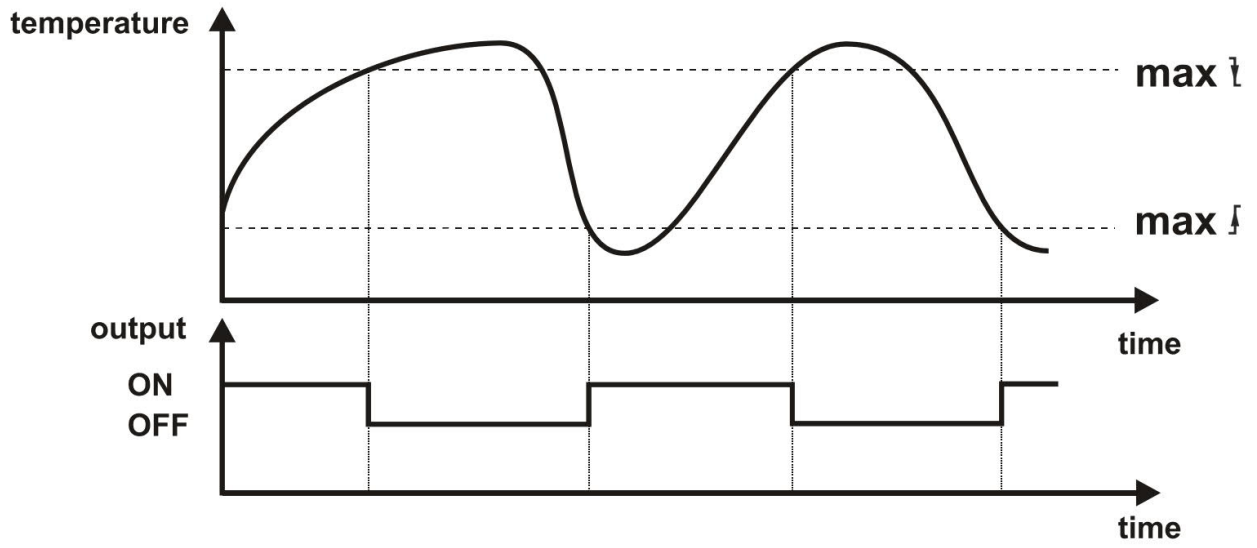
Depending on the chosen program, priority ranking might be available to be set up for example between two cylinders. The setting „1-2“ means that element 1 has priority over element 2. The sort of elements these are and which sensors they correspond to can be gathered from the chosen program and its diagram.

Example for thresholds

Program 0 is used for this example.

MAX1 S2 YES/NO	Activate/deactivate the influence of this threshold
MAX1 S2 OFF	Sensor S2 exceeding this temperature deactivates the output.
MAX1 S2 ON	The output deactivated by exceeding MAX1 OFF is reactivated below this temperature. Generally speaking, MAX serves to limit cylinder temperatures. Recommendation: The deactivation threshold for cylinders should be 3-5K higher than the activation threshold, for swimming pools it's around 1-2K. Range: 0 to 200°C in 0.1°C steps (valid for both thresholds, but MAX ON can't exceed MAX OFF).
MIN1 S1 YES/NO	Activate/deactivate the influence of this threshold
MIN1 S1 ON	Above this temperature on S1, the corresponding output is activated.
MIN1 S1 OFF	The output activated by exceeding MIN ON is deactivated again above this temperature. MIN prevents burners from sooting up. Recommendation: The activation threshold should be 3-5K above the deactivation threshold. Range: 0 to 200°C in 0.1°C steps (valid for both thresholds, but MIN OFF can't exceed MIN ON).
DIFF1 YES/NO	Activate/deactivate the influence of this threshold
DIFF1 S1-S2 ON	If the difference in temperature between the two exceeds this value, the output is activated. In most cases, DIFF represents the basic function of the device (differential control). Recommendation: For use with solar panels, DIFF ON should be set to about 7-10K. For charging pumps, 3-5K will suffice.
DIFF1 S1-S2 OFF	The output activated by exceeding DIFF ON is deactivated again below this difference in temperature. Recommendation: DIFF OFF should be set to about 3-5K. In regard of sensor and measuring tolerance, a value below 2K is not recommended. Range: -100.0 to 100.0K in 1K steps (Valid for both thresholds, but DIFF OFF cannot be greater than DIFF ON)

Schematic representation of thresholds



Time program

Up to 5 time programs with 3 time windows each can be set up.

Choice of time program 1-5

Days of the week for which the time window should activate.

Time of day of the window

And/Or: Linking between time window and program¹
1-5: Assigned outputs

Two identical time windows follow.

¹**And/Or:** If **And** is chosen, the chosen outputs are only activated, if the automatic operation activated the outputs **within the time window**.

If **Or** is chosen, the chosen outputs are activated for the entire duration of the time windows, with no regard to usual automatic operation. Outside of the time windows, usual automatic operation controls the outputs according to settings.

Timer

This functionality equals an astable timer.

Changing the linking (**And/Or**)*.

Assign outputs

Runtime

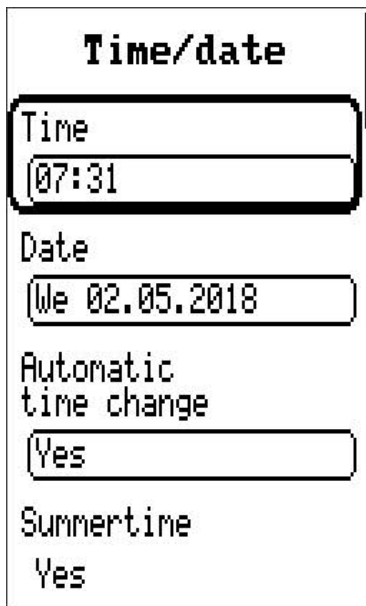
Pause time

The timer function offers the possibility to assign a **runtime** (output is activated during this time) and a **pause time** (output is deactivate during this time) to an output. **Runtime and pause time are activated alternately**.

***And/Or:** If **And** is chosen, usual operation according to the program regulates the chosen outputs. They remain inactive during the pause time.

If **Or** is chosen, the assigned outputs are activated during the runtime. Usual operation according to the program regulates the chosen outputs during the pause time.

Time/date



Time/date

Time
07:31

Date
We 02.05.2018

Automatic
time change
Yes

Summertime
Yes

Time of day

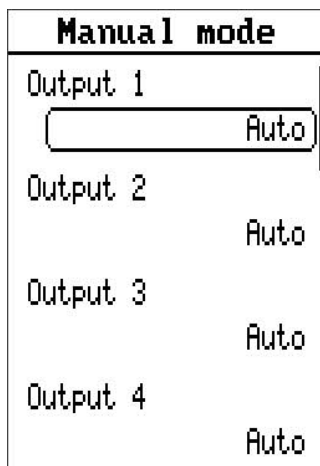
Date

Automatic time change of Summertime

Summertime Yes/No (Only changeable, if automatic time change = No– else this point only indicates the status of the summertime)

Manual mode

Changing of the individual outputs' mode of operation. Choice between Manual/ON (Output **constantly on**), Manual/OFF (Output **constantly off**) and Auto (Output regulated according to usual automatic operation and time windows).



Manual mode

Output 1
Auto

Output 2
Auto

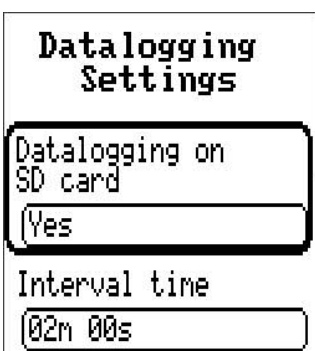
Output 3
Auto

Output 4
Auto

Only outputs used in the chosen program or ones that have been assigned a functionality (**Expert level/Programming settings/Assignment of free outputs**) are displayed here.

Control outputs (Outputs 4&5) are displayed as well. Manual/OFF outputs the variable for no operation (0V, PWM 0%), Manual/ON outputs the variable for full speed (10V, PWM 100%). Alternatively, „Manual“ can be chosen to output a specific variable

Datalogging settings



Datalogging Settings

Datalogging on
SD card
Yes

Interval time
02m 00s

Settings for datalogging: **Datenlogging on SD card** activates the logging of a preset of data to the plugged in micro SD card. The Interval time defines, how often data is to be logged. More detailed instructions are found in the chapter **Datalogging**. This chapter is of great importance, especially the points regarding the interval time and limited lifetime of SD cards.

Expert level

Expert level
Programming settings
Sensor menu
Ext. sensors
Outputs
Control outputs
System protection
Start function
Funct. check
Heat meter
Pasteurisation
Drainback
CAN/DL bus

Programming settings to change basic operation

Sensor menu: type, designation, correctional values etc.

Ext. sensors to read sensors and values via CAN-Bus/DL-Bus

Outputs: Designation, status, meter values, run-on time, blocking time and blocking protection

Control outputs: Function, mode etc.

System protection e.g. Excess temp limiter, frost protection etc.

Start function to ensure efficiency of solar panel

Solar priority only visible with a valid program chosen

Funct. check enable/disable, settings

Heat meter, Settings for up to 3 heat meter profiles

Pasteurisation enable/disable, settings

Drainback only visible with a valid program chosen

CAN/DL-Bus basic settings

Programming settings

Program	Choice of program according to hydraulic diagram. (FS = 0) Additional features and functionalities can be added to most programs. „All programs +1 (+2, +4, +8)“ means, that the chosen program number must be increased by the sum of the desired additions. Example: Program 48 +1 +2 = program number 51 = solar system with 2 consumers, with pump-valve-system and additional sensor S4 for temperature limitation.
Cancel output	Possibility to exchange the functionalities of outputs with one another (A1 with A2, A1 with A3 or A2 with A3). This enables the assignment of the potential free output A3 to wherever necessary (FS = - - - - -)
Assignment of free outputs	Outputs not used in the program can be assigned to other functionalities.
Off (= FS)	The unused output remains inactive.
On	The outputs is constantly activated.
And	Linking with one or more outputs. The output is activated, if all linked outputs are on.
Or	Linking with one or more outputs. The output is activated, if at least one linked output is on.

Sensor menu

The following settings are to be made individually for each of the 6 sensor inputs. They all have their own sub menu.

Designation	Each sensor can be given its own designation made of numbers, letters, symbols and spaces. This designation only serves the purpose of identification and has no influence on operation . The input is carried out by choosing one letter after the other, turn the wheel to change slots, hit enter to choose your symbol. Confirm by choosing the tick and hitting Enter. The arrow pointing left deletes the last symbol in your designation.
Sensor	Choice of sensor type, deactivating an input or assign a different functionality to inputs.
	unused Sensor input not in use.
	KTY (2k Ω) Usage as KTY type sensor.
	PT1000 (= FS) Usage as PT1000 type sensor (standard type of the Technische Alternative company).
	RAS Usage as room sensor RASKTY
	RASPT Usage as room sensor RASPT
	GBS Usage as insolation sensor GBS
	Fixed value Assign a fixed temperature value to the input.
	Sensor accept Taking on the value of another input.
	Digital For signals reading ON/OFF or Yes/No
Only sensor S6:	VIG Usage as flow rate pulse generator VIG.... with required input of the quotient in l/Imp
	Wind sensor Usage as wind sensor WIS01 required input of the quotient in Hz
Sensor correction	Possibility to correct the measured value for all programs
Average	Adjusting the time (in seconds) in which an average of the measurement is to be calculated. (FS = 1.0s) Simple measurement applications should use an average of about 1.0 - 2.0 seconds. A high average slows reactivity and is only recommended for sensor used for heat metering. Measurement with an ultra fast sensor (as used in DHW preparation) requires a faster evaluation of incoming signals. As such, the average of such sensors should be set to about 0.3 bis 0.5 seconds, though this might cause fluctuations in display values.
Sensor check	Y/N: Checking the sensor to detect interruptions or short circuits and outputting error values accordingly (+9999.9°C = interruption or -9999.9°C = short circuit).
Value	At the bottom of the menu, the currently measured value is displayed.

Simulation



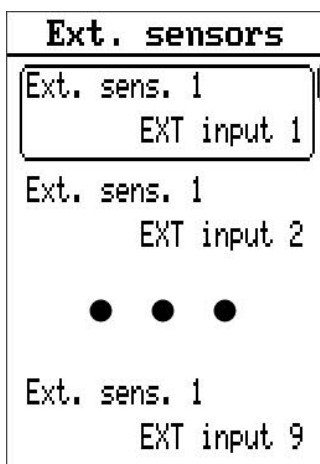
In the sensor menu, below the settings and measurements of all sensors, the setting **Simulation** is found.

- No average of sensor measurements
- All inputs are measured as PT1000 type sensors, even if a different type has been defined.

Choices:

- **OFF** – No simulation
- **Analogue** – Real time values (no averages etc.)
- **CAN SIM board** – Simulation with SIM-BOARD-USB-UVR16x2

Ext. sensors



Values like temperature, pressure, humidity, differential pressure etc. can be acquired from external electronic sensors. In this case, the power supply and signal reading occur via the **DL-Bus** (= Data line).

A maximum of 9 values can be read from external DL-sensors (over the DL-Bus) or CAN-Bus devices .

The values of external sensors can be assumed by sensor inputs for further operation. For this application, the sensor must be set to „Sensor accept“ in the **Sensor menu** and the respective external input must be chosen under „Sensor assignment“.

Due to the relatively high power drain of external sensors, pay attention to the **bus load**:

The controller UVR65 supplies a maximum bus load of 100%. The electronic sensor FTS-50DL, for example, has a bus load of 25% – a maximum of 4 such sensors can be connected to the DL-Bus. The bus load of an electronic sensor can be found in the specifications of its technical data.

Setting up external sensors

DL-Bus sensor

EXT input 1	
Designation	EXT input 1
Source	DL input
DL bus address	1
DL bus index	1
Sensor correction	0
Sensor check	Yes
Value	0

Designation

Each sensor can be given its own designation here. This designation only serves the purpose of identification and has **no influence on operation**.

Source

The source from which the signal is being read out. In this case, „DL input“ as chosen for a sensor in the DL-bus.

DL-Bus address

The address of the sensor in the DL-Bus.

DL-Bus index

Index of the external sensor's desired value. The instruction manual of a DL-Bus sensor has further details about the sensor's values and its indices.

Sensor correction

Correctional value in 1/10 degree steps (1 = 0.1°C)

Sensor check

With sensor check activated („Yes“) an error message is automatically generated to indicate short circuits or sensor interruptions, found in „System status“ in the overview.

The measured value is displayed at the end of the menu.

Value of a CAN-Bus device

EXT input 1	
Designation	EXT input 1
Source	CAN analogue input
Node number	1
Output number	1
Sensor check	Yes
Value	0

Designation

Each sensor can be given its own designation here. This designation only serves the purpose of identification and has **no influence on operation**.

Source

Source of the signal. For this case, „CAN analogue input“ was chosen, because the value is taken over from another CAN-Bus device. Alternatively, „CAN digital input“ can be chosen. Analogue inputs are measurements, digital inputs are Yes/No or On/off signals.

Node number

Input of the CAN node number of the respective device, as well as the desired **Output number**.

Sensor check

In addition to outputting a sensor error message (in case of interruption or short circuit), a CAN network error can be displayed.

The values of external inputs can be assumed by sensor inputs for further operation. For this application, the sensor must be set to „Sensor accept“ in the **Sensor menu** and the respective external input must be chosen under „Sensor assignment“.

Outputs

```

Outputs
-----
Output 1
      Output 1
      OFF
  . . .
Output 2
      Output 2
      OFF
Blocking
protection
  
```

In this menu, each used output has its own sub menu, in which each can be given a designation that has no influence on operation. Below that, settings for run-on time and blocking time can be found (further details below). Additionally, several infos and statistics are displayed, such as Mode (Auto/Manual), and meter readings for running hours and impulses („total“, „today“ and „previous day“ for each) and a button for both meters to delete the measurements of „today“. Before that, the button „Delete total meter readings“ is found, which resets all meter readings back to zero.

Blocking protection

Idle circulating pumps (e.g.: heating pumps in the summertime) may have troubles starting-up as a result of corrosion. Solution: Periodically (e.g. every 7 days) activating the pump for a few seconds.

Warning! For programs with heat exchangers (e.g. program 384) both the primary and secondary pumps must be switched on for blocking protection to avoid frost damages.

```

Blocking protection
-----
Enable
(Yes)
Interval time
(7 Days)
Start time
(15:00)
Pump run time
(15s)
Affected outputs
(1)
  
```

Enable	Blocking Yes/No (FS = No)
Interval time	If the chosen output has not been active for the duration specified here, it will be activated for the duration specified under Pump run time.
Start time	Time of day at which the outputs are activated. (FS = 15:00)
Pump run time	Pump run time in seconds. The chosen outputs will be activated for this duration (FS = 15s)
Affected outputs	Specifying the outputs which are to be activated by the block protection. If the output has a control output assigned to it, the variable for maximum speed will be output by it. Possible settings: Combination of all outputs (FS = ----)

Run-on time

Especially solar and heating pumps with long hydraulic pipelines may have issues with constant turning on and off again over longer times when attempting to start up. This is especially disadvantageous for modern high-efficiency pumps. Such behavior can be avoided by specific usage of the speed control or by setting up a run-on time.

```
Run-on time
0s -
09m 00s
hr   min  sec
    0   0  0
  (✓) (X)
```

This setting is to be made specifically for each output.

If usual automatic regulation would switch off an output, it will keep on running for the duration of the run-on time before actually deactivating. If the output is reactivated before the run-on time has passed, it will not have been deactivated. Manual mode ignores the run-on time.

Blocking time

This setting is to be made specifically for each output.

```
Blocking time
0s -
1h 00m 00s
hr   min  sec
    0   0  0
  (✓) (X)
```

If an output is deactivated by usual automatic regulation, the blocking time must elapse before the output may be reactivated. Manual mode ignores the blocking time.

Control output

The two control outputs (A4 and A5) are identical in terms of parameterization.

<p>Control output 4</p> <p>Function PWM output</p> <p>Outputs for enable 1</p> <p>Absolute value ctrl Mode Normal</p> <p>Sensor input S1</p> <p>Set value 50.0 °C</p> <p>Differential control Mode Normal</p> <p>Sensor input (+) S1</p>	<p>Sensor input (-) S2</p> <p>Set value diff. 10.0 K</p> <p>Event control Mode Normal</p> <p>Activation sensor S1</p> <p>Control sensor S2</p> <p>Set value event 60.0 °C</p> <p>Controller set value 130.0 °C</p> <p>Proportional comp. 5.0</p>	<p>Integral component 0.0</p> <p>Differential part 0.0</p> <p>Output node 0-100</p> <p>Min. correcting var. 0</p> <p>Max. correcting var. 100</p> <p>Control delay 0s</p> <p>Min. switch-off time 0s</p> <p>Current correcting var. 0.0 %</p> <p>Test correcting var. 18</p>
---	--	--

The parameters concerning the control outputs are found in this menu.

As analogue output, 0-10 V can be generated in 0.1 V steps.

In the mode PWM, a digital signal with a frequency of 1 kHz (level approx. 10V) and a variable duty cycle of 0 to 100% is generated.

In an active state, a control output can be enabled by an assigned output that is defined by the chosen program.

<p>Control output 4</p> <p>Function PWM output</p> <p>Outputs for enable 1</p>

Example: control output 4 is set to mode PWM 0-100 and assigned to output 1 (= FS)

Choices „Function“:

5V supply, 0-10V output, PWM output, error message, error mess. inv.

Off Control output deactivated, output = 0V.

5V Voltage supply, output = 5V

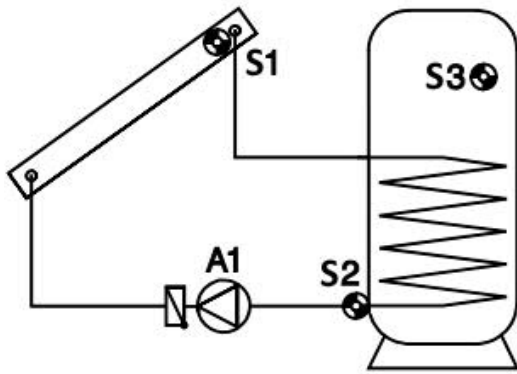
0-10V PID-regulator, output = 0-10V in 0.1V steps

PWM

PID-regulator, output = duty cycle 0-100% in 1% steps

Error message, Error message inverse

With function control activated and an error message in the system status (sensor interruption, sensor short circuit or circulation error) the control output will be set from 0V to 10V in mode **Error message** (if **inverse**: from 10V to 0V). Excess temp limiters do not switch the control output. An auxiliary relay can be connected to the control output which forwards error messages to signal indicators (LED-indicators, acoustic signals etc.)



This example will be used to describe the different possibilities for speed control.

Absolute value control

= maintaining a sensor's value

S1 can be kept at a certain temperature (such as 50°C) very well by using the speed control. If the insulation sinks, S1 becomes colder. The control unit then lowers the speed and hence the flow rate. That, however, causes the warm-up time of the heat transfer medium in the collector to increase, thus increasing S1 again.

A constant return (S2) may make sense as an alternative in various systems (such as boiler feeds). Inverse control characteristics are necessary for this. If S2 increases, the heat exchanger does not provide enough energy to the cylinder. The flow rate will then be reduced. The longer dwell time in the exchanger cools the heat transfer medium more, thus reducing S2. It does not make sense to keep S3 constant as the variation in the flow rate does not directly affect S3; hence, no regulator circuit will result.

The absolute value control is set via two parameter windows. The example has typical settings for the hydraulics:

```

Absolute value ctrl
Mode
  (Normal)
Sensor input
  (S1)
Set value
  (50.0 °C)
  
```

Mode: Off/Normal/Inverse

Normal operation means that the speed increases along with temperatures and is valid for all applications to keep a „feed sensor“ constant (collector, boiler, etc.).

Inverse operation means that the speed decreases along with rising temperatures and is necessary to maintain a return or control the temperature of a heat exchange outlet via a primary circulating pump (such as DHW). If the temperature at the heat exchanger's outlet is too high, excessive energy yield enters the heat exchanger, thus reducing the speed and as a result, the input.

Sensor input: Temperature at this sensor is to be held at a constant level.

Set value: This temperature is to be held constant. (FS = 50°C)

Differential control

= to keep the temperature between two sensors constant

Keeping the temperature difference between two sensors, e.g. S1 and S2, allow for a „modulating“ operation of the collector. If S1 drops due to sinking insolation, the difference between S1 and S2 sinks as well. The speed will be lowered, increasing the time the heat medium spends in the collector, increasing the difference between S1 and S2 again.

Example:

Differential control
Mode
<input type="text" value="Normal"/>
Sensor input (+)
<input type="text" value="S1"/>
Sensor input (-)
<input type="text" value="S2"/>
Set value diff.
<input type="text" value="10.0 K"/>

Mode: Off/Normal/Inverse

Sensor input +/- : The difference between the temperatures of the warmer sensor (sensor input +) and the colder sensor (sensor input -) is calculated as actual difference.

Set value diff.: The set value of the difference is 10K in the example (= FS). As such, according to the example, the difference between S1 and S2 is held at 10K.

Warning: The **set value diff.** must always be greater than the deactivation threshold diff. of the basic operation. If the set value diff. is lower, the basic operation blocks the activation of pumps, before the speed control has reached the set value.

If **absolute value control** and **differential control** are active simultaneously, the lower of the two speed results will be used.

Event control

If a set temperature threshold (set value event) is exceeded at the activation sensor, the event control starts, keeping the temperature at the control sensor constant (controller set value).

If S3, as exemplified, reaches 60°C (activation threshold), the collector is to be held at a constant temperature. The method of holding a temperature constant is the same with the absolute value control.

Example:

Event control
Mode
Normal
Activation sensor
S3
Control sensor
S1
Set value event
60.0 °C
Controller set value
130.0 °C

Mode: Off/Normal/Inverse

Activation sensor: The sensor which activates the event control.

Control sensor: Sensor that is to be held constant, if the event control activates.

Set value event: Temperature threshold at the activation sensor. According to the example, the event control will activate when 60°C is exceeded.

Controller set value: Set value of the temperature at the control sensor after activation of the event control.

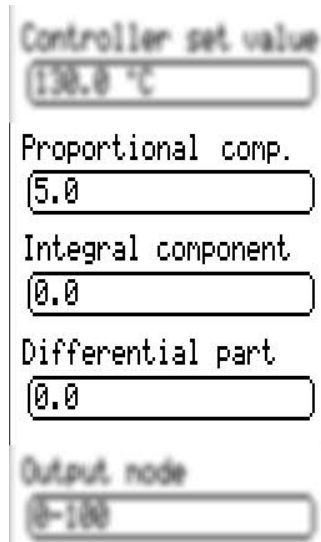
Summary: If the temperature at S3 exceeds 60°C, sensor S1 is held constant at 130°C.

The event control is prioritized above the speed results of other control methods. As such, a set event can block the absolute value control and the differential control.

Example: The collector temperature being held constant at 50°C by the absolute value control is being blocked (overwritten), if the cylinder (S3) has already reached a temperature of 60°C, generating a useful temperature of DHW is thus completed. Following this, charging is to continue with full flow rate (= lower temperature and slightly better efficiency). For this, a new desired temperature is to be entered in the event control which demands full speed automatically (e.g. controller set value at control sensor S1 = 10°C).

Stability problems

The speed control contains a „PID controller“. It ensures an exact and fast adjustment of the actual value to the set value. **In applications such as solar systems and charging pumps, the factory settings likely regulate in a stable manner.** Especially the DHW preparation via external heat exchangers (fresh water station) adjusting these values to the specific circumstances is absolutely necessary. In this case, the additional use of an ultra-fast sensor (optional accessory MSP60 or MSP 130) at the warm water output is required.



The image shows a control interface with the following settings:

- Controller set value: 130.0 °C
- Proportional comp.: 5.0
- Integral component: 0.0
- Differential part: 0.0
- Output mode: 0-100

The **proportional component** represents the reinforcement of the deviation between the desired and the actual value. The speed is changed by one increment for each $x * 0.1K$ of deviation from the desired value. A large number leads to a more stable system but also to more deviation from the predefined temperature. In the example, is set to 5. This means that the speed is adjusted by one level for every 0.5K of deviation from the set value.

(FS = 5)

If the **actual value** and the **set value** are identical, the output variable is the **median** between minimum and maximum variable.

Example: minimum variable **30**, maximum variable **100**, set value = actual value → variable = **65**

The **integral component** periodically adjusts the speed relative to the deviation remaining from the proportional part. For each 1K of deviation from the desired value, the speed changes one increment every x seconds. A large number provides a more stable system, but it takes longer to reach desired values. With an integral component of e.g. 5, the speed is changed per 1K of deviation from the set value every **5** seconds by one level. (FS = 0)

The **differential part** leads to a short „overreaction“ the faster a deviation between the desired and the current value occurs, to provide a fast compensation. If the desired value deviates at a rate of $x * 0.1 K$ per second ab, the speed is changed by **one** level. High settings provide a more stable system, but it takes longer to reach desired values. If the differential part is set to e.g. 5, the speed is changed by one level if the set value deviates at a rate of **0.5K** per second. (FS = 0)

In some cases, the parameters for **proportional, integral and differential component** must be assessed by trial and error.

A typical result of the **DHW preparation** (fresh water station) with fast sensors is Prop. = 3.0, Integr. = 3.0, Diffr. = 1.0 for pump with PWM signal. In practical experience, the settings Prop. = 3.0, Integr. = 1.0, Diffr. = 4.0 have proven useful combined with usage of an especially fast sensor.

Output mode, Correcting variables

Differential part	0.0
Output mode	0-100
Min. correcting var.	0
Max. correcting var.	100
Control delay	

Depending on the make of the pump, the control mode of the pump can be set to normal (0-100 „solar mode“, PWM 2) or inverse (100-0 „heating mode“, PWM 1). There may also be specific requirements for the limits of the control range. These can be found in the information of the pump manufacturer.

The following parameters define the control mode and the lower and upper limits of the output analogue value:

Output mode: 0-100 equals 0-10V and 0-100% PWM, 100-0 equals 10-0V and 100-0% PWM (inverse). (FS = 0-100)

Min. correcting variable: Lower speed limit (FS = 0)

Max. correcting variable: Upper speed limit (FS = 100)

Control delay, control commands

Max. correcting var.	100
Control delay	0s
Min. switch-off time	0s
Current correcting var.	0.0 %
Test correcting var.	18

Control delay: If the control output is activated by an assigned output, the speed control will be deactivated for this set time and the variable for maximum speed will be output. Only after this time elapsed, the control output will be regulated. (FS = 0)

Min. switch-off time: The control output can only be activated if the minimum switch-off time has elapsed since its last activation. (FS = 0)

Current correcting var.: Current correcting variable used for regulation.

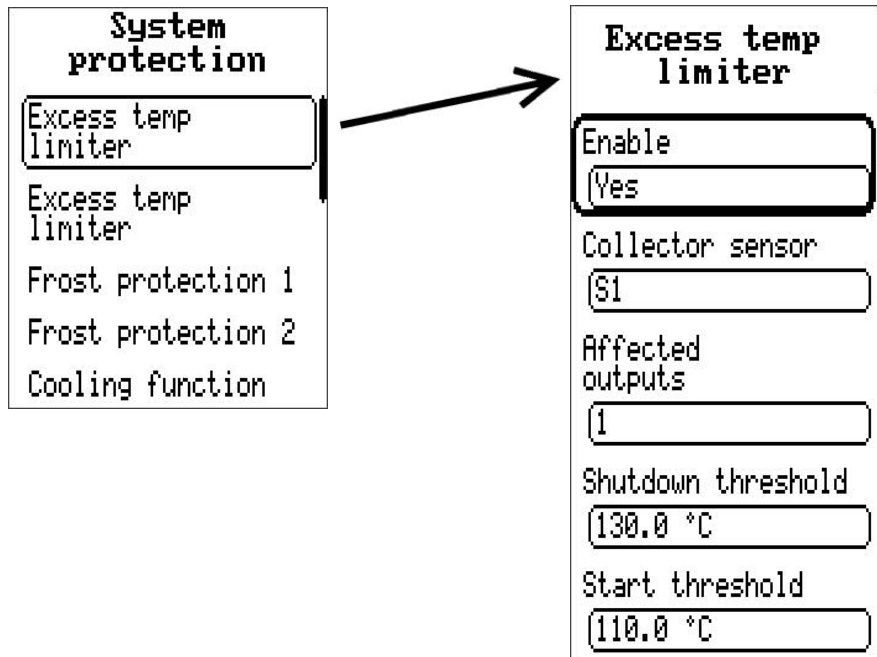
Test correcting var: For testing purposes, a specific correcting variable can be output. Entering this menu automatically sets the control output into manual mode. Leaving the menu sets it back to regular automatic regulation.

System protection

There are two functions for excess collector temperature limitation, two for frost protection, and a cooling function. Except for the first excess temperature limitation, all of these functions are deactivated in the factory settings.

Excess temp. limiter

Steam might build up in an idle system, making a reactivation difficult, as the pump can't lift the fluid above the highest point in the system (the collector feed line). With circulation rendered unattainable, the pump experiences enormous load. This function allows the pump to be blocked above a set collector temperature threshold until a second threshold is underrun. If a control output is assigned to the output, the analogue level for stagnancy is output, if the excess temp. limiter is active.



Enable	Excess temp limiter active (FS1 = Yes, FS2 = NO)
Collector sensor	Collector sensor, which is to be monitored. (FS1 = S1, FS2 = S2)
Affected outputs	Outputs, which are to be blocked when exceeding the shutdown threshold. (FS1 = A1, FS2 = A2) Options: Combinations of all outputs (1-5).
Shutdown threshold	Temperature, above which the affected outputs are to be deactivated. (FS = 130°C) Range: <i>Start threshold</i> to 200°C in 0.1°C steps
Start threshold	Temperature below which the outputs are to be re-enabled. (FS = 110°C) Range: 0°C to <i>Shutdown threshold</i> in 0.1 °C steps

Two of these excess temp limiters are available.

Frost protection

This function is deactivated in the factory settings and only necessary for solar systems that have no frost protection of their own. Souther latitudes offer the possibility of bridging the gap of the few hours below a collector minimum temperature with power from the solar system's cylinder. The settings as displayed in the image below activate the solar pump below the **start threshold** of 2,0°C at the collector sensor and a reactivation when exceeding the **shutdown threshold** of 4°C .

Frost protection 1	
Enable	Yes
Collector sensor	S1
Affected outputs	1
Start threshold	2.0 °C
Shutdown threshold	4.0 °C

Enable	Frost protection Yes/No (FS = No)
Collector sensor	Specifying of the collector sensor (S1 to S6), which is to be monitored. (FS1 = S1, FS2 = S2) Range: S1 - S6
Affected outputs	Specifying the outputs, which are to be activated when underrunning the start threshold. If a control output is assigned to the output, the analogue level for full speed is output. (FS1 = A1, FS2 = A2) Options: Combination of all outputs (1-5)

Start threshold

Temperature, below which the affected outputs are to be activated (FS = 2°C)

Range: -30°C to *Shutdown threshold* in 0.1°C steps

The start threshold cannot be set above the shutdown threshold.

Warning: It's possible to assign the same temperature to both thresholds, but a difference of at least 2°C is recommended.

Shutdown threshold

Temperature, above which the affected outputs are to be deactivated again (FS = 4°C)

Range: *Start threshold* to 120°C in 0.1°C steps

WARNING:

If the frost protection is activated and the collector sensor encounters an error (interruption or short circuit), the affected outputs will be activated for 2 minutes every hour.

Two frost protection functions are available.

With the Drainback-function activated, the frost protection functions are blocked (exception: program 4).

Collector cooling function

Using this function, a solar system's cylinder can be cooled overnight to allow it to take in warmth again the next day.

If the chosen sensor (cylinder temperature) exceeds the specified temperature, the specified outputs will be activated within the specified time window until the temperature is underrun again.

Cooling function	
Enable	Yes
Monitored sensor	S1
Maximum value	80.0 °C
Affected outputs	1
Start	22:00
End	06:00

Enable	Collector cooling function Yes/No (FS = No)
Monitored sensor	The (cylinder) sensor that is to be monitored.
Maximum value	This threshold must be exceeded by the monitored sensor in order for the cooling function to activate.
Affected outputs	These outputs are activated, once the chosen sensor exceeds the specified threshold within the defined time window. If a control output is assigned to the output, the analogue level for full speed will be output. Options: Combination of all outputs (1-5)

Start	Time of day, beginning at which the affected outputs may be activated. (FS = 22:00) Range: 00:00 to 24:00 in 1 minute steps
End	Time of day, beginning at which the affected outputs may be activated. (FS = 06:00) Range: 00:00 to 24:00 in 1 minute steps

Start function

(ideal for tube collectors)

```

Start function
Start function 1
Start function 2
    
```

Some solar systems might not be sufficiently bathe the collector sensor in the warmed heat transfer medium in the morning, resulting in an unfavorably late start of circulation. Flat collector panels generally tend to lack sufficient gravitational force.

The starting function attempts find a good point to activate the solar pump by constantly monitoring the collector's temperature. At first, the controller deduces the weather based on the constantly measured collector temperature. The resulting fluctuations of the temperature help in finding the right time for a short flushing period, to receive a measurement of the actual temperature of the collector for usual regulation of the system. When using an insolation sensor, the insolation measurement is regarded in the calculation of the starting function (optional accessory **GBS01**).

The starting function may not be used together with an active Drainback function. Since the controller supports systems with two solar collectors, this function is available **twice**. The starting function is disabled in the factory settings and is only practical with solar systems. In an active state, the following menu (identical for both instances of the function) will be displayed:

```

Start function 1
Enable
(Yes)
Collector sensor
(S1)
Radiation sensor
(----)
Activation ramp
(20.0 °C)
Monitored outputs
(1)
Flushing outputs
(1)
Pump run time
(15s)
Interval time
(20m)
Counter start attempts
0
    
```

Enable

Start function Yes/No (FS₁ = FS₂ = No)

Collector sensor

Specification of the collector sensor (FS₁ = S1, FS₂ = S2)
Range: S1 to S6

Radiation sensor

Specification of an input, if a radiation sensor is used.
(FS = ----)
Options:
S1 to S6 Input of the radiation sensor
EXT1 to EXT9 External sensor
---- no radiation sensor

Radiation threshold/Activation ramp

(display depending on setting under „Radiation sensor“)

Radiation threshold: Insolation value in W/m², above which flushing is allowed. (FS = 150 W/m²)

Activation ramp: A median value is calculated from the collector's temperature, with special regard to the lowest occurring temperature. Without a radiation sensor, the starting function is activated, if collector temperature exceeds the median value by the activation ramp. A lower activation ramp results in an earlier starting attempt, a higher ramp results in a later attempt. If more that ten attempts are necessary to set the solar circuit in motion, the activation ramp must be increased, and less than four attempts should see to a lowered ramp.

monitored outputs	Outputs which are to be monitored. If one of these outputs is active, no starting function attempt will be made. Range: Combination of all outputs (FS ₁ = A1, FS ₂ = A2)
Flushing outputs	Outputs used for flushing. If a control output is assigned to the output, the analogue level for full speed will be output. Range: Combination of all outputs (FS ₁ = A1, FS ₂ = A2)
Pump run time	Flushing time in seconds. The pump should be able to pump about half the collector's fluid content past the collector sensor within this time. (FS = 15s)
Interval time	Maximum allowed interval time between two flushing processes. This time is lowered automatically with a rise in temperature following a flushing process. (FS = 20 min) Range: 5m to 1h 39m in 1 minute steps
Counter start attempts	Number of starting attempts made. The counter is automatically reset if the last starting attempt is more than 4 hours past.

Solar priority

This menu entry is only displayed if a program with solar priority is set up.

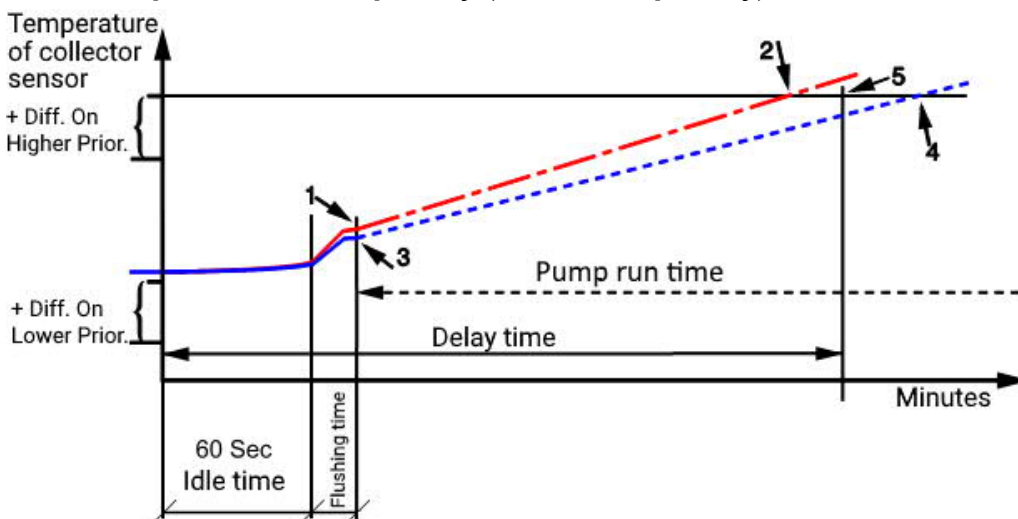
While charging the consumer with **lower priority** the device monitors the insolation on the radiation sensor or the collector's temperature. If the collector temperature reaches the activation difference of the currently targeted consumer while the pump is already running (collector reference), the priority timer is activated. When using a radiation sensor, the insolation must exceed a threshold, rather than the temperature difference. The priority timer deactivates the pump for the idle time (60 sec).

After the flushing time (1, 3) the device calculates the increase of the collector's temperature. It predicts, whether or not the set delay time will suffice to heat up the collector to the priority temperature (5).

In the second case, the switching of the priority will be waited out, because the collector temperature will reach the activation temperature for the prioritized consumer before the delay time runs out.

If the device detects that the increase within the delay time will not suffice (case 4), the process is aborted and the priority timer can only be reactivated after the pump run time and idle time have passed (60 seconds). The system remains set to lower priority within the pump run time.

With the pump run time set to 0, lower priority will only be allowed after reaching the maximum temperature of the priority (= absolute priority).



Solar priority

Pump run time
 (20m 00s)

Delay
 (05m 00s)

Flushing time
 (15s)

Flushing outputs
 (1)

Radiation sensor
 (-----)

Pump run time

Pump run time in lower priority. If the increase in temperature during flushing does not suffice to switch into higher priority, lower priority will be permitted for this time. **If the pump run time is set to 0, lower priority will only be permitted once the higher priority consumer reaches its maximum threshold (= absolute priority)** (FS = 20 min)

Delay

Delay time in lower priority. It equals the time, in which the collector should be able to reach the necessary temperature for operation in higher priority. If this time is set to 0, the solar priority timer is deactivated. (FS = 5 min)

Flushing time

Specification of the flushing time after the idle time. Within this time, half the collector's fluid content should be able to be pumped past the collector sensor. (FS = 15s)

Flushing outputs

Outputs used for flushing. If a control output is assigned to the output, the analogue level for full speed will be output. (FS = 1)

Options: Combination of all outputs

Radiation sensor

Specification of an input, if a radiation sensor is used. If the radiation sensor exceeds a set radiation threshold (insolation value), the priority timer will be started. Without a radiation sensor, the timer will be started according to the monitored collector temperature. (FS = -----)

Options: S1 to S6 Input of the radiation sensor
 EXT1 to EXT9 External radiation sensor
 ----- no radiation sensor

Radiation threshold

Radiation threshold: insolation value in W/m^2 if a radiation sensor is used, above which a flushing process will be permitted. (FS = 150 W/m^2)

Funct. check (Function check)

The function check serves to monitor a system for sensor defects or missing circulation in a solar system. The function check is deactivated in the factory settings.

<p>Funct. check</p> <p>Function control Yes</p>	<p>Function control Yes/No</p>	<p>Activate/deactivate (FS = No) Sensors will be monitored to detect interruption and short circuits. Sensors set to Digital (ON/OFF), VIG or fixed value are not monitored.</p>
<p>Circulation chk Yes</p>	<p>Circulation check Yes/No</p>	<p>Circulation check is only useful for monitoring solar systems. This options enables/disables the circulation check (FS = No)</p>
<p>Circ. chk 1 1</p>	<p>Circ. chk 1-3</p>	<p>1-3 is the index of the three available circulation check options. The numbers set for each check are the outputs that are to be monitored for circulation.</p>
<p>Sensor input (+) S1</p>	<p>Sensor input + (each circ. check has its own instance of this setting)</p>	<p>If the output assigned to the circulation check is active, the circulation is monitored according to the following concept:</p>
<p>Sensor input (-) S2</p>	<p>Sensor input - (each circ. check has its own instance of this setting)</p>	<p>If the temperature at sensor input + exceeds sensor input - by 60 K for a duration of 30 minutes, a circulation error will be displayed in the system status.</p>
<p>Circ. chk 2</p>	<p>Display on other devices</p>	<p>This option allows for errors and messages to be displayed on other CAN-Bus devices. These can only be viewed on other devices, not dismissed.</p>
<p>Circ. chk 3</p>	<p>Nodes 1-31</p>	<p>If activated, all errors and messages are displayed on other devices, not just those of the function check.</p>
<p>Display on other devices</p>	<p>Nodes 32-62</p>	

Heat meter

(3 identical entries)

The device offers the possibility to log heat quantities in 3 different sections of a system. The 3 heat meters are deactivated in the factory settings. A heat meter requires 3 basic inputs:

flow temperature, return temperature, flow rate (volume flow)

In solar systems, adequate mounting and placement of sensors (see installation instructions – collector sensor on the flow collection tube, cylinder sensor on the return outlet) ensures correct measurement of the necessary temperatures. However, heat meters also measure losses in the flow line. To increase precision, the share of anti-freeze in the heat transfer medium must be specified, since anti-freeze lowers the heat capacity of the medium. The flow rate can be measured with a flow volume sensor or set assigned with a fixed value.

Enable Yes/No

Activate/deactivate heat meter (FS = No)

Sensor flow

Sensor input of the flow temperature (FS = S4)

Range:

S1 to S6

Input of the flow sensor

EXT1 to EXT9

External flow sensor

Sensor return

Sensor input of the return temperature (FS = S5)

Range:

S1 to S6

Input of return sensor

EXT1 to EXT9

External return sensor

Volume flow sensor	<p>Sensor input of the volume flow sensor (FS = - - - - -)</p> <p>A pulse generator of the make VIG.... can only be connected to input S6. The following settings in the sensor menu are necessary:</p> <p>S6 Sensor: VIG</p> <p>Quotient: Liters per impulse</p> <p>Range:</p> <p>S6 = Volume flow sensor input 6</p> <p>EXT1 – EXT9 = External sensor (FTS....-DL) via DL-Bus</p> <p>- - - - - = no volume flow sensor -> fixed volume flow. The fixed value will be used for the calculations of the heat meter.</p>
Fixed flow rate	<p>Volume flow in liters per hour. If no volume flow sensor was specified, a fixed flow rate can be set up instead. If the assigned output is inactive, the flow volume is assumed to be liters/hour. Since speed control makes for a constantly shifting volume flow, this setting is not suitable in combination with speed control. (WE = 50 l/h)</p> <p>Range: 0 to 20.000 liters/hours in 1 l/h steps</p>
Assigned outputs	<p>The specified/measured volume flow is only used for the calculation of the heat quantity, if the output specified here is active (or at least one of the several). (FS = none)</p> <p>Options:</p> <ul style="list-style-type: none"> None = Heat quantity is calculated without regard to output activity Combination of all outputs (1-5)
Frost protection share	<p>Share of anti-freeze agents in the heat transfer medium, specified in percent. An average of all reputable anti-freeze producers has been calculated and implemented as a table in dependence of the mixing ratio. In typical cases, this method results in a maximum error of one percent. (FS = 0%)</p> <p>Range: 0 to 100% in 0.1% steps</p>
Calibration value	<p>The calibration value resulting from calibrating sensors. (described in the following paragraphs)</p>
Diff. incl. calibration	<p>Current difference in temperature between flow and return sensors (incl. calibration). If both sensors are submerged together in a container of water, (such that both measure the same temperature), a difference of 0 should be displayed. As a result of measurement tolerance of the device and the sensors themselves, a difference will be there nonetheless. If this display is set to 0, the device saves the difference as a correctional factor and regards this in future calculations to correct the natural measurement error. A temperature of 40-60° in the water container used for calibration is recommended.</p> <p>This menu point offers a calibration possibility or the measurement of the difference in temperature in the heat meter. The calibration does not affect anything besides the heat meter.</p>
Delete calib. values	<p>Deletes calibration values.</p>
Delete meter readings	<p>The summed up meter reading are reset to 0 with this prompt.</p>

If the heat meter has been activated, the following points will displayed in the **overview**:

current yield in kW
volume flow in liters/hour
heat quantity in kWh

WARNING: If one of the two sensors (flow, return) of the heat meter has an error (interruption, short circuit), the current yield is set to 0, so no false measurements will be added to the heat quantity.

Notes concerning precision:

The precision of all measured energies and energy flows depends on many factors, which will be looked into deeper here.

- PT1000 temperature sensor of **class B** have a precision of ± 0.55 K at 50°C
- The error of the device's own measurement stands at typically ± 0.4 K per channel

For an assumed spread of 10 K, these two measuring errors result in a **maximum** measuring error between the flow and return of ± 1.90 K = **± 19.0 %** for class B and ± 13.0 % for class A.

- At lower spread, the percentage measuring error **increases**
- The accuracy of the flow sensor FTS 4-50DL stands at approx. ± 1.5 %

In the worst case scenario, the maximum overall measuring error for heat metering therefore equals:

$$1.19 \times 1.015 = 1.208$$

This means heat metering accuracy of ± 20.8 % in the worst case scenario (at 10 K spread, without calibrating the temperature sensors), although all measuring errors would then skew the results to the same extent.

Experience has shown that a worst case scenario never actually occurs and in an unfavorable scenario, half of this value can be expected. However, even 10.4 % is not justifiable.

After calibrating the temperature sensors (see above), the measuring error of the overall temperature measurement reduces to a maximum 0.3 K. Relative to the spread of 10 K as assumed above, this equals a measuring error of 3 %.

The maximum overall measuring error for the performance factor therefore equals:

$$1.03 \times 1.015 = 1.045$$

At a **10 K spread** and **with calibrated** temperature sensors, heat metering accuracy therefore improves for the **worst case scenario** to ± 4.5 %.

Step-by-step setup guide for heat metering

Two volume flow sensors are available to choose from:

- pulse encoder VIG
- volume flow sensor FTS....DL, connected via DL-Bus

If no volume flow sensor/encoder is used, a fixed volume flow can be specified.

The necessary settings are illustrated step by step below.

VIG (pulse encoder)

1	Sensor VIG	The pulse encoder VIG can only be connected to input 6. Therefore, settings for S6 in the sensor menu: „Sensor“ to „VIG“ (second entry)
2	Quotient 0.5 l/Imp	Check and, if necessary, adjust the quotient (liters per pulse)
3	Heat meter 1 Enable Yes	In the expert level under heat meter , choose a heat meter profile and set the point „Enable“ to „Yes“ to activate the profile. Further settings appear.
4	Sensor flow S4 Sensor return S5	Setting up the flow sensor and return sensor in the respective menu points.
5	Flow sensor S6	Setting up the volume flow sensor as sensor input S6, if the VIG is used as exemplified.
6	Assigned outputs 1	Specifying the assigned outputs. In the menu window, assigned outputs are marked with a black background.
7	Frost protectn share 0.0 %	Specification of the frost protection share (amount of anti-freeze agents in the heat transfer medium) in %.
8	Start calibration	Consider calibrating sensors according to the instruction manual.

FTS...DL (Example: Installation in the return flow, only 1 FTS4-50DL is use, use of an external sensor for the flow, connected to the FTS4-50DL)

Ext. sensors	
Ext. sens. 1	EXT input 1



1

Source	DL input
DL bus address	1
DL bus index	1

The FTS4-50DL is connected to the DL-Bus, hence: **Expert level** → **Ext. sensors** and assign the volume flow sensor to an EXT-input.

For this, open the menu of the external input, define the source as „DL input“ and the respective DL-Bus address (e.g.: 1) and the respective index (e.g.: 1). The correct index is noted in the instruction manual of the respective sensor.

2

DL-Bus Index	2
--------------	---

Specifying the sensor temperature on another ext. input like in the previous step. Same address as before, but index 2.

3

DL-Bus Index	3
--------------	---

If an external temperature sensor for the return is connected to the FTS4-50DL, then define another external DL-input: same address as before, index 3.

4

Heat meter 1	
Freigabe	Yes

In the **expert level** under **heat meter**, choose a heat meter profile and set the point „Enable“ to „Yes“ to activate the profile. Further settings appear.

5

Sensor flow	Ext. sens. 3
-------------	--------------

Specifying the flow sensor in the respective point in the menu. If an external sensor is used, as exemplified: **Ext. sens. 3** (see step 3), else: specify the flow sensor as S1-S6.

6

Sensor return	Ext. sens. 2
---------------	--------------

Specifying the return sensor in the respective point in the menu, if an external temperature sensor at the FTS4-50DL: **Ext. sens. 2** (see step 2).

7

Flow sensor	Ext. sens. 1
-------------	--------------

In the point „Flow sensor“: Specifying the FTS4-50DL as **Ext. sens. 1.** (see step 1)

8

Assigned outputs	1
------------------	---

Assigned outputs.
Consider specifying frost protection share and calibrating the sensors (see „VIG“ steps 7 and 8)

No volume flow sensor/encoder:

Heat meter 1		Activate the heat meter profile as in the previous guides.
1	<input type="text" value="Enable"/> <input type="text" value="Yes"/>	
2	Sensor flow <input type="text" value="S4"/> Sensor return <input type="text" value="S5"/>	Specify the flow and return sensors in their respective menu points.
3	Flow sensor <input type="text" value="-----"/>	Choose „-----“ as flow sensor, since none is in use.
4	Fixed flow rate <input type="text" value="50 l/h"/>	Specify the fixed flow rate. Enter the assigned outputs, frost protection share and calibrate the sensors, as described in the previous guides.

Pasteurisation

Protection against the formation of legionella. If the cylinder temperature does not exceed the **Temp. threshold**, measured at the **Monitored sensor**, for duration of the **Hold time** (if the **Interval time** has passed since this last did occur), an affected output and, if so desired, the output of a „generator“ (z.g: Burner) is activated for the duration of the **Hold time** and held above the **Temp. threshold**. If the temp. threshold is exceeded for the duration of the hold time as per usual automatic operation, the time interval is reset to 0.

Pasteurisation <input type="text" value="Enable"/> <input type="text" value="Yes"/> Interval time <input type="text" value="7 Days"/> Monitored sensor <input type="text" value="S3"/> Temp. threshold <input type="text" value="60.0 °C"/>	Affected outputs <input type="text" value="1"/> Generator demand <input type="text" value="Yes"/> Generator sensor <input type="text" value="S1"/> Generator outputs <input type="text" value="2"/>	Generator max. On <input type="text" value="80.0 °C"/> Off <input type="text" value="85.0 °C"/> Hold time <input type="text" value="01h 00m"/> Start time <input type="text" value="17:00"/>
--	--	--

- | | |
|-------------------------|--|
| Enable | Pasteurization function Yes/No (FS = No) |
| Interval time | Interval in days. If the temperature measured at the monitored sensor does not exceed the specified temp. threshold within this time interval for the hold time, the affected outputs will be activated. |
| Monitored sensor | Specifies, which sensor is to be monitored.
Options: S1 to S6 (FS = S3) |

Temp. threshold	This temperature must be exceeded at the specified sensor for the duration of the hold time. The affected output is switched on (if the function becomes active) for the duration of the hold time and held above the temp. threshold.
Affected output	These outputs are switched on, if the function becomes active. Options: Combination of all outputs 1-5 (FS = A1)
Generator demand	Yes/No, opens further settings for the request of heating, in addition to the affected outputs.
Generator sensor	Sensor, at which measurements for the generator occur.
Generator outputs	Specifying of the outputs necessary for a generator request.
Generator max. On/Off	Maximum permissive generator temperature measured at the Generator sensor (e.g. to avoid excess burner temperature) (FS = On 80°C/Off 85°C)
Hold time	The time for which the temperature threshold must be exceeded on the monitored sensor in order for the pasteurization to be considered completed.
Start time	Time of day after which the outputs may be activated if the function becomes active.

Drain-Back

This additional function can only be activated with programs for one collector field and one consumer (e.g. programs 0, 80, 112, 432 etc.) or program 4.

With drain-back solar thermal systems the collector area is emptied outside the circulation time. In the simplest case, a solar pump is accordingly installed close to an open expansion cylinder, which when the pump is stationary receives all the heat transfer medium above the cylinder.

System start up is triggered either by a radiation sensor or by the exceeding of the temperature difference **diff_{On}** between the **collector-** and **cylinder sensor**.

During the filling time the pump runs at full speed to lift the heat transfer medium above the highest point of the system. Optionally, a second pump („booster pump“) can be connected to a free output, so that the filling pressure is increased.

Filling of the collector with cold heat transfer medium leads to the short-term undershooting of the switching difference **diff_{Off}**. In the following stabilization time the pump continues to run irrespective of the temperature difference **diff_{Off}** at the **calculated speed**.

If the pump is switched off during normal operation (e.g. as a result of undershooting of the temperature difference **diff_{Off}** or collector overtemperature switch-off), then the heat transfer medium runs out of the collector field back to the expansion cylinder.

A volume flow sensor is suitable for use as low water protection (VSG... or FTS...DL). If the volume flow falls below a minimum value after the stabilization time, the solar pump is switched off and the error message **Drain-back Err.** appears in the status menu. The system can only restart after the error has been dismissed.

For the speed control of the pump, a **control output** (for pumps with internal electronics with 0-10V or PWM input) must be activated. It makes sense to define a minimum speed for the stabilization time, that safeguards the circulation.

If an **electronic pump with 0-10V or PWM input** is used as booster pump during the filling time, **control output 2** must be activated and assigned to the output of the booster pump. The analogue level for full speed is output during the filling time.

The **start function** must **not** be used alongside the drainback function. If the drainback function is activated, the frost protection should not be activated alongside it (with the exception of program 4)

Drainback	
Enable	Yes
Radiation sensor	S1
Radiation threshold	150 W/m ²
Fill output	1
Filling time	02m 00s
Stabilisatn time	05m 00s
Blocking time	0s
Water shortage sensor	-----
Start attempts	0

Enable	Drainback function Yes/No (FS = No)						
Radiation sensor	<p>Specification of a sensor input, if a radiation sensor is in use. Without a radiation sensor, only the temperature of the collector sensor will be regarded when starting the drainback function. (FS = -----)</p> <p>Options:</p> <table border="0"> <tr> <td>S1 to S6</td> <td>Input of the radiation sensor</td> </tr> <tr> <td>EXT1 to EXT9</td> <td>External radiation sensor</td> </tr> <tr> <td>-----</td> <td>No radiation sensor</td> </tr> </table>	S1 to S6	Input of the radiation sensor	EXT1 to EXT9	External radiation sensor	-----	No radiation sensor
S1 to S6	Input of the radiation sensor						
EXT1 to EXT9	External radiation sensor						
-----	No radiation sensor						
Fill output	<p>Outputs intended for filling. This allows the usage of a „booster pump“. The output for the second pump must be available, and not already used for other purposes. If an output has speed control via a control output assigned to it, then the control output must also be selected here. (FS = 1)</p> <p>Options: Combination of all outputs (1-5)</p>						
Filling time	<p>After activation of the system due to insolation values or a difference in temperature between the collector's and cylinder's sensors, the filling outputs will run at full speed for the duration of the filling time. (FS = 120 sec)</p> <p>Range: 0s to 16m 30s in 1 sec steps</p>						
Stabilisatn time	<p>After filling the system, the solar pump involved in starting will run during the stabilization time to warm up the collector, even if the specified deactivation threshold is underrun. With speed control activated, the pump will run according to the speed that's calculated by the function control output (at least at the specified minimum speed). (FS = 5 minutes)</p> <p>Range: 0s to 16m 30s in 1 second steps</p>						
Blocking time	<p>Blocking time between to filling processes. (FS = 0 min)</p> <p>Range 0s to 1h 40m in 1 second steps</p>						
Water shortage sensor	<p>Specification of a volume flow sensor for the low water level protection. (FS = ----)</p> <p>Sensor input S6 and external sensor inputs can be specified.</p>						
Start attempts	<p>Counter of starting attempts. The counter is reset when a starting attempt ensues, if the last attempt is more than 4 hours in the past.</p>						

CAN-/DL-Bus

CAN/DL bus

CAN settings

Node
12

Designation
UUR65

BUS rate
50 kbit/s (std)

CAN analogue outputs

CAN digital outputs

DL settings

Data output
Yes

Node number in the CAN network

Designation of the device within the CAN network

Bus rate in the CAN-Bus (must be the same for all devices in the network!)

Shows analogue values that are issued to the CAN bus

Shows digital values that are issued to the CAN bus

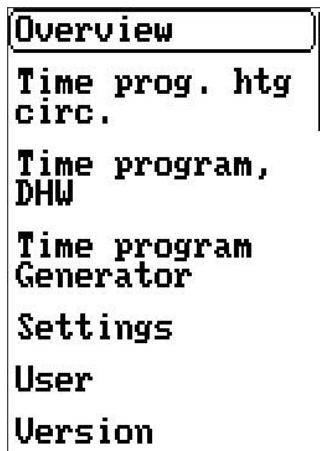
This point allows the activation/deactivation of data output via the DL-Bus for **Datalogging** or the remote display of the **RAS+DL**.

Depending on the specified program, the device outputs its relevant measurements and output statuses to the CAN-Bus.

Operation – Heating circuit control

Main menu

This instruction manual shows menus with expert level access.



Overview

- Time/Date
- Heating parameters
- Input values
- Status control output
- Chosen program (can't be changed here)

Time prog. htg circ./DHW/Generator

- A total of 5 time programs are available, split to three categories, depending on the chosen program.

Settings

- Technician level (e.g. parameter menu)
- Expert level (basic system settings)
- Display (timeout and contrast)
- Data admin

User

- Choice between use/technician/expert level
- Change passwords of the different user levels

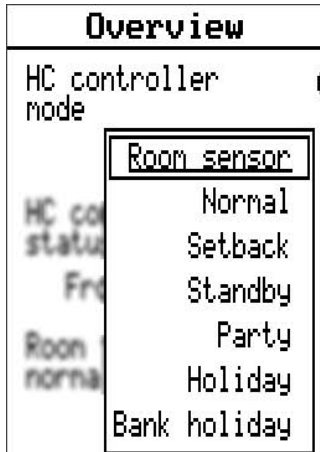
Version

- See chapter **Operation - General**

Overview

Overview	
Time/date 07:36 Mo 07.05.2018	Change time and date
Heating param.	Mode of heating circuit control (choices: Room sensor, Normal, Setback, Standby, Party, Holiday, Bank holiday)
HC controller mode Room sensor	Status of the heating circuit control (Hit „Enter“ for more details, further info on the following pages)
HC controller status Frost protection	
Room temp normal mode 22.0 °C	Room temperature in normal mode Range: 0 to 45°C in 0.1°C steps
Room temp setback mode 15.0 °C	Room temperature in setback mode Range: 0 bis 45°C in 0.1°C steps
Inputs	
Sensor 1 0.0 °C Time/auto •••	Current measurement, chosen mode of operation (Time/Auto)
Sensor 6 0.0 °C	Further sensors
Set flow t 30.0 °C	Set flow temperature (can't be changed here)
EXT inputs	
EXT input 1 0	External sensors and their measurements
Heat meter	
Heat meter 1 0.00 kW 50 l/h 0.0 kWh	Readings of the heat meter
Control output 4 10.00 V	Status of control outputs
Control output 5 0.00 V	
System status	
System status Ok	System status according to function control
Program 912	Chose program (can't be changed here)

HC controller mode



Time/Auto or Room sensor

Heating circuit control according to usual automatic operation. When using a room sensor, „Room sensor“ will be displayed instead of Time/Auto. The following settings overwrite the settings of the room sensor and time program settings:

Normal

Perpetual heating according to the temperature of Normal operation.

Setback

Perpetual heating according to the temperature of Setback operation.

Standby

Automatic operation is deactivated (except for frost protection).

Party

Normal operation up until the time of day specified below.

Holiday

Beginning with the current day until midnight of the date below, heating will run according to Setback operation.

Bank holiday

Beginning with the current day, the heating times specified for a Saturday will be used for operation, until the date specified below, which will use those of a Sunday.

When using mode **Party**, **Holiday** or **Bank Holiday**, the device switches back to automatic operation after the specified time/date has passed.

Time/Date

See **Operation - General**.

HC controller status

Shutdwn cond.	Status of the many shutdown conditions that affect the heating circuit control.
Min. temp. HC pump enable OFF	Min. temp. HC pump enable Enabling of the pump according to usual automatic operation. (e.g. exceeding of a minimum temperature of the boiler)
T.room < set ON	T.room < set Enabling of the pump according to room temperature in regard to set temperature
T.flow set > min. ON	T.flow set > min. Enabling according to the flow set temperature in regard to minimum temperature
T.outside < max. ON	T.outside < max. Enabling according to outside temperature in regard to maximum temperature
T.outside < max. (setback) ON	T.outside < max. (setback) Enabling according to outside temperature in regard to maximum temperature (in setback operation)
Remaining runtime ctr 0s	Remaining runtime ctr Countdown of the remaining mixer runtime. The mixer's motor is driven into one direction for no longer than 20 minutes at a time. The remaining runtime is reset after a change of direction or after manual operation is ceased.
T.flow min. effective No	T.flow min. effective The calculated flow temperature has not fallen below the minimum permissive temperature (specified under Technician level/Parameters). „No“ means that the actual flow temperature is not limited by the minimum threshold.
T.flow max. effective Yes	T.flow max. effective The calculated flow temperature has exceeded the maximum permissive temperature (specified under Technician level/Parameters). If „Yes“ is displayed, the actual flow temperature is limited by the maximum threshold.
Excess temp. functn effective No	Excess temp. functn effective Status of the excess temperature function (menu Expert level/Shutdown cond.), „Yes“ = Shutdown

Settings

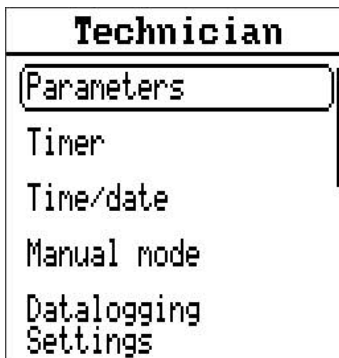


The screenshot shows a menu titled "Settings" with four options: "Technician level", "Expert level", "Display", and "Data admin". The "Technician level" option is highlighted with a thick border.

Choice of user level

The points **Display** and **Data admin** are described in the chapter **Operation – General**.

Technician level



The screenshot shows a menu titled "Technician" with five options: "Parameters", "Timer", "Time/date", "Manual mode", and "Datalogging Settings". The "Parameters" option is highlighted with a thick border.

Parameters

Specification of thresholds for activation, deactivation and differential values, settings regarding the heating circuit

Timer

Setting up a timer function for outputs

Time/Date

Time, date, summertime, automatic time change

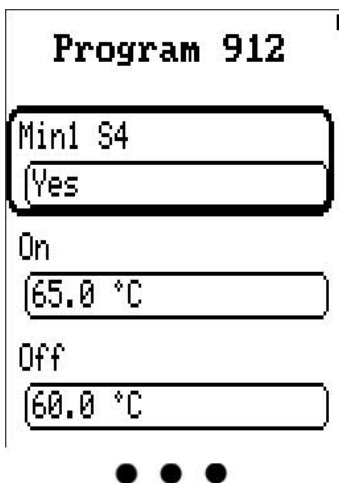
Manual mode

Switch outputs between *Automatic Mode*, *Manual mode ON* and *Manual mode OFF*

Datalogging settings

Activate/deactivate data logging to SD card, logging interval time

Parameters



The screenshot shows a menu titled "Program 912" with several options: "Mini S4", "Yes", "On", "65.0 °C", "Off", and "60.0 °C". The "Mini S4" and "Yes" options are highlighted with thick borders. Below the menu are three dots.

Chosen **program** (can't be changed here)

Value / sensor input (Example: Min1 / S4)

On: activation threshold (example: 65.0°C)

Off: deactivation threshold of the above value (example: 60.0°C)

Next threshold

The hystereses of these values are a result of the difference between activation and deactivation thresholds. Therefore, a maximum value, for example, should have its deactivation threshold set to several degrees above the activation threshold.

Further down in this menu, several more values for maximum thresholds (Max), minimum thresholds (Min), differential values (diff) and several settings regarding the heating circuit can be found.

After these values, several parameters follow, described in the following pages.

Example for threshold values Max/Min/Diff

For this example, program 928 is used.

MIN1 S6 Yes/No	Activation/deactivation of this threshold
MIN1 S6 On	Above this temperature at sensor S6 , output A1 is enabled. (FS = 45°C)
MIN1 S6 Off	The output that has been enabled by Min1 On is blocked again below this temperature. In some programs, Min prevents boilers from sooting up, in this program it prevents the buffer from cooling off. Recommendation: The activation threshold should be set about 3-5 K above the deactivation threshold. (FS = 40°C) Min Off can't be set above MIN On .
MAX1 S4 Yes/No	Activation/deactivation of this threshold
MAX1 S4 Off	Above this temperature at sensor S4, output A2 is blocked. (FS = 65°C)
MAX1 S4 On	The output blocked by reaching Max1 Off is re-enabled below this temperature. (FS = 60°C) Max serves to limit cylinder temperatures in this case. Recommendation: The deactivation threshold should be set about 3-5 K above the activation threshold. Max On cannot be set above Max Off .
MIN3 S6 Min3/Max3	Below this temperature at sensor S6, the heating request A3 is activated (FS = 60°C)
MAX3 S6 Min3/Max3	If this temperature is reached, the heating request is disabled (Hold circuit with Min3) (FS = 85°C) Min3 can't be greater than Max3 .
DIFF1 S6-S4 Yes/No	Activation/deactivation of this threshold
DIFF1 S6-S4 On	If the difference in temperature between the two sensors S6 and S4 exceeds this threshold, output A2 is enabled. Diff is the basic functionality for differential control function of the device. Recommendation: 3-5 K suffice for charging pumps. (FS = 5.0K)
DIFF S6-S4 Off	The output enabled by reaching Diff On is blocked again below this difference in temperature. Recommendation: Diff Off should be set to about 3-5K. In regard to the sensors' and the device's measuring tolerances, a value below 2K is not recommended. Diff Off can't be set above DIFF On (FS = 3K)

Further heating circuit parameters

Heat curve Temperature	Type of heat curve (Temperature/Slope)
Set flow temp. at +10°C 30.0 °C	Set flow temp. at +10°C temperature outdoors (heat curve Temperature)
Set flow temp. at -20°C 40.0 °C	Set flow temp. at -20°C temperature outdoors (heat curve Temperature)
Flow temperature	
T.flow max. 70.0 °C	Maximum flow temperature
T.flow min. 30.0 °C	Minimum flow temperature
Frost prot. cond.	
T.outside frost 5.0 °C	Temperature outside for frost protection
T.room frost 5.0 °C	Room temperature threshold for frost protection
Act. T.flow < 5.0 °C	Flow temperature threshold for frost protection
Frost prot. boiler	Frost protection function for the boiler
On 5.0 °C	Activation threshold for boiler frost protection
Off 50.0 °C	Deactivation threshold for boiler frost protection
Min. runtime boiler 30m 00s	Minimum runtime of the boiler, once requested
Time prog. set values No	Time program set values (Y/N) (overrides room set temperature settings)
Mixer selection Output pair	Mixer type (Output pair/0-10V mixer)

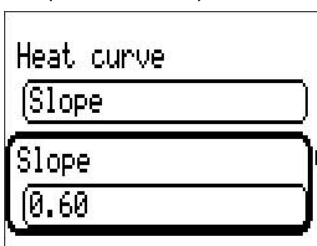
Heating characteristics

The flow temperature is usually calculated from the temperature outdoors and the heat curve (settings: menu **Technician level/Parameters**, Control type: **Temperature** or **Slope**). The heat curves are calculated for a set room temperature of +20°C and are shifted in a parallel direction in correspondence to other set room temperatures using the set room temperature influence.

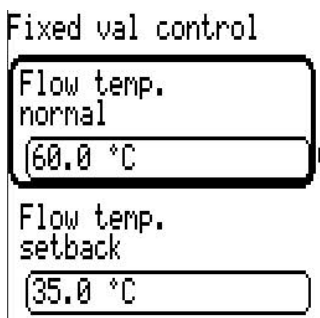
Control mode:

Outside temp.: Adjusting the heat curve via the correlation between the temperature outdoors (at +10°C and at -20°C) and the set flow temperature. Another point of reference is added at +20°C temperature outdoors = +20°C flow temperature. The values **+10°C** and **-20°C** are to be adjusted in their respective menu points (FS +10 = 40°C, FS -20 = 60°C).

Slope: Adjusting the heat curve via a slope, as commonly found in heating controllers. To adjust, select the slope in the respective menu point according to the diagram. (FS = 0.60°)



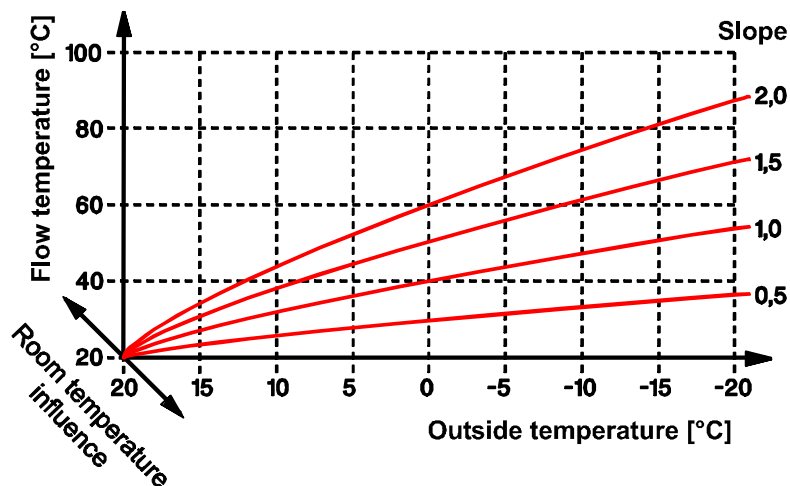
Fixed value: An exception to other control modes, (settings: menu **Expert level/Program settings**, Control mode: Fixed value) this control mode regulates the flow temperature according to the time programs **heating circuit**. The adjustment of the fixed values is found in the menu **Technician level/Parameters**. Keep in mind that the **Room influence** (see menu Expert level/Mixer) is also active for the the fixed value control mode, should a room sensor be installed.



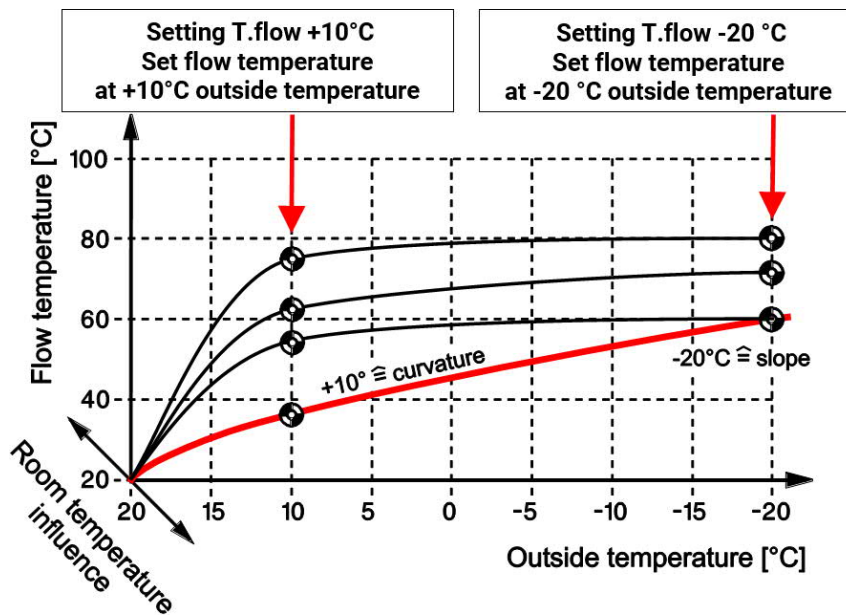
Heat curve

With both methods, the influence of the outside temperature on the flow temperature is not linear. For the mode Slope, the curvature is designed according to the norm. For the mode Temperature, the specification of the desired flow temperature at 10°C (outdoors) causes a „curvature of the heat curve“. This takes the differing grades of heat emission of different heating systems (floor heating, wall heating, radiators) into account.

Heat curve „Slope“:



Heat curve „temperature“ (Examples):



- T.flow max.** Maximum threshold of the flow temperature
This protective function is intended to prevent overheating of elements prone to heat damages (e.g. pipes of floor heating systems). The mixer regulation does not allow a flow temperature greater than **T.flow max**.
FS = 70°C, Range: *T.flow min.* to 100°C
- T.flow min.** Minimum threshold of the flow temperature
If the calculated flow temperature is below this threshold, a lower flow temperature will not be permitted regardless.
FS = 30°C, Range: 0°C to *T.flow max.*

Frost protection

This functionality becomes active in standby operation in any operation status, even if the heating circuit would block the pump due to a shutdown condition.

The frost protection function becomes active, if the median outdoors temperature (see menu Expert level/Mixer) goes below T.outside frost, if the flow temperature goes below Act. T.flow< or, with a room sensor installed, the room temperature goes below T.room frost. If frost protection is active, the set flow temperature is set to the specific flow temperature according to the heat curve, which correlates to the room temperature „T.room frost“, but no lower than „T.flow min.“.

The frost protection ends, if the temperature which caused it to start has exceeded its frost protection threshold by 2K (fixed hysteresis).

Frost protection boiler (only displayed for programs with boiler request and boiler sensor): If the temperature of the boiler sensor falls below the **On** threshold, the output for the boiler request is activated, until the boiler temperature has reached the **Off** threshold.

Adjusting time programs

Every heating circuit program features time windows labeled „Time prog. htg circ.“. The time programs switch between normal and setback operation, according to the settings of the room temperatures for these modes of operation. The heating pump is not deactivated by these time programs.

Depending on the chosen program, additional time programs for DHW and generators may be available, which regulate their respective outputs.

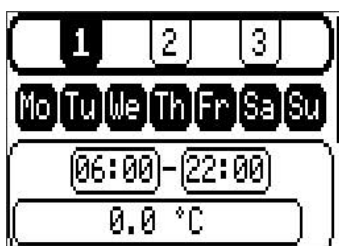
A total of 5 time programs is available, these are split up to *Heating circuit*, *DHW* and *Generator*, depending on the chosen program.



Chosen time program (black background indicates, which one is being edited)

Weekdays for which the time program is valid (black background = activated)

3 time windows = beginning and ending times



If the option **Technician level/Parameters/Time prog. set values** is set to „Yes“, the time programs change such as to allow adjusting of said set values below the different time windows.

Timer

This functionality equals an astable timer.

Timer	
Linking And	Changing the linking (And/Or)*.
Outputs 	Assign outputs
Runtime 00:00	Runtime
Pause time 00:00	Pause time

The timer function offers the possibility to assign a **runtime** (output is activated during this time) and a **pause time** (output is deactivate during this time) to an output. **Runtime and pause time are activated alternately.**

***And/Or:** If **And** is chosen, usual operation according to the program regulates the chosen outputs. They remain inactive during the pause time.

If **Or** is chosen, the assigned outputs are activated during the runtime. Usual operation according to the program regulates the chosen outputs during the pause time

Time/date

Time/date	
Time 07:31	Time of day
Date We 02.05.2018	Date
Automatic time change Yes	Automatic time change of Summertime
Summertime Yes	Summertime Yes/No (Only changeable, if automatic time change = „No“ – else this point only indicates the status of the summertime)

Manual mode

Changing of the individual outputs' mode of operation. Choice between Manual/ON (Output **constantly on**), Manual/OFF (Outputs **constantly off**) and Auto (Output regulated according to usual automatic operation and time windows).

Manual mode	
Output 1	Auto
Output 2	Auto
Output 3	Auto
Output 4	Auto

Only outputs used in the chosen program or ones that have been assigned a functionality (**Expert level/Programming settings/Assignment of free outputs**) are displayed here.

Control outputs (Outputs 4&5) are displayed as well. Manual/OFF outputs the variable for no operation (0V, PWM 0%), Manual/ON outputs the variable for full speed (10V, PWM 100%). Alternatively, „Manual“ can be chosen to output a specific variable

Datalogging settings

Datalogging Settings	
Datalogging on SD card	Yes
Interval time	02m 00s

Settings for datalogging: **Datenlogging on SD card** activates the logging of a preset of data to the plugged in micro SD card. The Interval time defines, how often data is to be logged. More detailed instructions are found in the chapter **Datalogging**. This chapter is of great importance, especially the points regarding the interval time and limited lifetime of SD cards.

Expert level

Expert level
Programming settings
Sensor menu
Ext. sensors
Outputs
Control outputs
Shutdown conditions
Mixer
Funct. check
Heat meter
Pasteurisation
CAN/DL bus

Program settings: basic settings, in addition to choice of program

Sensor menu: type, designation, correctional values etc.

Ext. sensors to read values from the CAN/DL-Bus

Outputs: Designation, status, meter readings, run-on time, blocking time and blocking protection

Control outputs: function, mode, enable/disable etc.

Shutdown conditions of the heating circuit

Mixer settings (control speed., room influence etc.)

Funct. check enable/disable, settings

Heat meter, settings for up to 3 different heat meter profiles

Pasteurization to avoid cultivation of legionella

CAN-/DL-Bus settings like node number, transfer speed etc.

Programming settings

Program	Choice of program according to hydraulic diagram. (FS = 0) Additional features and functionalities can be added to most programs. „All programs +1 (+2, +4, +8)“ means, that the chosen program number must be increased by the sum of the desired additions. Example: Program 48 +1 +2 = program number 51 = solar system with 2 consumers, with pump-valve-system and additional sensor S4 for temperature limitation.
Rm sensor present	Specify whether or not a room sensor is in use (Y/N) (FS = Yes)
Control mode	Specify, whether the device should regulate according to outside temperature or a fixed value. (FS = outside temperature)
Use S4	Specify, whether or not sensor input S4 is in use (Y/N) (only for program 800)
Cancel output	Possibility to exchange the functionalities of outputs with one another (A1 with A2, A1 with A3 or A2 with A3). This enables the assignment of the potential free output A3 to wherever necessary (FS = - - - - -)
Assignment of free outputs	Outputs not used in the program can be assigned to other functionalities.
Off (= FS)	The unused output remains inactive.
On	The output is constantly activated.
And	Linking with one or more outputs. The output is activated, if all linked outputs are on.
Or	Linking with one or more outputs. The output is activated, if at least one linked output is on.

Sensor menu

The following settings are to be made individually for each of the 6 sensor inputs. They all have their own sub menu.

Designation Each sensor can be given its own designation made of numbers, letters, symbols and spaces. This designation only serves the purpose of identification and has **no influence on operation**. The input is carried out by choosing one letter after the other, turn the wheel to change slots, hit enter to choose your symbol. Confirm by choosing the tick and hitting Enter. The arrow pointing left deletes the last symbol in your designation.

Sensor Choice of sensor type, deactivating an input or assign a different functionality to inputs.

unused	Sensor input not in use.
KTY (2k Ω)	Usage as KTY type sensor.
PT1000 (= FS)	Usage as PT1000 type sensor (standard type of the Technische Alternative company).
RAS	Usage as room sensor RASKTY
RASPT	Usage as room sensor RASPT
GBS	Usage as insolation sensor GBS
Fixed value	Assign a fixed temperature value to the input.
Sensor accept	Taking on the value of another input.
Digital	For signals reading ON/OFF or Yes/No
Only sensor S6: VIG	Usage as flow rate pulse generator VIG... with required input of the quotient in l/Imp
Wind sensor	Usage as wind sensor WIS01 required input of the quotient in Hz

Sensor correction Possibility to correct the measured value for all programs

Average Adjusting the time (in seconds) in which an average of the measurement is to be calculated. (FS = 1.0s)
Simple measurement applications should use an average of about 1.0 - 2.0 seconds. A high average slows reactivity and is only recommended for sensors used for heat metering.

Sensor check Y/N: Checking the sensor to detect interruptions or short circuits and outputting error values accordingly (+9999.9°C = interruption or -9999.9°C = short circuit).

Value At the bottom of the menu, the currently measured value is displayed.

Simulation



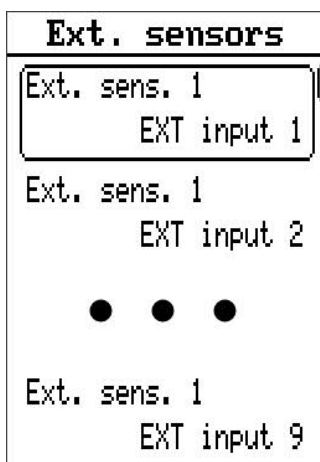
In the sensor menu, below the settings and measurements of all sensors, the setting **Simulation** is found.

- No average of sensor measurements
- All inputs are measured as PT1000 type sensors, even if a different type has been defined.

Choices:

- **OFF** – No simulation
- **Analogue** – Real time values (no averages etc.)
- **CAN SIM board** – Simulation with SIM-BOARD-USB-UVR16x2

Ext. sensors



Values like temperature, pressure, humidity, differential pressure etc. can be acquired from external electronic sensors. In this case, the power supply and signal reading occur via the **DL-Bus** (= Data line).

A maximum of 9 values can be read from external DL-sensors (over the DL-Bus) or CAN-Bus devices .

The values of external sensors can be assumed by sensor inputs for further operation. For this application, the sensor must be set to „Sensor accept“ in the **Sensor menu** and the respective external input must be chosen under „Sensor assignment“.

Due to the relatively high power drain of external sensors, pay attention to the **bus load**:

The controller UVR65 supplies a maximum bus load of 100%. The electronic sensor FTS-50DL, for example, has a bus load of 25% – a maximum of 4 such sensors can be connected to the DL-Bus. The bus load of an electronic sensor can be found in the specifications of its technical data.

Setting up external sensors

DL-Bus sensor

EXT input 1	
Designation	EXT input 1
Source	DL input
DL bus address	1
DL bus index	1
Sensor correction	0
Sensor check	Yes
Value	0

Designation

Each sensor can be given its own designation here. This designation only serves the purpose of identification and has **no influence on operation**.

Source

The source from which the signal is being read out. In this case, „DL input“ as chosen for a sensor in the DL-bus.

DL-Bus address

The address of the sensor in the DL-Bus.

DL-Bus index

Index of the external sensor's desired value. The instruction manual of a DL-Bus sensor has further details about the sensor's values and its indices.

Sensor correction

Correctional value in 1/10 degree steps (1 = 0.1°C)

Sensor check

With sensor check activated („Yes“) an error message is automatically generated to indicate short circuits or sensor interruptions, found in „System status“ in the overview.

The measured value is displayed at the end of the menu.

Value of a CAN-Bus device

EXT input 1	
Designation	EXT input 1
Source	CAN analogue input
Node number	1
Output number	1
Sensor check	Yes
Value	0

Designation

Each sensor can be given its own designation here. This designation only serves the purpose of identification and has **no influence on operation**.

Source

Source of the signal. For this case, „CAN analogue input“ was chosen, because the value is taken over from another CAN-Bus device. Alternatively, „CAN digital input“ can be chosen. Analogue inputs are measurements, digital inputs are Yes/No or On/off signals.

Node number

Input of the CAN node number of the respective device, as well as the desired **Output number**.

Sensor check

In addition to outputting a sensor error message (in case of interruption or short circuit), a CAN network error can be displayed.

The values of external inputs can be assumed by sensor inputs for further operation. For this application, the sensor must be set to „Sensor accept“ in the **Sensor menu** and the respective external input must be chosen under „Sensor assignment“.

Outputs

```

Outputs
-----
Output 1
      Output 1
      OFF
  . . .
Output 2
      Output 2
      OFF
Blocking
protection
  
```

In this menu, each used output has its own sub menu, in which each can be given a designation that has no influence on operation. Below that, settings for run-on time and blocking time can be found (further details below). Additionally, several infos and statistics are displayed, such as mode (Auto/Manual), and meter readings for running hours and impulses („total“, „today“ and „previous day“ for each) and a button for both meters to delete the measurements of „today“. Before that, the button „Delete total meter readings“ is found, which resets all meter readings back to zero.

Blocking protection

Idle circulating pumps (e.g.: heating pumps in the summertime) may have troubles starting-up as a result of corrosion. Solution: Periodically (e.g. every 7 days) activating the pump for a few seconds.

Warning! For programs with heat exchangers (e.g. program 384) both the primary and secondary pumps must be switched on for blocking protection to avoid frost damages.

```

Blocking protection
-----
Enable
(Yes)
Interval time
(7 Days)
Start time
(15:00)
Pump run time
(15s)
Affected outputs
(1)
  
```

Enable	Blocking Yes/No (FS = No)
Interval time	If the chosen output has not been active for the duration specified here, it will be activated for the duration specified under Pump run time.
Start time	Time of day at which the outputs are activated. (FS = 15:00)
Pump run time	Pump run time in seconds. The chosen outputs will be activated for this duration (FS = 15s)
Affected outputs	Specifying the outputs which are to be activated by the block protection. If the output has a control output assigned to it, the variable for maximum speed will be output by it. Possible settings: Combination of all outputs (FS = -----)

Run-on time

Especially solar and heating pumps with long hydraulic pipelines may have issues with constant turning on and off again over longer times when attempting to start up. This is especially disadvantageous for modern high-efficiency pumps. Such behavior can be avoided by specific usage of the speed control or by setting up a run-on time.

```
Run-on time
0s -
09m 00s
  hr   min  sec
      0   :  0
  (✓)  (X)
```

This setting is to be made specifically for each output.

If usual automatic regulation would switch off an output, it will keep on running for the duration of the run-on time before actually deactivating. If the output is reactivated before the run-on time has passed, it will not have been deactivated. Manual mode ignores the run-on time.

Blocking time

This setting is to be made specifically for each output.

```
Blocking time
0s -
1h 00m 00s
  hr   min  sec
      0   :  0   :  0
  (✓)  (X)
```

If an output is deactivated by usual automatic regulation, the blocking time must elapse before the output may be reactivated. Manual mode ignores the blocking time.

Control output

The two control outputs (A4 and A5) are identical in terms of parameterization.

<p>Control output 4</p> <p>Function [PWM output]</p> <p>Outputs for enable [1]</p> <p>Absolute value ctrl Mode [Normal]</p> <p>Sensor input [S1]</p> <p>Set value selection [Set value]</p> <p>Set value [50.0 °C]</p>	<p>Differential control</p> <p>Mode [Normal]</p> <p>Sensor input (+) [S1]</p> <p>Sensor input (-) [S2]</p> <p>Set value diff. [10.0 K]</p> <p>Event control</p> <p>Mode [Normal]</p> <p>Activation sensor [S1]</p>	<p>Control sensor</p> <p>[S2]</p> <p>Set value event [60.0 °C]</p> <p>Controller set value [130.0 °C]</p> <p>Proportional component [5.0]</p> <p>Integral component [0.0]</p> <p>Differential part [0.0]</p> <p>Output mode [0-100]</p>	<p>Minimum correcting var. [0]</p> <p>Maximum correcting var. [100]</p> <p>Control delay [0s]</p> <p>Min. switch-off time [0s]</p> <p>Current correcting var. 0.0 %</p> <p>Test correcting var. [18]</p>
---	--	---	--

In most heating circuit programs, the two control outputs are already used to control the mixer and can therefore not be used for other applications.

In this menu, the parameters for the functionality of the selected control output are adjusted. As analogue output, a voltage of 0 to 10 V can be output, scaled in 0.1 V steps.

In the mode PWM, a digital signal with a frequency of 1 kHz (level approx. 10V) and a variable duty cycle of 0 to 100% is generated.

In an active state, a control output can be enabled by an assigned output that is defined by the chosen program.

<p>Control output 4</p>
<p>Function [PWM output]</p> <p>Outputs for enable [1]</p>

Example: control output 4 is set to mode PWM 0-100 and assigned to output 1 (= FS)

Choices „Function“:

5V supply, 0-10V output, PWM output, error message, error mess. inv.

Off Control output deactivated, output = 0V.

5V Voltage supply, output = 5V

0-10V PID-regulator, output = 0-10V in 0,1V steps

PWM

Error message, Error message inverse

PID-regulator, output = duty cycle 0-100% in 1% steps

With function control activated and an error message in the system status (sensor interruption, sensor short circuit or circulation error) the control output will be set from 0V to 10V in mode **Error message** (if **inverse**: from 10V to 0V). An auxiliary relay can be connected to the control output which forwards error messages to signal indicators (LED-indicators, acoustic signals etc.)

Absolute value control

= keeping a sensor's value constant

The absolute value control is set via two parameter windows. The example shows typical settings:

Absolute value ctrl	
Mode	(Normal)
Sensor input	(S1)
Set value selection	(Set value)
Set value	(50.0 °C)

Mode: Off/Normal/Inverse

Normal operation means that the speed increases along with temperatures and is valid for all applications to keep a „feed sensor“ constant (collector, boiler, etc.).

Inverse operation means that the speed decreases along with rising temperatures and is necessary to maintain a return temperature.

Sensor input: Temperature at this sensor is to be held at a constant level.

Set value selection: Specify a set value / use set flow temperature

Set value: This temperature is to be held constant. (FS = 50°C)

Differential control

= keeping the difference in temperature between two sensors constant, e.g. the difference between heating flow and return (spread).

Example:

Differential control	
Mode	(Normal)
Sensor input (+)	(S1)
Sensor input (-)	(S2)
Set value diff.	(10.0 K)

Mode: Off/Normal/Inverse

Sensor input +/- : The difference between the temperatures of the warmer sensor (sensor input +) and the colder sensor (sensor input -) is calculated as actual difference.

Set value diff.: The set value of the difference is 10K in the example (= FS). As such, according to the example, the difference between S1 and S2 is held at 10K

Warning: The **set value diff.** must always be greater than the deactivation threshold diff. of the basic operation..

If **absolute value control** and **differential control** are active simultaneously, the lower of the two speed results will be used.

Event control

If a set temperature threshold (set value event) is exceeded at the activation sensor, the event control starts, keeping the temperature at the control sensor constant (controller set value).

Example:

Event control
Mode
Normal
Activation sensor
S3
Control sensor
S1
Set value event
60.0 °C
Controller set value
130.0 °C

Mode: Off/Normal/Inverse

Activation sensor: The sensor which activates the event control.

Control sensor: Sensor that is to be held constant, if the event control activates.

Set value event: Temperature threshold at the activation sensor. According to the example, the event control will activate when 60°C is exceeded.

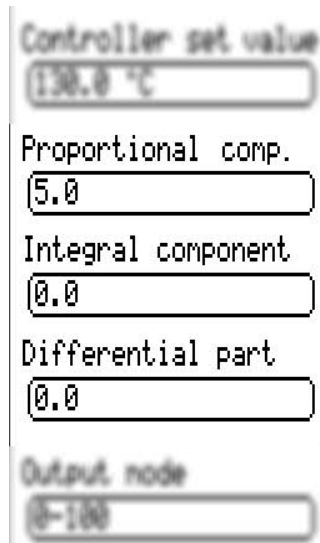
Controller set value: Set value of the temperature at the control sensor after activation of the event control.

Summary: If the temperature at S3 exceeds 60°C, sensor S1 is held constant at 130°C.

The event control is prioritized above the speed results of other control methods. As such, a set event can block the absolute value control and the differential control.

Stability problems

The speed control contains a „PID controller“. It ensures an exact and fast adjustment of the actual value to the set value. **In applications such as solar systems and charging pumps, the factory settings likely regulate in a stable manner.**



Controller set value	138.0 °C
Proportional comp.	5.0
Integral component	0.0
Differential part	0.0
Output mode	E-100

The **proportional component** represents the reinforcement of the deviation between the desired and the actual value. The speed is changed by one increment for each $x * 0.1K$ of deviation from the desired value. A large number leads to a more stable system but also to more deviation from the predefined temperature. In the example, is set to 5. This means that the speed is adjusted by one level for every 0.5K of deviation from the set value.

(FS = 5)

If the **actual value** and the **set value** are identical, the output variable is the **median** between minimum and maximum variable.

Example: minimum variable **30**, maximum variable **100**, set value = actual value → variable = **65**

The **integral component** periodically adjusts the speed relative to the deviation remaining from the proportional part. For each 1K of deviation from the desired value, the speed changes one increment every x seconds. A large number provides a more stable system, but it takes longer to reach desired values. With an integral component of e.g. 5, the speed is changed per 1K of deviation from the set value every **5** seconds by one level. (FS = 0)

The **differential part** leads to a short „overreaction“ the faster a deviation between the desired and the current value occurs, to provide a fast compensation. If the desired value deviates at a rate of $x * 0.1 K$ per second ab, the speed is changed by **one** level. High settings provide a more stable system, but it takes longer to reach desired values. If the differential part is set to e.g. 5, the speed is changed by one level if the set value deviates at a rate of **0.5K** per second. (FS = 0)

In some cases, the parameters for **proportional**, **integral** and **differential component** must be assessed by trial and error.

Output mode, Correcting variables

Differential part	0.0
Output mode	0-100
Min. correcting var.	0
Max. correcting var.	100
Control delay	

Depending on the make of the pump, the control mode of the pump can be set to normal (0-100 „solar mode“, PWM 2) or inverse (100-0 „heating mode“, PWM 1). There may also be specific requirements for the limits of the control range. These can be found in the information of the pump manufacturer.

The following parameters define the control mode and the lower and upper limits of the output analogue value:

Output mode: 0-100 equals 0-10V and 0-100% PWM, 100-0 equals 10-0V and 100-0% PWM (inverse). (FS = 0-100)

Min. correcting variable: Lower speed limit (FS = 0)

Max. correcting variable: Upper speed limit (FS = 100)

Control delay, control commands

Max. correcting var.	100
Control delay	0s
Min. switch-off time	0s
Current correcting var.	0.0 %
Test correcting var.	18

Control delay: If the control output is activated by an assigned output, the speed control will be deactivated for this set time and the variable for maximum speed will be output. Only after this time elapsed, the control output will be regulated. (FS = 0)

Min. switch-off time: The control output can only be activated if the minimum switch-off time has elapsed since its last activation. (FS = 0)

Current correcting var.: Current correcting variable used for regulation.

Test correcting var: For testing purposes, a specific correcting variable can be output. Entering this menu automatically sets the control output into manual mode. Leaving the menu sets it back to regular automatic regulation.

Shutdown conditions

Shutdwn cond.

Room temp. shutdown

Enable

OFF

Set flow temp. shutdown

Enable

OFF

O/S t shutdown

Enable

ON

Off

20.0 °C

On

18.0 °C

O/S t shutdown setback mode

Enable

OFF

Excess temp. function

Enable

S4

Off

85.0 °C

On

90.0 °C

Mixer action

Close

Room temp. shutdown

Deactivation of the heating pump if the current room set temperature is exceeded. Enable „**ON**“ shows further settings:

Diff. off: Difference to the room set temp. (can't be lower than **Diff. on**)

Diff. on: (Re-)Activation difference

Set flow temp. shutdown

Deactivation of the heating pump if the calculated set flow temperature is underrun **T.flow min** (see menu Technician level/Parameters). Enable „**ON**“ shows further settings:

Diff. off: Difference to the minimum flow temperature T.flow min (can't be lower than **Diff. on**)

Diff. on: (Re-)Activation difference

O/S t shutdown

Deactivation of the heating pump if the outside temperature exceeds a threshold

Enable: ON/OFF (activation/deactivation of this function)

Off: deactivation threshold (FS = 20°C)

On: (re-)activation threshold (FS = 18°C)

O/S t shutdown setback mode

Deactivation of the heating pump if the outside temperature exceeds a threshold (in setback mode)

Enable: ON/OFF (FS = OFF)

Excess temp. function

Enable this function by selecting a sensor

Preventing a solid fuel burner from overheating: If this function is active, the heating circuit is forced to activate and operated at **maximum** set flow temperature **T.flow max** to dissipate heat.

The function is activated via the sensor chosen under „Enable“.

Off: deactivation threshold of the function

On: (re-) activation threshold of the function

Mixer action when deactivating the heating pump

Choices: Close (= FS), Control, Unchanged, Open

Mixer

Mixer	
Room influence	50.0 %
Start excess	0.0 %
Mixer run time	03m 00s
Ave. time o/s temp.	10m
Curr. ave. o/s temp.	0.0 °C
HC controller status	Frost protection
HC controller mode	Room sensor
Room temp normal mode	22.0 °C
Room temp setback mode	15.0 °C
Control speed	100.0 %

Room influence

Influence of the room temperature on the mixer's behavior

Start excess in percent, assuming a setback time of 10 hours. The previous setback time leads to an increase (which recedes over time) of the flow temperature to shorten the heat-up time.

FS = 0%

Mixer run time

Total mixer run time (FS = 3min)

Ave. time o/s temp.

Compensation of fluctuating outside temperature for the calculation of the flow temperature.

Curr. ave. o/s temp.

Current average outside temperature

HC controller status

Status of the heating circuit

HC controller mode

Operation mode of the heating circuit controller¹

Room temp normal mode

Set room temperature in normal mode (FS = 22°C)

Room temp setback mode

Set room temperature in setback mode (FS = 15°C)

Control speed.

Adjustment of the control speed of the mixer's motor to the heating circuit (Range 20% - 500%, FS = 100%)

The length of the impulses responsible for opening/closing the mixer are adjusted by this percentage, the distance between the impulses remains unchanged.

¹Time/Auto or Room sensor

The heating circuit is operated according to time programs and the settings on the room sensor RAS.

Normal

Continuous operation according to the temperature of normal mode.

Setback

Continuous operation according to the temperature of setback mode.

Standby

System operation is deactivated (except for frost protection).

Party

Normal operation up until the time of day specified below.

Holiday

Heating in setback mode beginning with the current day, until midnight of the date below.

Bank holiday

Beginning with the current day, the heating times specified for a Saturday will be used for operation, until the date specified below, which will use those of a Sunday. When using mode Party, Holiday or Bank holiday, the device switches back to automatic after the specified time/date has passed.

Func. check (Function check)

The function check serves to monitor for defective sensors. The function is deactivated in the factory settings.

The screenshot shows a menu titled "Func. check". The first option is "Function control", which is currently set to "Yes". Below this are three other options: "Display on other devices", "Nodes 1-31", and "Nodes 32-62". Each of these three options has an empty rectangular input field next to it.

Function control Yes/No

Activate/deactivate function check (FS = No)
Sensors are monitored for interruptions and short circuits. Sensors of the type Digital (ON/OFF) or VIG, and sensor inputs set to Fixed value or to unused are **not** monitored.

Important: If the option „Display on other devices“ is being set up, it's important to scroll down and confirm changes with .

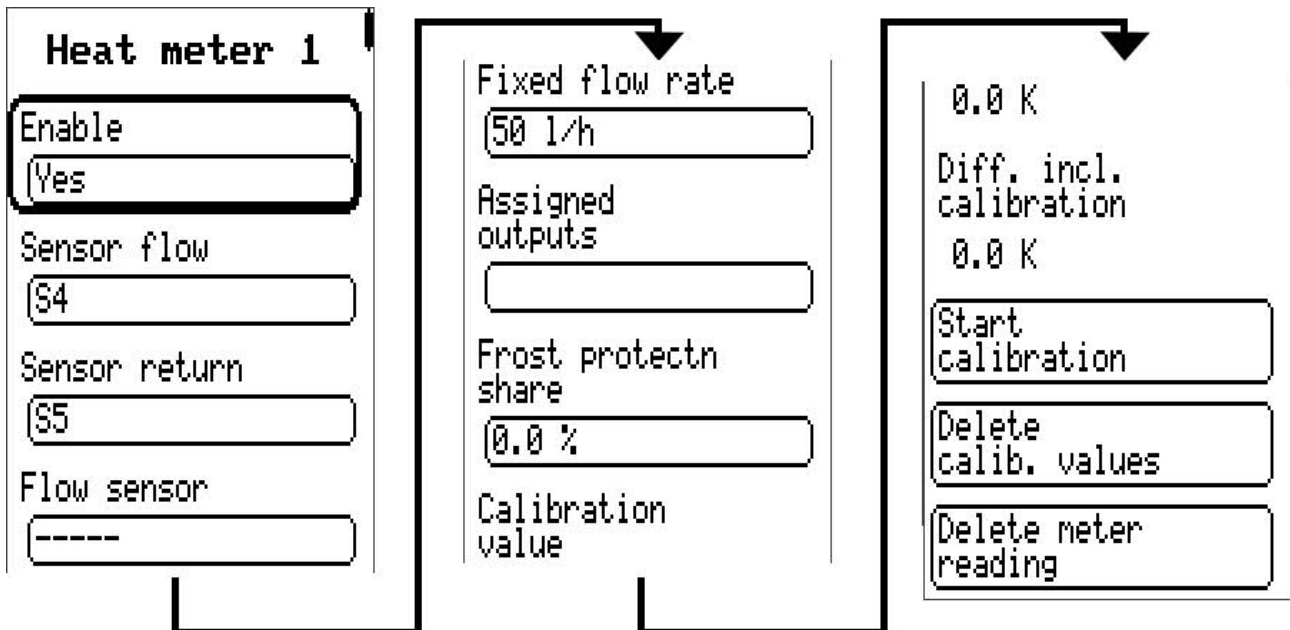
Heat meter

(3 identical entries)

The device offers the possibility to log heat quantities in 3 different sections of a system. The 3 heat meters are deactivated in the factory settings. A heat meter requires 3 basic inputs:

flow temperature, return temperature, flow rate (volume flow)

To increase precision, the share of anti-freeze in the heat transfer medium must be specified, since anti-freeze lowers the heat capacity of the medium. The flow rate can be measured with a flow volume sensor or set assigned with a fixed value.



Enable Yes/No

Activate/deactivate heat meter (FS = No)

Sensor flow

Sensor input of the flow temperature (FS = S4)

Range:

S1 to S6 Input of the flow sensor

EXT1 to EXT9 External flow sensor

Sensor return

Sensor input of the return temperature (FS = S5)

Range:

S1 to S6 Input of return sensor

EXT1 to EXT9 External return sensor

Flow sensor

Sensor input of the volume flow sensor (FS = ----)

A pulse generator of the make **VIG....** can only be connected to input S6. The following settings in the **sensor menu** are necessary:

S6 Sensor: VIG

Quotient: Liters per impulse

Range:

S6 = Volume flow sensor **input 6**

EXT1 – EXT9 = External sensor (FTS...-DL) via **DL-Bus**

----- = no volume flow sensor -> fixed volume flow. The fixed value will be used for the calculations of the heat meter.

Fixed flow rate	Volume flow in liters per hour. If no volume flow sensor was specified, a fixed flow rate can be set up instead. If the assigned output is inactive, the flow volume is assumed to be liters/hour. Since speed control makes for a constantly shifting volume flow, this setting is not suitable in combination with speed control. (WE = 50 l/h) Range: 0 to 20.000 liters/hours in 1 l/h steps
Assigned outputs	The specified/measured volume flow is only used for the calculation of the heat quantity, if the output specified here is active (or at least one of the several). (FS = none) Options: None = Heat quantity is calculated without regard to output activity Combination of all outputs (1-5)
Frost protection share	Share of anti-freeze agents in the heat transfer medium, specified in percent. An average of all reputable anti-freeze producers has been calculated and implemented as a table in dependence of the mixing ratio. In typical cases, this method results in a maximum error of one percent. (FS = 0%) Range: 0 to 100% in 0.1% steps
Calibration value	The calibration value resulting from calibrating sensors. (described in the following paragraphs)
Diff. incl. calibration	Current difference in temperature between flow and return sensors (incl. calibration). If both sensors are submerged together in a container of water, (such that both measure the same temperature), a difference of 0 should be displayed. As a result of measurement tolerance of the device and the sensors themselves, a difference will be there nonetheless. If this display is set to 0, the device saves the difference as a correctional factor and regards this in future calculations to correct the natural measurement error. A temperature of 40-60° in the water container used for calibration is recommended. This menu point offers a calibration possibility or the measurement of the difference in temperature in the heat meter. The calibration does not affect anything besides the heat meter.
Delete calib. values	Deletes calibration values.
Delete meter readings	The summed up meter reading are reset to 0 with this prompt.

If the heat meter has been activated, the following points will be displayed in the **overview**:

current yield in kW
volume flow in liters/hour
heat quantity in kWh

WARNING: If one of the two sensors (flow, return) of the heat meter has an error (interruption, short circuit), the instantaneous power is set to 0, so no false measurements will be added to the heat quantity.

Notes concerning precision:

The precision of all measured energies and energy flows depends on many factors, which will be looked into deeper here.

- PT1000 temperature sensor of **class B** have a precision of ± 0.55 K at 50°C
- The error of the device's own measurement stands at typically ± 0.4 K per channel

For an assumed spread of 10 K, these two measuring errors result in a **maximum** measuring error between the flow and return of ± 1.90 K = **± 19.0 %** for class B and ± 13.0 % for class A.

- At lower spread, the percentage measuring error **increases**
- The accuracy of the flow sensor FTS 4-50DL stands at approx. **± 1.5 %**

In the worst case scenario, the maximum overall measuring error for heat metering therefore equals:

$$1.19 \times 1.015 = 1.208$$

This means heat metering accuracy of ± 20.8 % in the worst case scenario (at 10 K spread, without calibrating the temperature sensors), although all measuring errors would then skew the results to the same extent.

Experience has shown that a worst case scenario never actually occurs and in an unfavorable scenario, half of this value can be expected. However, even 10.4 % is not justifiable.

After calibrating the temperature sensors (see above), the measuring error of the overall temperature measurement reduces to a maximum 0.3 K. Relative to the spread of 10 K as assumed above, this equals a measuring error of 3 %.

The maximum overall measuring error for the performance factor therefore equals:

$$1.03 \times 1.015 = 1.045$$

At a **10 K spread** and **with calibrated** temperature sensors, heat metering accuracy therefore improves for the **worst case scenario** to **± 4.5 %**.

Step-by-step setup guide for heat metering

Two volume flow sensors are available to choose from:

- pulse encoder VIG
- volume flow sensor FTS....DL, connected via DL-Bus

If no volume flow sensor/encoder is used, a fixed volume flow can be specified.

The necessary settings are illustrated step by step below.

VIG (pulse encoder)

1	Sensor VIG	The pulse encoder VIG can only be connected to input 6. Therefore, settings for S6 in the sensor menu: „Sensor“ to „VIG“ (second entry)
2	Quotient 0.5 l/Imp	Check and, if necessary, adjust the quotient (liters per pulse)
3	Heat meter 1 Enable Yes	In the expert level under heat meter , choose a heat meter profile and set the point „Enable“ to „Yes“ to activate the profile. Further settings appear.
4	Sensor flow S4 Sensor return S5	Setting up the flow sensor and return sensor in the respective menu points.
5	Flow sensor S6	Setting up the volume flow sensor as sensor input S6, if the VIG is used as exemplified.
6	Assigned outputs 1	Specifying the assigned outputs. In the menu window, assigned outputs are marked with a black background.
7	Frost protectn share 0.0 %	Specification of the frost protection share (amount of anti-freeze agents in the heat transfer medium) in %.
8	Start calibration	Consider calibrating sensors according to the instruction manual.

FTS...DL (Example: Installation in the return flow, only 1 FTS4-50DL is use, use of an external sensor for the flow, connected to the FTS4-50DL)

1	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Ext. sensors</p> <p>Ext. sens. 1 EXT input 1</p> </div>	<p>The FTS4-50DL is connected to the DL-Bus, hence: Expert level → Ext. sensors and assign the volume flow sensor to an EXT-input. For this, open the menu of the external input, define the source as „DL input“ and then the DL-Bus address and index</p>
2	<div style="border: 1px solid black; padding: 5px;"> <p>DL-Bus Index</p> <p style="text-align: center;">2</p> </div>	<p>Specifying the sensor temperature on another ext. input like in the previous step. Same address as before, but index 2.</p>
3	<div style="border: 1px solid black; padding: 5px;"> <p>DL-Bus Index</p> <p style="text-align: center;">3</p> </div>	<p>If an external temperature sensor for the return is connected to the FTS4-50DL, then define another external DL-input: same address as before, index 3.</p>
4	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Heat meter 1</p> <p>Enable Yes</p> </div>	<p>In the expert level under heat meter, choose a heat meter profile and set the point „Enable“ to „Yes“ to activate the profile. Further settings appear.</p>
5	<div style="border: 1px solid black; padding: 5px;"> <p>Sensor flow</p> <p style="text-align: center;">Ext. sens. 3</p> </div>	<p>Specifying the flow sensor in the respective point in the menu. If an external sensor is used, as exemplified: Ext. sens. 3 (see step 3), else: specify the flow sensor as S1-S6.</p>
6	<div style="border: 1px solid black; padding: 5px;"> <p>Sensor return</p> <p style="text-align: center;">Ext. sens. 2</p> </div>	<p>Specifying the return sensor in the respective point in the menu, if an external temperature sensor at the FTS4-50DL: Ext. sens. 2 (see step 2).</p>
7	<div style="border: 1px solid black; padding: 5px;"> <p>Flow sensor</p> <p style="text-align: center;">Ext. sens. 1</p> </div>	<p>In the point „Flow sensor“: Specifying the FTS4-50DL as Ext. sens. 1. (see step 1)</p>
8	<div style="border: 1px solid black; padding: 5px;"> <p>Assigned outputs</p> <p style="text-align: center;">1</p> </div>	<p>Assigned outputs. Consider specifying frost protection share and calibrating the sensors (see „VIG“ steps 7 and 8)</p>

No volume flow sensor/encoder:

1	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Heat meter 1</p> <p>Enable Yes</p> </div>	<p>Activate the heat meter profile as in the previous guides.</p>
2	<div style="border: 1px solid black; padding: 5px;"> <p>Sensor flow</p> <p style="text-align: center;">S4</p> <p>Sensor return</p> <p style="text-align: center;">S5</p> </div>	<p>Specify the flow and return sensors in their respective menu points.</p>
3	<div style="border: 1px solid black; padding: 5px;"> <p>Flow sensor</p> <p style="text-align: center;">-----</p> </div>	<p>Choose „-----“ as flow sensor, since none is in use.</p>
4	<div style="border: 1px solid black; padding: 5px;"> <p>Fixed flow rate</p> <p style="text-align: center;">50 l/h</p> </div>	<p>Specify the fixed flow rate. Enter the assigned outputs, frost protection share and calibrate the sensors, as described in the previous guides.</p>

Pasteurisation

Pasteurisation	
Enable	Yes
Interval time	7 Days
Monitored sensor	S3
Temp. threshold	60.0 °C
Affected outputs	1
Generator demand	Yes
Generator sensor	S1
Generator outputs	
Generator max. On	80.0 °C
Generator max. Off	85.0 °C
Hold time	01h 00m
Start time	17:00

Enable

Enable/disable pasteurisation to prevent the cultivation of legionella (FS = No)

Interval time

Interval in days. If the temperature measured at the monitored sensor does not exceed the specified temp. threshold within this time interval for the hold time, the affected outputs will be activated.

Monitored sensor

Specifies, which sensor is to be monitored

Temp. threshold

This temperature must be exceeded at the specified sensor for the duration of the hold time. The affected output is switched on (if the function becomes active) for the duration of the hold time and held above the temp. threshold

Affected outputs

These outputs are switched on, if the function becomes active.

Generator demand

Yes/No, opens further settings for the request of heating, in addition to the affected outputs.

Generator sensor

Sensor, at which measurements for the generator occur.

Generator outputs

Specification of the outputs necessary for a generator request.

Generator max.

On/Off

Maximum permissive generator temperature measured at the Generator sensor (e.g. to avoid excess burner temperature)

Hold time

The time for which the temperature threshold must be exceeded on the monitored sensor in order for the pasteurization to be considered completed.

Start time

Time of day after which the outputs may be activated if the function becomes active.

CAN-/DL-Bus

CAN/DL bus

CAN settings

Node
12

Designation
UUR65

BUS rate
50 kbit/s (std)

CAN analogue outputs

CAN digital outputs

DL settings

Data output
Yes

Node number in the CAN network

Designation of the device within the CAN network

Bus rate in the CAN-Bus (must be the same for all devices in the network!)

Shows analogue values that are issued to the CAN bus

Shows digital values that are issued to the CAN bus

This point allows the activation/deactivation of data output via the DL-Bus for **Datalogging** or the remote display of the **RAS+DL**.

Depending on the specified program, the device outputs its relevant measurements and output statuses to the CAN-Bus.

Datalogging

Data like measurements and output statuses can be recorded using two methods. For one, data can be logged directly to an SD card plugged into the device itself. Alternatively, the device **C.M.I.** can be used to log data. To evaluate logging data, the PC program **Winsol** (minimum required version 2.09) can be used, but (only when using a C.M.I.) *web-based Datalogging* is also available. For further information about web-based datalogging, please consult the C.M.I. online help under help.ta.co.at/EN/CMIHELP/index.htm at chapter *Webportal > Menu C.M.I.s > 4. Visualization*.

This manual only describes the settings related to the device UVR65 itself. The instruction manual for **Winsol** itself offers further information for the usage of this software (available for download under www.ta.co.at at *Downloads > Software > Winsol > Useful downloads*).

Logged values

Depending on the chosen program, only relevant inputs and outputs are automatically logged. Unused inputs and outputs will be ignored.

User defined designations for sensors and outputs can be automatically adapted with the selection of „*Read out configuration from logger*“ when running the *Setup* in **Winsol**.

Datalogging without C.M.I.

First of all, the point **Datalogging on SD card** in the menu **Technician level > Datalogging Settings** must be set to Yes. This shows the option **Interval time**, which allows adjusting the frequency with which data is logged to the SD card. A lower interval time means a more elaborate diagram when evaluating data, but a greater amount of memory on the SD card is used.

To evaluate logging data with this method, the SD card used for logging must be accessed on a PC using the software **Winsol** (minimum required version 2.09). When running the setup in **Winsol**, the *Datalogger* must be specified as **SD card**. Below this option, the *path* of the SD card on the PC must be stated. This implies the root directory of the SD card, no sub folder is to be selected. In the further steps of the setup, configurations and designations can be assigned manually or read out from the logger.

Keep in mind that common SD cards have a **limited number of write cycles**, which means that a very frequent logging interval can quickly bring an SD card to the end of its lifetime. Read the specification of your SD card's manufacturer and don't leave high logging intervals running for too long (e.g. only temporarily to find an error).

Datalogging with C.M.I. – Winsol



On the device itself, the only necessary settings are that which allow it to be accessed via CAN-Bus. As for the C.M.I., the CAN node number of the UVR65 (= source) and the data record x2 must be specified under *Settings > Data logging*.

In the setup of **Winsol**, the *Data logger* must be specified as **C.M.I.** and the *Connection to the datalogger* must have the desired option specified. After clicking *Next*, the *device* must be specified as **UVR65** and its *source* implies the device's **CAN node number**. Alternatively, these settings can be automatically read out by clicking *Read out configuration from logger*.

After clicking *Next*, designations can be assigned or read out from the device.

Datalogging with C.M.I. – Web-based

On the device itself, the only necessary settings are that which allow it to be accessed via CAN-Bus. The C.M.I. requires a minimum version of its firmware of 1.26.

In the overview of C.M.I.s under cmi.ta.co.at, clicking  **Visualisation** in the column next to the respective C.M.I.s opens the web-based data logging. Logging values must be specified (as described in further detail under help.ta.co.at/EN/CMIHELP/index.htm in chapter *Webportal > Menu C.M.I.s > 4. Visualisation*), a profile must be created, logging values must be assigned to the profile under „ *Manage display profiles*“ and lastly, a time window must be chosen, the logging values of which are to be displayed.

Tips on troubleshooting

Technical support

We offer free support to our customers in the event of issues with or questions about **our products**.

Important: In order to answer your question, we require the serial number of your device **in any case**.

If you are unable to locate the serial number, assistance in finding it is available on our homepage: <https://www.ta.co.at/haeufige-fragen/seriennummern/>

You can submit your request on our homepage using the following link:

<https://www.ta.co.at/support/>.

Alternatively, you can also call us during office hours under the following number:

+43 (0)2862 53635

However, before contacting our support, please try the following solutions:

Standard practice for suspected malfunction should be to first of all check all settings in the menus **Parameters**, **Sensor menu** and in the **Program settings**, as well as all the terminals.

Malfunction despite realistic temperature measurements:

- Check the program number
- Check the activation and deactivation thresholds as well as specified differential values. Are these threshold already exceeded or not?
- Check the settings in the many sub menus
- Check whether outputs can be activated via manual mode: If Manual/ON and Manual/OFF result in the correct reaction, the device is definitely not damaged to this extent.
- Check the terminals of all sensors. Consider carefully warming up a sensor and checking the display for reactions.

Wrong display of temperatures:

- Displayed values like -999°C for a short circuit or 999°C for an interruption do not necessarily mean an error related to material or terminal. Are the correct sensor types (KTY/PT1000) assigned in the **Sensor menu**? The factory settings has all inputs set to PT1000.
- Checking a sensor can also be done without measurement devices. Simply swap the sensor malfunctioning with a functioning one on the strip terminal and check the displayed values. The resistance measured with an ohmmeter should relate to the following temperatures:

Temp. [°C]	0	10	20	25	30	40	50	60	70	80	90	100
R (PT1000) [Ω]	1000	1039	1078	1097	1117	1155	1194	1232	1271	1309	1347	1385
R (KTY) [Ω]	1630	1772	1922	2000	2080	2245	2417	2597	2785	2980	3182	3392

The factory settings of parameters and menu functions can be restored at any time with a Total reset. Carrying out a total reset is described in the respective chapter.

If the device does not work in spite of connection to supply voltage, the 3.15A fast-acting fuse which protects the device and it's outputs should be checked or replaced.

Since the programs are continually being revised and improved it is possible that there are differences in the sensor, pump and program numbering compared with older documentation. Only the accompanying operating manual is valid for the device supplied (identical serial number). The program version of the manual must categorically correspond with that of the device.

Should in spite of inspecting and checking in accordance with the above-mentioned tips a malfunction of the controller be apparent please get in contact with your dealer or directly with the manufacturer. The cause of the malfunction can only be found, if, in addition to a description of the error, critical information such as selected program and parameter values can be stated.

If you decide to call us for technical support, we recommend that you can access your system, such that critical information can be assessed.

Table of settings

The following table provides an overview of all possible settings and parameters. This can be used as an alternative to the digital storage of the device's function data. Please note that some of these settings may not appear on the device, depending on the program selected.

Parameters

Max 1 Yes/No	
Max 1 Off	
Max 1 On	
Max 2 Yes/No	
Max 2 Off	
Max 2 On	
Max 3 Yes/No	
Max 3 Off	
Max 3 On	
Min 1 Yes/No	
Min 1 Off	
Min 1 On	
Min 2 Yes/No	
Min 2 Off	
Min 2 On	

Min 3 Yes/No	
Min 3 Off	
Min 3 On	
Diff 1 Yes/No	
Diff 1 Off	
Diff 1 On	
Diff 2 Yes/No	
Diff 2 Off	
Diff 2 On	
Diff 3 Yes/No	
Diff 3 Off	
Diff 3 On	

Time program

TP1 – Weekdays	
TP2 – Weekdays	
TP3 – Weekdays	
TP4 – Weekdays	
TP5 – Weekdays	

TP1 – Time window 1 – Time from - to	
TP1 – Time window 1 – Link A/O	
TP1 – Time window 1 – Link outp.	
TP1 – Time window 2 – Time from - to	
TP1 – Time window 2 – Link A/O	
TP1 – Time window 2 – Link outp.	
TP1 – Time window 3 – Time from - to	
TP1 – Time window 3 – Link A/O	
TP1 – Time window 3 – Link outp.	
TP2 – Time window 1 – Time from - to	
TP2 – Time window 1 – Link A/O	
TP2 – Time window 1 – Link outp.	
TP2 – Time window 2 – Time from - to	
TP2 – Time window 2 – Link A/O	

TP2 – Time window 2 – Link outp.	
TP2 – Time window 3 – Time from - to	
TP2 – Time window 3 – Link A/O	
TP2 – Time window 3 – Link outp.	
TP3 – Time window 1 – Time from - to	
TP3 – Time window 1 – Link A/O	
TP3 – Time window 1 – Link outp.	
TP3 – Time window 2 – Time from - to	
TP3 – Time window 2 – Link A/O	
TP3 – Time window 2 – Link outp.	
TP3 – Time window 3 – Time from - to	
TP3 – Time window 3 – Link A/O	
TP3 – Time window 3 – Link outp.	
TP4 – Time window 1 – Time from - to	
TP4 – Time window 1 – Link A/O	
TP4 – Time window 1 – Link outp.	
TP4 – Time window 2 – Time from - to	
TP4 – Time window 2 – Link A/O	
TP4 – Time window 2 – Link outp.	
TP4 – Time window 3 – Time from - to	
TP4 – Time window 3 – Link A/O	
TP4 – Time window 3 – Link outp.	
TP5 – Time window 1 – Time from - to	
TP5 – Time window 1 – Link A/O	
TP5 – Time window 1 – Link outp.	
TP5 – Time window 2 – Time from - to	
TP5 – Time window 2 – Link A/O	
TP5 – Time window 2 – Link outp.	
TP5 – Time window 3 – Time from - to	
TP5 – Time window 3 – Link A/O	
TP5 – Time window 3 – Link outp.	

Timer

Link And/Or	
Outputs 1-5	
Runtime	
Pause time	

Time/date

Automatic time change Yes/No	
------------------------------	--

Manual mode

We generally do not recommend leaving outputs in manual mode for an extended period.

Output 1	
Output 2	
Output 3	
Output 4	
Output 5	

Datalogging settings

Datalogging on SD card	
Interval time	

Display

Display timeout	
Contrast	

User

Technician password	
Expert password	

Sensor menu

Sensor 1 Designation	
Sensor 1 Sensor type	
Sensor 1 Correction	
Sensor 1 Average	
Sensor 1 Sensor check	
Sensor 1 Fixed value/assignment	
Sensor 2 Designation	
Sensor 2 Sensor type	
Sensor 2 Correction	
Sensor 2 Average	
Sensor 2 Sensor check	
Sensor 2 Fixed value/assignment	
Sensor 3 Designation	
Sensor 3 Sensor type	
Sensor 3 Correction	
Sensor 3 Average	
Sensor 3 Sensor check	
Sensor 3 Fixed value/assignment	
Sensor 4 Designation	
Sensor 4 Sensor type	
Sensor 4 Correction	
Sensor 4 Average	
Sensor 4 Sensor check	
Sensor 4 Fixed value/assignment	
Sensor 5 Designation	
Sensor 5 Sensor type	
Sensor 5 Correction	
Sensor 5 Average	
Sensor 5 Sensor check	
Sensor 5 Fixed value/assignment	
Sensor 6 Designation	
Sensor 6 Sensor type	
Sensor 6 Correction	
Sensor 6 Average	
Sensor 6 Sensor check	
Sensor 6 Fixed value/assignment	
Sensor 6 Quotient (flow rate pulse transducer/wind sensor)	
Simulation	

Program settings

Program number	
Free output assignment: A1	
Free output assignment: A2	
Free output assignment: A3	
Free output assignment: A4	
Free output assignment: A5	
Cancel outputs: 1 <-> 2	
Cancel outputs: 1 <-> 3	
Cancel outputs: 2 <-> 3	

Ext. sensors

Ext. input 1: Designation	
Ext. input 1: Source	
Ext. input 1: DL address/CAN node no.	
Ext. input 1: DL index/CAN output no.	
Ext. input 1: Sensor correction (only DL)	
Ext. input 1: Sensor check Y/N (only DL)	
Ext. input 2: Designation	
Ext. input 2: Source	
Ext. input 2: DL address/CAN node no.	
Ext. input 2: DL index/CAN output no.	
Ext. input 2: Sensor correction (only DL)	
Ext. input 2: Sensor check Y/N (only DL)	
Ext. input 3: Designation	
Ext. input 3: Source	
Ext. input 3: DL address/CAN node no.	
Ext. input 3: DL index/CAN output no.	
Ext. input 3: Sensor correction (only DL)	
Ext. input 3: Sensor check Y/N (only DL)	
Ext. input 4: Designation	
Ext. input 4: Source	
Ext. input 4: DL address/CAN node no.	
Ext. input 4: DL index/CAN output no.	
Ext. input 4: Sensor correction (only DL)	
Ext. input 4: Sensor check Y/N (only DL)	
Ext. input 5: Designation	
Ext. input 5: Source	
Ext. input 5: DL address/CAN node no.	
Ext. input 5: DL index/CAN output no.	
Ext. input 5: Sensor correction (only DL)	
Ext. input 5: Sensor check Y/N (only DL)	

Ext. input 6: Designation	
Ext. input 6: Source	
Ext. input 6: DL address/CAN node no.	
Ext. input 6: DL index/CAN output no.	
Ext. input 6: Sensor correction (only DL)	
Ext. input 6: Sensor check Y/N (only DL)	
Ext. input 7: Designation	
Ext. input 7: Source	
Ext. input 7: DL address/CAN node no.	
Ext. input 7: DL index/CAN output no.	
Ext. input 7: Sensor correction (only DL)	
Ext. input 7: Sensor check Y/N (only DL)	
Ext. input 8: Designation	
Ext. input 8: Source	
Ext. input 8: DL address/CAN node no.	
Ext. input 8: DL index/CAN output no.	
Ext. input 8: Sensor correction (only DL)	
Ext. input 8: Sensor check Y/N (only DL)	
Ext. input 9: Designation	
Ext. input 9: Source	
Ext. input 9: DL address/CAN node no.	
Ext. input 9: DL index/CAN output no.	
Ext. input 9: Sensor correction (only DL)	
Ext. input 9: Sensor check Y/N (only DL)	

Outputs

Output 1 Designation	
Output 1 Run-on time	
Output 1 Blocking time	
Output 2 Designation	
Output 2 Run-on time	
Output 2 Blocking time	
Output 3 Designation	
Output 3 Run-on time	
Output 3 Blocking time	

Control outputs

Control output 4 Function	
Control output 4 Outputs for enabling	
Control output 4 Absolute value control	
Control output 4 AVC: sensor input	
Control output 4 AVC: set value	

Control output 4 Differential control	
Control output 4 DIFF CTRL: sensor input +	
Control output 4 DIFF CTRL: sensor input -	
Control output 4 DIFF CTRL: set value diff.	
Control output 4 Event control	
Control output 4 EC: activation sensor	
Control output 4 EC: control sensor	
Control output 4 EC: set value event	
Control output 4 EC: set value controller	
Control output 4 Proportional component	
Control output 4 Integral component	
Control output 4 Differential component	
Control output 4 Output mode	
Control output 4 Minimum correcting variable	
Control output 4 Maximum correcting variable	
Control output 4 Control delay	
Control output 4 Min. switch-off time	
Control output 5 Function	
Control output 5 Outputs for enabling	
Control output 5 Absolute value control	
Control output 5 AVC: sensor input	
Control output 5 AVC: set value	
Control output 5 Differential control	
Control output 5 DIFF CTRL: sensor input +	
Control output 5 DIFF CTRL: sensor input -	
Control output 5 DIFF CTRL: set value diff.	
Control output 5 Event control	
Control output 5 EC: activation sensor	
Control output 5 EC: control sensor	
Control output 5 EC: set value event	
Control output 5 EC: set value controller	
Control output 5 Proportional component	
Control output 5 Integral component	
Control output 5 Differential component	
Control output 5 Output mode	
Control output 5 Minimum correcting variable	
Control output 5 Maximum correcting variable	
Control output 5 Control delay	
Control output 5 Min. switch-off time	

System protection

Excess temp. limiter 1 Enable	
Excess temp. limiter 1 Collector sensor	
Excess temp. limiter 1 Affected outputs	
Excess temp. limiter 1 Stop threshold	
Excess temp. limiter 1 Start threshold	
Excess temp. limiter 2 Enable	
Excess temp. limiter 2 Collector sensor	
Excess temp. limiter 2 Affected outputs	
Excess temp. limiter 2 Stop threshold	
Excess temp. limiter 2 Start threshold	
Frost protection 1 Enable	
Frost protection 1 Collector sensor	
Frost protection 1 Affected outputs	
Frost protection 1 Start threshold	
Frost protection 1 Stop threshold	
Frost protection 2 Enable	
Frost protection 2 Collector sensor	
Frost protection 2 Affected outputs	
Frost protection 2 Start threshold	
Frost protection 2 Stop threshold	
Cooling function Enable	
Cooling function Monitored sensor	
Cooling function Maximum value	
Cooling function Affected outputs	
Cooling function Start	
Cooling function End	

Start function

Start function 1 Enable	
Start function 1 Collector sensor	
Start function 1 Radiation sensor	
Start function 1 Activation gradient	
Start function 1 Radiation threshold	
Start function 1 Monitored outputs	
Start function 1 Flushing outputs	
Start function 1 Pump runtime	
Start function 1 Interval time	
Start function 2 Enable	
Start function 2 Collector sensor	
Start function 2 Radiation sensor	
Start function 2 Activation gradient	

Start function 2 Radiation threshold	
Start function 2 Monitored outputs	
Start function 2 Flushing outputs	
Start function 2 Pump runtime	
Start function 2 Interval time	

Solar priority

Solar priority Pump runtime	
Solar priority Delay	
Solar priority Flushing time	
Solar priority Flushing outputs	
Solar priority Radiation sensor	
Solar priority Radiation threshold	

Funct. check

Function check Y/N	
DHW circulation check Y/N	
DHW circulation check 1 Outputs	
DHW circulation check 1 Sensor input +	
DHW circulation check 1 Sensor input -	
DHW circulation check 2 Outputs	
DHW circulation check 2 Sensor input +	
DHW circulation check 2 Sensor input -	
DHW circulation check 3 Outputs	
DHW circulation check 3 Sensor input +	
DHW circulation check 3 Sensor input -	
Display on other devices nodes 1-31	
Display on other devices nodes 32-62	

Heat metering

HM 1 Enable	
HM 1 Sensor flow	
HM 1 Sensor return	
HM 1 Flow sensor	
HM 1 Flow rate fixed	
HM 1 Assigned outputs	
HM 1 Frost protection component	
HM 2 Enable	
HM 2 Sensor flow	
HM 2 Sensor return	

HM 2 Flow sensor	
HM 2 Flow rate fixed	
HM 2 Assigned outputs	
HM 2 Frost protection component	

HM 3 Enable	
HM 3 Sensor flow	
HM 3 Sensor return	
HM 3 Flow sensor	
HM 3 Flow rate fixed	
HM 3 Assigned outputs	
HM 3 Frost protection component	

Pasteurisation

Enable Y/N	
Interval time	
Monitored sensor	
Temp. threshold	
Affected outputs	
Generator demand	
Hold time	
Start time	


Drainback

Enable	
Radiation sensor	
Radiation threshold	
Fill output	
Stabilisation time	
Blocking time	
Sensor water shortage	
Min. flow rate water shortage	

CAN/DL bus

CAN set. node	
CAN set. designation	
CAN set. bus rate	
DL set. data output Y/N	

Technical Data

Power supply:	100-230V, 50-60 Hz
Power consumption:	1,5 - 2,0 W, depending on activity of switching outputs
Fuse:	3.15 A fast-acting (device + outputs)
Supply cable:	3 x 1mm ² H05VV-F conforming to EN 60730-1 (cable with standard plug included in the standard sensor pack)
Case (plastic):	ABS, Flame resistance: class V0 conforming to UL94 Norm
Protection rating:	II - safety insulated 
Protection class:	IP40
Dimensions (W/H/D):	149.5 / 100 / 56.2 mm
Weight:	with console: 350 g without console: 234.5 g
Allowed ambient temp.	+5 to +45 °C
6 inputs:	Temperature sensors of types PT1000, KTY (2 kΩ/25°C), Room sensors RAS or RASPT, Radiation sensor GBS01, Rain sensor RES01, Digital input
Additionally for input 6:	Impulse input max. 20 Hz e.g. for volume flow encoder VIG or wind sensor WIS01
Output A1:	Relay output, N/O
Output A2:	Relay output, N/O and N/C
Output A3:	Relay changeover contact – potential free
Current load:	Outputs 1-3: max. 2.5 A ohmsch, inductive cos phi 0.6
Control outputs A4 & A5:	Analogue outputs 0-10V (max. 20mA) or PWM (10V/1kHz) in 100 stages each (=0.1V or 1% per stage) or extension option and switching output with auxiliary relay modules
max. DL-Bus load	100%
CAN-Bus	Standard data rate 50 kbit/s adjustable from 5 to 500 kbit/s

The sensor leads on the inputs with a cross-section of 0.50 mm² can be extended to a length of 50 m.

Consumer (e.g. pumps, valves) with a cable cross-section of 0.75 mm² can be connected at a distance of up to 30 m.

Differential temperature: adjustable from -100 to +100 K

Minimum / Maximum thresholds: adjustable from 0 to 200°C

Precision temperature: typ. 0.4K, max. ±1K in the 0-100°C range **for PT1000 sensors**

Precision resistance measurement: max. 1,6% at 100kΩ (measure: resistance, process variable: resistance)

Precision voltage: typ. 1%, max. 3% of the maximum measuring range of the input

Precision outputs 0-10: max. -2% to +6%

Information on the Eco-design Directive 2009/125/EG

Product	Class ^{1, 2}	Energy efficiency ³	Typ. power consumption [W] ⁴	Max. power consumption [W] ⁴
UVR65	max. 6	max. 4 %	1.4 / 1.9	1.9 / 2.5

¹ Definitions according to Official Journal of the European Union C 207 dated 03/07/2014

² The classification applied is based on optimum utilisation and correct application of the products. The actual applicable class may differ from the classification applied.

³ Contribution of the temperature controller to seasonal central heating efficiency in percent, rounded to one decimal place

⁴ No output active = Standby / all outputs and the display active

Subject to technical modifications.

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EU - Declaration of conformity

Document No. / Datum: TA18001 / 12/04/2018
Manufacturer: Technische Alternative RT GmbH
Address: A-3872 Amaliendorf, Langestraße 124

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Product name: UVR65
Product brand: Technische Alternative RT GmbH
Product description: Universal controller

The object of the declaration described above is in conformity with the following directive:

2014/35/EU	Low voltage standard
2014/30/EU	Electromagnetic compatibility
2011/65/EU	RoHS Restriction of the use of certain hazardous substances
2009/125/EU	Eco-design directive

Employed standard:

EN 60730-1: 2011	Automatic electrical controls for household and similar use – Part 1: General requirements
EN 61000-6-3: 2007 + A1: 2011 + AC2012	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments
EN 61000-6-2: 2005 + AC2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 50581: 2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Position of CE-label: On packaging, instruction manual and type label



Issuer: Technische Alternative RT GmbH
A-3872 Amaliendorf, Langestraße 124

This declaration is submitted by

Dipl.-Ing. Andreas Schneider, General manager,
12.04.2018

This declaration certifies the agreement with the named standards, contains however no warranty of characteristics.

The security advices of included product documents are to be considered.

Warranty conditions

Note: The following guarantee conditions do not in any way limit the legal right to warranty, but rather expand your rights as a consumer.

1. The company Technische Alternative RT GmbH provides a two-year warranty from the date of purchase for all the devices and parts which it sells. Defects must be reported immediately upon detection and within the guarantee period. Technical support knows the correct solution for nearly all problems. In this respect, contacting us immediately will help to avoid unnecessary expense or effort in troubleshooting.
2. The warranty includes the free of charge repair (but not the cost of on site fault-finding, removal, refitting and shipping) of operational and material defects which impair operation the event that a repair is not, for reasons of cost, worthwhile according to the assessment of Technische Alternative, the goods will be replaced.
3. Not included is damage resulting from the effects of over-voltage or abnormal ambient conditions. Likewise, no warranty liability can be accepted if the device defect is due to: transport damage for which we are not responsible, incorrect installation and assembly, incorrect use, non-observance of operating and installation instructions or incorrect maintenance.
4. The warranty claim will expire, if repairs or actions are carried out by persons who are not authorised to do so or have not been so authorised by us or if our devices are operated with spare, supplementary or accessory parts which are not considered to be original parts.
5. The defective parts must be sent to our factory with an enclosed copy of the proof of purchase and a precise description of the defect. Processing is accelerated if an RMA number is applied for via our home page www.ta.co.at. A prior clarification of the defect with our technical support is necessary.
6. Services provided under warranty result neither in an extension of the warranty period nor in a resetting of the warranty period. The warranty period for fitted parts ends with the warranty period of the whole device.
7. Extended or other claims, especially those for compensation for damage other than to the device itself are, insofar as a liability is not legally required, excluded.

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